SCIENTIFIC AMERICAN

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Vol. XXXVII.—No. 18. [NEW SERIES.] NEW YORK, NOVEMBER 3, 1877. [$3.20 per Annum. [POSTAGE PREPAID.]

New Process of Embalming the Dead

Dr. Lowell, of Brooklyn, N. Y., has devised a process of embalming bodies which bids fair to revolutionize the business of undertaking. If his plan shall be adopted and succeed, the use of the ice-box and other expensive appliances, generally in request for the preservation of cadavers by the agency of cold, will become entirely unnecessary, and will be superseded by an inexpensive and simple process, which we will briefly indicate as follows: A solution of chloride of zinc is the preservative fluid used; this is contained in a porcelain-lined vessel, which is elevated to a convenient height, so that the contents will be injected into the cadaver after the manner of a gravity-syringe. For the passage of the fluid from its receptacle into a vein of the cadaver, glass and rubber tubing are all that is required. A finely tapered glass tube is held tightly in place in the vein, while a glass U-shaped tube acts as a siphon to conduct fluid from the receptacle. The quantity of fluid will, of necessity, vary in different cases; four or five gallons may be required. This plan will not work when operations have been performed whereby large vessels have been opened. A body thus treated was transported from this city to Richmond, Va., this summer, without odor, and without disfigurement or any external signs of decay. All that is required is that the physician shall expose a vessel, adjust the glass tube, and the fluid will find its own way. Dr. Lowell has let the instrument run all night. There is promise in this of a saving to the City of Brooklyn alone of from $75,000 to $100,000 each year in the one item of ice, in addition to doing away with much unpleasant and cumbersome material in caring for the dead. Dr. Lowell writes: "The injection may be made by either artery or vein. I have tried both with success. I prefer the brachial artery above the elbow as the point for introduction of glass tube, for the primary incision is slighter, and consequently divides smaller and fewer veins than when I expose the femoral artery. I use the gravity method, and introduce about five gallons of the antiseptic fluid. The effects are eminently satisfactory. The color of the integument is improved, even at points where hypotasis has been at work. I inspected a cadaver night before last—a lady. The body was in splendid condition—skin white and clear, and all points of discoloration along spine, nates, posterior surface of thighs, neck, etc., etc., clearing up. The patient died of typhoid fever; post-mortem discoloration rapidly supervened, and decomposition was rife. All changes were arrested, the skin cleared up, and when I saw the body last, its appearance had improved wonderfully.—*Proceedings of the Kings County Medical Society.*

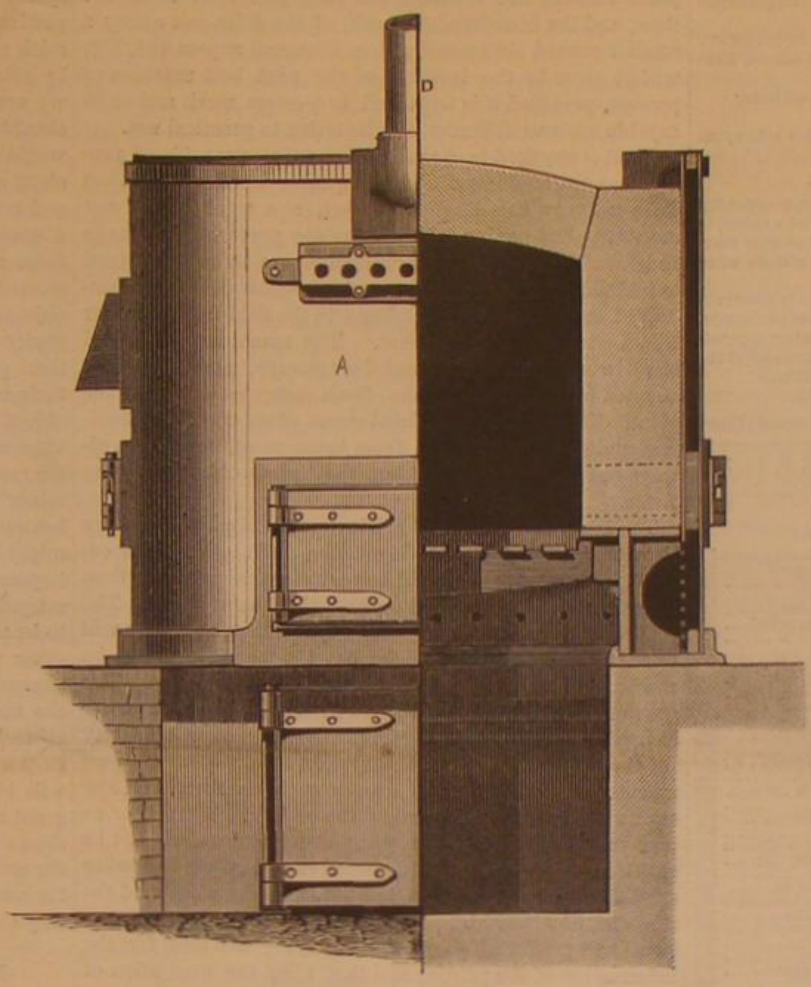

Fig. 1.—CADDICK AND MAYBERY PUDDLING FURNACE.

News from Naples announces an increased activity of Mount Vesuvius. The glow of fire in the crater is so intense that it can be distinctly seen from Naples at night.

IMPROVED PUDDLING FURNACE.

We illustrate from *The Engineer* a furnace patented by Messrs. Caddick and Maybery, which has been at work for some months at the Old Castle Iron and Tin-plate Works, Llanelly, South Wales. Mr. Caddick is a practical furnace builder, while Mr. Maybery is manager of the works.

Before proceeding to describe the furnace or particularize the results, it may be stated that the nature of the system of puddling employed is peculiar, not to the furnace but to the district, and materially affects the results obtained.

The Old Castle Works are employed solely in the manufacture of black, tin, and terne plates. It is scarcely necessary to say that the iron used in making tin plates must be of very fine quality or the plates would be worthless. Two or three different grades or classes of sheet are made. At one end of the scale is found the finest charcoal plates, at the other a very excellent iron made in the puddling furnace. The furnace as illustrated is double. It consists of a chamber or gas generator of fire bricks surrounded by a casing of thin iron plates, say, three sixteenths inch thick, and a puddling hearth. The whole of the plates are of wrought iron, the buckstaves, as we may term them, being cast iron columns, held together at the top by suitable tie rods. It is impossible to imagine a neater, simpler, or more compact furnace than that thus produced. The ordinary sliding firebrick door is used, but outside of this is provided a second door of thin plate iron, in which a suitable aperture is made to admit the rabble; this door acts to perfection in protecting the puddler from radiant heat.

Referring to the engraving, Fig. 1 is a half end view and half transverse section of the combustion chamber or generator; Fig. 2 is a longitudinal elevation; Fig. 3 a longitudinal section; and Fig. 4 a sectional plan. A is the generator; B the inner casing, and C the outer casing. Blast is admitted into the space between the inner and outer casing through the pipe, D; the air becomes heated by coming into contact with the inner casing, and passes into the inclosed space below the grate bars, through holes formed in the lower part of this casing. Here the already heated blast is heated to a further degree by the red hot ashes. A portion

[*Continued on page* 274.]

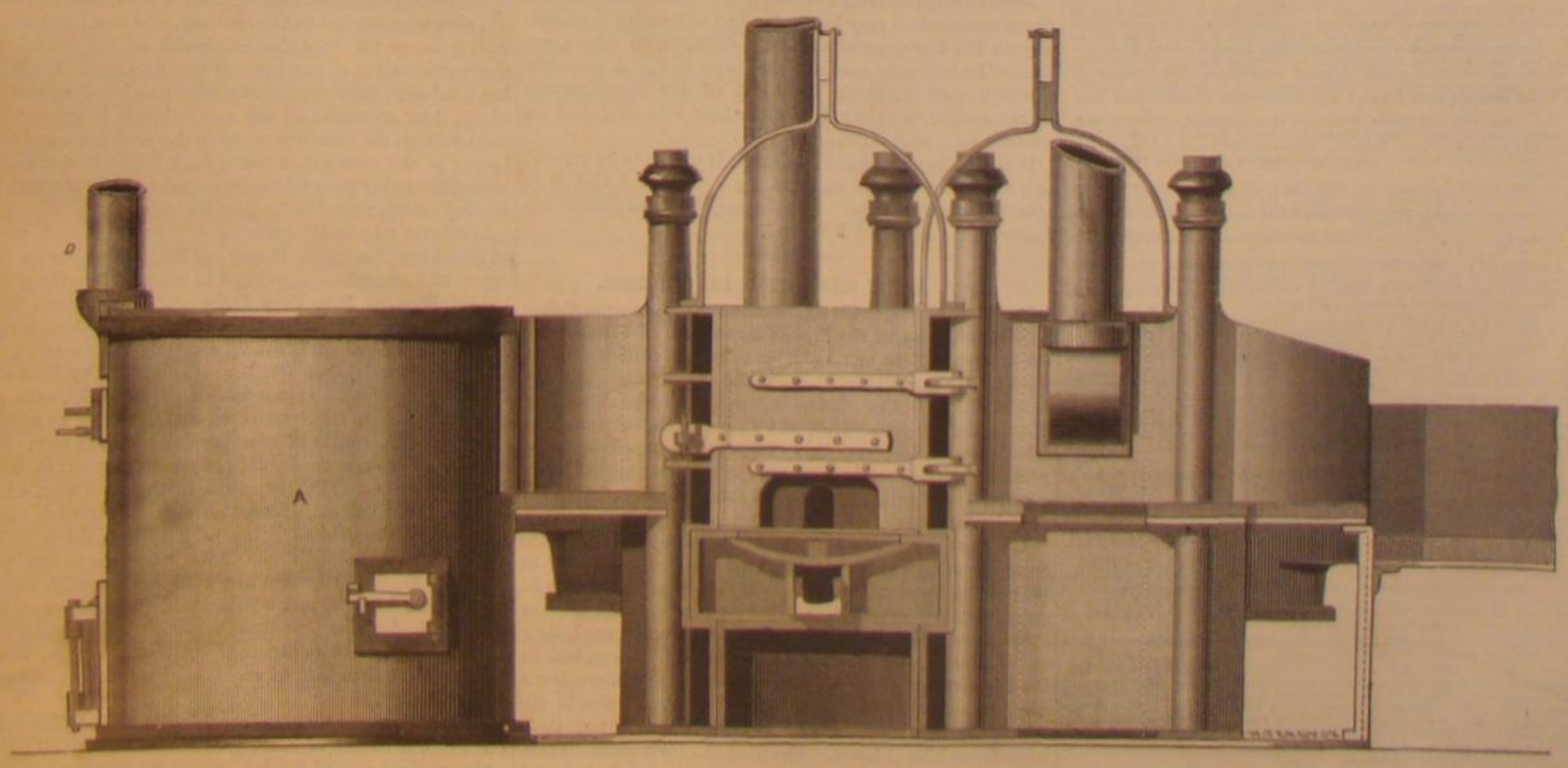

Fig. 2.—CADDICK AND MAYBERY PUDDLING FURNACE—LONGITUDINAL ELEVATION.

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VOL. XXXVII., No. 18. [NEW SERIES.] *Thirty-second Year.*

NEW YORK, SATURDAY, NOVEMBER 8, 1877.

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AN OPPORTUNITY FOR INVENTORS.—$24,000 REWARD OFFERED FOR A RAMIE CLEANING MACHINE.

The Department of State has received a circular from the Government of India, from which it appears that in 1871 a prize of £5,000 was offered to the inventor of the best machine or process for the preparation of the fiber of the *Böhmeria nivea* (popularly known under the names of Rheea, Ramie, and China grass), and the terms on which machines would be admitted to competition were widely notified in India, Europe, and America, but only one machine was brought to trial, which, having been carefully tested at Sahâranpur in 1872, was found imperfect, and the inventor was adjudged not entitled to the full reward. He was, however, presented with £1,500 in consideration of his partial success. As this machine has not since been adapted to practical use, and no better process of preparing the fiber of the rheea has been discovered, the conditions which induced the offer of a prize in 1871 remain substantially unchanged, and the government therefore offers a reward of about fifty thousand rupees (about $23,110) to the inventor of the best machine or process which will separate the bark and fiber from the stem, and the fiber from the bark, of the *Böhmeria nivea;* a smaller reward not exceeding ten thousand rupees ($4,622), will be given to the inventor of the next best machine or process, provided it is adjudged to possess merit and to be capable without difficulty of adaptation to practical use.

What is required is a machine or process capable of producing a ton of dressed fiber of a quality worth not less than £45 per ton in the English market, at a total cost of not more than £15 per ton laid down at any port of shipment in India. The processes of preparation are to be understood to include all the operations required subsequent to the cutting of the stems from the plants in the field until the fiber is in a condition fit for market. The machinery employed must be simple, durable, and inexpensive, and should be adapted for treatment of the fresh stems as cut from the plant. The treatment of dried stems offers certain difficulties, and the fiber prepared from them must, moreover, always be much more costly than that produced from green stems.

The trials will be held at Saháranpur in the Northwestern Provinces in August and September, 1879. Machines entered for competition should be ready for trial not later than August 15, the competition commencing the next day. The judges will be appointed by the government, and they will watch the whole of the trials; but the machines are to be worked and adjusted by the competitors themselves. The government will provide accommodation and motive power at Saháranpur for all competing machines, and will also pay for the transport from the sea coast to Saháranpur of all machines up to the limit of one ton each, the freight on any excess weight to be defrayed by the owners. The owner or owners of the successful machine or machines shall not be entitled to receive the reward offered except on the following conditions, viz.: That a complete technical description of the machine, illustrated by plans drawn to scale, shall be prepared and published (Government paying the cost) for the information of the public; and that after the expiration of three years from date of award, the public shall have the right of manufacturing similar machines, on payment to the owner of a royalty of 10 per cent on the cost of each machine so manufactured. All persons desiring to compete are requested to make known their intention not later than December, 1878, giving their name, residence, profession, and a brief description of each machine entered for competition. They must also declare themselves bound to conform to all rules which may be prescribed by the judges appointed to conduct the trials.

More detailed information than is contained in the circular above summarized may be obtained by addressing the Secretary to the Government of India, Calcutta, to whom notices of intention to compete should be sent. A complete description of the ramie plant and of the investigations hitherto made into the nature of its fiber will be found on another page of this issue.

It should be understood that ramie is sought to be utilized as a substitute for silk and not for cotton: and that it is already largely employed for this purpose by English manufacturers in Leeds and Bradford.

THE PARIS EXPOSITION IN CONGRESS.

President Hayes, in his recent message to Congress, makes special reference to the French Exposition of 1878, and to the necessity of an appropriation to enable exhibitors from the United States to participate in the show. The President recalls the fact that $200,000 was appropriated for the Vienna Exposition of 1873, and that practical artisans and scientific men, besides commissioners, were appointed to represent the country; from which the inference is that he recommends the granting of a like sum and the organization of a similar corps of officials.

We have so frequently pointed out the objections to Congress devoting any large amount of the people's money to purposes of international shows that it is not necessary to enter into their details here. Public funds should not be spent to advertise private individuals. People send their exhibits across the Atlantic for business purposes, and in the hope of gaining business advantage; and there is no more reason why the United States Government should cooperate to help them, any more than it should pay their advertising bills at home. The $200,000 for Vienna was appropriated before the panic. Since then the whole financial condition of the country has changed, rigid economy is imperative everywhere, and nowhere so much as in the control of government expenditures. Nor did the Vienna $200,000 save our representation from becoming a failure. The American contribution to that show was not representative of our industries, the official management fell into disrepute, and the results of the work of the scientific commissioners and artisans are by no means as highly appreciated as they ought to be.

Official reports on these Expositions, in any event, can hardly be worth to the people the money they cost. The press with its enormous facilities for gathering and promptly presenting intelligence, anticipates them by considerable periods of time, and affords much fuller information at very much less expense to the classes for whose benefit reports are designed.

If a large appropriation and a corps of salaried officials do no good, at least it should be expected that they will not defeat their own object; and we are not sure but that this was the sum total of the Vienna experience. At the recent Leather Exposition in Germany, our representation was a splendid success, and it was managed entirely by private parties. So also in 1851, the exhibits—notably the McCormick reaper and the yacht America—were wholly unaided by official help. On the other hand, it is desirable that, if we are going to have any representation at all in Paris, it should be one befitting our industrial importance; and it would no doubt facilitate this result to have some persons officially authorized to organize and manage the general display and confer with the Exposition authorities. The *Journal of Commerce* pertinently suggests that the Government appoint these commissioners to serve without salary, an idea which seems to us excellent. There are numbers of well known citizens who intend to visit the Exposition, and who would gladly undertake the service for the honor it brings. To these gentlemen the existence of a salary would be a bar to their acceptance of the positions, as its amount would be no object to them, nor would they consent to have their services reckoned on any cash or business basis whatever. In the case of an honorary commission, there would be sundry minor expenses, clerk hire, office rent, etc., which would have to be provided for, and for these a small appropriation might be made, as of course no personal outlay should be imposed upon the members of the commission. This arrangement would leave the bulk of the whole expenditure to be met by private subscription among the exhibitors and other parties directly benefited, and this many have expressed their willingness to do, at present, however, with the tacit proviso, "unless Congress makes an appropriation." The matter is pressing for speedy settlement owing to the very brief time which now remains before the show will be opened. As Congress has already once refused to grant a large specific appropriation, it can easily omit reconsideration of that subject, and can confine its legislation to the authorization of a board of honorary commissioners and the setting apart of a few thousand dollars for their necessary expenses.

IMPROVED METHOD OF WINTERING COWS.

Mr. Linus W. Miller, of Stockton, N. Y., an experienced dairyman, advocates, in a pamphlet entitled "Meal Feeding and Animal Digestion," a system of feeding cows during winter, which involves the use of but three quarts of meal per day. He asserts that this amount of good Indian meal, fed under proper conditions, is more than the equivalent for all the good hay a cow can be coaxed to eat—that the animal does not need to have its stomach distended with a great bulk of woody fiber, which imposes upon the system a large amount of extra mechanical work both in the processes of digestion and remastication—that, in brief, bulk in food is not advantageous but to the contrary, and that nutriment in food governs the condition and health of the animal, and that condensation of nutriment is true economy. Mr. Miller has conducted physiological investigations into the functions of the four stomachs of the cow, whence it appears that meal follows the same course as herbaceous food, and stays longer in the rumen than coarse food, while it also digests more thoroughly than when the energies of the stomach are divided between meal and coarse herbage.

Whatever may be the correct theory in this regard, results of actual practice appear to bear out Mr. Miller's views. The report of a committee, appointed to examine into the system by the Western New York Dairymen's Association, shows the following facts: The examination was conducted upon Mr. Miller's herd of Chatauqua county native cows, the average live weight of which was 900 lbs. The herd were fed exclusively upon corn meal for seven weeks, each animal, according to its digestive capacity, making an average of about three quarts of meal per day for each cow. The animals did not ruminate, did not manifest so much desire for food as cows fed on hay alone in the usual way, a little less than they will eat, showed no signs of unrest or suffering; and at the time of going back to hay, the cows had neither lost nor gained flesh. After returning to hay, their stomachs filled and ruminating went on normally, healthy calves were dropped, and when turned to grass the animals took on flesh faster than those wintered in the usual way. Their daily yield of milk was 29 lbs. 3 ozs., or 1 lb. 11 ozs. per cow more than that of any other herd sent to the same cheese factory.

As regards the economy of meal feeding, Mr. Miller points out that one bushel of corn, ground and tolled, will last an ordinary sized cow of 900 lbs. weight 12 days, and is equal to 240 lbs. of hay. Corn at 60 cents per bushel is therefore

the equivalent of hay at $5 per ton of 2,000 lbs., and where it can be had at that rate the cost of wintering the animal will range from $7 to $10, according to coldness and length of the foddering season. But hay as a rule costs at least $10 per ton, and frequently much more. Hence the estimated saving by meal feeding is placed at from $5 to $20 per animal, according to the respective prices of corn and hay.

THE FORTUNES OF THE OBELISKS.

The Egyptian obelisk, whose launch we discussed last week, narrowly escaped total loss while on its voyage to England. So severe a storm was encountered off Cape Finisterre that the towing steamer Olga was obliged to cast off from the obelisk craft, and, after removing the crew from the latter, to leave it to its fate. Six men were lost during the transhipment. The deserted needle drifted seaward, and finally was discovered by the English steamer Fitzmaurice, ninety miles north of Ferrol, Spain, and taken in tow again. The Fitzmaurice was bound for Valencia, and hence the travels of the famous stone will probably be prolonged.

The sister obelisk to that above referred to has been presented by the Khedive of Egypt to New York city. As we noted last week, it was proposed to defray the expense of transportation across the Atlantic by public subscription, but this course has since been rendered unnecessary by the magnificent offer of a well known citizen, whose name is as yet withheld, to bear all the expense, amounting to $100,000, himself. This proposal has been accepted, and we understand from the New York *World* that the contracts for the removal and shipment of the stone have been signed. At present the question is being discussed where the obelisk is to be erected when we get it; and opinion seems to be about equally divided in favor of establishing it in the center of Madison Square, between 23d and 25th streets, on Fifth Avenue, or in the park into which it is proposed the site of the present distributing reservoir on 42d street and the same avenue shall be converted, after demolition of the now unnecessary reservoir.

In view of the distribution of Egyptian obelisks over the surface of the earth, one being in Rome, another in Paris, another in London, and now another in New York, it has been humorously suggested that the archæologist of a dozen centuries hence will be vastly puzzled to account for the wonderfully wide contemporaneous dispersion of the Egyptian race, which will be indicated by the localities of its monuments.

SPEECH AUTOMATICALLY TRANSMITTED IN SHORT HAND BY THE TELEGRAPH.

In our next issue we shall present an illustrated article descriptive of Dr. Rosapelly's and Professor Marey's recent investigations into the mechanical productions of speech. By means of very ingenious apparatus the movements of the lips, those of the veil of the palate and the vibrations of the larynx, are simultaneously graphically inscribed, so that their inter-connection and succession may at once be seen. The result is a clearly marked phonetic character produced by the voice itself, the corresponding sound to which any one after a little study can at once produce.

The discovery of this automatic phonography may lead to two important results, first, that for which it is directly designed, namely the teaching the deaf mutes to speak, for the mute has only to make the sounds indicated and which previous investigation has determined to be exactly the right one to produce the articulated word, and second, vocal speech translated into phonographic short hand at any distance from the speaker. It appears quite possible with the apparatus of M. Marey aided by well known electrical appliances for the words of a speaker in New York to be taken down in legible short hand in San Francisco. This is an application scarcely anticipated by the investigators and their apparatus is perhaps not the best adapted to that particular end, but still it possesses none the less the "promise and potentiality" of that wonderful result.

ALLEGED POISON IN SUGARS.

Some attention was attracted last year by numerous letters, published by Mr. L. Rossiter, of Chicago, Ill., in the Chicago *Tribune*, with regard to alleged poisonous effects of sugars. Mr. Rossiter suggested that a large proportion of the sugars in the market might contain poisonous impurities arising from the use of chemicals in their manufacture, his opinion being based upon the effects of the use of sugars as food upon persons of weak or deranged digestion. In the *American Journal of Pharmacy*, we find accounts of analyses made by Messrs. J. S. Johnson and S. E. Parkill, of fourteen samples of sugars and syrups furnished by Mr. Rossiter. Neither lead nor arsenic was found, nor did the ash, by ordinary systematic qualitative analysis, reveal other constituents than sodium, potassium, calcium, magnesium, aluminum, and iron compounds, and sulphates, chlorides, carbonates, and silica. No zinc or tin was found. It thus appears that the sugars of commerce do not contain the injurious ingredients suggested by Mr. Rossiter.

The Double Postal Card.

A new style of postal card is now used in Germany. It consists of two cards of the ordinary size attached together, each having a postal stamp. These double cards are furnished by the Post Office, and sent for the purpose of facilitating the return of answers.

DECISIONS OF THE COURTS.

The suit of Northrop *vs.* Adams for the infringement of a design patent for a provision or cheese safe has been decided adversely to the complainant.

The specification of the complainant's patent described "A rectangular base, with a top supported by four corner posts, with an intermediate stile or support, dividing each side into vertical panels, all of which are covered with wire cloth of fine mesh. The front side is made to open as a door, which is single, but folds upon itself, the two parts being hinged together at the center style. Around the base is an ogee moulding, and a similar one is run round the top to serve as a cornice. A lighter moulding of the same pattern is run round the edge of each panel, and a pleasant effect is produced by staining all of the moulding a dark color, varnishing all the rest of the wood work, leaving it in its natural color." The patentee claimed as a design for a cheese safe, the rectangular cage, having two vertical panels on each wall, a moulded top and a moulded base.

The main question involved in the suit was the patentability of the claimed invention. Now, the law applicable to design patents does not materially differ from the law applicable to mechanical patents. The same general principles of construction extend to both. To entitle a party to the benefit of the act, in either case there must be originality and the exercise of the inventive faculty. In the mechanical patent there must be novelty and utility; in the design patent, originality and beauty. Mere mechanical skill is insufficient. There must be something akin to genius—an effort of the brain as well as the hand. The adaptation of old devices or forms to new purposes, however convenient, useful, or beautiful they may be in their new *rôle*, is not invention. Thus it has been held that the use of a small model of the Main Centennial Building, for paper weights and inkstands, was not patentable.

Upon applying these rules to the facts of the case, it was apparent that the complainant's patent could not be sustained. Thus it was shown that rectangular safes essentially similar to the complainant's, covered with wire cloth, had been made and used for many years. Such rectangular safes were formerly used for the exhibition of cheese in shops, but of late years had been supplanted by a round safe, with the top divided and connected with hinges, so as to permit one half of it to be thrown back. When these rectangular safes were constructed of large size, each side was divided into panels by a vertical stile; when of smaller size no such division was made. But as the difference in size would not be patentable, so the division of each side into panels was none the more so. The only novelty, then, in the patent, was the use of an ogee moulding about the top and bottom. Mouldings of this description, however, had been used for centuries, and applied, not by way of ornament in architecture, but to articles of furniture and the decoration of interiors. The embellishment of a provision safe with this ancient design was simply the adaptation of a well known ornament to a new purpose. The result, being neither novel nor original, was not entitled to the protection of the patent laws.

The Potato Bug in Germany.

The Germans are greatly interested in, not to say excited about, our Colorado beetle, and well they may be, for the German potato crop is a valuable one, and in no part of the world have we seen so many fine mealy potatoes as there. The beetle has been seen at Schildau in Saxony and in some other localities, and much attention has been given to a study of their habits and means of destruction. In a recent number of the *Industrie Blätter* is a translation of Professor Riley's article from the SCIENTIFIC AMERICAN (page 198) which is supplemented by remarks by Professor Sell and others. Dr. Sell advises to saturate the soil with sulphurets of potash or lime, then with dilute sulphuric acid, so as to generate the poisonous sulphuretted hydrogen in the soil. In regard to attempts made to burn them out by saturating sawdust with petroleum and sprinkling them over the soil, then igniting them, he says that, although the flames are high and an intolerable heat rises from it, the heat does not penetrate far enough into the earth to kill the larva. He found at a depth of 6 or 7 c. m. (2½ inches) the heat was not over 95° or 100° Fah., which is far too low to kill the single individuals.

At Schildau, in Saxony, where the beetle made its appearance, the fields were first burned over, then plowed up, and finally the sawdust saturated with benzine and mixed with the earth and fired.

In regard to our American remedy, the Paris green and lime, the *Industrie Blätter* remarks: "We are of the opinion that this means will really destroy the beetle, but the lime and Paris green dust might be dangerous to children and that useful animals and plants might be poisoned, and the soil become impregnated with such colossal quantities of arsenic that under some circumstances even the well water would be poisoned." Nevertheless this cure, in a wet form, is recommended by Professor Kuehn, of Halle.

In regard to this pest the *Gesundheit* says that Nature offers some aid. The odor of the hemp plant is so offensive and stupefying as to keep them out of a field. They have also an enemy in the lady bug (*Coccinella*).

Every effort is being made to prevent their importation from here. It is said that specimens of our potato bug have been sent there alive in a paper box without food, showing that it is rather a difficult matter to starve them.

That the farmer and gardener as well as the general public may recognize the insect upon its first appearance and set about its destruction, pictures of the bug, egg, and larva are freely distributed in the papers and by the police.

Models of the bugs at different stages, attached to a green leaf and brightly colored, are put up in little boxes with glass covers for use in the schools. Manufacturers of chocolate, candy, wax, or gums find in the Colorado beetle a convenient model for their wares. Among the latest novelties are sleeve buttons bearing each a full sized potato bug. Voigt has even published an illustrated pamphlet on the subject. In short, the Germans have the potato bug on the brain.

We learn that the Austrian, English, and French Governments have sent representatives to Germany to observe the beetle on the spot, as well as the precautions employed to destroy him. M. Henze, delegate of the French Department of Agriculture in Muehlheim, has shut up 80,000 specimens in little boxes to be furnished to all the communes and schools in France. He also desired, for the museums, large glass boxes in which the nature of the dangerous beetle should be shown by means of an artificial potato field.

An enterprising Muehlheim firm puts up: "Very fine Colorado Bitters," with a beetle on the label.

A patent has been taken out in Prussia for an apparatus to destroy insects and weeds by means of steam. A large apparatus for fields is drawn by horses and operated by two men.

Analysis of Butter Fats.

Hehner says that all methods for detecting foreign fats in butter, which are based upon the physical properties of butter fat, such as its solubility in alcohol, ether, and naphtha, melting point, etc., are useless because it is easy to mix liquid and solid fats in such proportions as to obtain a product totally undistinguishable in its external appearance and physical properties from butter. On the other hand, many a sample of genuine butter is considered to be adulterated because its odor and appearance seem to indicate the presence of tallow. All butter without exception, even the best, by standing a long time in the air acquires a decided odor of tallow and becomes as white as tallow too.

Hehner and Angell have found that the quantity of volatile acids in butter fat is far greater than previously supposed, and further, that this quantity is very constant and almost independent of the race of the cow, the fodder, and the method of making the butter; also the age of the butter has no effect upon it. By distilling the saponified butter with sulphuric acid, they obtained in eight experiments from 4·8 to 7·5 per cent of volatile fatty acids. In this manner no harmonious results could be obtained.

As all animal fats, except butter, consist of tristearine, tripalmatine, and trioleine, they must, when saponified and decomposed by sulphuric acid, yield from 95·28 to 95·73 per cent fatty acids. Hog's lard, mutton suet, and similar fats yielded, by direct experiment, within 0·1 per cent, exactly 95·5 per cent insoluble fatty acids, while pure butter gave from 85·4 to 86·2, on the average 85·5 per cent; others found as much as 87·5. A butter, then, which yields over 88 per cent of fatty acid can be considered as adulterated. To determin the quantity of foreign fats, subtract 87·5 from the percentage found, multiply by 100, and divide by 8 (= 95·5 − 87·5). As butter is never adulterated with a few per cent of another fat, but with at least one third, we can scarcely be in doubt whether it has been adulterated or not.

Hehner recommends to melt the butter and pour off the top through a dry filter, then put 3 or 4 grains of this fat in a small dish, add 50 c. c. alcohol and 1 or 2 grammes of pure potassic hydrate and heat 5 minutes, or until a few drops of water does not produce turbidity. The alcohol is driven off by evaporating to a syrup, the residue dissolved in water, dilute sulphuric or hydrochloric acid added to acid reaction. The insoluble fatty acids separate as a cheesy mass. Heat 30 minutes. Then filter on a tared, thick, moist filter, and wash with boiling water. When the filtrate ceases to show an acid reaction, the funnel is immersed in cold water to solidify the fatty acids, and dried in a weighed beaker in a water bath until the weight at two weighings is constant.

The Coming Winter.

Astronomer Royal Smyth, of the Royal Observatory, Scotland, says that the coming winter is going to be exceedingly cold. From the observations of earth thermometers over a period of thirty-nine years, he finds that between 1837 and 1876 three great heat waves from without struck Great Britain; namely, the first in 1846·5, the second in 1858·0, and the third in 1868·7. The next one will probably come in 1879·5, within limits of half a year each way. The periods of minimum temperature, or greatest cold, are not in the middle time between the crests of these three heat waves, but are comparatively close up to them, on each side, at a distance of about a year and a half. Hence the next cold wave is due at the end of the present year, and very frigid weather may be looked for.

Fertilization of Flowers by Birds.

A curious chain of circumstances, leading to a definite natural result, is noted by a correspondent of *Nature* writing from Mendanao. Certain flowers secrete nectar, which attracts certain insects. These insects are the natural prey of the sun birds and flower peckers; but to capture them the birds are obliged to probe diligently the corollas of numerous flowers. Each bird in so doing brushes off pollen, which adheres to the plumage surrounding its bill, and this pollen is thus conveyed to other flowers, which so become fertilized.

[*Continued from first page.*]

passes up through the grate bars, while another portion is admitted to the combustion chamber above the level of the fire. The result is complete combustion, so that smoke is practically prevented, and saving of fuel is effected. The admission of the blast over the fire is regulated by a valve, F. The frame which contains this valve is provided with a slide having sight holes, through which the holes in the brickwork may be kept free from obstruction. There is a gusset, G, on each side of the furnace opening downwards into the space below the furnace; the waste water from the boshes flows under the furnace, the vapor arising from which, together with the heated air, is drawn up through the gussets, and passes off through the pipes fixed on the same, so that there is a constant circulation of air under the bottom of the furnace, which keeps it cool, and a considerable saving of fettling, as compared with the ordinary puddling furnaces, is effected. Blast is supplied by a fan.

The system of puddling affects the results. This will be understood if it be borne in mind that puddling furnace economy may be dealt with under two heads, namely, economy of fuel and economy of iron. The latter item is measured by the proportion which the weight of puddled blooms produced bears to the weight of pig iron charged. It is evident that cinder being very heavy, if plenty of cinder is left in the iron, the yield will apparently be high. Again, if very rich fettling is used in a large quantity, a portion of this fettling will be actually deoxidized and converted into wrought iron by a species of direct process; and cases are not wanting in which the weight of puddled bars turned out by a furnace in a given time has exceeded that of the pig charged, the difference coming of course from the fettling. Now at the Old Castle Works, and indeed at all the Welsh tin plate works, the iron is puddled on a dry bottom; it is freely bled during the operation, and every possible precaution is taken to expel every particle of cinder. In fact the balls as drawn from the puddling furnaces are so dry that they can only be got to stick together under the shingling hammer with difficulty. It follows of course that the yields must appear to be small as compared with those to be had from furnaces making common iron.

Before an estimate can be made of the value of the furnace, it is necessary to have figures giving the work of the old furnaces, with which to compare them. A careful examination of the books shows that the results obtained are not very uniform, much depending no doubt on whether the furnaces are in good condition or not; but it may be said that the coal used on the old system averages 23 cwt. per ton of stamps, and the stamp average 18 cwt. 2 qr., or perhaps a shade more, per ton of pigs and scrap. From this it appears that the new furnace saves nearly 44 per cent in fuel, while the yield is augmented by 35 lbs. to 40 lbs. of iron per ton. There is 50 also a sav ng of over per cent in fettling.

It may be urged that this economy is due to the double furnace system. Even grant this to be the case, still the credit will remain with Messrs. Caddick and Maybery of producing an exceedingly simple and compact furnace, from which no heat is radiated to the annoyance of the puddler, while it is indispntable that the combustion is as nearly as possible perfect.

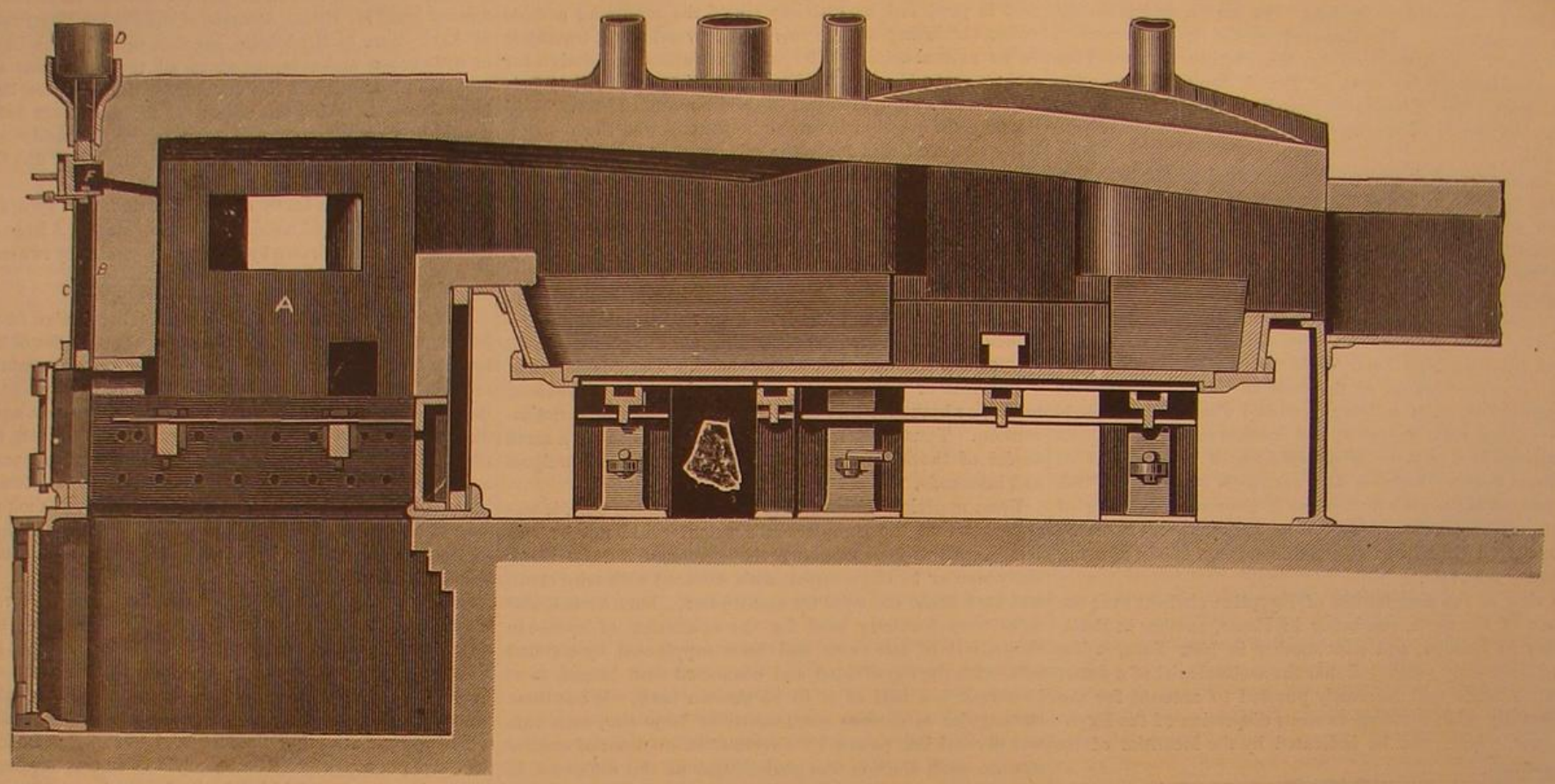


Fig. 3.—CADDICK AND MAYBERY PUDDLING FURNACE.—LONGITUDINAL SECTION.

The Satellites of Mars seen with a 7 Inch Glass.

In striking illustration of the truth of the assertion of Sir W. Herschel, that when a very faint object has been once discovered with a large telescope, it may be seen with a much smaller one, we received, since the above was written, a communication from Mr. Wentworth Erck, of Sherrington, Bray, dated September 8, in which he writes: "The outer satellite has been seen here three times; 1st, on September 2, at 22h. 40m. G.S.T., when the position was about 290°, and distance from limb something less than three diameters of the planet; 2nd, on September 3, at 23h. 0m. G.S.T., when the position was 54°; this position is pretty accurate; on this occasion I watched the satellite for two hours, during which I saw it move from 64° to 55°; at the latter position its distance from limb was equal to two diameters of the planet; 3rd, on September 8, at 22h. 35m. G S.T., when the position was about 78°. It was steadily visible with 7 inches aperture on my Alvan Clark, and was, I should say, something brighter than Enceladus, the second satellite of Saturn."

On comparing these observations with positions calculated from the above elements (which closely represent the Paris observation of August 27), it is evident the object observed on September 2 was a star, the satellite at the time being on an angle of 325°, and only 15 seconds from the limb, but it appears beyond doubt that Mr. Erck observed the outer satellite on the following night, when the position at the time named would be 65°, distance from center of planet 79 seconds, and two hours later the angle would have diminished to 53°, and the distance to 61 seconds, or roughly two diameters from the planet's limb as observed. On September 8 the angle was 71°, distance 85 seconds, so that the satellite may have been seen again this evening. So far as we know these are the first observations of a satellite of Mars in these islands, and it is singular that they have been made with an instrument constructed by the same optician as the great Washington telescope, with which the satellites were discovered.—*Nature.*

In this city, Mr. Rutherford, with his 13 inch glass, we believe, has not yet seen either of the satellites.—EDS.

Vapor Volumes.

In the *Journal* of the German Chemical Society there is a paper by Troost, detailing experiments made to determine the accuracy of Avogadro's theory that "equal volumes of substances in the state of vapor contained the same number of molecules," that is, that the volume of the molecule of hydrogen being called 2, the volume of all other molecules must also be 2; instead of, as happens in certain cases, apparently 4, 6, or 8. The method of experiment adopted was to introduce into the vapor of chloral hydrate a salt containing water having a dissociation tension nearly equal to that of chloral hydrate; if the chloral hydrate vapor undergoes dissociation, and consists of equal volumes of chloral and aqueous vapors, then the vapor volume will remain

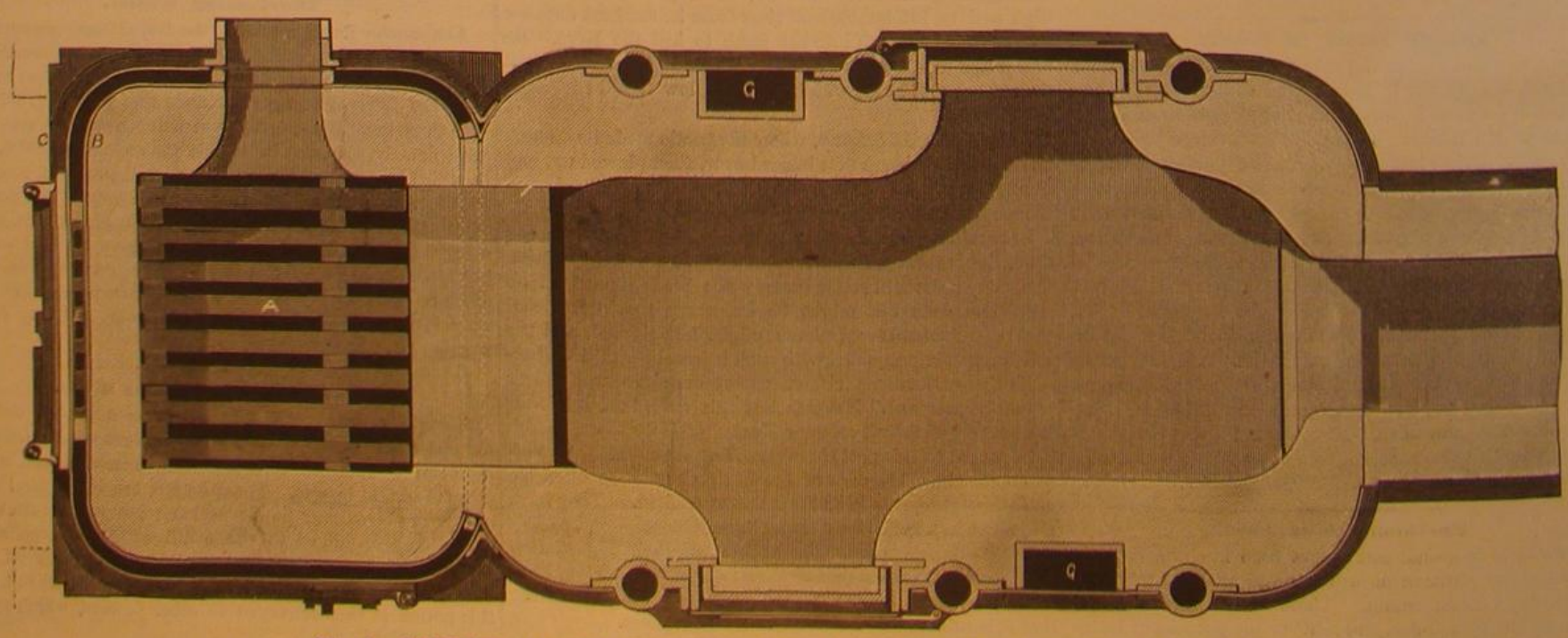


Fig. 4.—CADDICK AND MAYBERRY PUDDLING FURNACE.—SECTIONAL PLAN.

constant; but if chloral hydrate is volatile as such, its vapor will be free from water, and on introducing the salt it will give up water, and the volume of vapor will increase till the dissociation tension is reached. The salt used was potassium oxalate, containing one molecule of water. Troost has found that the volume increases on the addition of the oxalate, leading him therefore to the conclusion that chloral hydrate undergoes volatilization without decomposition.

Curious Phenomena in the Oil Regions.

A correspondent of the *Baltimore American* says that at Titusville, Pa., Senator Anderson's beautiful grounds, on the suburbs of the city, present a splendid sight every clear night during summer. The great attraction is the fact that they are brilliantly illuminated by natural gas from the Newtown Well, about four miles distant. This well yields nothing but gas, and when first opened the roar of the escaping gas could be heard, it is said, for a distance of seven miles. The gas has since been confined so as to be conveyed in pipes to the city and is used extensively for cooking and heating purposes. In the house of Senator Anderson not a stick of wood or lump of coal is used during the year either for cooking or heating. He uses the gas in cooking stoves and in open grates in his parlors, sitting rooms, and chambers. It gives too much smoke to be used for light indoors, and simply takes the place of fuel. There are about twenty standards on the lawns and around the fountain and lake in the Senator's grounds, and one magnificent arch, the innumerable jets from the pipe each throwing out a flame about twelve inches long. There are about twenty standards in all, with about thirty jets, each jet throwing out a fierce flame from twelve to eighteen inches long. The portion of the grounds illuminated is to the extent of about four acres, and is as light as day in every part. The fountain is a magnificent work of art, surmounted by a nymph pouring water from an urn into a goblet, and four swans, each throwing

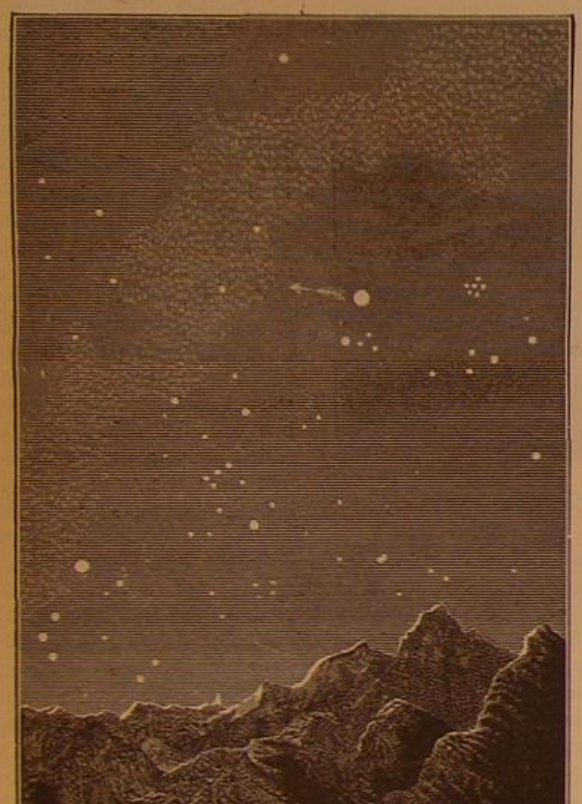


Fig. 1.—VIEW OF THE EARTH FROM MERCURY.

streams into the basin below, while there is a beautiful floral display at the base of the fountain and on the ground surrounding it. The lawn is kept in splendid condition, interspersed with variegated flowers, and the effect of this brilliant illumination may be imagined amid such a scene of floral attractions. The gas is also used for heat in the conservatory, and we are informed by the gardener that the entire cost of the gas used for domestic purposes and illumination of the grounds is but $100 per annum. The force of this gas is so great that recently, in tapping the pipe to put in a service pipe for a dwelling, the particles of iron were forced out with such velocity as to enter the flesh of the plumber's arm. The gas from the Newtown Well is extensively used in Titusville in place of fuel, similar to its use in the mansion of Senator Anderson, and there is some talk of using it for the general lighting of the city.

The *Pittsburgh Despatch* says that situated about four miles southwest of Clintonville, Venango county, is a well which, for volume of production, surpasses anything yet discovered in that county. The well was completed upward of a month ago. No oil was found, but an immense gas vein was encountered at the place where oil was expected. Before abandoning the well the owners resolved to draw out the casing. This was attempted in the usual way, but the casing stuck about a foot above its former resting place. As it was elevated to its present position, the fresh water from the upper part of the hole rushed into the well at the bottom of the casing in great quantity. As it did so, the gas raised it to the surface of the earth after sending it forty feet above the top of the derrick. There it continues to gush, and may for all time. It is estimated that at least twenty thousand barrels of water are thrown out daily. It is truly a remarkable phenomenon.

HOW OUR WORLD LOOKS FROM OTHER WORLDS.

There is no consideration better calculated to exhibit to

Fig. 2.—VIEW OF THE EARTH FROM VENUS.

us how entirely insignificant our earth is as a part of the universe, than that which leads us to realize how our globe would appear to one of its own inhabitants if he could be transported to one after another of the heavenly bodies. The journey of our imaginary celestial traveler need not extend to the fixed stars, for from them the earth is not visible at all. The nearest fixed star is 226,400 times more distant from us than is the sun. Figures convey no idea of this vast interval, for no one can conceive of a trillion, much less of 24 trillions, of miles. A spider thread on that star would blot out the space between sun and earth. Our luminary would appear as a small brilliant dot, our earth, even if it were not lost in the solar effulgence, would be absolutely and mathematically invisible. And this on the nearest fixed star, if we proceeded further into the star depths our sun itself would dwindle smaller and smaller and disappear long before, the stars were reached which now form the limit of our imperfect observations. If any fixed star is inhabited, the inhabitants are not merely ignorant of our earth but of all the other planets of the solar system, all might be swept away by some vast cataclysm and the rest of the universe would be none the wiser.

Restricting ourselves, however, to the planets of the suns family, it is probable that three are more familiar with our

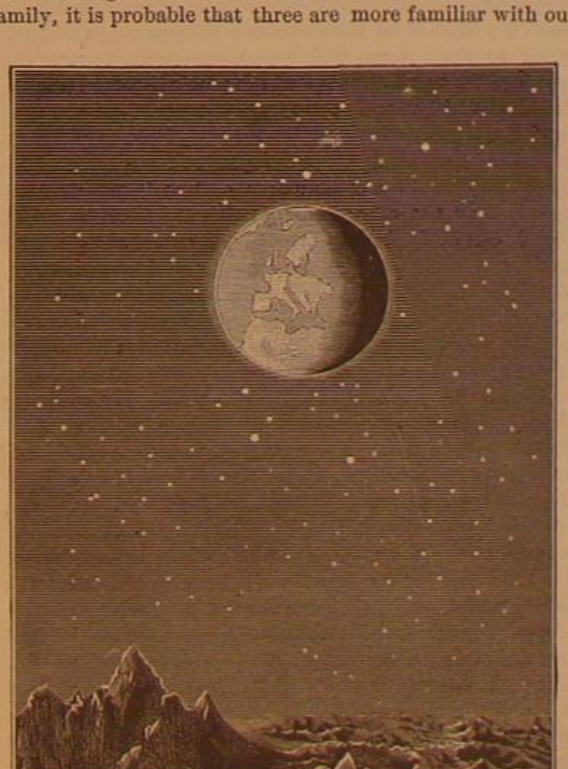


Fig. 3.—VIEW OF THE EARTH FROM THE MOON.

earth's characteristics than we are with theirs, the other three or the people who live on them if we make that violent assumption, probably see no more of us than do the dwellers on the fixed stars. The excursion we have suggested therefore being restricted to the planets, the starting point will be on Mercury, which moves around the sun at an average distance of 42 millions of miles, its year being 88 days and each of its seasons three weeks. Since the earth travels on an exterior orbit to that of Mercury just as Mars and Jupiter move in orbits exterior to our own, the best epoch for its observation from Mercury is when that planet, the earth and the sun are in a right line. Then the earth's side nearest Mercury is illuminated and our globe appears as a large brilliant star moving as shown by the arrow in Fig. 1, from west to east along the zodiac.

From Venus, the earth presents a far more splendid appearance. Every 584 days it approximates most closely to that planet and is only 180 millions of miles distant. Then it appears as a large bluish white and dazzling star, eclipsing in magnitude every other in the firmament, Fig. 2. The arrow again shows the direction of motion.

From the moon, the earth seems a colossal orb. Sun and planets all pass behind it It has phases like the moon itself; and in beautiful accord with the needs of the lunar day (equal to fifteen terrestrial days) the earth is full at midnight, in quadrature at sunrise, Fig. 3, new at noon, and in quadrature at sunset. At full earth, the lunar inhabitant can see the seas and continents, the poles white with snow and the cloud banks floating in the air. A light vapor surrounds the earth which, refracting the light of the millions of stars, make it seem as if our globe were bathed in a pale halo. Probably the view of full earth from the moon when our planet seems fourteen times as large as the sun is one of the grandest celestial spectacles that exist in all the universe.

Continuing our voyage through space, we next reach Mars, 168 millions of miles from the sun. The period when the earth is best visible to the Martial inhabitant is just opposite to the similar period in the cases of Mercury and Venus. Since the earth revolves around the sun in an orbit within

Fig. 4.—VIEW OF THE EARTH FROM MARS.

that of Mars, its greatest proximity to the latter occurs when between Mars, and the sun. But then it turns its shaded hemisphere to Mars and is therefore invisible. It is necessary then to find, before and after this position, situations in which the earth shows to Mars a portion of its hemisphere illuminated by the sun. The further it is separated from Mars, the greater will be the phase, but on the other hand the smaller will be the disk. There is however a moment of maximum brilliancy which occurs near quadrature. Then the earth appears to the Martial eye as a bright star and through a telescope as a large crescent. In fact there is an accurate reproduction of the behavior of Venus as regards the earth. As Venus is our morning and evening star, so are we the morning and evening star to Mars. The Martial inhabitant sees the earth as a larger star than Jupiter appears to us, while the brilliancy is such as to render the earth visible in daytime.

To the inhabitants then of Mercury, Venus, the moon, and Mars, the earth stands chief of the heavenly bodies. To those of Jupiter, however, it becomes suddenly of almost total insignificance. The orbit of Jupiter is 576 millions of miles from the sun. Hence the earth in revolving around the sun never appears further from it than 12 degrees. The earth is therefore not visible during the Jovian night, for there the twilight continues some time after sunset, and when twilight has ended, the earth itself has set. Moreover at the only moments when it might be visible from Jupiter the earth is in quadrature, and only half illuminated, and besides, it is too small to be seen by the naked eye. Astronomers on Jupiter could only discover the existence of the earth by telescopes, and at a suitable epoch, as for instance in the east just before sunrise or in the west just after

sunset, and then only for a few minutes. They would class our globe as an insignificant little satellite of the sun lost in his fiery beams. Happily for our astronomical reputation on Jupiter, there are circumstances when if we are not visible as a brilliant star we may at least be seen. Some Jovian astronomer hunting for sun spots might see a little black dot crossing the solar face, that would be a terrestrial transit, and our earth would be the telescopic speck, which we have attempted to indicate in Fig. 5.

The world of Saturn surrounded by its mysterious rings moves at a distance from the sun nine and a half times greater than that separating the sun and earth; or 1,059 millions of miles. From this magnificent planet our globe is a mere point which swings from one side of the sun to the other, thirty times during the Saturnian year, and never distant from the sun more than 6 degrees. The sun itself seems ten times smaller than it does to us. Fig. 6 is an imaginary view on Saturn (the earth of course is invisible), supposed to be taken at 30° latitude at midnight: the epoch when the sun, fully illuminating the vast rings, causes a brilliant ring light night. The satellites which move around this strange world vary by their motions and rapidly changing phases the marvelous spectacle. The inhabitants of Saturn however know nothing of our earth; and even if by the construction of colossal telescopes they discovered us, they never could tell whether we were an independent orb or were fastened to the sun. The best name they would apply to us would be "minute blemish" on the solar disk. From Uranus, nineteen times the earth's distance from the sun, or 2,130 million of miles, the earth's annual orbit is simply a little circle, of 3 degrees on each side of the sun. The sun itself, nineteen times smaller than it appears to us, transmits to the Uranian inhabitants seventy times less light and heat. Even during its transits the earth is not perceptible to people on that world. From Neptune, most distant planet of our system, three thousand million miles away from the sun, the sun seems a huge star, of diameter thirty times less than that seen by us. Here the earth is absolutely invisible; no conceivable instrument could make it seen. Thus, out of the millions of stars which spangle the heavens, out of the vast infinity of worlds there are only five, at most six, to inhabitants on which, if any there be, the existence of this world of ours can be known.

Fig. 5.—VIEW OF THE EARTH FROM JUPITER.

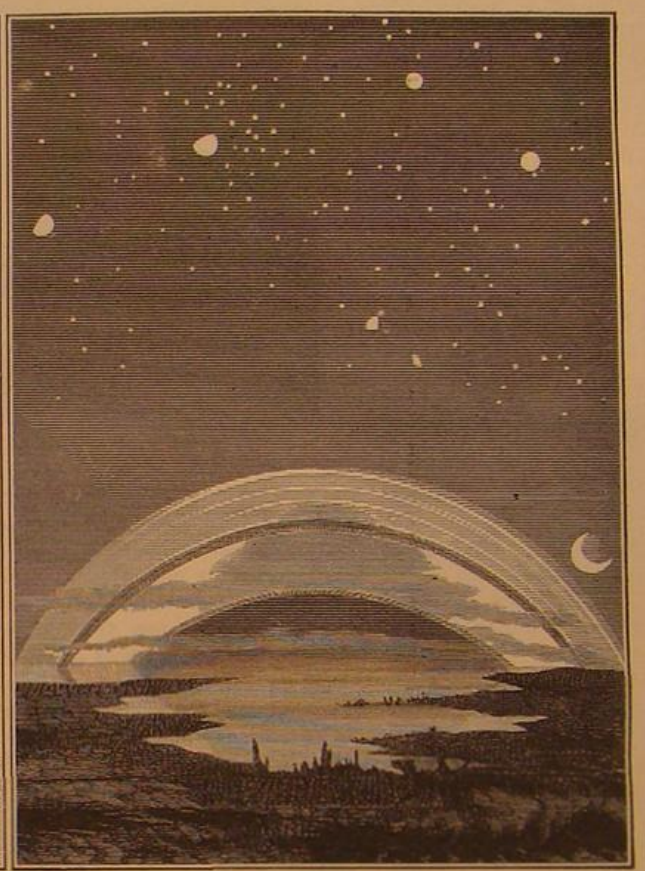


Fig. 6.—VIEW OF THE EARTH FROM SATURN.

Better Times.

The evidences that the hard times have spent their force and that a steady improvement in all branches of business has begun, are now too plainly to be seen on every hand for the most despondent to doubt their existence. The last bugbear of the farmers, the fear that the corn would be ruined by the frost, has now ceased to alarm, as for the most part this crop is too far advanced to be seriously injured, even if cold weather should set in at once, as is not at all probable. As to the harvests generally, they have perhaps never before been equaled; so that the farmers are ensured a good return for their labors, the working masses are afforded food at moderate prices, and the great avenues of transportation are crowded with the eastward flow of the harvests and the return flow of the comforts and luxuries which are sent in exchange. As no small encouragement, we may mention also the fact that our national currency has reached the highest figure it has known—the difference between it and gold having been quoted the other day at less than 3 per cent—so that there is little fear of the terrible results which have been predicted by some in case of specie resumption. One of the very best features of the whole outlook is the fact that the railways have ceased to cut each other's throats, and are all charging reasonably remunerative rates for the immense business which is pouring in upon them. As a consequence, their earnings are showing a marked improvement and afford the cheering hope that the companies will not only be able to pay their employés living wages, but that they will gradually become profitable to their proprietors.—*Railway Age.*

Heat of Combustion of Oxygen and Hydrogen in Closed Vessels.

In a recent number of the *Journal* of the German Chemical Society there are some experiments on the above subject communicated by Than. He has modified Bunsen's ice calorimeter, so as to make it available for heat determinations in chemical action, and by this means he has obtained accurate results of the heat of combustion of electrolytic gases in closed vessels. The terms "heat of combustion," or "total difference of energy," are used by Than to express the quantity of actual energy evolved when the combining gas, in the case of oxygen and hydrogen at 0° and 750 mm., is completely converted in a closed vessel into water. Taking the atom of hydrogen as unity, he finds that a gramme of the atom of hydrogen uniting with the requisite quantity of oxygen in a hydrogen uniting with the requisite quantity of oxygen in a closed vessel to form water, produces 33·982 units of heat, which number agrees closely with that found by Andrews, namely, 33·970.

What Kills the Russians.

The correspondents of the London papers with the Russian armies all speak of the deadly effect of the Turkish fire. It is sickening to read of the slaughter committed on the brave Muscovites in their hopeless assaults on Plevna and the other strongholds of the Turks. No mortal courage, it would seem, could face the pitiless storm of bullets that sweep the slopes up which the assailants press with an ardor carrying the survivors almost over the ramparts and among the unseen foes, until the bugle sounds their recall. The line of these attacks, say the correspondents, is strewn with dead and dying by hundreds from the edge of the glacis back to the point where the troops first ventured upon the open. The Turkish aim is almost sure for 200 or 300 yards. It is only a question of time when the entire Russian army would be melted away in these fruitless rushes. They have now been abandoned, it is said, and the surer and slower system of investment and reduction will be tried, with what success remains to be seen. It adds to the interest with which Americans regard the Russo-Turkish war to know that the whole Ottoman army is or will be furnished with these terrible weapons of our own manufacture. The rifle used in that army is a breechloader, made by the Providence Tool Company, and called the Peabody-Martini. It is a combination of two inventions, one American and the other Italian, uniting the best points of both. It can be fired by an expert hand nearly at the rate of once a second, and the soldier's capacity for killing is therefore only limited by his dexterity and supply of cartridges, of which Turkey, by the way, has an abundance from an American factory also. The Peabody-Martini rifle may or may not be superior in some respects to other arms of precision. There is no occasion for comparing its excellence with that of the Chassepot or the needle gun, or the Gorloff or Berdan rifle (used by most of the Russian troops). It suffices to know that, in the crucial test of war on the large scale, the American weapon does its appointed work, and keeps the Russians at bay wherever the Turks can get behind a cover in strong force. The possession of 500,000 of these rifles—that number having already been supplied by the American contractors, with 100,000 more to be delivered—used by brave men behind defences may not decide the final issues of the war for the Turks, but will protract the conflict, and make it frightfully costly to the Russians. American arms, and the American style of earthworks, which the Turks have copied, will give the Russians even more trouble than that fanaticism and valor which make the Turks foemen worthy of any nation's steel.—*Journal of Commerce.*

Formation of Sulphuretted Hydrogen by Algæ.

From an investigation of those thermal springs which evolve sulphuretted hydrogen, F. Cohn has come to the conclusion that in these waters vegetable algæ are the cause of this evolution of sulphuretted hydrogen, inasmuch as they reduce the sulphates dissolved in the water, some of the separated sulphur staying in their bodies and some being given out to the waters a sulphuretted hydrogen. Further investigations had shown that a number of other microscopic organisms living in bad water have the power of depositing pure sulphur in the form of little grains or crystals. Last year a visit to the Landeck baths gave Mr. Cohn an opportunity to confirm his previous observations. He found that the basin in which the thermal waters are collected was covered on the bottom and sides with a gelatinous mass, which was formed of algæ and thickly filled with numberless little grains of pure sulphur, which strongly refract the light. This separation of sulphur seems at first glance to be a peculiarity without analogy in the vitality of other plants. Hence it must be prominently stated that all plants really have the power of decomposing the sulphates within their cells and liberating sulphur within themselves. It is an established fact that the roots of all plants take up sulphates (gypsum, sulphate of magnesia, of soda, and of potash) in solution in the soil, and that in experiments of cultivation with artificial liquid fertilizers, sulphates must not be omitted if the plants are to exhibit their normal growth. It is no less firmly established that sulphuric acid is reduced in the interior of the plant in an analogous manner to the reduction of carbonic acid in the green cells. For as the carbon liberated from the carbonic acid in the light at once enters into combination with hydrogen and oxygen to form carbo-hydrates, so the sulphur set free by the decomposition of sulphuric acid in the cells at once combines with carbon, hydrogen, oxygen, and nitrogen, to form molecules of albumen or other protein substances contained in the protoplasma. It seems then as if the only peculiarity of the *beggiatoa* in the sulphur springs, and of many purifactive organisms, consists merely in this, that they are able to decompose a far greater quantity of sulphates in their cells, and produce by the reduction of this sulphuric acid a much greater quantity of sulphur than they are able to chemically combine in their cells, and that, consequently, the excess of sulphur is separated in grains.

It may seem somewhat strange that sulphur and carbon are the only elements which plants are able to liberate from their compounds; but it is probable that the list will not stop here, but be filled up by future investigators of plant physiology. Nitric acid and nitrates are reduced by plants, and the nitrogen absorbed. Of the mineral acids these three, carbonic, sulphuric and nitric, are the only abundant ones readily decomposable. Silicic acid is taken up by the plant either as silica or silicates, but silicon is never separated by the plant from its oxygen. It would be interesting to test the power of plants to reduce various other natural and artificial compounds.

Influence of Gaslight upon the Eyes.

The verdict of a scientific deputation for medical purposes has been presented to the Prussian Minister of Education. *Lithographia* extracts the following, which refers to living and study rooms, but is equally applicable to printing offices, factories, etc.:

"According to the previous experiences of oculists no injurious effects of gaslight upon the eyes of pupils has been observed, when it has been used properly, and especially where arrangements are present to protect the eyes from the direct influence of the bright flame. In general, shades and globes serve for this purpose. The dark, totally opaque tin shades are, however, very injurious, and all complaints against the use of gaslight are referable almost universally to these improper contrivances. With these, the eye stays in total darkness, but looks upon a brightly illuminated surface, so that a dazzling and over-irritation or superexcitement of the eye result, with all their attendant injurious results. Very suitable are the globes of milk glass, which diffuse the light more, and the eye is not injuriously affected. Experience shows that more heat is generated by gaslight, hence the gas flames must not be brought too near the head, because the radiant heat which it sends out might cause headache and congestion of the brain. Where several persons are using the same flame, the source of light has to be higher up, so that the unpleasant effect of the radiant heat disappears, especially if the so-called "plate" illumination is used, which consists of a large funnel-shaped globe of milk glass closed beneath by a plate, whereby the descending rays suffer a proper diffusion and loss of intensity, and at the same time the flickering of the flame by breaths of air is avoided and a more steady and quiet source of light is secured. Under special circumstances, where the eyes are particularly sensitive, chimneys of a blackish blue color may be employed. Under such precautions an injurious effect of gaslight upon the eyes is not to be feared in the least.

Communications.

Our Washington Correspondence.

To the Editor of the Scientific American:

The business of the Patent Office is taking its usual course notwithstanding the fire, as the following issues, being those for the past week, will show: patents, 217; reissues, 8; designs, 5; trademarks, 40; labels, 9. If any of your readers are delaying making application for fear they will have to wait, they need do so no longer on that account, but should forward their applications at once, as, owing to other inventors' postponement of their cases, those who apply now will have the best chance, and will not have to wait so long as if they delay until the reaction takes place.

Our Consul General at Berlin has communicated further particulars concerning the American department at the International Leather Exhibition in that city, from which it appears that the highest premium, a gold medal, was awarded to the American firm of Larabee & Co., for their collective exhibit of boot and shoe machinery. Several other American firms received diplomas and honorable mention for machinery and leather exhibits. It is believed that the American hemlock-tanned leather will meet with a large market in Germany; for although greater strength and durability are claimed for the home-made, salt-tanned article, the cheapness of the former will prove a decided advantage in selling. The consul also reports on our general trade with Germany, and states that the most urgent requirement to increase it is that the wants and peculiarities of the German markets should be studied, which he thinks can be most readily accomplished by resident agencies. The superiority of most articles of our manufacture exhibited there is fully acknowledged, but in many cases they are kept for show in the windows, and exorbitant prices asked, thus precluding their sale. With all drawbacks our trade with Germany is steadily on the increase, our exports thereto amounting to $277,000,000 during the last five years, being nearly $50,000,000 more than our imports during the same period. The exports of our manufacturers have increased in the ratio of four to one since 1872, and the Consul General says that by proper efforts a much greater ratio of increase may be accomplished hereafter.

In response to the request of a body composed of the leading merchants and manufacturers of Philadelphia and styled the Associated Industries of the United States, Postmaster General Key has issued a letter of credence to Mr. J. W. Fralick of Philadelphia, who is about to travel in the adjacent South American States with the object of increasing our postal facilities with those countries in order that our trade with them may be extended in a manner which the present limited and uncertain means now forbid. In an interview relating to the same matter which was had with the Secretary of State, it was shown that the Brazilian markets open up a large demand for a number of American manufactured articles, but that owing to the absence of proper facilities the trade is carried on through English houses who buy their goods here and ship them to Brazil, making from ten to fifty per cent on their own account, which advantage might be in the hands of American merchants if our postal and freighting facilities with those countries were as good as are those of the English. Secretary Evarts stated that he believed it to be the imperative duty of this government to do all it can to advance the commercial and manufacturing interests of the country by a more liberal policy regarding our foreign trade, and that this could only be accomplished by the establishment of ocean postal routes under the auspices and fostering care of the government. It has been ascertained that there are now building four iron steamships which are designed for a line between New York and Rio Janeiro, and by the establishment of this line all our manufacturing and commercial centers will be much benefited. For the more certain establishment of proper facilities for trade, the secretary thinks we should have a system of judiciously subsidized postal lines, particularly with those foreign ports which have a demand for American manufactures and products, and is disposed to exercise the influence of his department in their favor.

Postmaster General Key has received a communication from the English Post Office Department stating that it has been found necessary to take precautions against the admission of the potato bug into the United Kingdom through the mails, as several live specimens of this insect had been discovered in mails received from the United States, either surreptitiously inclosed in newspapers or forwarded as specimens. It is feared that, notwithstanding the utmost vigilance on the part of the British authorities, many newspapers and packages containing these insects pass without detection and therefore the friendly co-operation of our postal department is requested in putting a stop to the reprehensible practice of sending these insects in mail matter to Great Britain, whereby the potato crop of the kingdom may be endangered.

Among the documents recently received by the State Department is the first annual report of the Sappora Agricultural College, situated in the city of that name in the province of Nokkaida, Japan. This college was only opened in August, 1876, and now we have the first report, a pamphlet of 148 pages, printed on beautifully tinted paper, with clear type, and giving in tersest English information that bears the most incontestible proofs of the success of the undertaking, and of the practical spirit in which Japan proposes to educate the rising generation of agriculturists, combining all that is good in the old world with all that is best in the new. From it we learn that the college farm contains 250 acres, from which fine crops of a large variety of farm produce were raised; and that the college building contains a library (having a large collection of books in the English language), lecture rooms, chemical laboratory, dormitories, etc. Professor Clark, an American, was appointed director of the college for one year, and much of the credit of the success of the institution is acknowledged by the Japanese to be due to him. All of the farm utensils, machines, most of the seeds, etc., were purchased in the United States, and the surveys, draining, and planting were carried out under the direction of Professor Wheeler.

Since the burning of the model halls of the Patent Office a commission was appointed to examine the various public and other buildings where the Government papers and records are kept. The report of the commission has just been published, from which it appears that the new State Department, the Shepherd and Coast Survey buildings are as nearly fireproof as a building filled with records can well be. Two old wings of the Capitol adjoining the Congressional library are very defective, and have much woodwork under the roof. The War Department records are stored in many buildings which are, in most cases, complete tinderboxes, ready to blaze up from the smallest spark. The Treasury records are in a large degree exposed. Part of the Post Office Department roof is supported on wooden rafters. The National Medical Museum, supposed to contain the finest surgical collection and most extensive medical library in the world, is under a wooden roof and cornice. The Agricultural Department, with its museum, is also unsafe. In fact nearly all the archives of the Government are in constant danger of fire, and an unlucky spark may some time destroy a collection of records that will expose the government to the probability of having to pay many millions of dollars of fraudulent claims that would never have been brought forward had such records not been destroyed.

The United States steamer Guard is about to sail under the command of Lieutenant Commander F. M. Green, on an expedition to Lisbon, Cape De Verde Islands, and across the Atlantic to the coast of Brazil, for the purpose of establishing the longitude of the various places by means of the telegraph. The several cable companies along the route have offered to the Navy Department the gratuitous use of their cables for this undertaking in the interest of commerce and navigation. The Guard will be absent about a year and a half, and the work of the scientific corps on board is looked for with the greatest interest, as the correction of a vast number of charts depends upon the results of the expedition.

Washington, D. C. OCCASIONAL.

The American Middlings Purifier Company.

To the Editor of the Scientific American:

We are accustomed to being traduced by millers' journals catering to suit the taste of their customers, and regarding nothing but their subscription lists; but when we read in your journal the same charges, we are moved to ask your permission to reply to some of them. The original patents of Wm. F. Cochrane were issued, one for an improved process, and four for mechanical improvements. Some of them required to be reissued, generally because subsequent investigation showed that the originals were too broad in their claims. The process patent, however, required reconstruction; and when I tell you that the application was examined by the late lamented Nolan, than whom no abler or purer man has ever ornamented the examining corps of the Patent Office, you will be prepared to believe that these reissues probably rest on a safe foundation, and will at least require *some* proof of fraud; but except in the columns of newspapers and milling journals, nothing has been presented on this head.

Having obtained the reissues, we sued one of the largest milling firms in the United States. The case went through the courts the more rapidly because we had selected parties owning patents claimed to cover the same subject matter, who had made a good deal of money out of their patents, and were as anxious to get through with the case as we were, and all the more that they supposed they were going to beat us easily, as in fact they did in the lower court. Judge Miller said, in his decision in St. Paul, that the case was considered with unusual care in the Supreme Court, and the patents were fully sustained. Now they talk of collusion and threaten to have an examination, but though the Supreme Court is in session they don't move in the matter. We are ready and anxious to meet them, and would bring on the question ourselves, if we could, for the charge is without foundation; but they prefer to raise a clamor, and so encourage their members to stand by their association. Twice they have made the charge in the Circuit Court, and in both instances entirely failed to prove it. Have we not a right to ask you not to take the truth of this charge for granted?

Then they say the invention is old. That is fair ground for defense; but why yell fraud, and hurl all sorts of names at us, because, in the absence of any proof whatever to the contrary, we insist that our patent shall be accepted as valid. It is for them to overthrow it, and they have utterly failed; the patent stands, and up to date has never been shaken; why then do you talk of the patent ring trying to impose a fraud on these innocents?

Call a thing an evil name and all evil is at once accredited to it. How are we a ring? The company is a unit; it has a moderate capital *of only* fifty thousand dollars, and, all told, nine stockholders. Are you really afraid that we are going to override an association of millers representing five thousand mills and at least fifty millions of capital? The danger is to us, not them. Nothing but a cause most just can sustain us against such a combination; and why should we be abused because we have manfully stood up for what we believe to be the right against such enormous odds? What has become of the American sense of fair play? Our cause is in many points that of the whole body of inventors. These associations are formed, in the language of the Minnesota Association, to oppose, by their joint capital and influence, claims made against *any* miller by *any* person on *any* patent. Right or wrong, just or unjust, they claim the privilege of taking any person's patent, and the unfortunate patentee must prepare to fight the combined capital of all the millers. How many, with a cause however righteous, can sustain themselves against such a force? They can break down almost any one by the simple multiplication of expenses, which they can sustain because the amount divided among so many will be small for each; but the plaintiff must bear all the burden unassisted. There is a community of interest among patentees, which entitle us to some sympathy from them at least. We have tried to conduct ourselves squarely in this matter. We have not sued poor men, have struck at the strongest, have made our case, met theirs, and have tried to bear success without exaltation, or defeat without depression. We have beaten them upon every question of law which has ever yet been raised, and on every issue of fact, except in the last trial in St. Louis, when, by reason of our difficulty of obtaining witnesses, they were enabled to outswear us; and even then the court allowed us an order to inspect the mills, which we did, to find that they had succeeded by denying what we found to be the truth; but it was too late to get advantage of it, for one judge had gone and the other was going in a few days, and could not turn aside from the law cases then being tried with a jury in attendance to resume the chancery docket.

Now, having failed at every turn in the courts, they are circulating petitions that Congress shall interfere; and at this point your readers have a very genuine interest in the matter, for they can only hurt us by modifying the rules of recovery applicable to any other patent. It means that we are to have an attempt, backed by most formidable interests and untold money, to obtain legalization of the right of any man to confiscate other people's patents; and if at the end of long and expensive litigation they are held to account, it shall never be more than an ordinary license fee, say a few cents or a few dollars. This is what this appeal to Congress means; they can only strike us by striking at the system.

If we were so minded, we could tell things of the management of these cases for the association which would disgrace those implicated; but we do not care to try our case to the public. We are willing to stand or fall in the courts, and only ask of the public that it will await the development of the trials. If we should perchance fail, it is no new fate, and we will try to be patient; but if we should succeed, as we expect to, we ask the public not to believe that this one little company, with hardly capital enough to run an ordinary grist mill, has trodden under foot, crushed and cruelly oppressed these five thousand innocents, who have simply been trying, and heretofore successfully, to enrich themselves by the use of our property. Are your readers, of all the people on earth, the ones to turn against us in such a contest? Yours respectfully,

The American Middlings Purifier Company.

Washington, D. C., Oct. 13, 1877.

A Rich Silver Mine.

We have recently examined some remarkable specimens of silver ore from the mine of Todos Santos, near Batopilas, Chihuahua, Mexico, which is now being worked by Messrs. Mitchell, Ford & Co. This mine forms one of probably fifty which exist within a radius of five miles around the vicinity. It has been known some twenty years, but was abandoned and re-opened in 1875, since which time it has yielded some $75,000 worth of ore. At present, however, the ore extracted is of astonishing richness, yielding 12 ounces of silver to the pound, and in some cases a hard dollar to every ounce. The specimens exhibited to us were nearly solid silver, nodules and filaments of the metal being interspersed so thickly with the pure white quartz. The mine is situated nearly opposite that of the Batopilas Silver Mining Company, across the Batopilas river, and in the Sierra Madre Mountains at some 1,600 feet elevation, or 2,500 feet above the level of the Gulf of California, from which it is distant about 250 miles. Owing to the almost total absence of machinery—absent because of the inaccessibility of the locality—ore yielding as high as $200 to the ton is thrown aside as non-paying. The rich ore after treatment in the rude adobe furnaces of the country gives silver 993 fine. It is run into bars worth about $1,000 and $1,200 a piece. The cost of transportation of ore to New York is 12½ per cent, inclusive of the 5 per cent Government duty.

THE Cunard Company are constructing a new steamer to run between New York and Liverpool—the Gallia—of 5,000 tons, which will be built on a plan they intend to use on all new transatlantic liners—namely, the carrying of several watertight bulkheads to a deck 5 feet or 6 feet above water line. The Gallia will have seven of these bulk-heads, and will consequently be divided into eight watertight sections. It is to be hoped that the bulk heads will be found really watertight if the emergency should arise.

Test for the Presence of Gold in Solutions.

Protosulphate of iron gives a brown precipitate, which acquires a metallic luster when rubbed. Proto-chloride of tin gives a purple or blackish precipitate, insoluble in muriatic acid. Sulphuretted hydrogen and hydrosulphuret of ammonia give a black precipitate, insoluble in simple acids. Ammonia gives a reddish-yellow precipitate (fulminating gold) with tolerably concentrated solutions, either at once, or on boiling the liquid. Liquor of potassa gives, with neutral solutions of gold, a similar precipitate to that formed by ammonia, insoluble in excess.

AN ANCIENT HAND WARMER.

Our illustration represents a curious old article of comfort, which is almost forgotten now-a-days, but which once formed one of the many objects carried by ladies at their chatelaines. It is a hand-warmer, and consists of a small

spirit lamp hung in gimbals in several circles of metal, so that it stands always horizontal. It is enclosed in two hemispheres of copper, which are hinged together. The contrivance was clasped between the palms of the hands, and thus kept the latter warm.

IMPROVED SELF-FEEDING DRILL.

The annexed engraving represents a new self-feeding drill for boring iron, steel, etc. The feed is adapted for all classes of work and all sizes of drills, and therefore needs no adjustment. A is the drill shaft, having at its upper end the flywheel, B. This shaft is rotated by the bevel gearing shown, which is revolved by hand by means of the crank. On the bevel pinion is a feather which enters a keyway on the shaft, A, so that although said shaft is turned by the pinion it can be moved vertically within the latter. To the upper part of the shaft are attached collars, and between them is a sleeve which is secured for vertical movement upon the shaft by means of the collars, and prevented from revolving with it by the set screws which attach it to the beam, C. It will be observed that the shaft, A, is free to move vertically within certain limits, and that its vertical position is regulated by the beam, C, which is attached to the shaft by the sleeve above referred to. The short end of the beam is connected by a link to the frame. The long arm is notched so that the weight may be adjusted upon it to cause more or less downward pressure on the shaft. This beam is operated by means of a lever, D, the short arm of which is cogged and engages with the cogs of the bell crank shown, which latter is connected to the beam by means of clevises. By raising the lever, the long arm of the beam is depressed, and consequently also the drill shaft. In order to limit the motion of the beam and through it of the shaft, an adjustable stop, E, is provided which may be secured in any desired position. The table is likewise adjustable, and is placed as desired by means of the dog, F, which engages with a rack upon the standard.

The machine is strongly constructed and is in all particulars a very excellent and useful tool, especially adapted to the needs of the general machinist. For further particulars address the manufacturers, Messrs. Combs & Bawden, Freehold, N. J.

The Atmosphere of Mars.

Mr. R. S. Newall, F.R.S., at the observatory, Gateshead, England, states that on August 23, during the total eclipse of the moon, he observed that Mars is surrounded by a whitish envelope, the diameter being about twenty times that of the planet. He saw it again on September 7 and 19 distinctly. It has a well-defined edge, and is densest nearest to Mars. Small stars were seen through it.

A New Dyestuff.

Not long since a new dyestuff made its appearance in the German market, which consisted of a slightly crystalline powder of a light red color, similar to mercuric iodide. According to Professor A. W. Hofmann's experiments it is the soda salt of an organic acid, mixed with a not inconsiderable quantity of alumina. It dissolves quite abundantly in hot water, less so in hot alcohol, with a deep brownish-red color; the solutions, which dye a beautiful orange inclined to red, crystallize on cooling. The salt is insoluble in ether. The salt will endure quite a high temperature without decomposition. At a high heat it swells up almost like Pharaoh's serpents, and leaves behind almost exclusively a mass of carbon, which burns only with very great difficulty.

In order to obtain the acid the commercial product was dissolved in boiling alcohol and the solution treated with concentrated hydrochloric acid. From the deep violet-colored liquid there separated on cooling fine hair-like red needles, to which some of the mineral substance adhered most tenaciously. By frequently repeated crystallization from alcohol and acid the last trace of incombustible matter was at length removed.

The pure dye consists of beautiful reddish-brown needles, which are quite soluble in water, still more so in alcohol, but insoluble in ether. Free alkalies as well as ammonia dissolve it with a brown color. From the last named solution the dye is precipitated in a crystalline form upon the addition of an acid. In this case the liquid acquires a deep violet color. The composition of the dyestuff dried at 100° C. corresponds to the formula $C_{16}H_{12}N_2SO_4$, and that of the silver salt to $C_{16}H_{11}AgN_2SO_4$.

Such a substance could be obtained by the union of 1 molecule of naphtolsulfo acid with 1 molecule of diazobenzol:

$$C_{10}H_8SO_4 + C_2H_4N_2 = C_{16}H_{12}N_2SO_4.$$

In fact the new orange was obtained by the action of diazobenzol upon alphanaphtolsulfo acid. The last named acid was prepared by digesting naphtol with sulphuric acid upon the water bath. The lead salt was first prepared and the lead then removed with sulphydric acid, and the solution of the free acid concentrated and saturated with sodic carbonate. When the solution of this salt was mixed with a solution of aniline nitrate and potassium nitrite, a deep red precipitate was at once formed, of remarkable coloring power, but still impure. It was dissolved in ammonia, when a resinous mass remained undissolved. A purer substance was precipitated by acids; and after re-crystallizing several times from a boiling mixture of hydrochloric acid and alcohol, it was obtained in the same fine hair-like needles which were obtained from the commercial product.

Underground Telegraph Wires in England.

A considerable mileage of overground telegraph in the United Kingdom has been replaced by underground wires during the past year. At the time of the transfer of the telegraphs to the Post Office the total length of underground wire in existence was a trifle under 2,000 miles. On the 31st of March last it had been increased to a trifle over 8,000 miles, being more than four times as much in 1877 as in 1870. A considerable proportion of the increase in the mileage of buried telegraphs during the year has been in London alone. The aerial system was fraught with danger to life and property in the neighborhood of the wires. Under the new arrangement the telegraphic system generally will be less liable to interruption when the frosts and snows of winter set in.

A NEW FLOATING OIL BURNER.

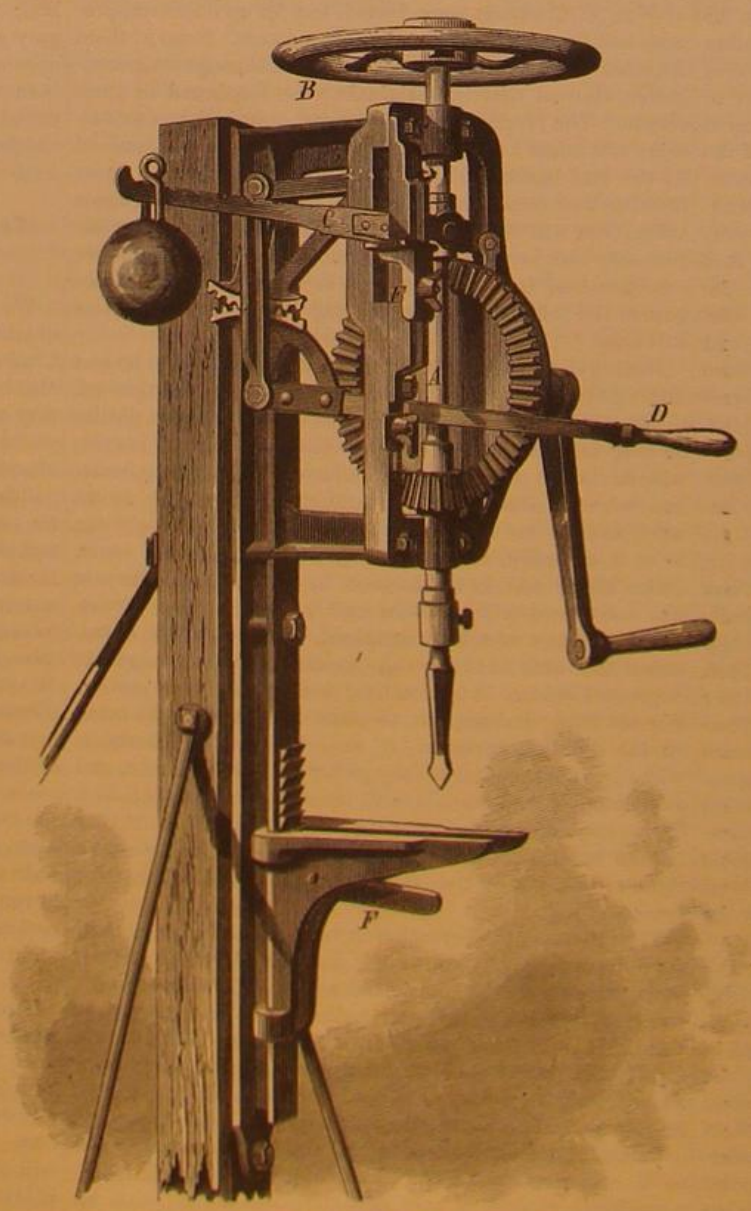
The annexed engraving represents a new floating oil burner for night or other lights in which a long wick may be used. It consists of a cup-shaped float, having a convex top. A tube passes through the float, extending both above and below it. The lower end of the said tube is loaded to

maintain it in a vertical position. A slot is cut in the side of the wick tube, near its upper end, to receive the edge of a serrated wheel, by which the wick is raised or lowered. A curved handle is attached to the top of the flat, for convenience in handling the burner. A ball is placed in the float which may be shifted so as to counterbalance the heavier side and cause the float to set evenly in the oil in which it is placed. The float is airtight and formed of thin sheet metal, and hence does not become oil-soaked.

This invention was patented through the Scientific American Patent Agency, September 18, 1877, by Mr. Oscar Tamagno, of New York city.

Mountain and Balloon Ascents.

In our number for August 9, we briefly noticed the ascent made by Mons. Wiener, of the mountain Illimani, one of the highest—if not the highest—of the Bolivian Andes, which forms a noble object from the city of La Paz, and was formerly reputed (by Mr. Pentland) to have an altitude of no less than 24,200 feet. Mr. Wiener, however, makes its height only 20,112 feet, while Mr. Minchin, as we have already observed, places its altitude at 21,224 feet. If the latter estimate be correct, Mons. Wiener has, we believe, not only made the highest ascent which has been made in the Andes, but has attained a greater altitude than has has been reached *on* the earth out of Asia, and in Asia has only been beaten by Mr. Johnson, who some years ago got to a height of 22,300 feet in Cashmere. As the recorded ascents to the height of 21,000 feet are extremely few, we shall be glad to hear further particulars respecting Mons. Wiener's exploit, and more especially whether he experienced much exhaustion through the rarefaction of the air. Practised mountaineers who have climbed to a height of 17,000 to 18,000 feet have been of opinion that even at such altitudes there is a very important and perceptible diminution of the bodily powers, and think it probable that the height of 25,000 or 26,000 feet will be found to be about the limit which will ever be reached on foot. As a set-off to this opinion we may mention the facts that hunters in the Himalayas frequently pursue their game at heights exceeding 20,000 feet without experiencing any notable inconvenience from the low barometric pressure; and that natives living on the base of Demavend, near Teheran, often ascend to its summit to gather sulphur from its crater without any great difficulty. The height of this mountain, there is reason to believe, also exceeds 20,000 feet, although it has never been accurately determined. If, therefore, severe work can be done with impunity at such elevations, it seems not unreasonable to suppose that much greater heights might be attained by men who had previously accustomed themselves to life at high altitudes. Aeronauts, anyhow, have



SELF-FEEDING DRILL.

proved that life can exist at 30,000 feet above the level of the sea, and that at 25,000 feet, and upwards, one may positively be comfortable if sufficiently warmly clad. That such is the case is sufficiently remarkable, for "travelers in the air" have to sustain incomparably more rapid variations of pressure and temperature than mountain climbers. Mr. Glaisher, on his memorable ascent on September 5, 1862, left the earth at 1 P.M., and in less than an hour shot up to a height of 30,000 feet. At starting the temperature of the air was 59°, and at its greatest altitude it was 61° lower! Mountaineers experience no such extreme variations as these. They rarely ascend more rapidly than 1,000 feet per hour, never so much as 15,000 feet in a day, and become to some extent acclimatized as they progress upwards. On the whole we are inclined to think that man will not rest until he has at least attempted to reach the loftiest summits on the earth, though we will venture to assert that it will be long before any one crushes down the snow on the summit of Mount Everest.—*Nature.*

Some Experiments with Diamonds.

It is not everyone who has an opportunity to conduct a series of experiments upon diamonds of various kinds, and we hope our readers will be interested in the results of Von Baumhauer.

Diamonds are not found exclusively in the form of more or less perfect, colorless or slightly colored, crystals. In washing diamondiferous sand there are frequently found rounded, and sometimes angular, masses, which are brilliant black on the surface, but when broken are dull and of a gray or violet color. These are known in the trade under the name of "carbonado," or "carbons."Under the magnifying glass they exhibit a great number of pores, and, if heated in water, give off a great many air bubbles. Although these carbons differ greatly from the real crystallized diamonds, yet E. H.Von Baumhauer found by examining a large number of carbons and diamonds, that there is an unbroken series of intermediate conditions between the carbon and diamond. It is remarkable that the carbon, which frequently accompanies the diamond in Brazil, has not been found in the diamond fields at the Cape.

Besides these two modifications of the diamond there is still a third, which is known to the dealers in stones as "bord." They consist of translucent, but not transparent, colorless or grayish spheroids, from which small octahedra can be split out, which are much harder than the well crystallized diamond, but are inferior to the "carbon" in this respect. Von Baumhauer determined the specific gravity of 17 different varieties, and his table of results shows that the highest specific gravity of 3·5225 to 3·5197 belongs to the purest diamond, that the "bord" comes next, being not much over 3·50, while the carbon has a considerably lower specific gravity, 3·3493 to 3·1552, probably because it is porous. The colorless diamond can be heated to a white heat in dry hydrogen gas, by excluding the air, without showing any change. Colored diamonds, on the contrary, change their color when ignited; a dirty green became pale yellow, a dark green turned to violet, the brown diamonds lost the greater part of their color, while the yellow remained unchanged. A colorless diamond acquired an intense rose color in consequence of being heated, and retained the color a long time in the dark, but soon lost it in the light.

If diamonds are heated by access of air, they become dull and opaque on the surface, they burn with loss of weight, but retain their transparency within. In oxygen the diamond comes to a lively glow, and burns with dazzling light long before the platinum crucible gets red hot. Small diamonds burn completely up after the lamp has been removed from under the crucible, while in larger ones the heat of combustion is not sufficient to support any farther combustion.

Although Von Baumhauer repeated these experiments several times, he never saw anything more than a quiet burning with dullness and cloudiness of the surface; a sight of blackening, conversion into coke, change of its state of aggregation, swelling up, fusion or softening, rounding of the corners or edges, was never vouchsafed to him.

By combustion of the diamond, it is perfectly established that the diamond is surrounded by a small flame whose exterior color is a bluish violet. When heated in superheated steam the diamond does not change at all, even for 10 minutes. The temperature employed was, however, only a moderate one. Heated to whiteness in an atmosphere of dry carbonic acid, the diamond became dull on the surface and lost in weight; hence it must have decomposed the carbonic acid and united with its oxygen.

[It is very rare that an element is able to drive out another atom of its own kind from a compound and take its place. The atomic condition of carbon in the diamond seems to differ from that in its compounds from its greater condensation, but it has not hitherto been considered to be in a very active state. Is the diamond perhaps when highly heated a kind of ozone carbon?—TRANSLATOR.]

Deep Mining.

Connection has been made between the Gould and Curry mine on the 1,900 level and the joint winze on the Savage line. This gives a fine circulation of air at that depth, the draft being southward through the Curry and up through the joint winze. It is a very important connection, as it opens up in the Curry mine for cross-cutting and prospecting 460 feet of new ground. Before this connection was made the drift was fearfully hot, the heat at the face being 126° Fah.

The benefit derived from such a connection is not instantaneous; on the contrary, when the opening is first made the miners get out of the place as soon as possible, as the heat and smell are such as to be unendurable, and frequently produce asphyxiation. It is the same air that the men breathe before an opening is made, but when it is set in rapid motion it appears to acquire some new and noxious quality. But for this the miners might drill ahead a great number of feet when drifts are being run to make such connections. A drill hole so run, however, would so sicken the men that they would be unable to work. When a connection is made it is desirable, therefore, to knock out as large a hole as possible with the last blast, then let the men employed retire for some hours until the foul air shall have passed out of the drift and level.—*Virginia City (Nev.) Enterprise, October 9.*

THE RAMIE PLANT AND ITS UTILIZATION.

In our editorial columns will be found the particulars of the recent offer by the British Government of large rewards to the successful inventors of a machine capable of preparing the fiber of the ramie plant for textile uses. In the following article we propose to explain what the plant is, and to summarize what has hitherto been done towards its utilization.

Ramie is the Indian name for the plant producing the fiber called China grass. It belongs to the *urticaceæ*, or nettle family, and is nearly related to the true nettles. It is found either in a wild or cultivated state throughout the greater part of tropical and eastern Asia. In 1867 it was introduced into this country from Mexico, and its cultivation has since been carried on chiefly in Louisiana, with but partial success. The plant itself is perennial and somewhat shrubby, growing to a height of about four feet. Its character is well shown in the annexed engraving, Fig. 1. Numerous stems, each about as thick as a man's little finger, bear opposite pointed serrate leaves, each 6 inches long by 4 inches broad, on long hairy petioles. There are two principal types of the plant bearing the specific names *nivea* and *tenacissima*; both are utilizable, but the latter is much the better for industrial purposes. The first has leaves green on one side and silvery on the other, and yields a fiber which is greenish, stiff, and brittle. The other is the true ramie, or East Indian rhea, and it is for the utilization of this variety that the reward is offered. The useful portion is the fiber of the inner bark, which must be bleached and picked apart into threads. The Chinese have for centuries accomplished this by hand, skinning the stalk and cleaning off the outer bark with a knife. This is exceedingly slow, as one man can produce but from one to two pounds per day of marketable raw product, which should be in the form of clear ribbons of a light yellow color. This is ungummed and bleached, dressed, and combed smoothly, and becomes a strong and brilliant staple now used for the manufacture of "Japan silk," "Canton goods," "grass cloth," "Nankin linen," and similar goods.

Fig. 1.—THE RAMIE PLANT.

The nature of this fiber has been microscopically and otherwise investigated by Dr. Ozanam with the following results. Under a magnifying power of 80 diameters he finds: (1.) The fiber of ramie is, so to speak, of any length, as it has been traced throughout a length of nearly 10 inches on the field of the microscope, without any break being found in it, whether it be constituted of a continuous cellula, or whether the different cellulas which succeed each other have lost their points of separation by reason of a more intimate fusion, one with the other. Hence the ramie fiber possesses great strength. (2.) Taking the ramie fiber as a unit in comparison with other fibers, the following relative results were obtained:

	Thickness.	Traction.	Elasticity.	Twist.
Ramie	1	1	1	1
Flax.....	½	½	½	½
Hemp	½	½	½	½
Cotton....	½	½	½	½
Silk.. ...	½	½	4	6

Thus the fiber of the ramie is longer and more uniform than all the others, except that of silk. It is stronger, offers greater resistance to traction and to torsion, and is more elastic than hemp or flax, and even than cotton, which is more flexible in twisting. Ramie in these respects only yields the palm to silk. To these advantages are to be added the sparkling whiteness and brilliant luster of the fiber, the easy cultivation of the plant, and its rapid reproduction and excessive multiplication. It yields three crops yearly and as many as 500 pounds of fiber to the acre. This last varies with the density of growth, a plantation with regular thick stands producing the above maximum. A mowing machine with thick short blades suffices to gather the plants, which are gathered in sheaves like wheat and are left in stacks. After a few days the leaves wither and fall under the handling and shaking they undergo while they are being carried to the machine. The plant should be cut from eight to fifteen days, according as the weather is dry or damp, before it is decorticated.

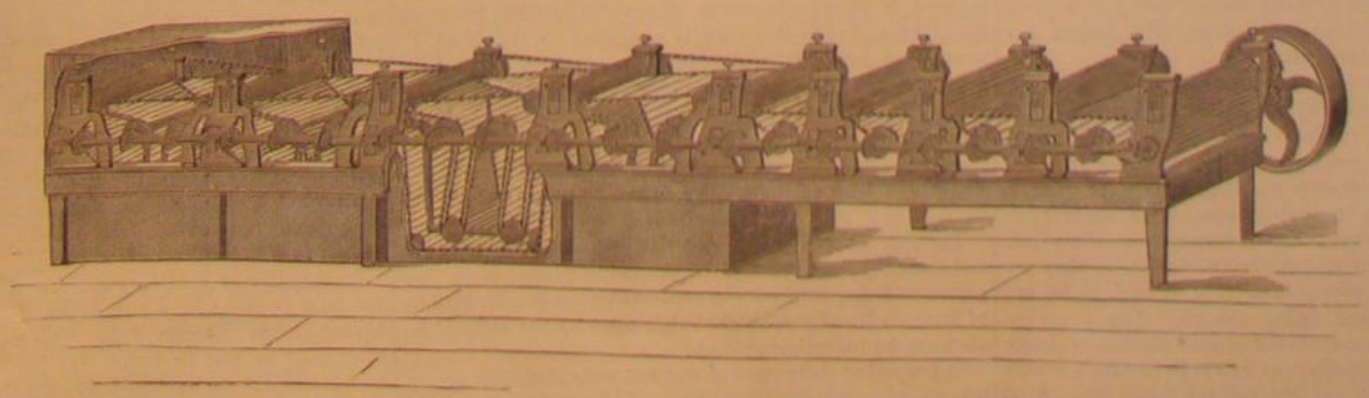


Fig. 2.—COLEMAN'S MACHINE FOR PREPARING RAMIE.

Persons familiar with the treatment of textiles know the impossibility of cleaning thoroughly any fiber, dried or green, by the continuous action of machinery. Either with drums or beaters the cleaning instruments cannot turn out the filaments without a certain amount of chaff and other refuse entangled in the fiber. All ex

periments on this point have failed and proved the insuperable difficulty of expelling, by continuity of friction, all the particles of pith that have penetrated into the fiber. It is only through a scraping process, acting in a backward and forward direction, that a perfect cleaning can be obtained.

In a pamphlet entitled "The Culture and Manufacture of Ramie and Jute," Mr. Emile Lefranc, who has extensively studied into this subject, states that the true principle to be adhered to in a ramie-cleaning machine is as follows: "Revolving cleaners, provided with a peculiar sort of knives, receive gradually, by means of a circular carrier, bunches of stems, which are doubled down and hooked in the middle. The carrier withdraws them from the rotary action of the cleaners and delivers them in the form of clear yellow ribbons." The yield of the machine will be in proportion to its size and power. The cleaning is incessant if the machine

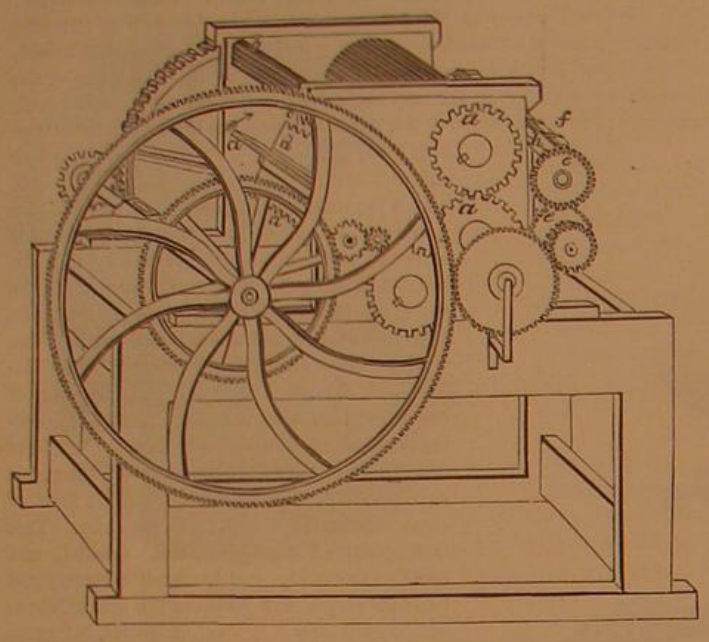


Fig. 3.—LEFRANC AND NAGOUA'S MACHINE.

is fed constantly by a quick handling. This principle, the same authority goes on to explain, offers the facility of such an expansion that the apparatus can be made large enough to clean one ton of fiber per day with a twenty horse motive power. It is not only to ramie, but also to jute, flax, hemp, and all strong textiles, in green plants, that this new machine can be successfully applied. It is demonstrated by theory and practice that the textiles extracted in a green state retain all the natural qualities of strength and color, which lose always 50 per cent by the ordinary process of rotting in stalks. The avoiding of that loss is one of the great advantages of the machine, besides the economy in labor. Now comes the disintegration of the decorticated fiber.

The yellowish ribbons produced from the plant engaged in the machine are the crude fibers. Albumen keeps them undivided, but being dried in the shade they acquire in that state a marketable value, which will double and triple by subjecting the filament to the bleaching treatment. The best method is that of Berthollet, which has been the most extensively used. It consists in first steeping the fibers or vegetable tissues in boiling water, and then in rinsing them in a copious supply of water in order to disengage them from soluble matter. When the water has entirely dropped off they are plunged into a bath of alkaline lye, which is raised to the boiling point; they are then immersed in a solution of hypochlorite of lime or an alkaline hypochlorite. The tissues are washed in a copious supply of water, and then immersed in water acidulated by sulphuric acid; washed with soap and water; then rinsed in water and dried. Now, much labor is spared by bringing the chlorite into immediate contact with the fibers washed in hot water and still damp, or by plunging them into a bath saturated with chlorate.

Some machines for preparing ramie have already been patented in this country. Fig. 2 represents the invention of Mr. C. C. Coleman, of Honolulu, Sandwich Islands, which the inventor claims will clean the fiber at a cost of $20 to $30 per ton.

The plant, freshly cut at its full ripe stage, is passed through a series of rollers, being carried along by moving wire screens. It dips into tanks filled with steam, hot water, and bleaching chemicals.

The rollers crush the plant and squeeze out the glutinous matter, which is absorbed by the water and steam. The mass is passed through the machine as often as may be necessary to dissolve and remove all the extraneous gum and other elements and to bleach the fiber itself. After each submersion it is passed through rollers, which squeeze out the water with the matter it has absorbed from the plant. It is not even necessary to remove the leaves, as they are separated by the machinery. The fiber is said to be not broken or even weakened by the process. This is an immense reduction of labor from the manual process of India and China, where a workman does well if he secures a pound and a half of clean fiber per day, making it cost about $150 per ton.

In Figs. 3 and 4 we illustrate an improved machine for treating ramie and other textile plants, devised by Messrs. Emile Lefranc and Joseph Nagoua, of New Orleans, La., and patented August 23, 1870, which embodies the construction advocated, as already stated by Mr. Lefranc.

Fig. 3 is a perspective longitudinal, and Fig. 4 an end, view of the machine. *a a'* and *b b'* are crushing and feeding rollers, having their peripheries grooved correspondingly, as shown. *c* is a toothed support for the plant while moving into the rollers, *a a'*, and *d*, revolving beaters. *e e'* are cylinders, furnished with a series of knives, *f*, which said knives may be either spiral, curved, or elliptical in form, cushioned by a rubber or other elastic surface, *h*, adapted, as shown, to the periphery of the cylinders, *e e'*. The motive power is applied to the axis, *g*.

The operation is as follows: The ramie, or other plant, is first fed between the rollers, *b b'*, from whence it passes between the rollers, *a a'*, and thence between the knives, *f*, of the cylinders, *e e'*. The speed of the surface of the rollers, *a a'*, is a little slower than that of the rollers, *b b'*, better to avoid the tension of the plant, which might break the fibers; but the speed of the cylinders, *e e'*, is much higher than that of the rollers, *a a'*, in order that, when the plant is crushed, the knives, *f*, should strip off the bark and the pith of the stalk, leaving only the fibers in a ribbon-like state; while rollers, *a a'*, revolving comparatively slow, hold firmly the same, and deliver between the knives, *f*, as gradually as the necessity may show.

It is obvious that there would be left uncleaned one end of the plant, equal in length to the distance between the centers of the rollers, *a a'*, and cylinders, *e e'*, because, as soon as the rear end of the plant is past the crushers, *a a'*, the cylinders, *e e'*, instead of stripping the plant, would simply roll it out. To avoid this, revolving toothed beaters, *d*, and a toothed support, *c*, are employed.

The plant is crushed first, by the rollers, *b b'*, and, secondly, by the rollers, *a a'*, and while the forward part of the plant reaches the latter, the rear end of the plant, when past the former, falls on and between the arms of the beaters, *d*, which, revolving at a high velocity in the direction of the arrow shown in the drawing, bend and divide the plant over the toothed support, *c*, and, jointly with it, strips the bark and the pith off the end of the plant before it reaches the crushers, *a a'*, so that the plant, after passing through the machine, is cleaned from end to end, the fiber alone being left.

Fig. 5 represents a machine for the same purpose patented May 2, 1871, by M. Adolph Bouchard, of New Orleans, La. The plant is placed upon the table, F, and introduced by the lower end of the stalk through the rollers,

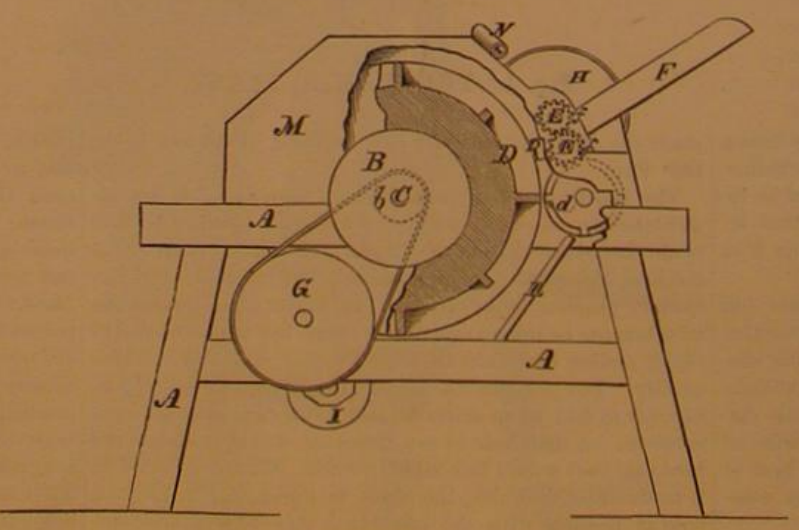


Fig. 5.—BOUCHARD'S MACHINE.

E E, and then the machine is set in motion, the supply being maintained. The small drum, *d d*, does the decortication, the pipe, N, supplies the water, which will partially macerate the plant, and then the mass is projected by the lever, P, toward the drum, D, which, in its revolutions, will totally disintegrate it and pass it through the rollers placed below, fibrated, filamented, and deprived of all its gummy and glutinous substance.

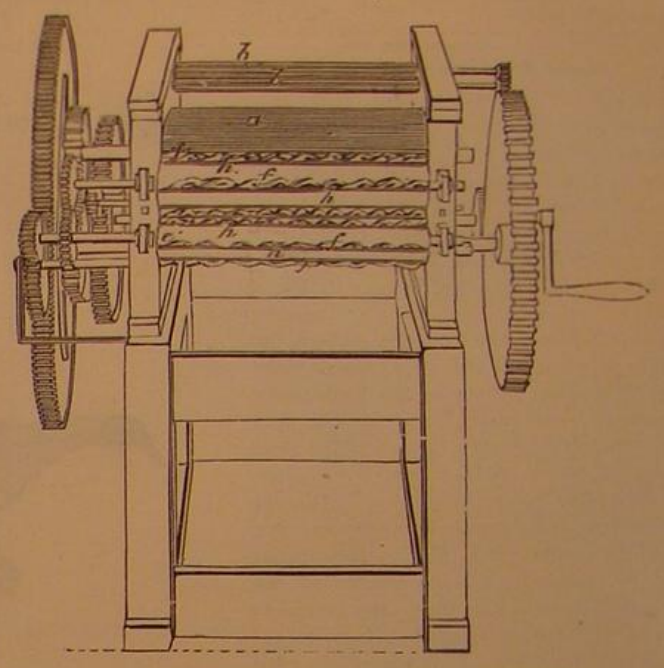


Fig. 4.—LEFRANC AND NAGOUA'S MACHINE.

Prize Method of Preparing Plaster Casts that can be Washed.

The prize offered by the Prussian Minister of Commerce and Industry for a method of preparing plaster casts that permit of being washed was conferred upon Dr. W. Reissig of Darmstadt. From Dr. Reissig's essay on the subject we abstract the following points:

In preparing these casts it was not only desirable to obtain a surface which should not wash away, but also to include a simple process for preventing dust entering the pores and render them more easily cleansed. Laborious experiments convinced this gentleman that the only practical method of accomplishing this and retaining the sharpness of outline was to convert the sulphate of lime into

1. Sulphate of baryta and caustic or carbonate of lime, or

2 Into silicate of lime by means of silicate of potash.

Objects treated in this way are not affected by hot water or hot soap solutions, but, from the method of preparation, they remain porous, catch dust, etc., and when first put into water eagerly absorb all the impurities. To avoid this evil, he subsequently coats the articles, now rendered water proof, with an alcoholic soap solution, which penetrates more easily, deeper, and more freely into the pores than an aqueous solution. After the alcohol evaporates a layer of soap remains which fills the pores, and when washed it is converted into a suds which easily removes the dust without allowing it to penetrate.

1. Process with baryta water. This is the simplest, easiest, and cheapest method. It depends upon the fact that gypsum, or sulphate of lime, is converted by baryta water into sulphate of baryta (which is totally insoluble), and caustic lime which is converted by contact with the air into carbonate of lime. The practical method of carrying this out is as follows: A large zinc vessel is required with a tight-fitting cover. In each vessel is a grating made of strips of zinc, resting on feet 1¼ inch high. This vessel is two thirds filled with soft water at 54° to 77° Fah., and to every 25 gallons of water is added 8 lbs. of fused or 14 lbs. of crystallized, pure hydrated oxide of barium, also 0·6 lbs. of lime previously slaked in water. The solution stands about 4° Beck. As soon as the baryta water gets clear it is ready to receive the casts. They are wrapped in suitable places with cords, and after removing the scum from the baryta bath are dipped in as rapidly as possible, face first, and then allowed to rest upon the grating.

Hollow casts are first saturated by rapid motions, then filled with the solution and suspended in the bath with the open part upwards. After the cords are all secured above the surface of the liquid, the zinc vessel is covered. The casts are left in it from 1 to 10 or more days according to the thickness of the waterproof strata required. After taking off the cover and removing the scum, the plaster casts are drawn up by the strings, rinsed off with lime water, allowed to drain, carefully wiped with white cotton or linen rags, and left to dry, without being touched by the hands, in a warm place free from dust. The same solution which has been used once can be used again by adding a little more barta and lime.

Of course this process can only be applied to casts free from dust, smoke, dirt, colored particles of water, rosin and varnish, soap, animal glue from the moulds, or sweat from the hands. To prevent the casts getting dust upon them, they should be wrapped in paper when taken from the mould and dried by artificial heat below 212° Fah. If in spite of every precaution the casts when finished show single yellow spots, they can be removed in this manner: The perfectly dry, barytated casts saturated with carbonic acid are painted over with water and oil of turpentine, then put in a glass case and exposed to the direct rays of the sun. All spots of an organic nature will then disappear; but, of course, rust, smoke and mineral spots cannot be removed in this way.

In the place of cold baryta water the casts may be placed for half an hour in a concentrated solution of baryta heated to 104° to 122° Fah. This has the advantage that casts may be put in before drying. As the casts treated in this way are not hardened very deeply and are still porous, it is well to place them subsequently in a cold bath for a longer time.

The casts are now ready, as soon as perfectly dry, for the soap solution. For cheapness he selects a pure, good, hard soap, shaves it up, dries it and dissolves it in 50 or 60 per cent alcohol; 10 or 12 parts of alcohol to one of soap. Such a solution of Marseilles soap, known as "spiritus saponatus," can be had at any drug store. The finest appearance, as well as a high degree of durability, is obtained by the use of a solution of stearate of soda in strong alcohol. Both the solution and cast should be warm so that it may penetrate as perfectly and deeply as possible. It is no harm to repeat the operation several times, as long as the liquid is absorbed by the cast. When dry the cast is finished.

2. Process with silicate of potash solution. This process depends upon the conversion of the sulphate of lime into silicate of lime, an extremely hard, durable, insoluble compound, and is accomplished by the use of a dilute solution of silicate of potash containing free potash. To prepare this solution he first makes a 10 per cent solution of caustic potash in water, heats to boiling in a suitable vessel, and then adds pure silicic acid (free from iron) as long as it continues to dissolve. On standing, the cold solution usually throws down some highly silicated potash and alumina. It is left in well stoppered glass vessels to settle. Just before using it is well to throw in a few bits of pure potash or to add 1 or 2 per cent of the potash solution. If the plaster articles are very bulky, this solution can be diluted to one half with pure water.

The casts are silicated by dipping them (cold) for a few minutes into the solution, or applying the solution by means of a well cleaned sponge, or throwing it upon them as a fine spray. When the chemical reaction, which takes place almost instantly, is finished, the excess of the solution is best removed with some warm soap water or a warm solution of stearin soap, and this finally removed with still warmer, pure water.

The casts which can be immersed or easily moved around may be treated as above when warm; a very short time is required, but some experience is necessary. In every case it is easy to tell when the change is effected from the smooth dense appearance and by its feeling when scratched with the finger nail. It is not advisable to leave them too long in the potash solution, as it may injure them. A little practice renders it easy to hit the right point. The fresher and purer the gypsum and the more porous the cast, the more necessary it is to work fast. Castings made with old and poor plaster of Paris are useless for silicating. These silicated casts are treated with soap as above.

In washing plaster casts prepared by either method, the author recommends the use of a clean soft sponge, carefully freed from all adherent sand and limestone, wet with lukewarm water and well soaped. They are afterwards washed with clean water. They cannot, of course, be washed until thoroughly dry and saturated with carbonic acid. The addition of some oil of turpentine to the soap is useful, as it bleaches the casts on standing. The use of hot or boiling soapsuds must be avoided.—*Industrie Blatter.*

ASTRONOMICAL NOTES.

OBSERVATORY OF VASSAR COLLEGE.

Position of Planets for November, 1877.

Mercury.

Mercury may possibly be seen early in November, as it rises on the 1st at 5h. 57m. A.M., at a point several degrees north of that at which the sun rises. It cannot be seen after the first few days. On November 30 it rises at 8h. 6m. A.M., and sets at 4h. 52m. P.M.

Venus.

On November 1 Venus rises at 10h. 27m. A.M., and sets at 7h. 3m. P.M. On the 30th, Venus rises at 10h. 46m. A.M., and sets at 7h. 42m. P.M. It keeps nearly the same diurnal path through the month, increasing some in brilliancy.

Mars.

Although Mars is farther and farther from us, it will be very brilliant through the November evenings, as it has higher declination and comes to the meridian between 7 and 8 P.M.

On November 1 Mars rises at 2h. 47m. P.M., and sets at 1h. 44m. the next day. On the 30th, Mars rises at 1h. 13m. P.M., and sets at 12h. 54m. the next morning. Mars is moving rapidly toward the east, among the stars, and Saturn's apparent motion is toward the west; they are therefore approaching rapidly. According to the *Nautical Almanac* they will be in conjunction November 3 at midnight, Mars being the higher in altitude.

Jupiter.

Jupiter can be seen in the southwest. It rises on November 1 at 10h. 51m., and sets at 7h. 49m. P.M. On November 30, Jupiter rises at 9h. 22m. A.M., and sets at 6h. 21m. P.M.

Saturn.

On November 1 Saturn rises at 2h. 48m. P.M., and sets at 1h. 48m. of the next morning. On November 30, Saturn rises at 0h. 54m. P.M., and sets at 11h. 54m. P.M.

Saturn and Mars will be very nearly together on November 3, at midnight; they will diverge rapidly, as Mars rises higher in the sky and passes to the east of Saturn. Saturn is the most interesting planet at the present time; the ring which surrounds it seems exceedingly narrow, as the sunlight strikes almost in its plane. Through a good telescope the ring seems almost like a belt, running across the ball of Saturn and extending beyond the sphere on each side.

Saturn has eight satellites. A large telescope will show many of them lying around the planet, some at the distance of several times its diameter, and some skirting along the edge of the ring. On October 13 one of these moons was seen to pass across another, so that the two were seen as one for a few minutes. Saturn is so far off that few of these satellites can be seen with an ordinary glass; but Titan, the largest, can be found with a telescope whose object glass is two or three inches.

Uranus.

On November 1 Uranus rises at 0h. 36m. A.M., and sets at 2h. 8m. P.M. On November 30, Uranus rises at 10h. 41m. P.M., and sets at 11m. after noon of the next day. It has passed to the east of Regulus and a little below it in altitude.

Solubility of Sulphur in Acetic Acid.

Liebermann ("Wien. Anz.") finds that sulphur is soluble to no inconsiderable degree in warm concentrated acetic acid, and that a trace is taken up even by the dilute acid. If the concentrated solution be diluted with water, much of the sulphur separates as milk of sulphur; if it be evaporated with the Sprengel pump, fine long prisms of sulphur separate; when cooled, moreover, the liquid deposits sulphur in a crystalline form. All modifications of the element appear to be taken up by acetic acid. The author refers to analytical methods where these changes occur, and are apt to mislead the operator.

Inventions Patented in England by Americans.

From September 18 to October 5, inclusive.

COMPRESSED AIR.—T. F. Rowland, Brooklyn, N. Y.
ERASERS.—A. S. Mills, Brooklyn, N. Y.
FIRE ARMS.—E. Remington & Sons, Ilion, N. Y.
LOCKS.—M. A. Dalton, Cincinnati, O.
LOOM.—B. J. Stowe, New York city.
MATCHES.—E. B. Beecher, Westville, Conn.
PAPER CUTTING, ETC.—G. L. Jaeger, New York city.
PAPER FASTENERS.—P. H. Sweet, Washington, D. C.
PESSARIES.—W. H. W. Campbell, Norwich, Conn.
POSTAGE STAMPS, ETC.—J. Sangster *et al.*, Buffalo, N. Y.
PRINTING PRESSES.—T. S. Bowman, St. Louis, Mo.
PULP MACHINE.—A. H. Elliott, New York city.
RAILWAY CROSSINGS, ETC.—J. S. Williams (of Riverton, N. J.), London, England.
TREATING BLOOD.—W. L. Palmer, New York city.
WATER CLOSETS, ETC.—J. E. Folk, Brooklyn, N. Y.
WINDOW SHUTTERS, ETC.—A. Bijar, New York city.
WOOD SCREWS.—A. L. R. Monson, New York city.

Recent American and Foreign Patents.

Notice to Patentees.

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

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

NEW MISCELLANEOUS INVENTIONS.

IMPROVED COMPOSITION FOR PAVING BLOCKS.

James S. Wetnered, New York city.—This invention relates to a compound for paving blocks and other purposes, and it consists in a composition formed by mixing pulverized slag with asphaltum and heavy petroleum or other non-drying oils. The inventor says: In carrying out my invention I take 17 parts of asphaltum (Trinidad preferred) and subject it to a slow heat until it becomes liquid. I then add 3 parts of heavy petroleum or other fixed oil, and thoroughly mix them together, and while this mixture is still hot I add 80 parts of broken, granulated, or pulverized iron or other slag, or its equivalent, which has been previously heated. I then, by aid of suitable machinery, thoroughly incorporate the ingredients while in the heated state, and form the composition into blocks, which I subject to heavy pressure in molds. I do not confine myself to the exact proportions herein stated, as the proportion of oil may be varied to suit the quality of the asphaltum, the oil being one of the most essential ingredients, as it renders the block elastic and durable.

IMPROVED SAP SPOUT.

Francis E. Lord, Readsborough, Vt.—This invention relates to a sap spout for maple and other trees, by which the sap is taken up in superior manner, and the bucket suspended therefrom without the use of nails or other iron material, which is injurious to the tree. The invention consists of a centrally perforated spout, whose end that is driven into the tree is made longer and provided with a rim, and annularly recessed and perforated or mortised to take up the sap. The outside of the spout is provided with side recesses for attaching a hanger or hook, from which the pail or other vessel is suspended. The connection of the spout and hanger or hook dispenses with the iron spouts and nails, which are so injurious to the trees.

IMPROVED METHOD OF PURIFYING RAW ANIMAL FAT.

Isaac Mayer, New York city.—The object of this invention is to furnish a superior machine tallow, by a quick, cheap, and convenient process, from raw animal fat without the use of special machinery; and it consists of treating the raw fat with diluted nitric acid, then boiling the fat, and finally separating the tallow from the heavier fibers by cooling. The raw animal fat is first cut up in small slices or blocks of about one inch in size, and then treated in a wooden vessel with diluted nitric acid of about 2° Baumé. The acid has to cover entirely the fat, and is allowed to remain in the vessel for from thirty to forty-eight hours or more, the liquid being then poured off, and the so-prepared fat exposed to boiling in an iron vessel for from fifteen to thirty minutes, the fat being stirred up from time to time to prevent the burning of the fibrous and tendonous parts. The fat is then removed and allowed to cool under addition of water, the fibrous parts settling on the bottom of the cooling vessel, while the tallow is obtained at the top, and readily drawn off or removed. The fibrous sediments form a valuable food for pigs, while the tallow is of clear and superior nature, and obtained in a cheap and convenient manner, without the use of expensive presses, etc., and without producing any obnoxious odors.

IMPROVED MEAT BLOCK.

Newton Wells, Painsville, O.—This invention consists of a meat block having a roughened plate detachably applied thereto, so that it can be used for tendering meat, and by removing said plate the block is left with a plain or flat surface, upon which meat may be cut or dressed. The block is provided with a cover to protect it from flies and dirt. The block is designed for use in families for chopping, pounding, or tendering meat. It is also provided with an attachment consisting of a plate of iron of suitable thickness, the upper surface of which is roughened or provided with pyramidal projections, and upon the lower side of which lugs are formed that project over the edge of the block for retaining the plate in position. Meat may be tendered upon this plate by means of an ordinary plain mallet. The block is so small that it is easily moved from place to place, and may be washed without difficulty.

IMPROVED TRANSFERABLE BARREL COVER.

Sylvester W. Sheldon and Daniel Dunscomb, New York city.—This invention consists in the combination of an adjustable fastening device with a barrel cover that is made in two parts and hinged together. The cover is attached to a barrel by placing it upon a barrel with brackets or fasteners outside and the block inside of the rim of the barrel, and forcing the block outward by turning the thumb screw until the edge of the barrel is firmly clamped between the brackets and the block.

IMPROVED COFFEE ROASTER.

John H. Bankston, Pulaski, Tenn., assignor to himself and T. J. Wells, of same place.—This invention relates to an improved device for roasting coffee, baking bread, meat, cakes, and other articles in perfect manner by the radiated heat of an open fireplace, so as to utilize the heat in convenient and economical manner; and the invention consists of a conical reflector with fixed cap or apex, being supported in suitable manner, with the open base or mouth toward the fire, and provided with flanges and supports for the baking pans, roasting cylinder, etc. The device is used by placing either the roasting cylinder or baking pan in position in the reflector, and then placing the reflector before the fire. The roasting cylinder is then slowly turned by the crank or handle of the cylinder shaft, the roasting being accomplished by the heat of the radiated and reflected rays of the open fire. The bread, cakes, meat, etc., are baked in the same manner by placing the mouth of the reflector at proper distance from the fire, the same being readily moved by a top handle.

IMPROVED METHOD OF SETTING ARTIFICIAL GEMS.

Henry Pic and Maurice Nelson, Paris, France, assignors to Veit & Nelson, New York city.—The object of this invention is to substitute for the soldering and gluing or cementing on of glass, enamel, or other imitation stones on their metallic mountings, an improved method of setting the stones in articles of jewelry for mourning or fancy purposes, by which the breaking off of the stones from the metallic parts is prevented, and a more durable and neater style of such articles obtained. The invention is intended to overcome the objections to the methods heretofore employed, and consists of glass and enamel melted on stems, which are riveted, screwed, soldered, or otherwise affixed to the perforated metallic mountings. The stones are thereby firmly connected to the metal parts without any danger of breaking off and marring the appearance and effect of such articles. A substantial and durable class of ornamental jewelry is thus furnished, which gives thereby greater satisfaction, and may be used for a large number of different applications.

IMPROVED MAINSPRING ATTACHMENT FOR WATCH BARRELS.

Edwin H. Flint, Cincinnati, O.—The winding of the watch is effected by turning the arbor, which carries the outer end of the spring around, and coils the inner end of the spring around the boss of the barrel wheel. The advantages claimed for this improved watch are that it is perfectly dust proof, it does away with the usual retaining mechanism, and obviates injury to the watch in case the spring breaks.

IMPROVED LAMP BRACKET.

Thomas J. Jury, Spencer, Ind.—This invention has for its object the combination, with a sectional jointed bracket and clamp, of a rotary spool stand and a lamp holder. The bracket is composed of sections jointed together, so that they will articulate freely, and can be extended or contracted at will. A clamp is applied for the purpose of fastening the bracket to the edge of a table. The spool stand is free to rotate on a post that is secured to the section, and into the upper side of which stands are fixed a number of pins, intended to receive spools of thread and allow the spools to rotate freely while the thread is being unwound from them. The lamp is held in its place on a shelf by means of fixed lugs and a movable lug, which latter is confined by means of a clamp screw, and allows the lamp to be removed from the shelf.

IMPROVED FAUCET.

William S. Lempert, Fort Davis, Tex.—The object of this invention is to furnish an improved faucet, which shall be so constructed that it will not be liable to be injured by being screwed into and out of the cask, which will not be liable to leak, which will have the button of the valve stem protected from accidental injury, and shall be simple in construction and easily operated. The invention consists in the combination of the inner part provided with the square or octagonal flange, the outer part provided with the valve seat, the spring chamber, the channel, and the nozzle, the cup or flange, the valve, valve stem, and button, and the spiral spring. This faucet can never be left open by carelessness, accident, or manipulations of children, as the moment the pressure is taken from the button it closes itself securely.

IMPROVED SMOKE-EXCLUDING MASK.

George Neally, New York city, assignor to himself and Charles W. Bloomingdale, of same place.—A great many persons perish by being suffocated by the smoke and gases in attempting to escape from burning buildings, while also a large quantity of valuable property is destroyed by the inability of the firemen to determine the location of a fire on account of the smoke, so that it gains such headway that it is impossible to check it before a great deal of damage has been occasioned by throwing the water in localities where the fire does not really exist. The invention consists of a novel combined mask and cap, of suitable elastic material, that fits tightly to the head, and whose mouth and nose are connected, by a mouthpiece and one or more tubes with suitable filters containing moistening sponges, which filters are again connected, by one or more tubes, with an elastic water receptacle strapped around the neck or body, so as to resupply from time to time the filters with the required degree of moisture by a slight pressure on the receptacle.

IMPROVED WRENCH.

Jacob Eiseman, Galena, Ill.—This invention relates to an improvement on monkey wrenches, and the nature of the invention consists in the combination of a detachable serrated jaw with the fixed jaw of a monkey wrench, whereby the common nut wrench can be made to serve as a pipe wrench. The movable jaw is confined in its place on the wrench by a hook that passes over the nose of the jaw and the pin that passes through the ends of the jaw back of the shank. This affords a very strong attachment, and enables a common monkey wrench to be converted into a pipe wrench.

IMPROVED ADDING MACHINE.

William L. Hofer, Deposit, N. Y.—This invention has reference to an adding and subtracting machine, by which these arithmetical operations may be accomplished in quick and accurate manner by mechanical means; and the invention consists of a revolving wheel or disk, provided with the figures from 1 to 99, and with a corresponding number of holes or notches, that are engaged by a centrally pivoted spring arm and pin for working the disk. A raised circular rib, at the under side of the revolving disk, engages, by the end points of the rib, which are a small distance apart, a sliding and toothed bar, so that the slide moves at every revolution of the disk, and indicates the hundreds and thousands on the face plate of the machine, while the tens and units are read off in a side recess of the face plate.

IMPROVEMENT FOR DRYING FERTILIZERS, ETC.

Asa P. Meylert, Brooklyn, N. Y.—This apparatus consists of a large drying chamber, having a series of sectional spaces at both sides, which are divided by partition walls, having communicating openings at alternately opposite sides of the main chamber. A series of cars are made to pass on a tramway through the drying chamber. These are constructed with inclosed vertical partitions and closed ends, having horizontal platforms or trays intervening between the partitions, which platforms communicate with the sectional side spaces, and the linear space between the vertical inclosed partitions occupied by the series of platforms is similar to the length of a side section in the drying chamber. The platforms or trays within the cars are placed in successive series, one platform being put above another in a series, with an intervening space between each two platforms in a series. Each of these platform spaces is open on both sides, to let the heated air pass through below and above the material to be dried, thus providing a free transit for the air from one side section of the apparatus to another opposite.

IMPROVED HEDGE-FENCE LAYER.

Ferdinando Poole and Wilson A. Pendergraft, Augusta, Kan.—The object of this invention is to furnish an improved machine for bending down and pressing together the Osage orange and other hedge plants, and holding them until tied, so that the hedge may be narrow and the upright shoots close together, making a close hedge. As the cent and compressed hedge plants come out at the rear end of the machine they are bound by a wire or tarred cord carried upon spools pivoted to the rear end of the frame work of the machine. The wire or cord is passed around the plants with a needle, through the eye of which it passed, and is then tied and cut off, the said wire or cord being never withdrawn from the said eye, but being slipped through the eye as each knot is tied. In this case the wire or cord is continuous, is secured to a plant or stake at the place of beginning, and is fastened with a half hitch each time it is passed around the plants. The hedge plants may be laid the first time close to the ground, and afterward laid one or more times at a higher level, so as to form a thick, close hedge with comparatively few plants.

IMPROVED GATE.

Aaron Hyre, Churubusco, Ind.—The object of this invention is to furnish an improved gate, which shall be so constructed that it may be readily opened and closed by a person in a vehicle or upon horseback, and which shall be simple in construction, convenient in use easily operated, and not liable to get out of order. The gate slides open and shut upon a bar attached to the upper parts of the post, and which passes between the adjacent edges of two horizontal bars of the said gate and between the cross-bars attached to said horizontal bars. A series of levers are so arranged and placed in connection and pivoted to the upper ends of two posts, placed upon the opposite sides of the rear part of the gate, and at such a distance from it that a person sitting in a vehicle can reach and operate the levers, the forward ends of which project toward the roadway, to open and close the gate before the horses have come in contact with the gate, and after his vehicle has passed through the gateway.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED WAGON BRAKE.

Christopher Heinen, Leavenworth, Kan.—The object of this invention is to furnish an improved brake for wagons, which shall be simple in construction, conveniently applied, and reliable in operation. To the end parts of the brake bar are secured the castings, upon the forward side of which are formed slightly wedge-shaped grooves to receive the wooden rub blocks, which are thus forced more firmly to their seats by the friction of the wheels. To the brake bar are attached the rear ends of two rods, which pass forward through the spaces between the rear axle and its bolster, and their forward ends are pivoted to the upper ends of short arms formed upon or rigidly attached to a shaft which works in bearings attached to the rear axle, and to one of its ends is rigidly attached, or upon it is formed, a longer arm, which projects upward at the side of the wagon box or body, and to its upper end is pivoted the rear end of a rod that extends forward along the side of the wagon box or body, and to its forward end is pivoted the lever, by means of which the force of the brake is applied to the wheels.

IMPROVED THILL COUPLING.

Frederick C. Potter, Poughkeepsie, N. Y.—The object of this invention is to furnish an improved thill coupling which shall be simple in construction, safe and noiseless in use, and easily coupled and uncoupled. To disconnect the thill irons from the clips the thills are raised to a vertical position, in order that the lugs may be drawn out of the notches in lugs. The function of a rubber block is to prevent rattling of the thill iron in the socket when the parts are in working position, the projecting end of the thill iron being then in contact with a leather plate. A cam projection comes in contact with the leather plate when the thills are thrown up into vertical position, and the friction serves to hold them in such position out of the way.

IMPROVED SHUTTER BOWER AND FASTENER.

Thomas B. Rogers, Jr., Brooklyn, N. Y., assignor to himself and Peter Cooper, New York city.—The object of this invention is to provide a convenient and reliable shutter fastener and adjuster. The shutter is adjusted by loosening a thumb screw, releasing a catch, and swinging the shutter open to the desired point, and clamping it by means of a screw. The engagement of the convex portion of the screw with the concavities of the bar insures the fastening of the shutter in any desired position. When the shutters are wide open the bar is engaged by a catch, which is pivoted between ears that project from a plate attached to the shutter. This catch is provided with a shoulder, which prevents it from dropping below a horizontal line drawn through its pivot, and the same shoulder projects sufficiently to touch the bar when the shutter is open, and throw the catch over in case the catch should remain in a vertical position when disengaged from the bar. A plate is attached to the window stool to receive the end of the screw when the shutters are closed.

IMPROVED COMBINED AWNING AND SHUTTER.

William A. Hoyt, Paris, Tex.—This invention relates to an improvement in the class of awnings which are hinged to a building front and supported at their outer ends upon pivoted posts, the awnings being thus adapted to fold against the side of the building to protect the same in case of fire. The improvement consists in the construction of the posts for supporting the awning and the means for attaching them to the awning and securing them to the pavement. The hooks are affixed to the outer sides of the posts, and the upper ends of the latter are cut off at an obtuse angle, to adapt them to fit against the under side of the awning, and thus support the same in the inclined position required. By this construction, when the posts have been attached to the awning and brought into vertical position, they are secured rigidly in place by pushing down sliding bolts. In case of fire in front of the building or upon the opposite side of the street, the two outer posts are first removed. The bolt is then drawn in the central one, and the awning is allowed to drop. By means of this improvement the glass and wooden portions of the front are covered, so that the fire cannot affect them. This device may be used instead of ordinary shutters, as it renders the front burglar-proof, and as an awning it is more durable and serviceable than those of canvas or wood.

IMPROVED CARRIAGE.

Warren H. Hancock, Augusta, Ga.—This is an improved carriage for agriculturists' implements, such as stalk cutters and the like. To the frame of the carriage are fitted the axles and the wheels. With one wheel is connected a friction drum of conical form, and provided with a clutch that engages with teeth on the wheel. A conical drum on the crank shaft is arranged with its larger portion opposite the smaller portion of the friction drum. An intermediate wheel is placed on a rod that is supported by a vertically sliding frame, whose lower end passes through a mortise in the platform, and is connected with a lever and a ratchet bar, projecting through the platform. A spring bolt engages with ratchet, and has a disengaging lever that projects through platform. The intermediate wheel is grooved and provided with a clutch, moved by a lever acting through a lever and rod. The intermediate wheel is forced between the drums by pressure on a ratchet bar, and the motion of conical drum transmitted to friction drum and the wheel. The relative speed of the drums is varied by means of sliding the intermediate wheel on the rod.

NEW HOUSEHOLD INVENTIONS.

IMPROVED CHURN.

William H. Sterns, Humboldt, Neb.—The object of this invention is to furnish an improved churning apparatus which shall be so constructed that the milk may be thrown into violent agitation, so as to bring the butter in a very short time by the movement of the churn body, and which shall be simple in construction, effective in operation, and not liable to get out of order. The invention consists in a frame work to adapt it to receive the operating mechanism; in the combination of bars and hooks with the frame, and with a platform upon which the churn body stands; in the combination of bars, pivot, and a crank with the driving gearing, and with the platform that carries the churn body; in the combination of pivoted bars and a swinging bar with the frame and the platform upon which the churn body stands; and in the combination of pins with the base frame and with the platform upon which the churn body stands.

IMPROVED BAKING OVEN.

Samuel Axford, Freeport, Ill.—This invention relates to baking ovens, and it consists in a baking oven of circular form, having a revolving shelf or table, and constructed with a furnace outside of the main wall, and with three flues leading one each from the furnace door, the oven door (outside thereof), and the body of the oven. The heat and unconsumed products of combustion then pass into the oven through an opening in the furnace side thereof, thence out through opening and flue into the chimney.

IMPROVED IRONING TABLE.

Charles W. Barber and George Lenox, Lindleytown, N. Y.—The object of this invention is to furnish an improved device which shall be so constructed as to serve as a receptacle or basket to receive the clothes to be ironed, as clothes bars to air or dry the clothes, and as a table and a shirt board for ironing them, and which may be folded into small compass for storage and transportation. To the bars at one end of the device is hinged the end of a board, which forms the shirt board, and which is supported in place, when raised, by bars, the upper ends of which are hinged to the lower side of the outer part of the board. The lower ends of these bars are notched or have hooks formed upon them to hook upon the hooks or pins attached to the lower parts of the bars hinged to the end of the board.

IMPROVED WASHING MACHINE AND CHURN COMBINED.

Wiot H. Clarke and William Collins, Council Grove, Kan.—The object of this invention is to furnish an improved machine which be so constructed that it may be used as a clothes washer or as a churn, and which shall be simple in construction, convenient in use, and noiseless and effective in operation. When the machine is to be used as a churn, a churn body is placed within the suds box to receive the milk. The churn body is provided with a closely fitting cover, through the center of which the dasher shaft passes. This construction allows hot or cold water to be put into the suds box, around the churn body, to temper the milk as required. When the machine is to be used as a washer, the dasher and the churn body are removed.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED DRAFT-EQUALIZING DEVICE FOR HORSE POWERS.

John R. Dickinson, Ida, Mich.—The object of this invention is to furnish a draft attachment for horse powers which shall be so constructed as to compel all the teams to draw equally, which may be so adjusted as to prevent a weak horse or team from being drawn too far back, and which shall be simple in construction, easily applied, and reliable in use. In case a weak horse ar team be used, a pawl is pivoted in the outer part of the box, to which is attached a short chain, a part of which is formed by a spiral spring, and which has a hook attached to its outer end, to be hooked into the main draft chain, so that if the weak horse or team is drawn back by the said chain the pawl may be drawn against the chain to clamp it, and prevent the said weak horse or team from having to draw against the others. The spring is designed to prevent the chain from being broken should the pawl slip upon the chain. The chain passes round a pin attached to the box, and which is provided with a ferrule or tubular washer to prevent wear. The chain can be readily detached or allowed to hang, and the pawl turned back or detached when not required for use.

IMPROVED LIFT PUMP.

Emory Barnes, Mount Pleasant, Mich.—This invention has relation to means for raising water, and the nature of the invention consists in combining, with a submerged cylinder, a piston which is depressed by a helical spring and raised by means of a treadle and a chain, which is attached to the piston rod and passed over a pulley attached to the discharge pipe. By depressing the treadle the piston will force water up through the discharge pipe. At the foot of this pipe is a check valve, which allows piston to force water up the pipe, but prevents it from returning.

IMPROVED CARPET-SEWING MACHINE.

Joseph Hesse, San Francisco, Cal.—The object of this invention is to furnish an effective and readily operated hand sewing machine, by which carpets may be readily and evenly connected by a loop stitch formed of one thread. The invention consists of a bent main plate or saddle straddling the edges of the carpet, and having a rectangular plate, to control the distance of the stitch from the edges and compress them for the needle. A presser spring, with a lifter and feed roller, is attached to the inside of the main plate. The feed bar, needle bar, and devices for imparting motion to the reciprocating hook receive their motion from a hand crank wheel and driving shaft geared therewith, the feed bar operating two feed pawls and rollers, working independently of each other. The compound motion of the thread hook is imparted by a top plate with guide grooves and the beveled upper end of the hook stem, in connection with pins and a bevel plate of the connecting rod of needle bar and driving shaft.

IMPROVED VALVE.

Seth Lloyd, Conshohocken, Pa.—Hitherto it has been the experience in valves for steam and water pipes that, by the frequent screwing and unscrewing of the same, the screw portions are worn out while the other parts of the valves are still in good condition. The valves need also repacking from time to time, which is troublesome and expensive. Valves are also frequently placed at points which are reached only with difficulty for the purpose of packing. Now, the object of this invention is to furnish a valve with improved stem, that produces a steam or water tight fitting without requiring any packing for the stuffing box, and which has no parts that wear out by use, being capable of application directly for use as they are furnished by the manufacturer. The invention consists of a compound and spring-acted valve stem, of which the upper handle section is connected to the lower valve-operatingsection by a kind of coupling or clutch, both sections having conical valves that are forced by an interposed spring against seats of the casing or box to produce the tight fitting of the stem.

IMPROVED HORSE POWER.

Thomas C. Churchman, Sacramento, Cal.—The object of this invention is to furnish an improved horse power for working pumps and other machinery, which shall be so constructed as to give two motions at each revolution of the traction wheel, which shall be free from the jerking motion which always accompanies the action of a crank, and which shall be simple in construction and convenient in use. The invention consists in an improved horse power, formed by the combination of the step, the spindle having a bearing or box upon its upper end, the guide standard provided with a ring at its lower end, the grooved disk, the sliding T blocks, and the pitman bent twice at an angle, with each other and with the shaft and the traction wheel.

IMPROVED HORSE POWER.

Isaac D. Albin, Sr., Chilhowee, Mo.—The object of this invention is to furnish an improved portable horse power for thrashers, separators, and other agricultural machinery, the power having the advantage of being run with double reversible draft and any desired number of horses, from two to fourteen, according to the machinery to be driven. The horse power may also be as a single power, and the transmitting shafting be arranged in elevated position above the horses, or in a position near the ground, as desired. The double reversible draft frames of the power produce the balancing of the apparatus so as to dispense with the staking or chaining down of the same, and admit, therefore, a lighter construction and its mounting on a wide truck or common farm wagon, all of which serve to render this horse power of great advantage for the various applications. The invention consists of a master wheel and frame, having a number of draft levers that are driven in one direction, and of a pinion frame, with levers that are drawn in opposite directions, the draft levers of the pinion frame being elevated to admit the horses of the master wheel to pass under them, inside of the track of the horses attached to the pinion frame. The pinion frame transmits the power by suitable gearing to a crown wheel, and by an intermeshing speed pinion to the driving line shaft, that is supported in a triangular top frame.

IMPROVED CAR COUPLING.

James R. Lamb, St. James, Minn.—This invention refers to that class of car couplings that may be coupled without danger automatically, the link being held in a horizontal position for entering the approaching drawhead, and the pin dropped on the entrance of the link. The entering of the link pushes the follower back and drops the pin, so as to couple thereby the cars. The follower presses on the link and forces it against the pin, holding the link by the curved and concaved top part in horizontal position for the coupling, so as to readily enter the mouth of the drawhead to be coupled. The follower gives the link the necessary play, so as to work free in the drawhead when coupled. The pin is supported stationary in the curved end of the slide piece without being released by the forward motion of the follower, so as to allow the backing of a lot of loose cars on side track, or other operations in which cars are not required to be coupled.

IMPROVED CHANNELING MACHINE.

George W. Bacon, South Groveland, Mass.—The object of this invention is to produce an effective cutter for sole-channeling machines. The channeling knife has a chisel-shaped cutting edge at its projecting end, near which the grooving knife is placed, its cutting edge projecting below the channeling knife. When in use this knife is prevented from springing downward and backward by a grooved block which receives the tongue of the knife. The knife thus secured cuts evenly and forms a uniform groove and channel.

IMPROVED NUT-TAPPING MACHINE.

Samuel L. Worsley, Taunton, Mass.—In front of the mandrel that carries the tap there is a nut holder, having in it a mortise of the thickness and width of the nuts to be tapped, which extends horizontally through the holder at right angles with the mandrel. A follower is fitted to the holder, and is forced by a spring against the nut in the holder. The nut blanks are fed to the mortise in the holder through a chute, and are carried by a follower. The feeder has in its upper edge a groove, which receives the nut blanks from the hopper when the feeder is dropped down, and delivers the blanks to the chute when the feeder is raised up. The time of the movement of different parts is governed by cams and by change wheels on the machine, which are proportioned to the different sizes of nuts. The blank holder is provided with the removable portions, which are changed when the holder is adapted to different sizes of nut blanks.

IMPROVED STEAM ENGINE.

Jacob J. Anthony, Sharon Springs, N. Y.—The object of this invention is to furnish an engine that is simple in construction, compact in form, and efficient in operation, which may be adapted to any of the purposes for which ordinary engines are used; but it is especially designed for locomotives and steamboats. The operation of this improved engine is as follows: Steam is admitted to the chest through an opening, whence it passes through ports to the steam chest and through one of the ports into a cylinder. The valves, by their connection with a lever, are made to move in opposite directions, so that when one of the supply ports is opened the exhaust port below it in the same end of the cylinder is closed, while at the opposite end of the cylinder the exhaust port is open and the supply port is closed. The piston is propelled by the steam toward the end of the cylinder until it strikes one of the ribs, when the valves are shifted and the piston is moved toward the opposite end of the cylinder. The reversing of the engine is effected by admitting steam to the valve chest to start the engine on one side of a partition, and afterward admitting it to the other side. All of the cylinders may be used in connection, or by disconnecting the coupling they may be used in pairs. When the engine is applied to steamboats one pair of cylinders may be connected with each wheel, and by the action of the engine alone the boat may be steered.

IMPROVED CAR HEATING APPARATUS.

James F. Callaway, Louisville, Ky.—A steam pipe leads from the dome of the locomotive back to and through all the cars of the train. It is laid in convolutions over the floor of each car, and valves control admission of steam and escape of water of condensation. Suitable flexible couplings connect the pipe sections between the cars.

IMPROVED DITCHING AND EXCAVATING MACHINE.

Samuel A. De Force, Crockett, Tex.—The object of this invention is to furnish an improved machine for making ditches and other excavations, which shall be so constructed as to separate the slice from the soil, raise it and deposit it at the side of the cut, which will feed itself forward automatically, shall be simple in construction, and easily guided and controlled. The invention consists in the combination of a rotating cutter and a reciprocating holder with the shaft upon which they are hung and with the frame work of the machine; in the combination of segmental gear wheels and bevel gear wheels with the shaft and the bevel gear wheel that carries the holder and the cutter; in the combination of a spout with the cutter, a holder, and an endless carrier; in the combination of a spring and arm with the shaft, to which the spout is attached, for moving the spout forward to receive the dirt; in the combination of an arm, lever, and stop pin with the cutter and the shaft, to which the spout is attached, to move the spout back to allow the cutter and holder to pass; in the combination of stops, a latch, and stop pins with the shaft, the frame, and the cutter, for controlling the movements of the holder from the movement of the cutter; in the combination of a tooth, sliding rod, spring lever, and gear wheel with the bevel gear wheel and the axle of the carriage; in the combination of gear wheel, a clutch, sliding bar, and lever with the driving shaft and frame.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion.

James E. Austin, inventor of Shingle Cutting Machine, patented August 13, 1870, will please address F. L. Johns, Calcutta, Clay county, Ind.

Wanted—A first-class Planer, with table, to plane 30 inches square. Edward Harrison, New Haven, Conn.

40 Horse Second-hand Upright Engine wanted, in good order. J. Leffel & Co., Springfield, O.

Brown & Sharpe Universal Milling Machine for sale. Address W. E. Lewis, Cleveland, O.

I want to buy some good second-hand Lathes, Planers, Drills, and Boiler Maker's Tools. Address Shearman, 132 N. 3d St., Philadelphia, Pa.

Pattern Makers can get Metallic Pattern Letters, to letter patterns, of H. W. Knight, Seneca Falls, N. Y.

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

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Chester Steel Castings Co. make castings for heavy gearing, and Hydraulic Cylinders where great strength is required. See their advertisement, page 286.

Silver Solder and small Tubing. John Holland, Cincinnati, Manufacturer of Gold Pens and Pencil Cases.

Diamond Saws. J. Dickinson, 64 Nassau St., N. Y.

Patent Scroll and Band Saws. Best and cheapest in use. Cordesman, Egan & Co., Cincinnati, O.

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

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

Notes & Queries

(1) J. R. asks how to bleach human hair? A. Gaseous chlorine is the most effective agent. Cleanse the hair in a warm solution of soda, and wash with water. While moist, put in a jar and introduce chlorine, until the air in the jar looks greenish. Allow to stand for 24 hours, and if necessary repeat the operation.

(2) E. W. M. asks how to make celluloid? A. See reply to G. R. (73) p. 204, No. 13, present volume SCIENTIFIC AMERICAN.

(3) J. H. H. asks: What is used to make gold leaf adhere to the letters cut into a granite monument? A. Apply a coat of size and then two or three coats of size and fine powdered whiting. Let each coat dry and rub down with fine glass paper before the next is applied. Then go over it thinly and evenly with gold size, and apply the gold leaf.

(4) J. L. S. asks: 1. If coal oil will percolate through glass? A. No. 2. Also, if there is any known material which can percolate through glass without destroying it? A. No.

(5) C. W. & S. ask how the marbling of paper is done? A. A mucilage of gum is prepared, about the thickness of sweet oil, and placed in a shallow trough. The colors are sprinkled on the gum and disposed as fancy may dictate. The sheets of paper are taken, one by one, bent in the form of a bow, and gradually let fall on the composition in the trough. The colors, which float on the surface, and a portion of the mucilage adhere to the paper, which is then taken up and hung on racks to dry. The paper is then finished by burnishing.

(6) W. H. S. & F. D. ask for a recipe for making liquid solder, to be used without heat? A. Mix together bismuth ¼ oz., quicksilver ¼ oz., block tin filings 1 oz., spirits of salt (muriatic acid) 1 oz.

(7) K., B. & L. ask how to ebonize hard wood in durable color? A. Black may be produced by means of copperas and nutgalls, or by japanning with two coats of black japan, after which varnish or polish, or use size and lampblack previous to laying on the japan. Another method is to pour two quarts boiling water over one oz. powdered extract of logwood, and when solution is effected, add one drachm of yellow chromate of potash, the whole being well stirred. Repeat on the wood with general applications until the desired depth of color is produced.

(8) M. J. G. asks for information in the art of "marbleizing" or imitating the colored marbles on inferior marble? My chief difficulty lies in the preparation of the water and in the colors. A. It is necessary to heat the marble hot, but not so hot as to injure it, the proper heat being that at which the colors nearly boil. For blue, use alkaline indigo dye, or turnsole with alkali; for red, dragon's blood in spirits of wine; for yellow, gamboge in spirits of wine; for gold color, sal ammoniac, sulphate of zinc, and verdigris, equal parts; for green, sap green in spirits of potash; for brown, tincture of logwood; for crimson, alkanet root in turpentine. To stain marble well is a difficult operation.

(9) F. H. S. asks how rubber stamps are made? A. See SCIENTIFIC AMERICAN, present volume, No. 6, p. 91 (33), and No. 17, p. 267 (17), and SCIENTIFIC AMERICAN SUPPLEMENT No. 83.

(10) J. W. W. asks for a black composition or cement to fill in zinc work that will stand exposure to the weather? A. Use pitch 11 lbs., lampblack 1 lb., turpentine sufficient. Mix with heat.

(11) H. G. asks for a recipe that will show the twist on gun barrels? A. Spirits of niter ¾ ozs., tincture of steel ¾ oz., or use the unmedicated tincture of iron if the tincture of steel cannot be obtained; black brimstone (sulphur vivum) ¼ oz., blue vitriol ½ oz., corrosive sublimate ¼ oz., nitric acid 1 drachm, copperas ¼ oz.; mix with ½ pint of rainwater, and bottle for use. Clean the barrels and apply as directed in (36), p. 203, current volume.

(12) J. B. asks for a recipe for tempering millpicks? A. Select good cast steel. Forge carefully, using a low heat, and light blows. To harden get two gallons of rain water, add 2 lbs. of salt. Take off the chill of the water by plunging a hot iron into it. Heat the pick gradually from the center, and plunge the point vertically into the water, letting the heat toward the center draw the temper. Draw to a "red" or "copper color."

(13) C. R. & F. S. ask if the price of gold as a metal is higher than that of platina? A. Yes.

(14) A. T. B. asks how to drill a ⅝ inch hole through glass ⅛ inch thick? A. Use a sand blast or a revolving cylinder of wood, brass, or copper, of the desired size of hole, supplied with emery and water.

(15) W. B. asks: What is Zeiodite, and how is it made? A. It is made by mixing 20 to 30 parts roll sulphur with 24 parts powdered glue or pumice, which forms a mass as hard as stone. It is said to resist the action of water and acids.

(16) E. A. J. asks how to fill the engraved parts of plated ware, that after plating with gold the designs may appear like burnished silver? A. Cover the parts not designed to be plated with wax, deposit the metal by electro-plating, and finish by burnishing.

What is used as a body for filling the texture of silk goods used in banner making, that will keep the silk flexible and elastic? A. A thin size of bleached shellac and alcohol is used. For inside work the white of an egg makes a good size. If gold is to be laid, put it on while the size is still wet. A little honey, combined with thick glue, is sometimes used.

(17) C. N. N. asks: When is the greatest strain upon a bridge? Is it while a train is moving slowly or while running at a high rate of speed? A. When moving at a high speed.

(18) E. B. D. asks how to color gold plate Roman or Etruscan color? A. See SCIENTIFIC AMERICAN, present volume, No. 5, p. 75 (27).

(19) J. S. H. asks: What is the best method of making an oil belt for finishing or polishing hard wood? A. If a wide belt is desired, use canvas, if a narrow one use leather, running over pulleys the same as common belts are run, one pulley, of course, being the driver. Coat the belt with glue and sprinkle on fine sand, the fineness of which must be appropriate to the finish required. Let the glue get thoroughly dry before using.

(20) E. C. C. says: I wish to make moulds to cast a few badges of soft metal. How can I best succeed in so doing? A. See No. 17 SCIENTIFIC AMERICAN SUPPLEMENT, p. 272, for directions for such work.

(21) C. H. W. asks how to prepare the paper matrix for stereotyping? A. Take thick soft unsized paper and paste upon it two or three sheets of tissue paper, or until it is about the thickness of pasteboard. Cover the under side with fine powdered French chalk, and lay it upon the form of type, and beat with a stiff brush so as to force the soft paper into all the interstices of the type. Add other sheets of adhesive paper until a sufficient thickness is obtained. Cover with a woolen blanket and place in a press, the bed of which has been moderately heated. Screw the press down and the heat will dry the matrix, which may then be removed for casting.

(22) A. A. K. asks if there is a patent on engraving glass by means of the sand blast? A. Yes.

(23) M. A. C. says: 1. With an engine running at 54 revolutions per minute, turning the main shaft 200 revolutions per minute, if the speed of this shaft be reduced to 25 revolutions by increasing the size of pulleys, will it tend to economize steam? A. You do not give sufficient details to give an answer. 2. Will you give a rule to reduce or increase the size of pulleys to give any required speed? A. See p. 181, No. 12, current volume SCIENTIFIC AMERICAN. 3. Also a rule to line a shaft of any length, supposing the building not to be square? A. Use a level and plumb. See No. 2, p. 24, last volume SCIENTIFIC AMERICAN. 4. Also a rule to find the points where a belt will pass through floors running over different sized pulleys? A. Lay out a diagram to any convenient scale and then transfer the points to the floors where the belt is to pass through. 5. Suppose the valve of an engine be set a little back, what effect does it have on the diagram as made by the indicator? A. The diagram will show that the valve does not open as soon as is desirable. 6. How is the power of an engine computed from an indicator diagram? A. Find the mean effective pressure in the piston in lbs.; multiply this by the speed of the piston in feet per minute, and divide by 33,000.

(24) A. Z. asks for a recipe for waterproofing heavy manilla paper? A. Melt in a vessel 30 ozs. good glue and 3 ozs. gum arabic in 10 pints hot water. In another vessel 20 ozs. soap and 4 lbs. alum. Mix the contents of the two vessels. Call this composition No. 1. In another vessel heat ½ gallon benzole and 1 gallon paraffin, and melt it in 24 ozs. resin. Boil until it attains a good degree of consistency. This is called No. 2. Dip the paper to be waterproofed in composition No. 1 while in a heated state, and then dry it. Next apply composition No. 2 in a cooled state, with a brush, in any convenient manner.

(25) C. H. C. asks how to remove the taste of hydraulic cement, that at first permeates the water in a cistern when first filled? A. The presence of lime in water is a source of great trouble, and to those using it for steam boilers, of the greatest danger, in crusting either as a sulphate or carbonate; and preventing contact between the water and the iron. The only absolute remedy is to distill the water; but this is expensive and inconvenient. If you breathe slowly, through a common clay pipe stem, into a tumbler of lime water, the water will become clouded with carbonate of lime, produced by the carbonic acid of the breath combining with the lime; a deal of this carbonate will gradually settle to the bottom of the tumbler; you might be able to use the water by burning a bushel of charcoal in a clay stove, suspended just over its surface; stir the water occasionally with a stick, and it will absorb a large quantity of the carbonic acid; be careful not to fall in the cistern, as the gas would cause immediate suffocation and death.

(26) C. W. asks how to make a good cement for glass and china ware? A. Soak 2 drachms cut isinglass in 2 ozs. water for twenty-four hours, boil down to 1 oz., add 1 oz. alcohol and strain through a cloth. Mix this while hot with a solution of 1 drachm mastic in 1 oz. of alcohol, and triturate thoroughly with ½ drachm powdered gum ammoniac.

How can I make glycerin soap? A. Take any mild toilet soap and intimately mix with it about one twentieth of its weight of glycerin, while the soap is in a liquid state. It may be tinged red or rose color with a tincture of orchil or dragon's blood, or orange yellow with a little annatto. It may be variously scented, but oil of bergamot or rose-geranium supported with a little oil of cassia, or cassia supported with oil of almonds, appear to be the best perfumes.

(27) A. S. G. asks: 1. What is the calcium light? A. It is commonly called the Drummond light, and is produced by the action of the oxyhydrogen flame on perfectly pure lime, made free from silica by precipitation and afterwards calcined and pressed into moulds. 2. Is it practical to use for lighting a dwelling house? A. No.

(28) R. K. S. asks if water will act as well as oil for lubricating journals, when iron is run on Babbitt metal? A. No.

(29) K. asks: What is meerschaum, and where is it obtained? A. Meerschaum is a hydrous silicate of magnesia. It is a mineral of soft earthy texture somewhat resembling chalk. It is found in Spain and several countries at the head of the Mediterranean, but chiefly in some parts of Greece and Turkey.

(30) H. B. K. asks how to dye horn a black color? A. A deep black may be produced by boiling the horn for some time in a strained decoction of logwood, and then steeping it in a solution of red sulphate, or red acetate of iron.

(31) A. T. R. asks how to color iron wire cloth a blue tint? A. Grind Prussian blue in shellac varnish and use as a paint.

(32) C. H. H. asks: 1. How patent leather is made? A. See SCIENTIFIC AMERICAN No. 4, p. 60 (47). 2. How is the polish given to morocco leather? A. By varnishing with white of eggs and burnishing. 3. How can I make liquid blacking that will give a gloss without the use of a brush? A. Gum arabic 4 ozs., coarse moist sugar 1½ ozs., good black ink ¼ pint; strong vinegar 2 ozs., rectified spirit of wine and sweet oil, of each 1 oz.; dissolve the gum in the ink, add the oil, rub them in a mortar until thoroughly united, then add the vinegar, and then the spirit. Apply with a bit of sponge.

(33) E. O. H. asks: What is the best preparation for removing inkstains from collars, cuffs, etc.? A. Stains may be removed by the application of a little lemon juice, citric acid, diluted muriatic acid, oxalic acid, or tartaric acid; or by means of chlorine water or solution of bleaching powder. The linen should be free from starch and soap, and should be afterwards thoroughly rinsed in warm water before using soap. Marking inks are variously removed by ammonia water, solution of bleaching powder, chlorine water, dilute iodine tincture, or cyanide of potassium—this latter is very poisonous.

(34) W. J. asks: Is there anything that can be mixed with melted paraffin in order to thin it without depriving it of its quick chilling property? A. We know of nothing.

(35) C. D. N. asks: 1. What is dextrin, such as is used for mucilage? A. Commercial dextrin, or "British gum" is obtained by heating dry potato starch to a temperature of 750° Fah. in sheet iron trays or revolving iron or copper drums, similar to those used in coffee roasting, whereby it is transformed into semi-transparent, brownish lumps, which are converted into a pale yellow powder by grinding between millstones. It is completely soluble in cold water, from which it may be precipitated by addition of excess of strong alcohol. 2. How can I keep away the skin or mould that collects on such mucilage? A. Add a few drops of oil of cloves, and exclude dust and air by a suitable cover.

To make a good solution of carbolic acid, what proportion of crystals and water must be used? Must the water be hot? The solution is needed for healing sores. A. Pure (crystalized) carbolic acid dissolves in 20 parts cold water. For use in surgery and medicine it is usually dissolved in diluted glycerin; the strength of solution depends upon the application; for ordinary external healing purposes dissolve one drachm of the carbolic acid in a mixture of one oz. of glycerin and eight ozs. of water.

Why does black ink get ropy like molasses, and what is the remedy? A. Usually from the evaporation of the water, accumulation of dust, or decomposition of the excess of tannin.

(36) B. A. W. asks: How is the dilute solution of terchloride of gold prepared for coloring brass chain? How much soda must be added? A. Dissolve the gold chloride in about 40 parts of water; add 10 parts of the alkali and boil; dip the articles to be colored in this while boiling.

(37) P. O. S. asks how to prepare potassium or ammonium sulpho-cyanide? A. To prepare potassium sulpho-cyanide, mix together 48 parts of anhydrous potassium ferrocyanide, 17 parts of potassium carbonate, and 32 parts of sulphur; introduce the mixture into an iron pan provided with a lid, and fuse at a gentle heat: maintain the same temperature until the swelling of the mass which ensues at first has completely subsided, and given place to a state of tranquil fusion; increase the temperature now to dull redness. Remove the half cooled and still soft mass, pulverize it, and boil with alcohol. Let the alcoholic solution cool, when a part of the salt in the pure state will crystallize out, and the remainder may be obtained by distilling the alcohol from the mother-liquor. Ammonium sulpho-cyanide may be obtained by mixing ammonium cyanide with yellow ammonium sulphide, and digesting this for some time with finely divided sulphur; by boiling the filtered solution the excess of ammonium sulphide may be expelled, and the sulpho-cyanide crystallized out.

(38) J. T. S. asks: What is the gum used on the United States postage stamps composed of, and how is it made and how is it applied? Also whether it can be bought in a gum state? A. Gum dextrin, 2 parts; acetic acid, 1 part; water, 5 parts; dissolve in the water and acid by heat, and add ½ part alcohol. Heat moderately in a covered vessel for some time with occasional stirring. It is applied hot by suitable rollers. It is not sold prepared.

(39) W. T. K. asks: What is honey dew as found occasionally on leaves of trees? A. The saccharine liquid phenomenon has been the subject of much discussion. By some it is supposed to be the secretion of insects; by others not. That plant lice, or aphides, do secrete a saccharine liquid is well established; on the other hand it seems to be equally well established that sometimes the liquid is exuded by the leaves of trees without insects being concerned in the operation. Dry weather is most favorable to its production. It is especially frequent on certain kinds of trees, such as linden. The rain or dew has nothing to do with its formation.

(40) E. T. S. asks: 1. How to make a permanent magnet, horseshoe shape? A. Use hardest crucible steel, wrought into form and tempered nearly to straw color. It may be magnetized by bringing its poles in contact with those of a strong magnet, or by winding it (in one direction) with covered copper wire, and then passing through the wire a strong current of electricity from a galvanic battery. 2. Will it still be a permanent magnet if the horseshoe is straightened out, or can a straight rod be made a permanent magnet? A. Yes; tempered steel of any form can be magnetized.

(41) T. W. asks: 1. What is the easiest and simplest way of finding the horse power of any engine? A. The power of a steam engine is calculated by multiplying together the area of the piston in inches, the mean steam pressure in lbs. per square inch, the length of stroke in feet, and the number of strokes per minute; and dividing the product by 33,000. 2. Was James Watt the first inventor of the steam engine? A. No. 3. What kind of an engine did he produce? A. A low pressure condensing engine. 4. We have a well that always had plenty of water in it, but this summer it has dried up. A well adjoining has always plenty of water. Our well is open at the top and the other is not. Is there a remedy so we can get water? A. Perhaps the following will start the flow: Introduce several hogshead of water, seal the mouth of the well around a tube reaching to the bottom, and apply a pump. 5. An engineer says that a suction pump when put in to feed a boiler against 60 lbs. pressure, the pump would always stop and stick. I said it was the strain put on it, he said the pump contained more water than it could force. Which is right? A. You are probably both right.

(42) R. S. asks: I have a recipe for silver plating which reads thus: Dissolve 1 oz. nitrate of silver (crystal) in 12 ozs. water, then dissolve in the water 2 ozs. cyanuret of potash, and shake; then add ½ as much whiting as there is of the fluid, and it is ready for use. Is this a good recipe and safe to use? A. The bath will probably work well without the addition of whiting. The double cyanide of silver and potassium is the best

bath for electro-plating, but it is well to observe that the materials are extremely poisonous when introduced into the human system.

How can I make soft solder in thin sheets? A. By rolling.

(43) B. & S. ask how to detect the presence of benzine in turpentine? A. The presence of any notable quantity of benzine in turpentine can readily be detected by the sense of smell. Place a little of the suspected oil in a small test tube, pour over it an equal quantity of rain water, cork, and shake once or twice; then let rest. If, after standing a minute, the parted fluids still remain opalescent, adulteration is provable.

(44) R. L. F. asks of what the ink with which postage stamps are printed is made of? A. For the three cent stamps the ink is made of a mixture of Prussian blue and chrome yellow of a standard grade (made only for the government) ground in a compound oil, the precise nature of which is not made public. For the one cent denomination the color is ultramarine—sulphides of sodium and iron, and silicate of alumina. For two cent stamps sulphide of mercury is used, and for the 90 cent, carmine.

(45) N. C. L. asks how to copper plate leaves of trees, insects, feathers, and other perishable things, so as to preserve the form? A. Brush the leaves or other objects over with black lead. Insert a pin, and to this attach a wire that is connected with the zinc of the battery. It may be placed in the solution and the whole arrangement completed by the insertion of a piece of copper, which is to be connected with the silver of the battery.

How can I cast a medal, and what composition can I use? A. You can make the mould of calcined plaster of Paris. Old type metal is a good material to use for casting.

(46) G. R. G. asks: Is such a thing as a hydraulic ram without an air chamber practically possible? A. No.

(47) J. C. asks if there is a preparation or paint that, when applied to a building, will render it fireproof, and withstand the heat of a burning building adjoining? A. No.

(48) J. B. asks for a process for engraving on brass? A. Cover the plate with a film of wax and surround it with a border made of beeswax 1 part, pitch 2 parts, and tallow 1 part. Cut through the film of wax with sharp instruments, leaving the outline of the design clearly shown in the metal of the plate. Flow the plate with a mixture of equal parts of aquafortis and water. When the acid has eaten sufficiently into the plate, wash thoroughly in warm water to prevent its further action.

(49) A. S. asks for a recipe or composition for beeswaxing floors? A. In a hot solution of 5 lbs. of good pearlash, in soft water, is stirred 10 lbs. of good yellow wax, shaved or rasped fine. Stir the mixture while boiling, and when effervescing, add, while stirring, 5 lbs. dry yellow ocher. Pour into cans or boxes and let it harden. When wanted for use, diffuse 1 lb. of the mixture in 5 pints boiling hot water, stir the mixture well, and apply, while hot, to the floor with a paint brush. It dries in a few hours, when polish with a floor brush and wipe with a coarse woolen cloth.

(50) L. P. S. asks for the quickest and best method of making vinegar from cider, and also which makes the best vinegar, early or late cider? A. Take, say 10 gallons, new cider, and suffer it to ferment fully, which will probably be in about two weeks if the weather be warm; then add about 8 gallons of new cider for producing a second fermentation, and in about two weeks add a like quantity to produce a third fermentation. Stop the bunghole of the barrel with an empty bottle with the neck downward, and expose to the sun. When the vinegar is come, set in a cool place. When making, let there be a moderate degree of heat and free access of external air. The process is hastened by adding to the cider a quantity of mother of vinegar, as it is called, a whitish ropy coagulum, of a mucilaginous appearance, which is formed in vinegar and acts as a ferment. The strength of vinegar depends on the amount of sugar or starchy matter to be ultimately converted into acetic acid. Cider made from late apples is esteemed the best for vinegar.

(51) Orator asks if the drug cucu possesses the power to make the bashful bold, as some persons claim for it? A. No; but a whiff or two of ether is said to allay "stage fright" and similar forms of nervousness.

(52) N. Y. asks: What is butter of antimony? A. It is liquid chloride of antimony. It is made by dissolving crude or roasted black antimony in muriatic acid with the addition of a little nitric acid.

(53) S. E. N. says: I want to prevent iron rollers from rusting that are used on wet and dry linen? A. Heat your rollers with steam if practicable.

(54) D. A. R. asks for a recipe for red ink, to be used with a rubber stamp? A. Mix aniline red 2 to 4 drachms, alcohol 15 ozs., and glycerin 15 ozs.

(55) J. M. W. says: I send you a worm that I found in an old rotten log; there were several of the same kind in said log. Can you tell me the name of it? A. It is the *Julus multistriatus*, belonging to the group *millepedes*. It is commonly found under sticks, etc. It is long, cylindrical, hard, with numerous feet, short and weak, attached to the under surface of the body nearly at the middle of the abdomen. The antennæ are short and filiform. They crawl rather slowly, and at rest curve the body into a ring. They live on vegetable substances or eat dead earthworms or snails.

(56) A. W. P. says: I send a box containing a bug or fly; what is the name of it, and the product of the egg laid? You will observe it was captured in the act of pregnating a piece of bark. The probe that is pierced in the bark belongs enclosed in the sheath under the belly, which divides in halves to receive it. A friend says that the egg forms a grub between the bark and the wood. A. It belongs to the family of "horntails," *sroceridæ*, Leach, so called from the long prominent horn on the abdomen of the males, while the ovipositor or "saw," resembling that of the true saw flies, is attached to the middle of the abdomen and extends considerably beyond its tip. The larvæ are "cylindrical fleshy grubs," of a whitish color, with a small rounded horny head and pointed horny tail. They are provided with powerful jaws, wherewith they bore long holes in the trunks of the trees they inhabit. They are wood eaters, and often do great damage to trees—mostly of pine and fir.

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

S. L. S.—No. 1, sample of clayey soil in small bottle, contains silica, alumina, lime, magnesia, oxide of iron, silicates, traces of sulphates, phosphates, and sulphides, organic matter, and about 15 per cent of water. It is not a rich soil. No. 2 is a deposit of carbonate of lime, with much carbonate and oxide of iron, in a trap rock. —W. H. W.—From the examination made, it appears to be a clayey deposit, containing a large percentage of iron, moisture, and an oily or waxy substance somewhat resembling ozocerite—if the latter proves to be the case it may be of more value.—W. G. B. H.—It is semi-decomposed ferric sulphide—white pyrites—mixed with earth and iron oxides. The partial desulphurization may have been occasioned by heat.—A. D.—Dark greenish-blue powder. It is probably a mixture of sperm oil and aniline blue, with traces of copper and iron. The amount of substance was too small for a complete examination.

COMMUNICATIONS RECEIVED.

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

On the Carolina Mantis. By C. F. S.

On a Magnetic Railway. By J. W. C.

Also inquiries and answers from the following:

J. M. B.—W. W.—A. M. R.—A. T. O.—M. M.—E. H. —A. A. F.—M. M. S.—W. V. P.—A. W. P.—B. & N. —Mrs. L. N. C.

HINTS TO CORRESPONDENTS.

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

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

Hundreds of inquiries analogous to the following are sent: "Who publishes text books on journalism? Who makes well augers and drills?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

OFFICIAL.

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FOR WHICH

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

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AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

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

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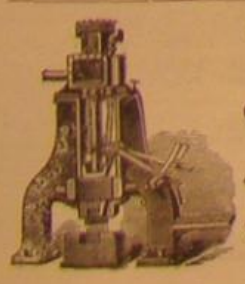

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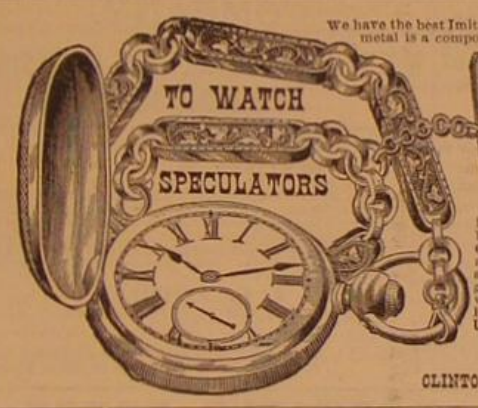

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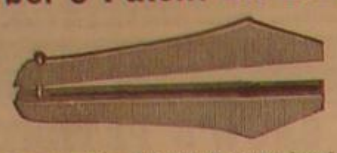

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A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. XXXVII. No. 19. [NEW SERIES.] NEW YORK, NOVEMBER 10, 1877. [$3.20 per Annum. [POSTAGE PREPAID.]

THE IMPERIAL BRICK MACHINE.

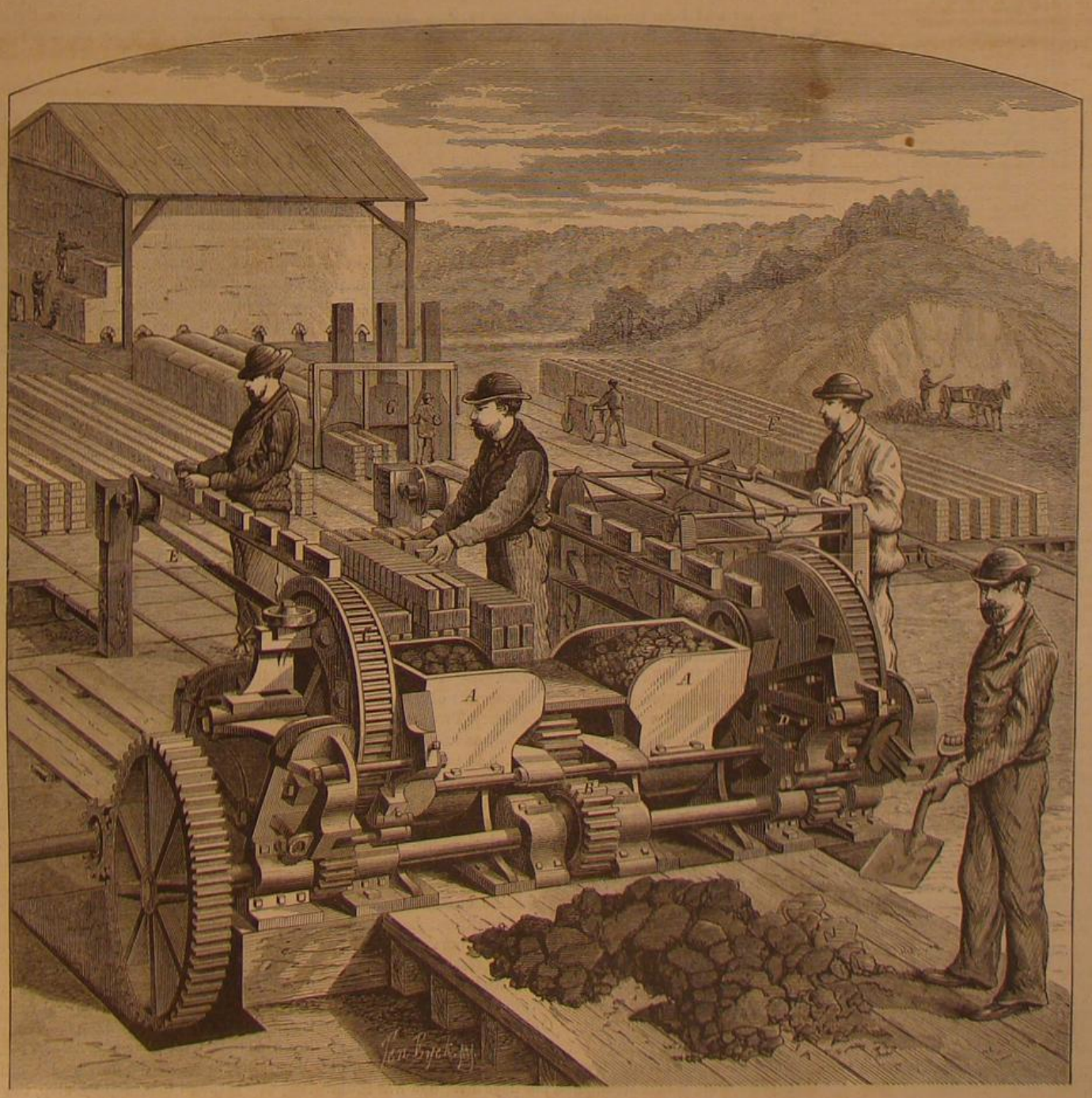
The brick machine illustrated in the annexed engraving belongs to that class which comprises all those in which the clay is first mixed in a pugmill and therefrom pressed into moulds disposed on a rotating mould-carrying disk. In this class there are two varieties, first, machines in which the pugmill is vertical and the mould disk horizontal; second, those in which the above relative positions are reversed. A glance at the engraving will show that the present apparatus is of the last mentioned variety. It uses clay taken directly from the natural bed, over which, just before entering the machine, sufficient water is thrown to cause it to be properly tempered while being ground and mixed. Another important feature of the apparatus, as here illustrated, is that it is double—two machines in one—which produce a proportionately greater quantity of bricks.

The clay is thrown into the two hoppers, A, and descends into the horizontal mixing cylinders below. Of these there are two, and through both passes a 6½ inch wrought iron shaft, actuated by the gearing shown at B. In each cylinder and on the shaft are steel cutters, and also screws, the latter adjusted in relatively reverse directions, so that the clay is thus forced out of the outer ends of both cylinders at once; and at the same time the thrust due to the resistance in working the clay is sustained wholly by the shaft, which becomes subjected simply to a compression. This last is an important advantage, as the thrust being removed from bearings or any other neighboring portions, durability is gained, friction diminished, and consequently less power is required to drive the machine.

The tempered clay on being forced outward by the screws enters the moulds, which are formed in the inner faces of the rotating mould carriers, C. As these revolve, a stationary knife at D removes any excess of material. Ten of these moulds are contained in each carrier or wheel, and each mould has a movable bottom with a roller that travels on an eccentric track beneath it. This, as the wheel turns, gives a series of pressures to the brick. An opening is left before the last pressure to allow any surplus clay to escape, so that when the brick comes to the cam that pushes it out upon the endless belt, E, it is perfectly formed.

With the double machine two of these belts are of course employed and a man stationed at each removes the bricks as fast as formed and places them on hacks, planks capable of holding five hundred bricks each. Each belt is about 10 feet in length, and is capable of holding 11 bricks. The capacity of the double machine is claimed to be from fifty to sixty thousand bricks per ten hours—for the single machine, where but one mixing cylinder and mould carrier is employed, half that aggregate. In connection with the above described apparatus, a truck is employed for transporting the brick to the drying yard. The construction of this is shown at F. It runs on four wheels, and is brought over a loaded hack plank. By means of a crank and simple mechanism the latter with its load is lifted, and suitable tracks being provided, the truck can be moved off by one man to any desired point, where the hack is deposited. He then takes a hack plank of dried brick to the setter (in the same way) under the kiln shed, deposits it, and returns to the machine in plenty of time to get a new load. By this means, we are informed, one man can move 25,000 green brick from the machine to the yard, and take therefrom 25,000 dry brick to the setter in one day. The other hands required are two men to shovel in clay, and two to remove and hack the brick.

Another brick-making improvement, devised by the manufacturers of these machines, is the drying oven shown at G. This is simply a long brick chamber, into which in winter time the hacks of green bricks are placed to be dried. A fire is ignited at one end of the chamber, and the heat passes through and escapes at the chimney at the other end. This admits of the bricks being expeditiously dried, and saves their exposure to the weather. We have seen this machine in operation at the brickyard of the company below named. It produces excellent bricks with remarkable rapidity. Patented January 11, 1876, by Mr. E. R. & W. E. Gard. Other patents now pending. For further particulars address the Imperial Brick Machine Company, Croton Landing, New York.



GARD'S IMPERIAL BRICK MACHINE.

THE English arctic exploring vessel Pandora is to undertake another expedition next Spring, and an attempt to reach the pole by way of the Spitzbergen, instead of by the Smith's Sound, route will be made.

Properties of the Human Gastric Juice.

The *Press and Circular* says M. Charles Ricket has been experimenting upon the patient on whom Professor Verneuil recently performed the operation of gastrotomy. According to his researches the acidity of the gastric juice is equivalent to 1·7 grammes of hydrochloric acid to 1,000 grammes of fluid. This acidity increases a little at the end of digestion. Wine and alcohol also increases it, but cane sugar diminishes it. It tends to return to its normal acidity after the introduction of acid or alkaline matters. The mean duration of digestion is from three to four and a half hours, and the food does not pass gradually out of the stomach, but in masses. According to four analyses, after a modification of Schmidt's method, free hydrochloric acid exists in the gastric juice; and altogether this secretion appears to consist of one part of lactic acid to nine parts of hydrochloric acid, the former of which is free in the gastric juice. The nature, therefore, of the free acid in the stomach seems almost solved, and it may be said that in every 1,000 grammes of the juice there are 1·53 grains of hydrochloric acid and 0·43 of lactic acid.

Medical Uses of the Tupelo.

The root of the tupelo tree, indigenous to the United States, is being used with success, so says the *Medical and Surgical Reporter*, by various obstetricians, for dilating the *os uteri*. It is said to be superior for this purpose to seatangle, as its power of absorption is greater; it is as light as a cork, and its fibre is fine-grained, capable of being made very smooth, and therefore easily introduced.

The Compass Plant.

It is well known to botanists that the western plant growing on the open prairies, and known as *Silphium laciniatum*, has the remarkable property of turning many of its leaves nearly north and south, and hence the name "compass plant." It is also called "rosin-weed," from its copious resinous juice. In order to determine to what extent this alleged polarity exists, C. E. Bessey, of Ames, Iowa, has made a large number of accurate observations, which he reports in a late number of the *American Naturalist*. Out of 93 observations, 54 were found which pointed more or less east of north, and 39 more or less west. Of the 54 which pointed eastwardly, 18 were within 5° of north; 8 more within 10°; 7 more within 15°; 5 more within 20°, and 3 more within 25°; leaving only 14 leaves which diverged more than 25° from due north. Of the 39 which pointed to the west of north, 9 were within 5°, 5 more within 10°, 3 more within 15°, 7 more within 25°, and 7 more within 35°; leaving only 8 which diverged more than 35° from due north. Its polarity is fully established.

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ARRESTED DEVELOPMENT.

The interest excited by Von Chauvin's recent observations upon the axolotl seems to be somewhat in excess of the actual novelty or importance of their results. The axolotl is not the only creature whose development has been rapidly carried forward from a stage, permanently low in the natural state, to another and higher one, in consequence of human interference. Nor, as we noticed the other day, were that lady's specimens of the axolotl the first to undergo, under observation, the, to them, abnormal transformation into fully developed *amblystoma*. Besides, we are strongly inclined to suspect that, so far from determining or compelling the evolution of the two which survived her treatment, the German lady's attention to her pets was the reverse of helpful. Had they been let alone, it is quite possible that the fatalities would have been fewer and the progressive development of the survivors not less remarkable.

For the benefit of those unfamiliar with the creatures in question, we will note here that the transformation alluded to corresponds to that of the water-breathing tadpole into the land inhabiting and air-breathing frog. Seventy years ago Cuvier suggested that all siredons (like the axolotl) might in reality be larval salamanders, that is, the tadpole stage of higher batrachians. The observations of Dumèril upon numerous specimens of axolotl, bred in the Natural Historical Museum at Paris, proved the old suspicion to be substantially true, at least in one instance. In its natural habitat—the Lake of Mexico, and neighboring mountain lakes—the axolotl is, so far as known, always an inhabitant of the water. The specimens transported to Paris remained unchanged; but some of their offspring passed on to a higher stage of development, developing lungs in place of branchia, and becoming perfect *amblystoma*, hitherto regarded as belonging to a distinct family. Why all did not complete the same course of development was a mystery to Dumèril (whose observations were published in *Comptes Rendus*, 1865 and 1867); but a possible explanation was suggested by observations made soon after by Professor Marsh and other American students, upon several allied species of siredons from the elevated lakes of the Far West. Professor Marsh's observations were published in the *American Journal of Science* for November, 1868.

That distinguished observer had seen Professor Dumèril's account of the remarkable metamorphosis of the second generation of the axolotl (*siredon Mexicanus*) in Paris; and, during his next summer's excursion to the Rocky Mountains, took pains to secure a number of specimens of *siredon lichenoides*, Baird, from Lake Como, Wyoming Territory. At the same time a number were secured by Professor Eustis, of Harvard. The two lots were brought to New York together and here divided, part going to New Haven with Professor Marsh, the rest to Cambridge, to be observed by Professors Wyman and Eustis. Professor Marsh's specimens made the passage to New Haven without apparent inconvenience, either from the long journey or their transference to fresh water, the water of Lake Como being brackish. They fed readily upon worms and insects, and occasionally came to the surface and inhaled air. More rarely an exhalation occurred, usually under water. On being removed from their native element they showed the same distress as fishes under similar circumstances, although in a much less degree.

The first indications of any change were observed in one of the smaller specimens; and the metamorphosis apparently began during the journey, which lasted about a week. The animal first became spotted and of a darker hue. Then the broad thin membrane along the back, and above and below the tail, was gradually absorbed; the external branchia followed more slowly; the dark spots increased in number; and the animal came more frequently to the surface for air. By the time the swimming and water-breathing appendages were absorbed, and the openings on the neck closed up, the head had undergone marked changes in shape; the eyes had become more convex and prominent; the body had largely decreased in bulk; the thin external skin was shed, and the secretion of mucus from the surface sensibly diminished. At the same time the animal showed an increasing desire to leave the water, often remaining for some time with its nostrils above the surface, and occasionally made violent struggles to escape. Aided by a heavy rain at night it at last succeeded, and thus put an end to further observation, just at a time when it had lost the generic characters of siredon and become a true *amblystoma*.

A few days later, several other specimens of various sizes began to show signs of transformation. Two were placed in a glass jar, and left in a strong light, and five others were left in a cooler place in the shade. At the end of three weeks the first two had completed the metamorphosis. The others changed less rapidly, or not at all, three completing the metamorphosis in about six weeks, while two showed little or no change, remaining typical siredons. In those that were transformed, a succession of warm days hastened the process remarkably, while it was all but arrested by a series of cooler days. Of the specific changes which the specimens underwent in structure, dentition, habits, etc., in passing from the siredon to the amblystoma state, full information may be found in Professor Marsh's paper.

At the time his specimens were under observation, the specimens taken to Cambridge were being studied by Professors Wyman and Eustis. Only one of the latter was transformed, and change occurred much less speedily than those in New Haven. Two, kept by Professor Eustis, escaped during a rain storm, and six days after one was found still alive, though shrivelled up and the branchia partially gone. On being placed in water, it refused food and died. The lateness of the season probably prevented the transformation of the others.

In the next number of the *American Journal of Science*, Professor Silliman contributed a note describing a colony of *amblystoma* in the possession of a person at Cheyenne. The proprietor assured him that when they were received from Lake Como, a few weeks before, they were all in the "fish" state; that they began to change soon after, and in about three weeks were all completely developed into salamanders. That this change ever occurs in Lake Como, there is, so far as we are aware, no evidence. In this connection, Professor Marsh remarks that, in the elevated region where Lake Como is situated (7,000 feet above the sea), although the weather in summer is quite warm, the nights are always cool, and the changes of temperature often sudden and very great; hence the metamorphosis, if it began, would probably proceed slowly and be liable to suspension during its various stages. That the animal breeds in the siredon state, like the axolotl, he is quite ready to believe; and he remarks that it is probable that after reproduction the power of complete development would be lost. Here is, perhaps, the explanation of the persistence in the siredon state of the majority of the specimens of axolotl observed by Dumèril and Von Chauvin.

A legitimate inference from all the facts would seem to be that the siredons of the elevated lakes of Mexico and the United States are *amblystoma*, whose complete development has been arrested by increasing elevation and consequent climatic change, at a period relatively so recent that they have not entirely lost their ancestral capacity for becoming fully developed under favorable conditions. The transference of reproduction to the larval state is not an insuperable objection to this inference, since, as Professor Marsh observes, the near approximation in many batrachians of the periods of reproduction and metamorphosis, and the effects (especially upon the latter) of even slight differences of physical conditions, are known to produce remarkable variations in the same species, as well as other results, until recently quite unexpected.

It is well known, for example, that our common large bullfrog (*rana pipens*) may remain in the larval or tadpole state, in the colder parts of New England, for many times the normal period; and Professor Wyman once kept the transformation of such tadpoles under arrest for a number of years, the experiment being thwarted at last by an accident, which emptied his tank and killed his specimens. This line of investigation is worth the attention of some of our younger naturalists. It is quite possible that, by a skillful use of light and temperature, the tadpole stage in the bullfrog may be continued until after the reproductive faculty has been developed, and the natural history of siredons paralleled by art.

PROFESSOR TYNDALL ON THE PHENOMENA OF HUMAN LIFE.

Professor Tyndall has recently delivered before the Midland Institute at Birmingham, England, one of those characteristic addresses of his which seems to us likely to excite discussion as widespread as that aroused by his famous prayer gauge proposal and the great Belfast speech. The idea that there is no necessity for invoking the supernatural to account for the ordinary phenomena of human life has already been repeatedly foreshadowed in Professor Tyndall's writings. Nor has he been at all alone in that view, as it is virtually the same as is held by the majority of scientific reasoners of the present time. But in this late address, (which, owing to its length, we cannot publish in these columns, and therefore refer the readers to the pages of the SCIENTIFIC AMERICAN SUPPLEMENT, current issue, where it is printed in full) he crystallizes, so to speak, that opinion and the arguments on which it rests into a compact mass of logical reasoning. With all that clearness, precision, and beauty of language which have rendered him almost without a peer as a public lecturer, he places before us a chain of argument, or rather causes his hearers to forge the links themselves, he only acting as guide, and thus enables them to reach for themselves a logical conclusion.

Just as in the opening of a musical work, a suggestion is given of the themes afterwards to be wrought out, so in his introductory sentences, by which the audience is placed in good humor with themselves and the lecturer, Professor Tyndall manages to shadow forth an instance of absence of free will. Half humorously he deplores the hard fate of modern scientific men, who like himself are drawn from their quiet laboratories and forced into publicity which is not conducive to the exercise of their best powers. Unlike Joule and Darwin, who are not dragged from their seclusion and made presidents of associations, he himself is a special sufferer, but social duties are paramount to his will. With this much preamble he launches into a splendid account of that great theory of modern science, the doctrine of the conservation of energy. "There is nothing gratuitous in physical nature," he says, "no expenditure without equivalent gain, no gain without equivalent expenditure. With inexorable constancy the one accompanies the other, leaving no nook or crevice between them for spontaneity to mingle with the pure and necessary play of natural force. Has this uniformity of nature ever been broken? The reply is, 'Not to the knowledge of natural science.'" Then follows a wealth of illustration to show the universal application of the great law, and through this, step by step, the hearer is led to the

question of the energy of the human machine. Joule's statement is quoted, that unless we abandon the physiological axiom that "the animal body cannot create heat out of nothing, we are driven to the conclusion that it is the total heat within and without that ought to be regarded as the real calorific effect of the oxidation within the body." A man weighing 150 pounds consumes, we are told, in lifting his own body to a height of 8 feet, the heat of a grain of carbon. Jumping from this height, the heat is restored. The muscles of a laborer whose weight is 150 pounds weigh 64 pounds. When dried they are reduced to 15 pounds. Were the oxidation corresponding to a day laborer's ordinary work exerted on the muscles alone, they would be wholly consumed in 80 days. It is but a step further on to ask what enables the production of bodily motions, and to enquire whether it is the action of the will. The answer is that the will is mediate, not direct. The nerves controlled by the brain pull, as it were, the trigger, but the gunpowder which they ignite is stored up in the muscles. "We all know the effect produced on a nervous organization by a slight sound which causes affright. An aerial wave, the energy of which would not reach the minute fraction of that necessary to raise the thousandth of a grain through the thousandth of an inch, can throw the whole human frame into powerful mechanical spasm, followed by violent respiration and palpitation."

Thus far—and we have given but the barest outline of the argument—nothing has been advanced which rises to any other level than that of plain scientific truths which no one can hesitate to accept. But now comes the question: What causes the nerves to act and liberate this gigantic power? Who or what is it that sends and receives massages through the bodily organism? The query is answered thus: "You picture the muscles as hearkening to the commands sent through the motor nerves; you picture the sensor nerves as the vehicles of incoming intelligence; are you not bound to supplement this mechanism by the assumption of an entity which uses it? Are you not forced by your own exposition into the hypothesis of a free human soul?" Henceforward the whole drift of the address changes—persuasion and abstract argument replace scientific deduction; but the speaker has proved us necessitarians by necessity, and then, lest the dilemma afflict us, goes on to show that the belief is by no means such a dreadful one.

Are the brain, and the moral and intellectual processes known to be associated with the brain, subject to the laws we find paramount in physical nature? This is the final problem. Science has led us into the domain of metaphysics, and we have been prepared for the affirmative response. The phenomena of heredity, of how much we owe to the transmitted influences of the past, how closely we are bound up in a chain of events—evolution, whence we cannot escape—all are adduced to prove that we are not masters of the circumstances in which our motives and wishes originate, and "if finally our motives and wishes determine our actions, in what sense can these actions be said to be the result of free will?" "There is," says Professor Tyndall, in his closing sentences, "on all hands a growing repugnance to invoke the supernatural in accounting for the phenomena of human life; and thoughtful minds, finding no trace of evidence in favor of any other origin, are driven to seek in the interaction of social forces the genesis and development of man's moral nature. If they succeed in the search—and I think they are sure to succeed—social duty would be raised to a higher level of significance, and the deepening sense of social duty would, it is to be hoped, lessen, if not obliterate, the strife and heart burnings which now beset and disguise our social life."

THE AMERICAN RAILWAY SYSTEM.—MAINTENANCE OF WAY.

In presenting some facts illustrative of the progress in railway management in this country, we take data from the Pennsylvania Company, that great organization, by virtue not only of the unparalleled extent of its lines, but by the rare administrative ability by which they are controlled, pre-eminently deserving to take first rank as an example. In no other similar organization are the principles of engineering, construction, maintenance, and management carried to higher standards, and we doubt if any other road can show so thorough a system in all its departments. In each of these, for example, certain standards are decided upon as a result of long experience, and these become the inflexible and governing law, whether it be a mechanical measurement or a matter of policy, and subordinates are rigidly held thereto, no departure being permitted. A somewhat amusing illustration of this occurred recently, when a friend, traveling on their line on a pass issued to him as the company's guest, because of an informality therein, and having insufficient funds to buy a ticket, had presented to him by the conductor the alternative of getting off the train or depositing his watch as security. Being a sensible man he appreciated the situation, surrendered his time-piece, and continued his journey, receiving his property back in due time with a polite explanation from the company's office. The conductor had no discretion in the matter, and courteously maintained the regulation for such case made and provided. This inflexibility might appear to defeat progress in certain departments, but to prevent this tendency, the company maintains a corps for the express purpose of conducting experiment, and any practical improvement reported by it, is put to the working test, and, if demonstrated to have real value, is adopted, but is not, prior to its adoption, allowed to affect any of the railway company's operations in the slightest degree.

A recent article furnished some interesting facts relative to the running of their trains under the block system, and it is proposed herein to explain the method by which their magnificent roadway is maintained in such superior condition. To begin with the official organization of the company is such as to secure with a proper distribution of labor and responsibility the greatest possible efficiency.

The entire line is divided into three grand divisions, severally known as the New Jersey, the Pennsylvania, and the Philadelphia and Erie. Over the whole there presides, independent of the Board of Direction, one general manager and two engineers, one of the latter having charge of bridges and buildings, the other of maintenance of way. Each division is under a general superintendent, and being divided into sections of about 100 miles each, called sub-divisions, for each of which there is a division superintendent. These subdivisions are again divided, say into three parts, over each of which is a supervisor. Under him are sub-division foremen, having 2½ miles of track each to work and keep in order. The number of men allowed to these foremen is determined by the peculiarities of the locality, more men being necessary for difficult sections, as in the mountain regions or wherever the trackway is exposed to exceptional danger.

The important relation of the condition of a road way to its carrying capacity, and the economical management of the traffic over it, was so evident that it was determined to develop the highest possible standard of excellence in this department. The various engineers, superintendents supervisors, and other practical men, met in consultation to decide what various items were essential to the production of a perfect road. Suggestions were made and discussed fully, after which short sections were ordered, constructed according to the plans agreed on, and when ready these were inspected and criticised by the same officers, some modifications suggested, and still further improvements developed. This sample track was as nearly ideal in every particular as it could be made, as to solidity, evenness, drainage, joints, ties, etc., while the surface was finished with all the care and accuracy of that of a drive in Central Park.

When completed to the satisfaction of all, the sub-division foremen and others were referred to it as the standard, and notified that it was expected that the entire line would be brought to a like condition. To encourage a healthful emulation among the subordinates, it was suggested (by Mr. Cassatt, Vice-President) that premiums should be offered for excellence of trackway, namely, $100 to the supervisor whose section should rank highest, and $50 to each foreman whose piece should approach most nearly to the standard. The method employed to determine these awards is both thorough and impartial. About the first of November the various engineers, superintendents, and others go over the entire line in a special car from east to west at a speed of forty-five miles an hour, to test severely the riding qualities of the road. Then the party make the return trip at ten miles an hour in a gondola car, as it is called, which is placed in front of the engine and has seats arranged in tiers, so that all have an unobstructed view of the track. Each person is provided with a printed table, the horizontal rulings of which represent the different 2½ mile sections, with the names of their respective foremen at the left side and the perpendicular rulings representing the different items, specified by name, which are to be examined and criticised. Under these latter rulings each inspector enters a number from 1 to 10 to express his estimate of the quality of each part of the work; 10 is the symbol of perfection, and is never employed, on the principle that the ideal is never quite reached; in fact 8 is rarely used.

The total of each foreman's number is extended to the right, and his average obtained by dividing the sum by 11, that being the number of ratings on the table. Each member of the inspecting party makes his own figures independently, and they are subsequently aggregated and a grand average struck to determine which of the men are entitled to the prizes. It should be remarked, however, that as not all the eleven items that go to make up the perfect roadway are of equal importance, discrimination is made in favor of the foreman whose track is in the highest mechanical condition in the essential points, these features very properly outweighing mere superficial appearance.

When the awards are made, printed announcement is given, and the effect has proved most healthful. The prize money is of course in itself very acceptable, but the prestige is still more valued, as the man is put in the line of promotion, and his work attracts much attention from his fellows, who are guided by its excellence in the next competition.

It is by this system that the Pennsylvania Railroad Company, having first constructed its roadway upon the most thorough principles, not only maintains its excellent condition but constantly improves it. No thoughtful traveler in passing over it can fail to be struck with its solidity and fine appearance, it being in fact a great macadamized way. If he is really observant he will see that its condition is an explanation of the safety and comfort of the great travel over it. Those familiar with the freedom from dust, secured by the stone ballasting used on the entire line in Pennsylvania, will be pleased to learn that the road between New York and Philadelphia is to be finished in the same way, the work now being in progress.

NOTES OF PATENT OFFICE DECISIONS.

In Gordon's case, just decided by the Acting Commissioner of Patents, the trade mark sought to be registered was described as a narrow strip of leaf tobacco placed as a wrapper around the mouth piece of a cigarette.

It was held by the Examiner of Trade Marks that the above matter claimed, as a trade mark, was a functional part of the cigarette and was consumed with it; that, in fact, it entered into the mechanical structure of the article itself, and therefore was not an arbitrary symbol or a lawful trade mark.

It will do, however, to carry this doctrine to the extreme of saying that nothing can be regarded as a proper trade mark which is so intimately connected with an article as to be consumed with it; for if that were the rule, a mark upon a cake of soap, a symbol in the sole of a shoe, and many other forms of devices which might be mentioned, and which are undoubtedly excellent trade marks, would lose their character and value as such from the mere fact that the use or consumption of the article would also result in the destruction of the mark.

A distinction must be made in these cases, between the material, which is essential in the structure of the article, and unessential matter placed thereon or incorporated therein, for the mere purpose of distinguishing the origin or ownership of the article.

Thus the box, barrel, or wrapper containing merchandise, whatever its form, cannot, *per se*, be the trade mark; but a name, symbol, figure, letter, form, or device, cut, stamped, cast, impressed, or engraved thereon, or in some other manner attached thereto, or connected with the article itself, may be a proper trade mark. The trade mark need not be inseparably connected with the package, as when blown into glass, but it must have the *independent and sole* quality of distinguishing the goods as being of a particular manufacture, or as belonging to a particular party. There could be, therefore, no legitimate objection to the trade mark sought to be registered by Gordon, on the mere ground that it was connected so intimately with the article to which it was attached as to necessitate its consumption with that of the article itself.

But there was a serious objection to the registration on the ground that it did not perform the *sole* office of a trade mark. No one has a right to appropriate to his own use, as a trade mark, a device which, from the nature of the use to which it is put, others may adopt and employ for the same purpose. Now, in this case, the leaf of tobacco which was wrapped around the mouthpiece or end of the cigarette, answered a practical, and, perhaps, a very useful purpose. Being composed of tobacco, it was an addition to the material of the cigarette, strengthened the wrapper, and was probably more agreeable to the taste than the paper of a cigarette. The useful properties of the article, therefore, seemed to be the predominant ones, while the function the wrapper performed as a trade mark was merely incidental. Perhaps a trade mark would have been granted had Gordon applied merely for a silk band attached to the cigarette, or a colored piece of paper, or similar device connected therewith, since, in such instance, the device would perform no mechanical function, or answer any other purpose than that of a trade mark.

The intent of the trade mark law being to afford protection to symbols, and not to inventions or mechanical devices, the question whether Gordon had introduced an improvement in the manufacture of cigarettes was immaterial. If he had introduced an improvement, and was entitled to protection thereon, it could be by a patent only. In the absence of any patent, other manufacturers of cigarettes could not be prevented from using the like useful device.

The Acting Commissioner of Patents, therefore, while overruling the decision of the Examiner of Trade Marks, that a trade mark, which is so intimately connected with an article as to be consumed with it, cannot be registered, yet affirms the decision of the latter officer, that the strip of tobacco leaf served more a mechanical than a distinctive purpose. He therefore denies it registration as a trade mark.

THE WOODEN PAVEMENTS OF CHICAGO.

The *Engineering News* severely criticises the present wooden pavements of Chicago, and declares they are a standing disgrace to everybody concerned in them. That the foundation of the paved streets is not only filled with earth hauled from adjacent excavations, but with all the rubbish, bricks, stones, manure, and kitchen slops that can be obtained in the neighborhood. Nothing is excluded from the fillings. The material is carelessly dumped, and there is no sufficient puddling, ramming or rolling. The solidification of the accumulated mass is anything but uniform. Upon this foundation, so unfavorable to permanence, the pavement is laid. As a consequence it soon shows settlement in places, and solidity is the general exception. There are some hundreds of miles of wood pavement in Chicago, but the *News* declares that there is scarcely a dozen miles fit to travel on, and this pavement has been laid only from three to five years. A Committee of the City Council have the subject in hand, and are earnestly seeking to improve the condition of things and determine what kind of pavement can be best adopted to replace these defective paved streets.

THE publication of the illustrated article on "Graphic Phonetics," to which reference was made last week, has been unavoidably deferred. It will appear at an early day.

THE WREN GAS WORKS.

We illustrate herewith an improved system of manufacturing illuminating gas from crude petroleum, which is cheaper and of higher candle power than ordinary coal gas, and in the production of which apparatus which is both simple and easily managed is employed. Tests made in our presence showed that a 6 foot burner, consuming Brooklyn city gas, gave less light than either a 1-foot or 1⅛-foot burner using the petroleum gas, pressures being the same in both instances.

The common objection to oil gas is that it does not come to the consumer in the shape of permanent gas. That is, the hydrocarbon is not fully gasified, but is rather in a semi-vaporous state; consequently the gas leaves a deposit in the pipes, and smokes when burned. In the present system this difficulty is claimed to be obviated by the construction of the retort used, which is divided by longitudinal partitions into chambers. The oil entering one of these is vaporized, and the vapor then passes through the retort from end to end four times in traversing the compartments. As a large sized retort enters six feet into the fire, it will be seen that the gas traverses 24 feet of heating surface, and in doing so it changes from vapor into a permanent gas.

The engravings given herewith exhibit plainly the arrangement of the apparatus. Fig. 1 shows the construction suitable for fixed works. Fig. 2 represents a portable arrangement. The crude petroleum is held in the receptacle, A, Fig. 2, and thence passes, by the pipe shown, into the inverted siphon, B, which communicates with one of the chambers of the retort which is imbedded in the furnace. It will be noticed that this construction effectually prevents any danger of explosion of the retort, because as soon as the stand pipe chokes, the pressure in the retort meets the entering oil and stops the inflow—the oil running over the funnel of the siphon. Consequently no more oil can get in and no more gas can be made until the excessive pressure is relieved. The stand pipe conducts the gas to an ordinary washing vat, C, and thence it goes to the receiver.

We are informed that such an apparatus as is exhibited in Fig. 1, the retort being 6 feet in the fire, 13 inches high, and 17 inches wide outside, will produce as much as ten large 9 feet gas retorts, or 40,000 cubic feet of gas per day of 24 hours. A No. 2 retort and bench complete, size 5 feet, 6x4 feet, and height 6 feet, is claimed to make the equivalent of 25,000 feet of coal gas per day, or sufficient to supply a village of from six to eight thousand inhabitants, the works being run continuously day and night. If more gas is required two or more retorts can be placed in the same bench, the labor and fuel used being no greater. To produce petroleum gas the equivalent in illuminating power of 25,000 feet of gas, using the single retort, the manufacturer states that 300 lbs. of coal will be consumed in the 24 hours' continuous run. So that the cost of making the gas will stand as follows:

50 gallons of petroleum, at 6 cents	$3.00
¼ ton of coal at $8 per ton	2.00
Labor	4.00
Total	$9.00

This averages 36 cents per 1,000 feet of 80 candle gas. Actual practice has shown that over 4,000 feet of gas of the above candle power can be made from one barrel of crude petroleum which, even at the high rate of 10 cents per gallon, brings the cost of the gas to $7 for 4,000 feet. "This," says one user of the system, "gives a better light than $70 worth of coal gas at $3 per 1,000 feet."

We are further informed that the gas is unaffected by temperature, and that it retains all its properties over an indefinite period. It has been stored in a cylinder for four years, and at the end of that period it was foundto have left no deposit and not to be impaired in its illuminating properties. It is well adapted for enriching coal gas of 11 candle or other low power. One part of petroleum gas to 5 parts coal gas makes a 17 candle light; 4 parts a 21½ candle light, and to 3 parts a 30 candle light. It is also suitable for heating purposes, and especially so for iron and steel working, owing to its freedom from sulphur.

The system is in use in Ashtabula, Ohio, where it supplies the town, the gas holder containing the equivalent of 50,000 feet of coal gas. Also in Shelbyville, Ind., Morris, Ill., and elsewhere, where its employment, we are informed, has proved uniformly successful.

Fig. 2.

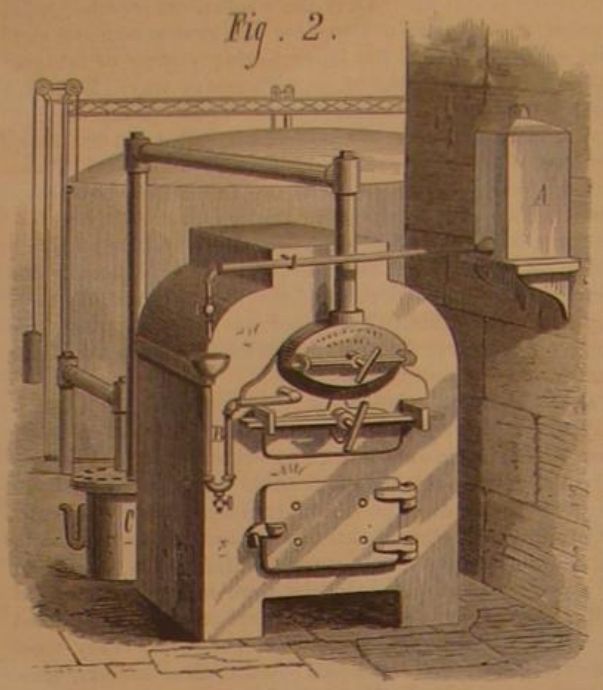


Fig. 2.—THE WREN PORTABLE GAS WORKS.

For further information address Dr. W. C. Wren, Wren's Gas Works, corner of Jay and Water streets, Brooklyn, N. Y.

Analysis of Petroleum.

Anything in relation to petroleum is presumed to be interesting at the present time, and for this reason it may not be out of place to notice that the chemical constituents of rock oil are carbon and hydrogen, generally ninety parts carbon and ten parts hydrogen, by weight. The proportions form about an equal bulk, carbon being heavy while hydrogen is light and volatile. Originally, they both existed as gases, and by their union they form protocarburet of hydrogen, which, being condensed, forms naphtha, or light volatile oil; and after the escape of a portion of hydrogen, the product is petroleum. By a further escape of hydrogen, the product becomes more solid, as bitumen, pitch, or asphaltum, the higher stages of condensation being cannel, bituminous and anthracite coal. The diamond is the purest state of solidified carbon, and is probably a crystalization of carbonic acid gas, unadulterated with hydrogen. Coal oil is artificially produced by converging coal into gas, adding a proper equivalent of hydrogen and then condensing the gas. Iron, sulphuric acid, and water, when placed in contact, give off hydrogen gas. Burning charcoal gives off carbonic acid gas. Mix these gases in proper proportion, subject them to heat under confinement, then allow the heated gas to escape through water, and the condensation will produce carbon oil on the surface of the water, but it will cost about ten dollars a gallon, even if you get through without an explosion.—*Osceola Reveille.*

Columbia Water Works.

The Columbia, Ohio, water works, which are upon the Holly system, have now been in operation about seven years. Since they were built, the city has abandoned the use of their entire force of steam engines, and the losses by fire have been decreased from an average, previous to the introduction of the water supply, of 65-100 of one per cent to 9-100 of one per cent upon the total tax valuation, while since 1870 the valuation of taxable property has increased, in round numbers, from $16,000,000 to $27,000,000 in 1876. The average daily amount of water now being pumped is about 1,600,000 gallons, the machinery with which the works are supplied being capable of furnishing 10,000,000 gallons daily for domestic use or 7,000,000 gallons under fire pressure. There are now in use in the city upwards of 600 improved water meters, from the Eagle Meter Co., of Brooklyn, L. I., which are recommended by the engineer in his report as giving better satisfaction than any meter yet tested. Since their introduction three years ago, the consumption has but slightly increased, notwithstanding the growth of the city. There are about 45 miles of cast iron pipe laid, in connection with the works, which was furnished by H. R. Smith & Co., of Columbus, to the credit of which establishment it may be said that not a single length has thus far been obliged to be taken up from any faultiness of the pipe.

Fruit Bread.

Mr. Campbell Morfit, of Baltimore, Md., has recently patented a new method of preserving the juice of lemons, currants, oranges, and other fruits. He mixes the juice, with or without sugar, with any kind of cooked meal, makes the mass into cakes and bakes them. These cakes are afterwards ground up and used to make a very palatable fruit farina. The fruit juices are said to retain their original flavor and character indefinitely, and thus the fruit bread may become a valuable and convenient addition to the daily ration of sailors, and soldiers in the field.

The Utilizations of Slag.

The principal utilizations of blast furnace slag, nearly all of which, with the exception of the employment of the material as road metal, have come into use within the past four years, are summed up in a valuable paper recently read by Mr. Charles Wood before the Iron and Steel Institute.

Slag sand is employed for making concrete, building blocks, mortar, and cement. The cement is composed of slag sand with common lime and iron oxides, and its strength is said to be little inferior to that of Portland cement, while its price is not one fourth. Slag sand, with about 10 per cent of common slaked lime, makes a good mortar. Concrete is either made from slag sand or slag shingle. The latter is well suited for covering roads and foot paths. Slag wool, produced by the impact of a steam jet with a stream of molten slag, is used for covering steam boilers, steam pipes, ice houses, and cisterns, as a protection against fire, and as a filter for chemicals. Paving blocks and building bricks are made by pulverizing the solid slag and then pressing the bricks in a press.

A remarkble property of the bricks is that nails can be driven into them withoutcausing their splitting. The bricks harden with age. Glass is produced of an impure quality by Mr. Bashley Britten's process, the molten slag being taken in a ladle from the blast furnace and poured into a Siemens furnace, where soda and silica are added according to the quality of the slag used.

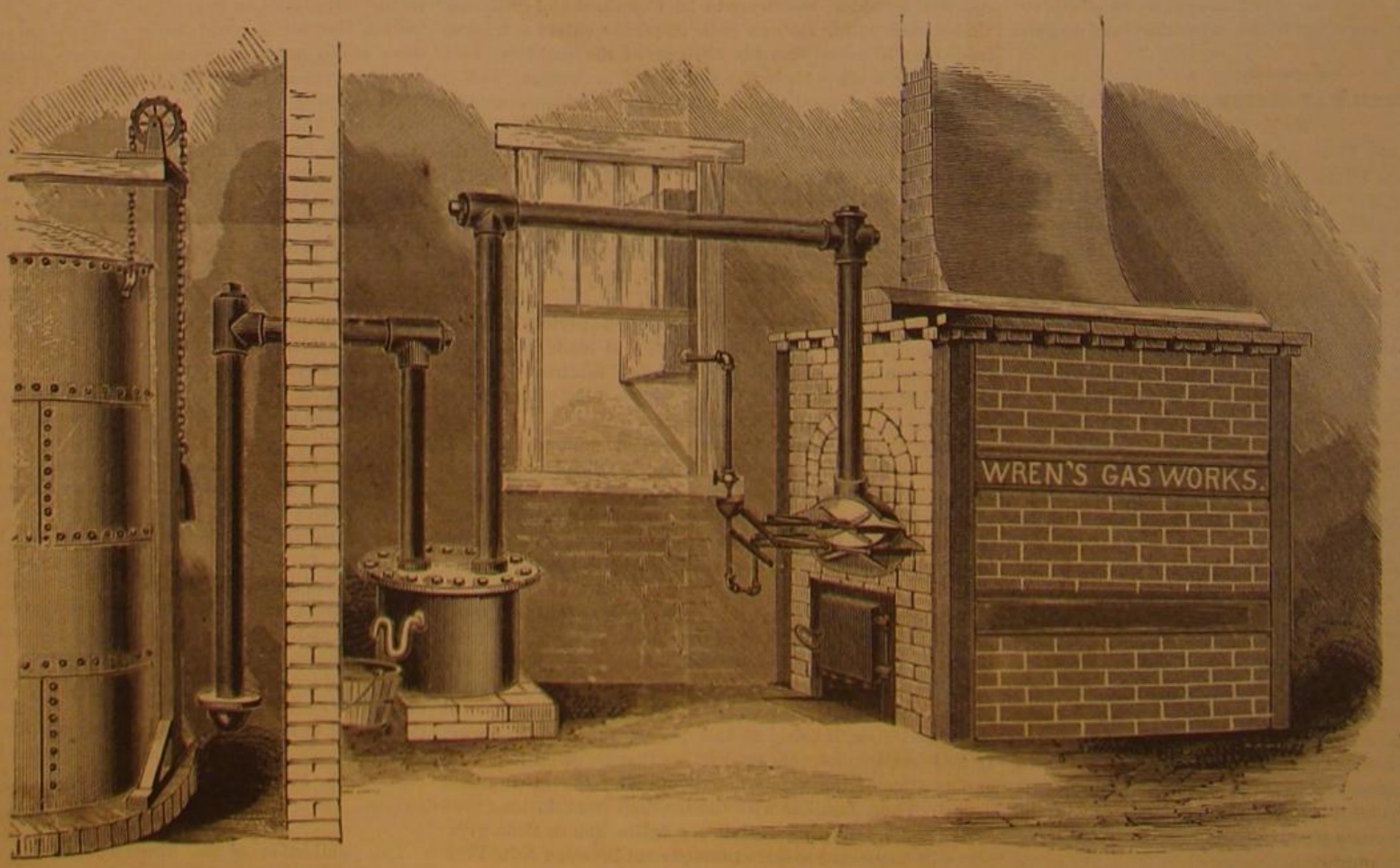


Fig. 1.—THE WREN GAS WORKS.

NEW STANDARD GRINDING MILL.

The annexed engravings represent a new standard heavy 20 inch mill, manufactured by Mr. Edward Harrison, of New Haven, Conn., with which is combined a pedestal and temporary dressing frame, on which the stones may be dressed. The mill is thus rendered complete, and despite its high power is portable, requiring nothing to be built for it to rest upon. It is claimed that the grinding surface of this mill, at 1,400 turns per minute, is equal to three quarters more than an old style 48 inch run at 175 revolutions per minute. The grinding capacity per hour is from 14 to 75 bushels and the weight 1,250 lbs. Fig. 2 shows the pedestal and case made in one casting, with a dressing frame bolted on and the burrs turned out upon it for dressing. The frame is made in two parts which are fastened one on each side of the case by tap bolts, the operation requiring but a few minutes.

This mill, in common with others of different sizes, which we shall illustrate in subsequent issues, is constructed in accordance with the principles, the demonstration of which the manufacturer states to be the result of his fifty years' experience in mill building. Mr. Harrisen believes that no process of milling can be perfect without the use of burr stones, and that such furnish the only proper grinding surface; that the stones should not be large and heavy, or horizontally superposed, or run at low velocity, but that on the contrary they should be light, hung vertically face to face, and driven at high speeds. In the former case there is mashing and over-grinding, in the latter there is neither, while high speed produces the necessary grinding surfaces.

In the present new machine, we are informed that the entire construction is of iron and steel except the burr stones. The runner stone is held as firmly to the spindle as a lathe head. All the bearings in which it runs are unusually long, which render it impossible for the spindle to get out of line. The faces of the burrs are protected from injury during the passage of hard or foreign substances through the mill by means of a very heavy safety spring and step, against which the end of the spindle always rests. The mill may be used for any kind of grinding, from wheat to quartz, and either wet or dry. It is hardly necessary to point out that for machines of this type a wide field of usefulness exists in this country. The heaviest tax paid by the consumer for cereals is that due to transportation, and when grain is cheap and transportation high, enormous quantities of the former are wasted because it does not pay to send it ever long distances to be converted into flour and meal. The economy and portability of these mills renders such transportation practically unnecessary. Any farmer possessing a small farm steam engine—and no farmer working even a moderate sized farm should be without this most valuable adjunct—can with a Harrison mill grind his own grain and that of his neighbors, and thus secure a double profit. Horse power may be used to drive some of the smaller sized mills, which show a capacity equal to the old style 48-in. mills.

For further information address the manufacturer, Mr. Edward Harrison, 135 Howard avenue, New Haven, Conn.

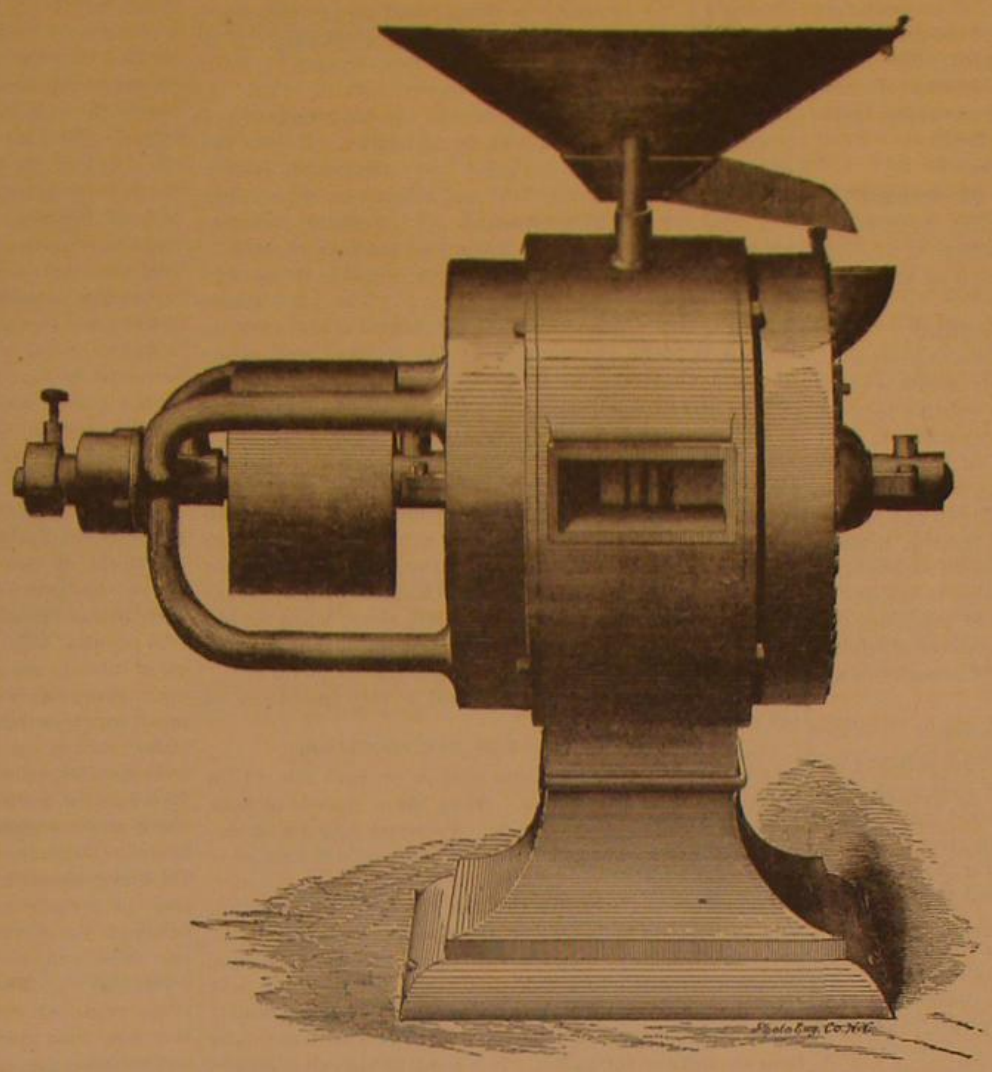


Fig. 1.—HARRISON'S NEW STANDARD GRINDING MILL.

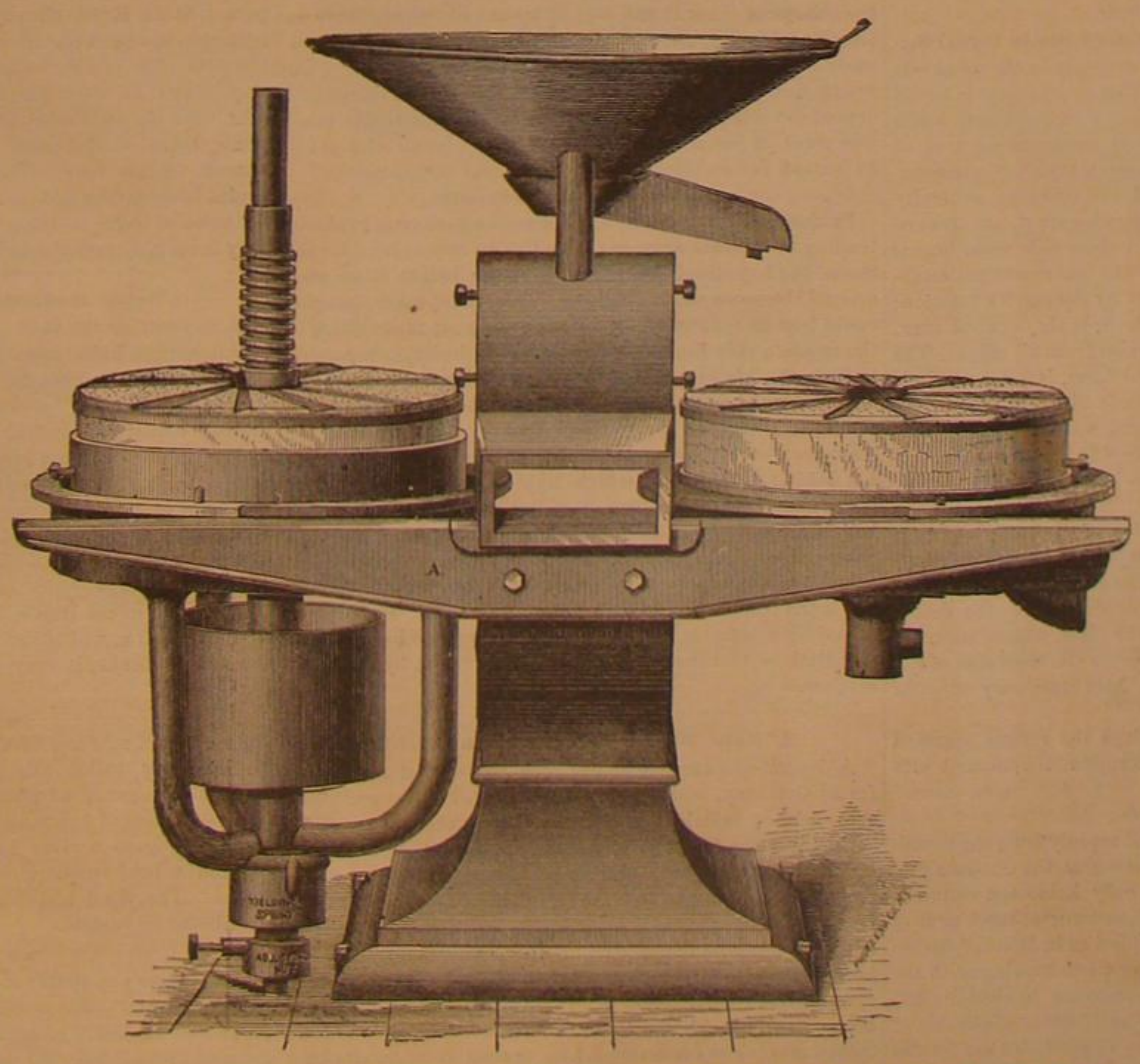


Fig. 2.—GRINDING MILL WITH COMBINED PEDESTAL AND DRESSING FRAME.

Petroleum in California.

It is now an established fact that we have oil in Ventura county in paying quantities. Out of the crude material a fluid can be made better than Pennsylvania oil—because, while it produces as clear a light, it is a safer oil, the poorest of it being non-explosive. It will pay to refine the light dark oil, and very well to refine the light green. Our advantages are not alone in the superiority of our oil, nor in the accessibility of our territory. One of the chief advantages, often overlooked by even our most sanguine oil prospectors, is in the proximity of our oil territory to the sea, and another is in the ease with which the refined oil can be placed on board vessels bound for foreign ports. A vessel at the end of the oil wharf, to be put at the foot of California street, can be loaded with ease from the refineries, which will extend from the wharf eastward to the corporate limits. Our pipe line will convey every gallon to the barrels in the holds of the vessels, thus saving all the immense expense of hauling and storing in hazardous places the oil barrels awaiting shipment. The nearness of the oil springs, facing as they do the great ocean, the highway of nations, and the facilities offered in loading the oil, are advantages not possessed by our Eastern producers, and will be greatly appreciated by them when they come to look at the field. Undoubtedly, with extensive and properly supplied refineries, we could now ship oil to the foreign markets cheaper than it is done from New York and Philadelphia. All the advantages are greatly in our favor, giving margins for profit in every direction.—*Ventura (Cal.) Signal.*

Lake Tahoe Lumber Operations.

A writer in *Appleton's Journal* says the lumber interest and the lumbermen sustain Glenbrook, Cal., and all the neighboring settlements. They are seen nearly everywhere in that beautiful region, which, once clothed from head to foot in pines, is being denuded to supply the Comstock mines with fuel for their hoisting apparatus and supports for their excavations. Penetrating a pine forest to its heart we find an industrious gang of vandals blasting trees out of beds upon which a tangle of roots seems to have fastened for eternity; and standing upon the foot hills we hear the sibilant grind of the sawmills, the crash of axes, and the dull reverberations of the blast. Following one of many devious wagon roads—one out of use, for instance—a curious litter of chips and shavings represents a forest sacrificed; following another road still in use, we discover the lumbermen at work carrying the havoc further.

On one side of Lake Tahoe a steam railway several miles long is used exclusively in the transportation of logs to the shore; the logs are towed across the water in immense rafts to Glenbrook, where they pass through the sawmills; and thence another steam railway, also used exclusively in the lumber service, extends to the summit of the divide. Down the eastern slope of the mountains, leading to the Carson river, flumes 20 and 30 miles long are carried over valleys and ravines on high trestle work bridges, and the wood is floated through them over another stage of its journey toward the mines.

"One morning as I was riding through Truckee cañon, a great wave and a cloud of spray leaped from the river into the air some distance in front of me. I went a few paces further, when, by the merest chance, my eye caught what was intended to be a sign—the lid of a baking powder box tacked to a pine stump, and inscribed with dubious letters: 'Look out for the logs!' In which direction the logs were to be looked for was not intimated, and I paused in uncertainty as to whether security depended on my standing still or advancing. Suddenly my mule shied round, and a tremendous pine log, 80 or 100 feet long, and about five feet in diameter, shot down the almost perpendicular wall of the cañon into the river, raising another wave and an avalanche of spray.

"This was to me a new phase of the lumber industry. A wide,, strong, V-shaped trough, bound with ribbons of iron which had been worn to silvery brightness by the friction, was laid down the precipice; and out of sight on the plateau above, some men were felling the trees, which they conveyed to the river in the expeditious manner aforesaid."

The English Channel Tunnel.

Operations connected with the submarine tunnel have already been commenced on the other side of the Channel, several pits having been sunk to a depth of about 110 yards. At the same time the French and English committees have definitely drawn up the conditions of working for the route. The property of the tunnel is to be divided in half by the length: that is to say, each company is to possess half of the line, reckoning the distance from coast to coast at low tide. Each company will cover the expenses of its portion. The general work of excavation will be done, on the one

hand, by the Great Northern of France, and on the other by the Chatham and South-Eastern companies, the two latter having each a direct route from London to Dover. All the materials of the French and English lines will pass through the tunnel in order to prevent unnecessary expenses and delay of transhipment, as in England and in France railway companies use each other's line, and goods can pass from one line to another without changing vans. It is understood that an arrangement will be established for a similar exchange of lines between all the English and continental railway companies when the tunnel is completed. The tunnel will belong to its founders. At the expiration of thirty years the government will be able to take possession of the tunnel upon certain conditions.—*Mining Journal.*

THE MEETING OF THE ACADEMY OF SCIENCES.

The semi-annual meeting of the National Academy of Sciences was recently held at Columbia College in this city, Professor Joseph Henry presided. Abstracts of the papers read are given below.

Professor Stephen Alexander in a paper entitled

LAWS OF EXTREME DISTANCES IN THE SOLAR SYSTEM

in which he showed the relations of various members of the solar system and the curious proportions existing between them, the whole indicating that in their organization they have obeyed the rule of law. The ratios of the planetary distances for example he pointed out as follows: Neptune to Uranus $\frac{2}{3}$; Uranus to Saturn $\frac{1}{2}$; Saturn to Jupiter $\frac{1}{2}$; Jupiter to Asteroid $\frac{1}{3}$; Asteroid to Mars $\frac{2}{3}$; Mars to Earth $\frac{2}{3}$; Earth to Venus $\frac{2}{3}$; and Venus to Mercury $\frac{1}{2}$, and then he showed that the difference between the distances according to law and in fact were small, not exceeding in any of the preceding instances ·078. Tables of relations for the systems of Jupiter and Uranus were given which also showed remarkable approximations of theory to fact.

VELOCITY OF VIBRATIONS IN EARTH.

General H. L. Abbot gave an account of his series of experiments to test the rate at which tremors from explosions are transmitted through the earth. He stated that for one mile through drift formation, a severe shock gives a velocity of about 8,500 feet per second. The rate for the great Hallett's Point (Hell Gate) explosion was about 8,300 feet per second for the first eight miles and about 5,300 feet per second for the first thirteen miles. These estimates enormously exceed those reported by Mr. Mallet some years ago to the Royal Society, the highest velocities obtained by him being not over a third of the lowest and a fifth of the highest noted by General Abbot.

Professor O. N. Rood presented two essays on the study of color, in which he described a means of determining the effects of a given mixture of colors by means of superposed diagrams, and also a method of comparing the relative brightness of colors.

Professor Alexander propounded the ingenious theory that the inner satellite of Mars is an asteroid which has traveled so near to the orbit of the planet as to be drawn and held within the sphere of the latter's attraction. Investigations of the orbits of several of the asteroids apparently confirm this view.

Professor Elias Loomis read a paper on the

ORIGIN OF STORMS

based upon data obtained by the United States Signal Service. He stated that our great storms begin in the neighborhood of the Rocky Mountains and that no example is found of any considerable storm arising on the Pacific Coast, south of Oregon. At the outset there is generally an area of several hundred miles diameter, through which the barometer stands at mean. On opposite sides of this area, generally east and west, at a distance of 1,000 miles apart, are areas of high barometer. The atmosphere in these side areas begins to move toward the central area. The currents thus established are deflected toward the right by the earth's rotation; and a diminished pressure results over the central area, when the inflow increases and comes from all sides. The area of low pressure assumes an oval form, but if the winds are very violent, it may be more nearly circular. With rotation a centrifugal force is developed which increases the depression, and within the latter there is an upward movement of the atmosphere which carries large amounts of vapor, which on cooling condenses as rain. The heat liberated by condensation increases the rarefaction of the area; and thus rain increases the force of the storm, though never originating it. The upward motion within the storm area takes place chiefly on the east side, so that the depression at the center is constantly transferred toward the east, unless however there is a great precipitation of vapor on the west side of the area, in which case the storm is held stationary or even moved westward.

Professor Joseph Henry summarized the results obtained by the Lighthouse Board to determine the utmost efficiency of

FOG SIGNALS.

These are (1.) Loud sounds spread rapidly from the mouth of a trumpet, and fill the whole horizon at the distance of a few miles. A parabolic reflector only holds the sound in the direction of its axis for a mile or two; at three or four miles the sound is heard as well behind as in front of the reflector. (2.) Sound is heard further when moving with the wind near the surface than when moving against it; but there are exceptions to this rule, and before a change of wind the sound is heard further in opposition than in the same direction as the surface wind. The exceptions are referred to the effect of an upper wind prevailing in a contrary direction. (3.) It is established that neither fog, snow, nor rain interferes with the transmission of loud sounds. (4.) A sound may become inaudible over a certain space and be heard again beyond it. This occurs when the wind blows against the direction from which the sound is moving: and is referred to the tilting of the front of the sound wave so that it passes over the head of the observer, and afterward descends. It is not due to a special condition of the atmosphere in a circumscribed locality by which the sound is absorbed, since there is no such effect when the sound is transmitted in an opposite direction—that is, with the wind. (5.) Independently of the wind, however, the air does not on all occasions transmit sound with equal facility. If intervening air be heated above or cooled below the general temperature, there will be refractions and reflections, which interfere with the progress of sound. (6.) "Sound shadows" are sometimes produced by projecting portions of land, or other obstacles. In these shadows the sound is temporarily diminished, or lost to the observer. (7.) The phenomenon known as the "ocean echo," is a return of sound from the horizon opposite the opening of the trumpet, and occurs during both clear and foggy weather, and with various winds. Its explanation is difficult.

The remainder of Professor Henry's essay described a very interesting series of experiments tried in Penobscot Bay, at a locality where the sound of a loud fog signal suddenly became inaudible for a considerable space, and beyond that was heard again. The experiments were very satisfactory in proving many of the propositions above enunciated, especially that the interference with the sound was due to the opposition of the wind, since, when the signal was carried on the vessel going outward, there was no such interruption to hearing the sounds on the shore.

Professor Alexander Agassiz read a very important essay on

THE DEVELOPMENT OF THE FLOUNDER,

which fish, in early youth, has one eye on each side of the head, like other bony fishes. After three or four months, both eyes are found on one side. Professor Agassiz reaches the curious conclusion that the eye slides around instead of going through.

The notion has been that this fish has its eyes both on one side, because its facilities for securing food are thereby increased. But why should not this process have, by natural selection, resulted in a fish that, when hatched, has both eyes on the same side? We do not find this peculiarity in fossil flounders, and no flounders have yet been found later than the tertiary formation. It is not true that all flounders are destitute of swimming bladders. There are other fishes as flat as a flounder, but with eyes on both sides of the frontal bone.

The sides of the flounder in the young are identical as to color. The color is due to the pigment cells, of which there are three kinds, red, black, and yellow. By contraction of these cells the different colors are produced. Now, if a flounder is left in a vessel with a gray ground it becomes gray; if on a black ground, black; if on a red ground, red. This power of changing color is, however, lost on the side where the eye is absent. The inference is that the nervous system, being affected by a change of color through the eye, originates the change of color in the fish, by means of appropriate contraction of the pigment cells. But when light was continuously admitted to the under side of the vessel holding the young fish, before its eye had gone to the other side, the process of development and the removal of the eye to the other side went on just as before. There was a great deal yet to be learned before this series of facts could be explained.

NEW ASTRONOMICAL THEORIES.

Professor Alexander brought forward a variety of evidence tending to indicate some envelope like an atmosphere for the moon, the hypothesis being based on the bright band seen around the moon during eclipses. This, the speaker thought, could best be accounted for by supposing an atmosphere to the moon, a thin remnant of ancient nebulosity, comparable to that which accompanies the earth and gives rise to the appearance of the aurora Professor Alexander also propounded a curious geometrical theory, showing that the shadows thrown by celestial objects are retrograde, being left behind by the time which light takes to travel. The effect is that these shadows lean backward, and allowance has therefore to be made for a resulting difference between observations on occultations and on eclipses. Applying the calculations to observations on Jupiter's satellites the following is the result: There is a difference of ten seconds of actual time between all such observations made by means of occultations and those which have been made by means of eclipses.

A New Discovery of Potash Fields.

A deposit of potash salts has been discovered near Stassfurth, Germany, which is said to be so vast that it will yield these salts in sufficient quantity to supply the entire world for many years to come. The uses of potash salts in the arts are very numerous and important, and to obtain them recourse has been had to washing of sheep's wool, the liquor from which cane sugar is crystalized, and to sea water. The entire bed, the immense size of which was determined by borings made with the diamond drill, lies within the triangle formed by the three towns of Magdeburg, Halle, and Nordhausen, and is supposed to be due to the evaporation of an inland sea. The company, which is soon to begin working the mines, has obtained a concession of about 8 square miles.

Mechanical Stoking.

The *English Mechanic* gives the following summary of the various inventions for mechanical firing of furnaces, now in use in England.

It has been generally admitted that the theoretically correct manner of feeding fuel to the fire is to supply *upwards* through the bottom of the furnace from below. It is on this principle that the "Frisbie Feeder" and Mr. Holroyd Smith's "Helix" stoker are constructed; the latter giving a continuous supply of fuel, and therefore more correct in method than the former, whose supply is intermittent. This arrangement causes the smoke and gases, when passing upwards through the incandescent coal, to be thoroughly consumed. Another method is to supply fuel from a hopper to the front of the bars, which rotate slowly backwards, and the desired combustion is the result. Such is the construction of Regan's stoker, which has been very successful as regards economy, both in the quantity and quality of the fuel used, only small coal being burnt.

Another contrivance, applicable principally to marine boilers, has recently been patented by Mr. Regan, and this is known as the "jogglebar furnace." It allows of the agitation of the bars by means of a lever, so as to be free them from clinkers, and to keep the space between the bars clear for the passage of air. The bars are placed transversely, and nothing is easier than their removal and replacement when necessary.

Another method is that of the Henderson stoker, which provides that, as the crushed coal falls from the hopper, it is caught on the vanes of horizontal or vertical fans, and thrown by them over the fire in such a manner that an even distribution can also be made, as mentioned above, by means of a peculiar motion imparted to the bars. The rocking or other motions are produced by means of gearing, eccentrics, etc., driven either by shafting from the main engine or by a small supplementary one. At the same time the bars are either rocked up and down, or from side to side, revolve over spindles, or rotate backwards from the front *en masse* by means of horizontal shafts. In Dillwyn Smith's stoker there are two grates placed crosswise in the same fire, and these are so arranged that the gases given off by the coal on the first grate are burnt, with perfect combustion, on the second. It is unfortunately impossible to speak with any certainty on the comparative merits of the various stokers in use, as no competitive trial has been made. Some inventors assert that the saving effected by their stokers is as high as 30 per cent. Of course such may have been the case where they have been erected, but it only proves that where such an immense percentage is claimed there must previously have been a shameful waste of material. By the use of mechanical stokers hard labor is, of course, almost entirely dispensed with, the filling of the hopper and the raking out of the ashes constituting the only manual work. Sometimes, however, even the filling of the hopper is performed by mechanical means. Such is the case at the General Post Office, where four of Vickers' stokers are at work. They use only small coal, which is lifted by an automatic arrangement, driven by an engine of a small horse power. The coal is then delivered into a trough about twenty yards in length, in which works a helical screw. The fuel is thus forced forward and dropped in measured quantities into the hoppers. At the Royal Mint mechanical stoking on the Juckes' principle has been in active operation for many years. Mechanical stokers can be used with equal benefit on board ship, where an even fire can be kept up in spite of heavy seas, with the additional advantage of a comparatively cool temperature of stokehole. Thus far all the objections advanced against hand stoking have been overcome by these useful labor-saving and money-saving machines; and though the price of some of them occasionally appears rather high, they invariably repay their cost in a short time.

Solar Radiation and Sun Spots.

In an essay on the above subject in *Nature*, Mr. S. A. Hill, of Allahabad, India, considers it to be possible that the excess of tropical and oceanic rainfall in maximum sun spot years may be caused by precipitation near the place of evaporation, owing to the diminished force of the trade winds and anti-trades at those periods, and that if the winter rainfall of Europe and America were examined it might show an excess in minimum sun spot years, derived from vapor brought by an unusually strong upper current from region of great evaporation in the South Atlantic. The registers of nearly twenty years show that the winter rainfall of India, north of the tropic, is probably subject to such a periodic variation, and if this surmise be verified in the future the author thinks, it may prove of the greatest economic importance.

AT a recent meeting of the French Academy of Sciences, M. Duplessis called attention to the infection of grain through the agency of floods in water courses. A case was noted of a field of rye which became partially infected with smut, owing to a river having overflowed its banks and covered a field further up stream, which was already infected. The flood had been the means of communicating the disease or fungus.

THE bakers and pastry cooks of Paris have been forbidden to burn in their ovens wood which has been painted or impregnated with any metallic salt, as it is believed that the articles of food may be rendered deleterious through the agency of the same.

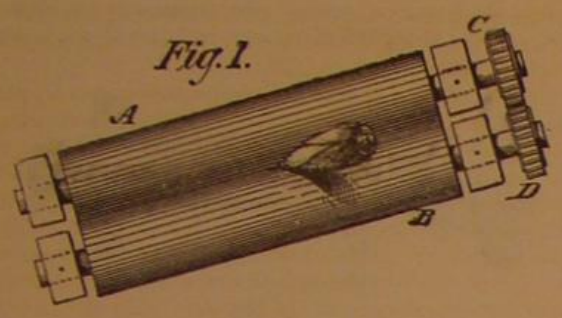
[From a Correspondent of the Scientific American.]

SOME INVENTIONS FOR HUSKING CORN.

The production of a machine to successfully husk corn has of late years engaged the attention of many mechanics. Numerous devices have been made and patented, but none of them has thus far been adopted by the corn raiser. Many of the earlier machines were intended to first strip the ears from the stalk and then strip the husk from the ears. It is the latter operation which has so far baffled the efforts of inventors.

The first method tried was that of providing two revolving inclined rollers, made of an iron rod covered with a rubber tube. The rolls were kept in contact by springs acting upon the journal boxes, which were made to slide. The ears of corn were fed in at one end of the apparatus, and traversed by gravity along the two rollers, as shown in Fig. 1. The rollers, A B, are revolved by the gear wheels, C and D. E represents an ear of corn sliding down between them. The action of the rolls was designed to strip the husk, by friction, from the cob, the ears passing down the rollers and falling at the end. The husk was to be carried through the rollers and fall beneath. This simple device

Fig. 1.



would husk dry corn fed into it in small quantities, say, one ear at a time, providing that the husk was dry and somewhat ragged or loose upon the ear. It would husk small sized ears much more readily and perfectly than the larger sized ones. Its defects were that the rubber rollers elongated, and the silk lapped around the ends.

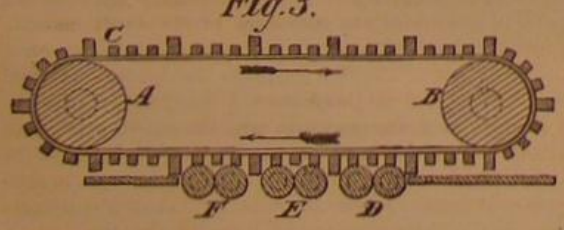
Another inventor used the device shown in Fig. 2, in which A B are one pair and C D another pair of rollers. E E and F F are endless bands, made of sheets of rubber pass-

Fig. 2.

ing over their respective pairs of rollers, of which B and C were the ones driven. This is the representative of numerous devices, the fault of which is that when several ears of corn fall upon the rollers together, the top ones are apt to ride without coming into contact with the rollers, and therefore pass out unhusked. This defect is incident to all machines of this class, in which gravity alone is depended upon to feed the unhusked corn through the rollers.

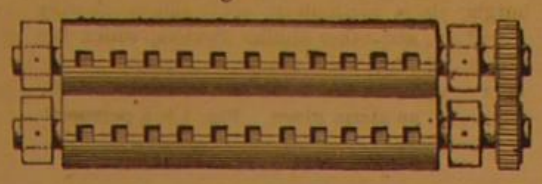
The next step was to give the corn a positive feed by means of an apron. This is shown in Fig. 3, in which A and B are two revolving drums around which passes a leather belt at each end. Fastened to the two belts were strips or slats

Fig. 3.



of wood, C, every fourth one being higher than the others, being designed to take hold of the corn and carry it to the rollers. It was found that the short slats would press the ears of corn to the rollers and leave them there, the high slats carrying them off after the husks were removed. A difficulty was found, that to use such a feed, the corn requires to pass across and not along the rollers, and thus necessitating the use of at least three pairs of rollers, as shown at D, E, and F. Rubber rollers were first used, but being found deficient, eccentric rollers were substituted, the object being to induce friction upon the husk by reason of the eccentricity of the rollers. Next, rollers were made composed of small disks of wood, supposing that the end grain of the wood would afford a sufficient grip upon the husk without catching hold of the silk. These rollers were found defective in husking capacity, and a resort was made to iron rollers, the first of which were made with isolated cavities about half an inch wide by three quarters of an inch long, as shown in Fig. 4. The edges of these slots were intended to catch hold of the husk and carry it between the rollers. There were two rows of the slots in each roller, and the rollers were so geared together that the slots of each would simultaneously grip the husk on each side of the ear. After the slot edges had thus gripped the husk and carried it down between the rollers, it was intended to have the plain part of the roller behind the row of slots strip the husk from the ear. These rollers were found to husk some corn well

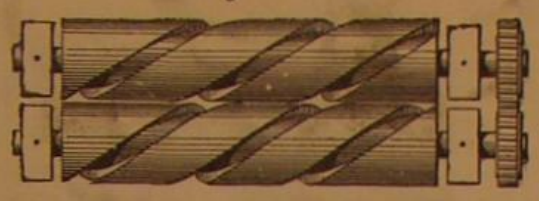
Fig. 4.



enough, but they were not adapted to husk in sufficiently large quantities, nor to husk various sizes and kinds of corn.

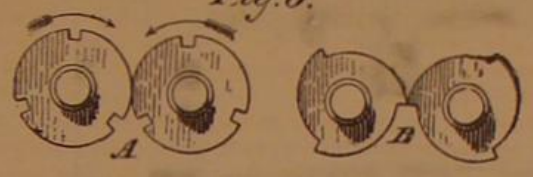
The next invention was to make the rollers with a spiral groove, as shown in Fig. 5. This was found to be an improvement upon large ears of corn, but was found deficient in husking when the husk was damp or not held close upon

Fig. 5.



the ear. The grooves were then changed in shape, the back edge being cased off, as shown in Fig. 6, in which A represents an end view of the rollers of Fig. 5, and B an end view of the grooves as changed. By this change keener husking edges were obtained, but the liability to shell the corn from the cob was increased, the edges of the grooves being so

Fig. 6.



prominent as to shell a large proportion from some ears while other ears could be passed through the machine several times in succession without ever being husked.

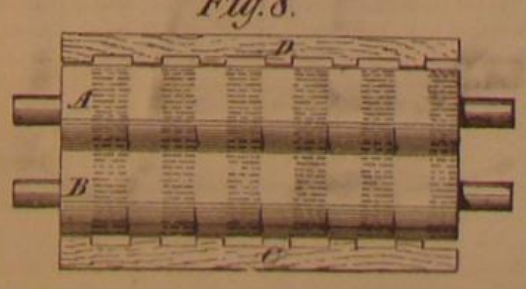
Another inventor conceived the idea further, and made more husking edge, but with the former style of groove. His first idea was to make iron rollers as represented in Fig. 5, but with right and left hand grooves, as shown in Fig. 7. The object being that the edges of the grooves would grip the husk simultaneously on opposite sides of the ear. This plan was abandoned because of its inadaptability to

Fig. 7.

husk ears of varying sizes. The amount of twist suitable for small ears being inadequate for large ones, and *vice versa*.

Another inventor conceived the idea of giving a large and continuous amount of husking edge by roughing the surface of the rollers, but in that a new difficulty was encountered, as the silk and husk clung to and wound around the rollers, thus increasing their diameter in places and throwing them apart. To remedy this defect, plain spaces were left, and a scraping attachment was added as shown in Fig. 8, in which

Fig. 8.



A and B are the rollers, and C and D are the scrapers. It was found that the silk and damp husk, as cleaned from the plain spaces, would lap around and clog the roughened parts, and the device was abandoned.

During all these experiments it was found that ears of corn that would pass over rollers several successive times, without being husked, would be denuded very readily if the husk was jagged by some sharp instrument like a knife, even though the jagging were performed upon one small spot upon the ear only; and the next experiment was to attach to the slats of wood which formed the feed apron, as shown in Fig. 3, a series of sheet iron strips serrated at the edge similar to a saw, but it was found that these edges would sometimes take hold of the ears and drag them unhusked through the machine.

Another inventor achieved considerable success by making a roller with a deep spiral groove, and placing at the bottom of this groove a row of small cylindrical projections which were intended to loosen the husk so that the groove edge would remove it. Another effort was made with the rubber rollers, by giving to the surface of the rollers a series of raised rubber projections intended to firmly grasp the husk and drag it off, but this was found to not equal the expectations formed of it. One more effort is worthy of note. This was to pass the stalks of corn, butt end first, through two pairs of rollers, such as shown in Fig. 9, in which there is shown at A a pair of rollers containing a series of grooves, each groove being provided with a series of husking edges of a form made in the same way as shown in Fig. 6, at B. Behind these rollers was another plain pair, as shown in the end view of Fig. 9, at B, the idea being to pass the corn stalks, butt end first, through the revolving grooved rollers, which would carry the stalk through to the

Fig. 9.

rollers, B, which were made to revolve somewhat faster than those shown at A, so that when an ear of corn met the grooves, the two pairs of rollers, A and B, would pull it violently and firmly against the grooves, the edges of which would cut off just so much of the end of the ear as would detach the husk therefrom; but only a partial success, however, was by this method obtained.

A New Glacial Period in Progress.

A Swedish paper states that in the Bay of Komenok, near Koma, in Greenland, fossil and very characteristic remains of palm and other trees have been discovered lately, which tend to show that in these parts formerly a rich vegetation must have existed. But the ice period of geologists arrived, and, as a consequence of the decreasing temperature, this fine vegetation was covered with ice and snow. This sinking in the temperature, which moved in a southerly direction, as can be proved by geological data, that is, the discovery of fossil plants of certain species, seems to be going on in our days also. During the last few years the ice has increased far towards the south; thus between Greenland and the Arctic Sea colossal masses of ice have been accumulated. On European coasts we now frequently find ice in latitudes where it never existed before during the summer months, and the cold reigning upon the Scandinavian peninsula this summer results from the masses of ice which are floating in the region where the Gulf Stream bends towards the British coasts. This is a repetition, says *Nature*, of the observations made in the cold summer of 1865. The unaccustomed vicinity of these masses of ice has rendered the climate of Iceland so cold that corn no longer ripens there, and the Icelanders, in fear of a coming famine and icy climate, begin to find new homes in North America.

Petroleum for Removing Scale in Boilers.

Petroleum has recently been successfully employed for the removal and prevention of scale in steam boilers, also for the removal of deposits from water pipes where the water contains large quantities of lime. It has the effect of penetrating and rotting the scale, causing it to become porous and disengage itself from the surface to which it is attached. It is a very simple remedy and can be used in small quantities without any difficulty whatever, say about a quart every week for a twenty-five horse power boiler, and in quantities more or less, according to the size of the boilers. It may be introduced in the feed water or through the safety valve, or in any way most convenient for that purpose; but to be effective it must be pure. The heavy oil used for lubricating purposes in cold situations is the most efficient, as the refined oil of this description is of no use, as it is soon expelled by the heat.—*Oil, Paint and Drug Reporter.*

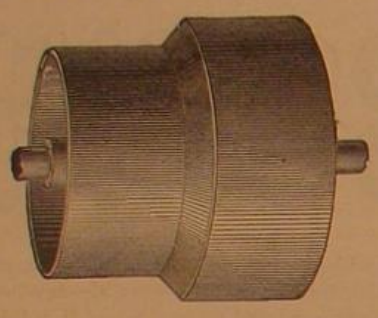
Progress of the Western Union Telegraph Company.

On the first day of July, 1877, there was in operation 76,955 miles of line, 194,323 miles of wire, and 7,500 offices. There are in use on the lines of the company, 10,306 sets of instruments for reading by sound, 9 printing instruments, 1,639 recording instruments, 220 repeaters, 183 duplex instruments, 113 quadruplex instruments, 98,558 cups of main battery, and 21,996 cups of local battery. The number of messages transmitted during the year ending June 30, 1877, was 21,158,941, being an increase of 2,429,374, or 12·9 per cent. This includes press reports *sent*, reduced to messages on the basis of 30 words to each message. The average tolls upon each message for the year were 43·6 cents, average cost 29·8 cents, and average profit 13·8 cents.

STREIT'S NEW BEVEL FLANGE LOOSE PULLEYS.

The chief difficulty encountered in the use of tight and loose pulleys, is that of keeping the loose pulley properly lubricated when the machine is at rest, and, consequently, while the loose pulley is revolving upon its shaft. The combined influences of the pressure of the belt, produced by its tension, and the centrifugal force from the revolution of the pulley, tend to force out and throw off the lubricating substance, leaving the shaft and bearing of the pulley exposed to all the effects of friction, which is increased in a ratio corresponding to an increased velocity of the pulley. By a departure from the usual line of invention, it is now claimed that these objectionable features have been overcome in a remarkable degree by the use of a loose pulley having a smaller radius than its accompanying tight pulley, the belt being conveyed from the loose pulley to the tight pulley by means of an incline, which is shown in the accompanying illustration.

The principle involved in this device consists in relieving the loose pulley from the effects of the tension of the belt. The belt, when upon the tight pulley, has a tension requisite for driving the machine, but when moved to the loose pulley, the lesser diameter of which reduces the distance between the outer peripheries of the driving pulley and loose pulley, practically lengthening the belt and reducing the friction on the bearing of the loose pulley to that resulting from the belt alone.



These pulleys, we are informed, were subjected to a thoroughly practical test at the recent Centennial Exposition at Philadelphia, where the results obtained were such as to insure the success of the device, which has since been demonstrated in evidence received of their continuing to grow in favor with those having them in use.

A patent for this improvement—"The combination of a tight pulley, a loose pulley of lesser diameter, and a means, in the nature of an incline, for guiding the belt upward from the smaller to the larger pulley"—was granted to J. A. Fay & Co., September 25, 1877; and they are placed upon all counter-shafts constructed by the above-named firm, and from whom any further desired information can be obtained by addressing J. A. Fay & Co., Cincinnati, O.

How to Kill Entomological Specimens.

A correspondent says the method of killing entomological specimens, by putting them in a glass cylinder closed at one end, and then inserting a wad of tow saturated with ether on closing the other end of the cylinder, is very good, but when putting the insect, especially butterflies, in the tube, it flutters its wings, and so loosens some of the colors. A better way is to put a small drop of chloroform on the insect's head as soon as it is caught, and the effect is that it instantaneously dies. Not even a relaxation of the muscles being perceptible.

JOHNSON'S IMPROVED BOILER PLATE SHEARS.

The improved boiler plate shearing machine herewith illustrated is claimed to be solidly constructed, not liable to become out of order, and to be capable of being expeditiously changed to give any desired bevel upon different thicknesses of plate. A is the stationary blade attached by bolts passing through lugs formed upon the side edges of the bed plate. It is held against outward pressure by a wedge, B, driven between its outer edge and a flange formed on that of the bed plate. The movable plate, C, is bolted to a holder, D, which works in a guide socket, E, which is pivoted to the standard at F. Lugs having curved slots are formed upon said guide socket, and through these slots pass bolts, so that by adjusting the latter the sockets may be placed to give any desired bevel to the cut. To the upper corners of the holder are pivoted bars, which in turn are pivoted to another pair of bars, and these last to the end of the standard. At the point of meeting of the pairs of bars is pivoted a connecting bar, G, which passes back through the standard and is connected to the short arm of the bell crank lever, H, which is pivoted to the standard, as shown. To the long arm of this lever is adjustably connected a connecting rod, which communicates with the operating lever, I. At J is a guide, which can be adjusted by the hand nut shown, and which serves to keep the plate parallel with the blade while being cut.

Patented through the Scientific American Patent Agency, May 15, 1877. For further information address the inventors, Messrs. J. W. & R. Johnson, Ferrysburg, Ottawa county, Mich.

IMPROVED BURGLAR ALARM WINDOW FASTENING.

The annexed engraving represents an improved fastener and burglar alarm particularly applicable to securing windows, shutters, and other similar devices, which is so constructed that in case of any one attempting to raise or lower the lower or upper sash without first releasing a bolt, a bell is sounded and an alarm given. Fig. 1 is a perspective and Fig. 2, a sectional view.

A represents the top bar of the lower sash, and B, the bottom bar of an upper sash, of a window.

To the bar, A, is affixed the main framing of the device by means of screws. On the frame is a standard, which supports the bell shown.

Fig. 1.

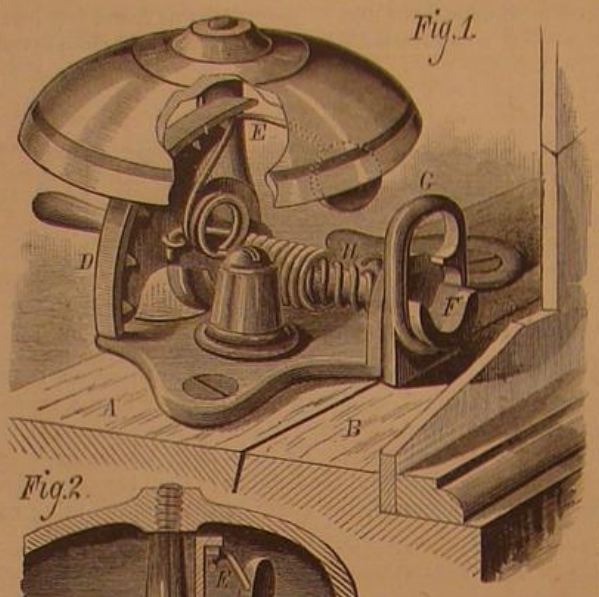
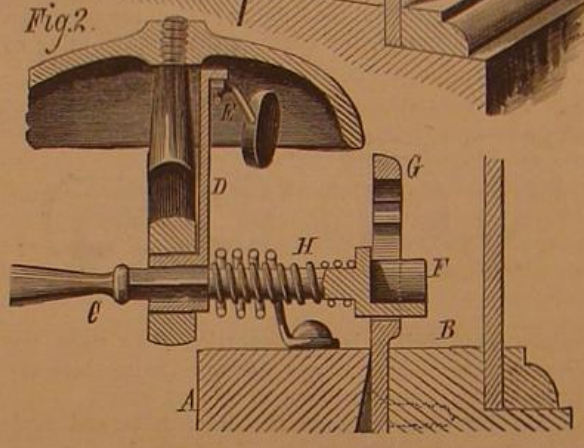


Fig. 2.



C represents a bolt, which is supported in bearings in such manner that it is capable of a to-and-fro as well as a revolving motion. Upon the bolt, C, is mounted a semicircular disk, D, which is provided with a circumferential rim, and a series of serrations or projections, adapted to engage with and operate the arm of the gong hammer, said arm being formed on the end of a spring coil, which is mounted on a standard, forming part of the main framing, C.

The bolt, C, at one end is provided with a handle, and at its opposite end with a semicircular locking piece, F, which, when the bolt is thrown, passes into a recess, in a plate, G, carried by the bar, B.

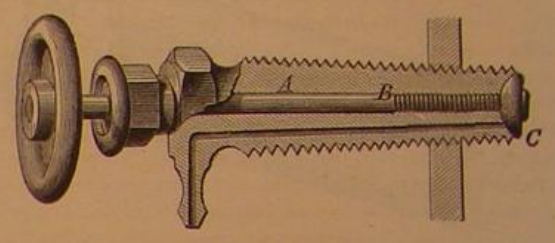
A projection is formed on one side of the recess, the object of which is that, in the event of either of the sashes of a window being attempted to be raised or lowered without the bolt being withdrawn, the projection will immediately come in contact with the semicircular locking piece, and cause the same to make a partial revolution, and in so doing cause the disk, E, to also revolve, thereby operating the arm and ringing the gong each time a serration or projection passes said arm.

The bolt is kept forward in a locking position (when not otherwise held by the handle) by means of a spring, H. Around this spring is also arranged a second spring, adapted to bring the bolt and disk back to their normal position when they have been revolved.

Patented August 21, 1877. For further particulars relative to purchase of patent rights address the inventor, Mr. George Saurbrey, 195 East Livingston avenue, Columbus, Ohio.

BORDEN'S IMPROVED GAUGE COCK.

The object of this invention is to provide a gauge cock that will not allow of the escape of hot water or steam if it should be broken off outside of the boiler shell. In the engraving, A is the body of the gauge cock, which is bored longitudinally through its center, and threaded internally to receive the spindle, B, upon which a thread is cut that fits the internal threads of the body, A. The inner end of the body is concaved to receive the convex valve, C, which is attached to the end of the threaded portion of the spindle, B. The outer end of the spindle, B, is provided with a hand wheel, and is surrounded by a stuffing box at the outer end of the body. A passage runs lengthwise through the body, A, the inner end of which terminates at the annular

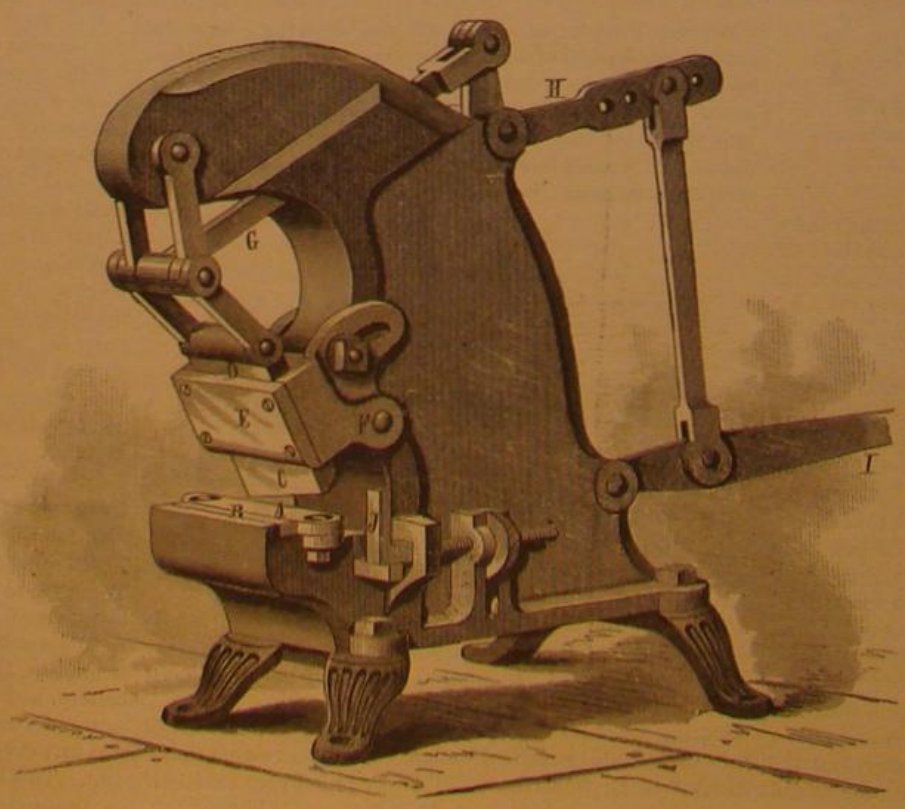


groove cut in the valve seat, and is closed by the valve, C, and its outer end terminates in a nozzle. The body, A, is threaded externally and screwed into the boiler in the usual way. The internal thread of the body, A, and the thread of the spindle, B, extend from the valve and valve seat outward beyond the boiler shell, so that if the gage cock should by accident become broken outside of the boiler shell the valve would be undisturbed, and the accidents that usually follow the breaking of gage cocks entirely avoided. The valve of the cock is opened or closed by turning the screw by means of the hand wheel.

This invention was patented through the Scientific American Patent Agency, June 19, 1877, by Mr. Henry L. Borden, of Elgin, Ill.

Is There a Resisting Medium in Space?

Mr. C. B. Warring, of Croton-on-the-Hudson, has written to the *Tribune*, suggesting that the rapid motion of one of the newly discovered moons of Mars may be explained without impugning the nebular hypothesis, by the supposition that there is a resisting medium in space. If at the time this moon was left behind by the shrinking nebula of Mars, its distance from the center of that nebula was comparable with that of our moon from the earth, and it was afterward drawn nearer to the planet because of the check occasioned by a resisting medium, its time of revolution would be shortened as it approached the planet. On the other hand, the revolution of the planet itself would be little affected by the resisting medium; but to whatever degree it was affected, its speed of rotation would be decreased, and hence the difference between the times of the planet's rotation and the satellite's revolution would become greater. Mr. Warring regards the discovery of the swift moving satellite as evidence in favor of the presence of a resisting medium in space. He suggests as problems not less difficult of solution, the questions why the eighth satellite of Saturn is 12° or 14° out of the plane of the other satellites and the rings of the planet; and why our moon is 18½° nearer the ecliptic than the plane of the earth's equator.



JOHNSON'S BOILER PLATE SHEARS.

Substitute for Tea and Coffee.

In an official report by Mr. O'Conor on the general condition and economic progress of Brazil, he states that the cultivation and preparation of sterva-maté, which is largely exported from the province of Paraná to the neighboring countries of Uruguay, Paraguay, and the Argentine Confederation, has not yet become an article of commerce for European markets, and this will be regretted by those who have experienced what a capital substitute it is for either tea or coffee. In its nature more fortifying and alimentary, and far more wholesome, it can be bought at a price so moderate that it would easily be within the means of the poorest inhabitants of Ireland or Scotland; and it is said there can be no doubt that if it were once known it would be extensively used in place of the far more expensive and sometimes adulterated beverages of tea and coffee. A small sum has been appropriated by the Minister of Agriculture, with a view to make this excellent plant

known in Europe, and it is sincerely hoped that the experiment will be productive of beneficial results.—*London Grocer.*

What They Say About Us in India.

Campbell, the poet, in his poem on "The Last Man," has written verses which have attractions for most men, more or less. The Bible tells us the history of the first man, and unsatisfied curiosity peers forward, and wants to know the situation and position of the last man.

Almost numberless have been the speculations on this topic. The raciest of them which we have seen is that which we give elsewhere from the SCIENTIFIC AMERICAN, and to all of our readers who can enjoy genuine humor, based on good scientific knowledge, we commend the perusal of this very clever skit. *En passant*, we may say that for good sound scientific knowledge, clear cut and luminous engravings, combined with ability and liveliness in general conduct, the SCIENTIFIC AMERICAN has no peer. It is *sui generis*. There are English journals which give more scientific matter, but there is none which has such decided characteristics as those that make this publication peculiarly unique. One is sure to know from it the latest results of science put in the most attractive form, realizing, indeed, Tennyson's line:

"The fairy tales of science and the long results of time."

—*Madras Times.*

Ventilation of Soil Pipes.

At a recent meeting of the New York Board of Health it was resolved that soil pipes in tenement houses and vaults, when within twenty feet of any dwelling, should be carefully ventilated by pipes to be laid as the Board directs. After November 1, violations of this resolution will be prosecuted civilly and criminally.

ARCHER FISHES.

The chelmons are a species of fish indigenous to the Indian Ocean. They are divided by naturalists into two varieties, distinguished respectively by the short and long nose or snout, and by the disposition of the very beautiful colors which their bodies exhibit. The short-nosed chelmon has a greenish hue over its body; the fins are green with blue reflections. A black spot surrounded by a pearly white circle appears on the dorsal fin, and on the body itself are bands of blue and mother-of-pearl. The long-nosed chelmon, which is represented in Fig. 1, is of a citron yellow color. There is a large black spot beside the forehead, the front of which is azure blue. The eye is of a bright rose tint; and on the anal fin is a circular spot of black bordered with white.

This fish has a singular way of obtaining its food, which has earned for it the name of archer fish or fish pump. It frequents the mouths of rivers, and especially shallow places, in search of the insects which exist on the marine plants, the stalks of which rise a little above the surface of the water. As soon as the fish spies its prey, it approaches cautiously as near as possible, and then, raising its snout above the surface, squirts out a fine stream of water with considerable force and unerring aim. The jet is often projected over a distance of 6 feet. The insect struck is stunned and falls into the water, and there is easily captured by the chelmon.

The representation of another group of archer fishes, and to which this name is more specifically applied, is depicted in Fig. 2. The body is elongated, the line of the back being nearly straight, while the belly is strongly curved. The color is olive brown, or yellow, marked with large oblong spots or bands. Although the mouth of this fish is of entirely different formation from that of the chelmon, it takes its prey in precisely similar manner. The Chinese keep the fish in tanks in their dwellings, as pets, feeding them by presenting the insect on the end of a straw, from which the fish knocks it off by ejecting his water jet.

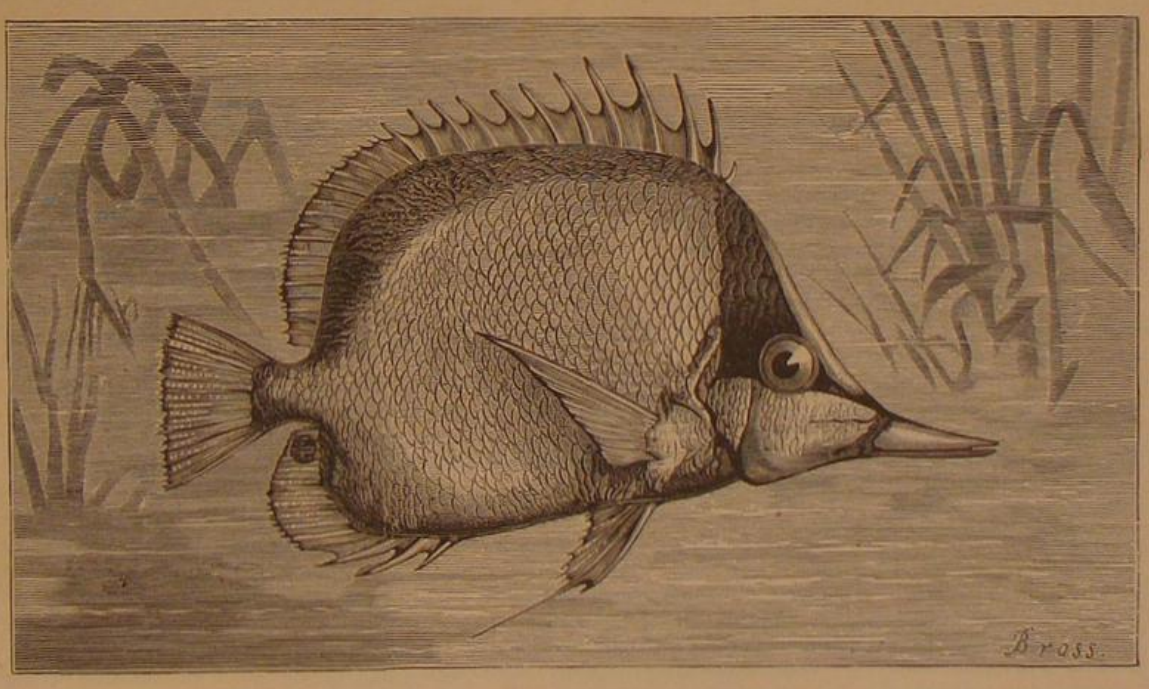


Fig. 1.—THE LONG-NOSED CHELMON.

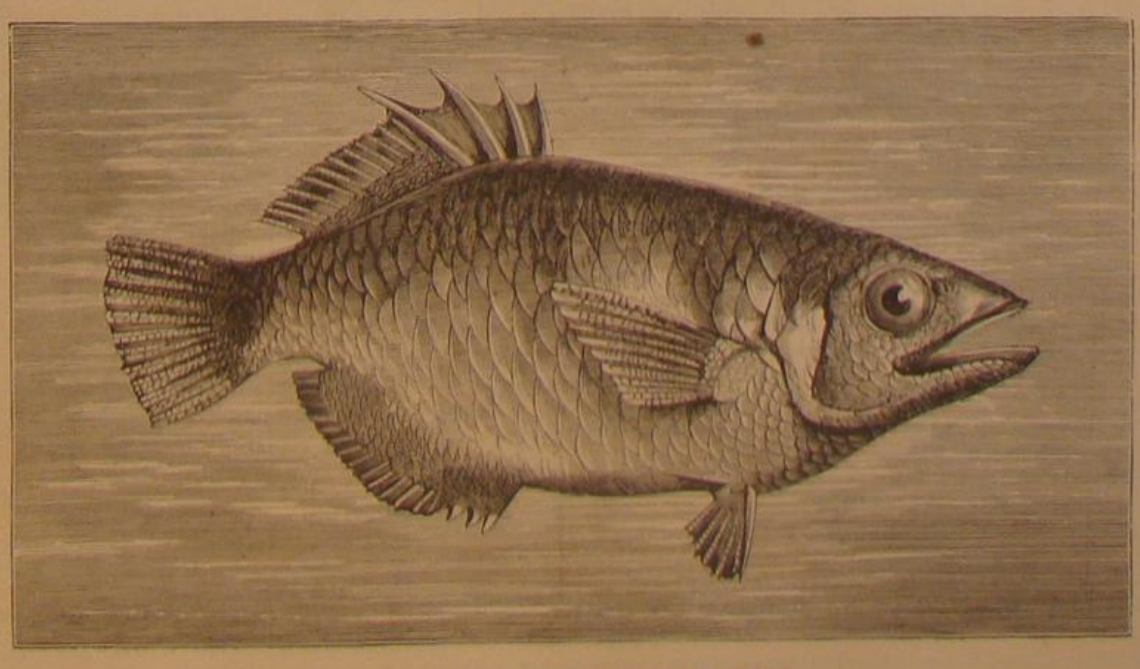


Fig. 2.—THE ARCHER FISH.

THE RED AND THE TWO-LINED SALAMANDER.

BY C. FEW SEISS.

You may, perhaps, have seen in some brook or spring, a bright red, lizard-like animal, either lying motionless at the

bottom, or wriggling beneath a stone at your approach, to escape observation. This is the red salamander, Fig. 3, *spelerpes ruber*, Daudin. The whole superior surface of this animal, in life, is vermilion red, thickly spotted with black, the spots smallest on the head and tail, and disappearing half way down the sides of the body. A few small spots on the under jaw and the legs. Beneath, spotless orange-red. The eyes are prominent, with a golden yellow iris; a dusky spot before and behind the pupil; pupil oval and black. The dark spots on the iris give it a linear appearance. It varies in size; I have seen it from 3½ to 6 inches in length.

Although so bright and pretty during life, a few hours' immersion in alcohol changes its bright vermilion color to a dirty white. It seems nonsensical to label a uniform soiled white, black-spotted animal, the *s. ruber*. Dr. Holbrook says "it is a land animal, and is found under rocks, fallen and decaying trees, etc." This is not the case with the red salamander in Pennsylvania and New Jersey, for I have never seen it captured out of the water. The finest specimen I ever saw was in a spring of cold water, and as the time was the middle of summer, it is not probable it had gone there only to deposit spawn. It can, however, remain out of water for a long time; specimens in our aquarium often remained upon floating objects for several successive hours. It is quite possible it could live in extremely moist situations for months at a time.

The food of the red salamander consists of insects and small earth-worms. In the aquarium it is showy and interesting, but as it is an air-breathing animal, it should be furnished with the means of quitting the water when it is so desired.

Another animal belonging to the same genus as the preceding, and frequently met with in Pennsylvania, is the two lined salamander, Fig. 1, *spelerpes bilineatus*, Green. It is a terrestrial species, but frequents only moist places, and most generally in close proximity to a stream of water or spring.

Occasionally during the breeding season two barbels or cirri appear upon the upper jaw of the male, between the nostrils and the lip. Green's *salamandra cirrigera* appears to be a male of this species thus adorned (see Fig. 2). The use of these barbels is unknown, but they seem to be simply ornamentations, to show, perhaps, when the possessor pays his addresses to the females, that "the sign of man is now upon his chin!"

The young or larva of this, as with other species, are provided with gills, and breathe water only. When the gills disappear it becomes a perfect salamander, and respiration is performed with lungs. The young *bilineatus* resembles the adult in color, but the colors are less bright, and the lines less distinct. In mature animals the color is brownish yellow above, with a black line on each side beginning behind the eye, extending along the flanks, and lost near the end of the tail. Beneath, bright yellow. It is a small species, rarely exceeding three inches in length. In activity, it far surpasses the red salamander, and you will learn, as I have, "you must be quick with your hand if you wish to catch a *bilineatus*."

Pheasants Poisoned by Shot.

A short time ago the keepers on Sir H Tufton's estate at Ashford, England, noticed a singular mortality among the pheasants. The cause was not immediately discovered, but it was eventually found out that the birds swallowed the splinters from spent bullets lying about on the ground at the range of the local volunteers, which was close at hand. The lead did not produce immediate death, but caused lead poisoning, to which the birds by slow degrees succumbed. Other even more remarkable instances than the above have occurred with pheasants and grouse swallowing shot picked up in the coverts that have been shot, and among the heather, in mistake either for seed or gravel.

Last year a considerable number of pheasants died in one gentleman's preserve alone in Lancashire from this cause, and there is every probability that many of both pheasants and grouse casually found dead from some unknown cause owe their death to picking up pellets in this manner.

How Tomatoes are Canned.

The large consumption of canned goods in this country, and the market which is opening for them in Europe, the great variety of farm products which the factories demand, and the near home market which they make for perishable fruits and vegetables, render this industry a matter of interest to all intelligent farmers. Besides meats and fish preserved by this method, nearly all the more common and perishable fruits and vegetables are canned and made available for food during the whole year. A canning factory is one of the most useful and economical institutions that can be established in an agricultural community. The process of preserving is now so well understood, and the work is so thoroughly done that the goods will keep for years, and can be sent on long sea voyages to all climates and to the remotest countries. There is hardly any limit to the demand for these goods, so that a factory will make a good home market for nearly all fruits and vegetables that cannot be disposed of in the fresh condition. It is a complete remedy for any glut in the local markets; for when the hucksters or middlemen cease to pay living prices, the factory takes the overplus. The packing companies are one important factor in the solution of the question of a cheap food supply for the million. An almost inconceivable amount of wholesome food is gathered and marketed at cheap rates that would otherwise be lost. In many ways this industry stimulates the production of fruits and vegetables in districts remote from large markets. It gathers up the fragments, so that nothing is lost.

Mr. W. Clift, of Mystic Bridge, Conn., writing to the *Country Gentleman*, says: Your readers will be interested in a description of the canning process as carried on by the Dudley Packing Company at their factory, established in this place the present season. The capital called for in a factory that will use up a thousand bushels of tomatoes a day is about $15,000. The company began with tomatoes, because the demand for them is very large, and they can be grown in quantity on short notice. Seeds were distributed during the winter and spring, and the farmers pledged themselves to cultivate at least 115 acres of tomatoes, and the price was fixed at 30 cents a bushel. It was regarded as an experiment, many of the farmers doubting whether the crop would pay at that price. The company engaged to take all that they would raise. Both parties have kept their engagements, and not only has the factory consumed all the tomatoes produced in this vicinity, but large quantities have been brought from New Jersey by steamer and rail for packing here. The yield on good land, well cultivated, has reached in some cases 400 bushels to the acre, which plays fairly for a rather bulky crop.

The company furnish crates, holding just a bushel, open at the top, and furnished with projecting posts at the corners, so that they can be packed one crate on the top of another without damaging the fruit. The payments are in cash on delivery of the goods. The first operation in the canning process is the scalding of the fruit to loosen the skin. The scalding tank is six feet long, three feet wide and two deep, and stands upon the platform, outside of the building, near the door. This tank is filled with water, and kept near the boiling point by steam. A sieve of iron wire fits into the top of the tank, and receives two bushels of tomatoes for a charge. A jet of steam is turned into the water, and the tomatoes remain in it a half minute, when they are raised by the sieve, which turns on a hinge, and are dropped into two boxes at the lower end of the tank. Two men manage the scalding tank, and a boy distributes the fruit among the peelers within.

Thirty-six women and girls attend to this department. They are arranged at the sides of troughs, elevated sufficiently for convenient handling, each workman having a pail and a box for the deposit of the skins and refuse; each tomato is peeled and cleaned of all decay and green around the stem. The price paid for this work is 3½ cents a pail, and the day's work is from 30 to 40 pails to each operative, according to her skill and activity. The pails are carried by boys to the steamer, which is upon an elevated platform, and discharges into the hopper for packing. The overseer of the steamer carefully examines each pailful, as it is spread out, for any neglect among the peelers, and removes the unripe portion if any is found. She also gives a check for each pailful, which the boy returns to the operative, and these checks are the certificates of the amount of labor performed.

From the steamer the tomatoes fall into a hopper, and then into the stuffer, which is a cylinder worked by a treadle. The cans used here are quarts and gallons, of which a large stock is kept on hand in the loft above the packing room. The cans are passed down to the packer by a trough, which is kept constantly full. The filling is done through a hole about an inch and a half in diameter in the top of each can. This hole is placed over the end of the stuffer, and with a slight pressure of the foot upon the treadle, the packer fills his can, and nearly excludes all air and water. The next step in the process is regulating the cans for soldering. Some of the cans are a little too full, and some do not contain quite enough. This work is done by two girls. A boy fits the caps over the holes, and puts seven cans upon a tray, and delivers them to the solderers. This is done by boys at the Gulden's patent capping machine, which is exceedingly ingenious, and saves a great deal of labor. The can to be capped is put upon the platform of the machine. The soldering iron, a semi-circular piece of iron, adjusted to the size of the cap, is immediately lowered upon the edge of the cap, which the workman turns with one hand, while he holds the strip of solder in the other. A stream of gas made from naphtha is thrown from the burner upon the soldering iron, which melts the solder and seals the can as fast as it can be turned upon the platform. Two cans are sealed every minute, when everything is ready. A boy will seal from 700 to 1,000 cans in a day, and the pay is 7 cents per 100. This work was formerly done by men at a cost of $7 or $8 a day, consuming twice as much solder, and this is a good illustration of labor-saving machinery.

The cans pass immediately from the solder to the cooking apparatus. The cooking tank is six feet long, three wide, and four deep, furnished with an elevator having a capacity of 112 gallon cans. The sealed cans are lowered into the tank, and cooked by steam for two hours. There are four of these cooking tanks. The cans are partially cooled after cooking, and vented by making a pinhole to let out any air within, and are immediately sealed again. They are then removed to the platform outside of the building, to complete the cooling. After this comes a thorough examination of every can, for any defect in the soldering which admits air. The smallest hole would spoil the contents of the can in a few days. Any leakage of air is indicated by the bulging of the head of the can. If it is perfectly tight, there is a slight depression of the head. The cleaning of the outside of the cans, and labeling, completes the work. The goods are then boxed and sent to Acker, Merrall & Condit, and to Park & Tilford, wholesale grocers of New York, who take all the tomatoes manufactured by this company. They are mostly consumed in the city and its vicinity.

The cases are made of half-inch pine, with inch heads, and come in shooks from Michigan, and are put together here. The cost of labor and material is about 15 cents a case.

Besides the canned goods, catsup is manufactured from the skins and the refuse that is rejected from the hopper. The whole mass first passes through a mill, which separates the pulp from the skins. From the vat of the mill the pulp is pumped upstairs into a reservoir. When a sufficient quantity has accumulated, it is drawn from the reservoir into the cooking tank, and cooked three hours. It is then drawn off into barrels, and allowed to ferment one week. The pulp settles at the bottom, free from impurities, and the water at the top is poured off, and the barrel filled again with the tomato pulp. It is then returned to the cooking tank and heated; the spices are added, and the catsup is barreled and sent to market, where it is bottled, labeled and sent to the retailers. Charles Gulden of New York takes all the catsup made by this company, at 15 cents a gallon.

Apples will follow tomatoes in due order, and have already begun to come in from the neighboring farms in limited quantity. These are packed in gallon cans, and are designed for pies and sauce in family use. There is a large demand for canned apples in the European markets, and it is not improbable that they will supersede the shipment of apples in barrels, which are greatly exposed to decay and loss, both on the voyage and after arrival. The canned goods are a safe article for shipment, and, if necessary, can wait a long time for market and consumption, without damage.

The large piles of apples in the store-house, the streets about the factory crowded with teams waiting to unload, the platforms filled with tomato crates, the busy crowd inside the factory, and the daily shipment of canned goods, look like the revival of business in this community.

Applications of Steam Power.

BY JAMES BINX.

It seems to me that something more might be profitably said during this season of extreme drought, when many are adding, and others are thinking of adding, steam engines to their plant of machinery. Many owners who partially rely upon steam power to run their mills, and who are not advantageously situated for fuel and freight, and who have not perhaps applied their steam power in as economical a manner as possible, count the cost of so applying it, and solemnly shake their heads when anything is said upon their having soon to apply it altogether. But for all that, I believe the day is near at hand when a steam mill, well located as to freights and fuel, will be a better investment than a water mill, unless the latter is situated on a never failing water power, with moderate water rent and freights.

A mill, to run wholly by steam, should be so designed from the foundation. Such a mill does not need rotary boilers. The boiling should be done in tubs with the exhaust steam from the main steam engine. The engine should be of ample size, economical in the use of steam, and one as little affected by back pressure as possible.

In boiling bleach tubs by exhaust steam there will be back pressure, and it will amount to from ten to eighteen pounds, according to the depth of the bleach tub. Many have fitted up mills without taking this into account, and have been grievously disappointed with the result.

Steam engines running under a boiler pressure of sixty pounds and losing fifteen pounds by back pressure lose twenty-five per cent of their effective power. A steam gauge placed in the exhaust pipe will always tell the tale.

While on this subject let me say that I have known of two instances in which paper makers, having heard of boiling by exhaust steam, have tried it in connection with their rotaries. I knew an old paper maker in Connecticut, of excellent reputation as a paper maker, but with a poor education, who make this blunder. He owned a mill which was extremely short of water. He bought a large engine and put it in. He had the exhaust piped to his rotary, and only found his mistake when back pressure shut his engine down. The same man, when the engine was put in, had her speeded ten revolutions faster than the water wheel; and, of course, as the head of water went down (the revolutions of the wheel consequently falling off), the steam engine had all the work to do and carry the water wheel besides. This gentleman told me he was disappointed in his engine, and did not see but what he did just about as well without it, and will tell me to-day that it is not to be thought of as a motor for a paper mill.

Within the past year a Jersey firm concluded to utilize the exhaust from a steam engine they had put in to run the machine. Instead of using it for drying their paper, as they might have profitably done, they piped it to the rotary, and found out their mistake when the Connecticut man did—that is, when the engine stopped from back pressure. Comment is unnecessary. These men lacked knowledge. In the latter case they gained it, in the former I am afraid they never will.

I once ran a mill in which the machine was driven by a steam engine. There was no speed shaft on the machine, and the owners ran her on low grades of bleached papers, in weight anything from box lining to card middles. The engine would not drive the machine over sixty feet, nor less than forty, and the engine had to be slowed down until she ran unsteadily to make the latter speed. We pretended to dry by exhaust steam; the driers were also piped for live steam. When on card middles the engine ran so slow she would not exhaust steam enough to dry, and we had to use some live steam. The engine ran so unsteadily we let her exhaust into the open air, thinking we could get a slower steady speed, and dried by live steam. We could not then make steam enough in the boiler to keep us running in that manner, and the owners were obliged to do what I recommended at first—put in a speed shaft for the machine. When this was done the steam engine ran a regular speed, and we could run the machine anywhere from ten to one hundred feet. The exhaust would dry anything we made, and we had exhaust steam to spare, and did run our feed water, after leaving the exhaust pump, twelve feet in the exhaust pipe, heating it so hot that the hand could not be borne on the feed water pipe between the engine and boiler, and our steam troubles vanished.

In a mill running wholly by steam, the boiling of stock and drying of paper can be done for but a trifle more of expense than if the engines exhausted into the open air, and if the owner attempts to substitute live steam he will immediately (if able to make steam enough) find the amount of his loss in his fuel account.

Mills running partially by steam and part by water, where the water wheel and engine are attached or drive the same line of shaft, should have the wheel at or near one end of the shaft and the steam engine at the other end. The couplings on the shaft should be faced. Then, as the water in the steam fell off or gained, these couplings could be fastened or unfastened, adding rag engines to the steam engine, or detaching therefrom, as the capacity of the stream demanded. I know of some mills where steam has been added, that the water wheel cannot be detached from the main line, and sometimes when there is not even water enough to drive the wheel, the wheel gates are shut, and the engine is obliged to carry it also.

Steam engines coupled on to water wheels seldom work well together. A large machine shop and foundry in Ansonia, Conn., formerly had a 600 horse power engine, which they tried to run conjointly with a water wheel. After numerous breakages they gave up the attempt, and ran them separately. This concern has turned out some of the best mechanics in the country. If both motors were speeded alike, and the head of water constant, it seems to me they ought to work, but it is evidently a safer, surer mode of working to have them separate. You then know what each is doing.

The connecting pipes between the boiler and engine should be of ample size; it is better to err on the large side. Steam engines should be located as near the boiler as possible, for reasons obvious to any one.

There are many inventions that are urged on paper manufacturers and others as economizers of steam. I once worked for a wealthy manufacturer in the Western States, who was a great economist in his own estimation, and who bought everything that came along that promised to lessen running expenses. He invested in a patent boiler setting that was to save a certain per cent, a feed water heater and lime extractor ditto, a boiler and pipe composition covering ditto, super-heater ditto, water-trap ditto. Coming to figure them up one day he found to his astonishment that his economy had run ahead of his arithmetic. He was saving 133 per cent. There is no doubt that many of these are great helps, but the inventors' claims can usually be discounted fifty per cent without doing them injustice, and often more. It has been frequently demonstrated that the average gain of the best feed water heaters cannot be over ten per cent, and that for non-condensing engines. For condensing engines, which take their feed water from the hot well, it cannot be over five per cent.—*Paper Trade Journal.*

ZINC WHITEWASH.—Mix oxide of zinc with common size and apply to the ceiling with a brush. Then apply a wash of chloride of zinc, which will form a smooth, shining surface.

Japanese Process of Varnishing.

In 1873 Professor Rein, of Marburg, was sent by the Prussian Minister of Finance and Commerce to Japan, to study those branches of industry in which that people excel, and thoroughly examine processes of manufacture. Upon his return he gave a course of instruction in varnishing, or japanning, to an employee of Messrs. Beuttenmueller & Co., from whose report to the Baden Minister of Commerce we abstract the following:

The course of lessons given by Dr. Rein lasted 9 hours a day for 6 days. Dr. Rein filled up the intervals, while waiting for the work to dry, with theoretical instructions about the plants from which the varnishes are prepared, the method of preparing the different qualities, etc.

Japanese varnish is obtained from a tree, *rhus vernicifera*. This varnish tree, which is called *urishi naki* by the Japanese, reaches a height of 33 feet; and at the age of 40 years, the trunk is 40 inches in circumference, grows very slowly, about 13 inches per year in height. The wood is strong and heavy, has few branches, consequently very little foliage, and the tree is not very pleasing to the eye. The fruit resembles grapes, and grows in thick spikes on the branches. In October the fruit is ripe, and is collected in November to obtain from it a vegetable wax, known as Japanese wax. The tree is best propagated from the root shoots. It reaches its greatest perfection at its 18th year, and then produces the largest yield of lac or varnish. This is obtained by slitting the bark in a horizontal direction, and may be performed at any time between April and October; later in the year the lac is very thick and viscid, so that its collection is attended with much greater difficulty. The lac tapper carries his own peculiar bow-shaped knife, made for this purpose, with which he cuts a 2 millimeter ($\frac{8}{78}$ inch) cut in the trunk of the tree in a horizontal direction, and then draws the point of the knife through the cut again, to remove any chips formed by the first cut. This cut is made low down; on the opposite side of the trunk 15 or 20 cm. (6 or 8 inches) farther up, a second cut is made, then on this side again, and so on until the trunk has 6 or 10 such cuts. After he has cut 10 or 15 trees, he returns to the first tree and collects the sap oozing from the cuts, which sap is light gray, and thick; but by exposure to the air, it at once turns dark brown and afterwards quite black. The crude lac is called *ki-urushi*.

The tree is hacked in this way for 60 to 80 days, until it dies; it is then cut down, the wood chopped up and put in hot water, which extracts the last remnant of the sap. From the tree when cut down, ¼ liter at most of sap is obtained, and this forms the poorest kind of lac. The value of 100 lac trees is about $30 to $40.

The lac is purified in the following manner: It is first filtered through cotton stuff, ground on a paint stone like ordinary paints, mixed with water, and the water evaporated again by warming. The finer sorts are bleached in shallow dishes in the sun. The best kind is called *nashyi-urushi*, the poorer kind *henki-urushi*, the unbleached *jeshime-urushi*. The black varnish, *roiro-urushi*, is made from the crude lac, *ki-urushi*. There are about 20 different kinds in market, of which the above named are most used. The cost in Japan is: *Nashyi-urushi*, $4.77 per lb.; *jeshime-urushi*, $1.65 per lb.; *roiro-urushi*, $3.70 per lb. The Japanese varnishes are as often adulterated in trade as wine in Germany (or milk with us)?

The operation of varnishing is conducted totally different from what it is in Europe. The Japanese apply their varnishes mostly to woodwork, less frequently to copper and unglazed stoneware and porcelain. When applied directly to tinware, the japan does not stick. The varnishes, when applied, are generally brilliant black, dark colored, impure vermilion, or impure dark green, or dark gray. Pure light colors and white cannot be produced with Japan varnish.

The Japanese varnishers prepare their woodenware with the utmost care, the surfaces are smoothed and the chinks filled with cement. The ground coat is a mixture of jeshime-urushi with paste; upon this is laid Japanese paper, rubbed smooth with a brush, and dried. Afterwards several very thin coats of the same varnish, now and then well dried, and, after every coat, polished with Japanese carbon.

The drying is performed in a moist atmosphere. For this purpose they take a box that will shut tightly, put the articles to be dried in it, close the box and wet it on all sides with water. After 24 hours one coat is dried. If the articles are to be black, it is now given a coat of black varnish, roiro-urushi, but if it is to be gray or gray-brown, jeshime-urushi is used instead, and if it is to be red, the latter varnish is mixed with vermilion. The appearances of gold and pearl are obtained by mixing real gold dust, or mother of pearl dust, with the varnish, whereby a beautiful effect is produced. It is then dried, rubbed down, and polished; and if there are gold, tortoiseshell, or mother of pearl decorations, another coat of azure varnish, nashyi-urushi, is applied. Dr. Rein communicated other methods of japanning, the introduction, of which, in this place, would lead us too far.

In applying their varnishes, the Japanese use broad brushes, the bristles of which are very stiff, and inserted in wood, just as the graphite is in our lead pencils. After long use the bristles get worn short, and the wood is cut away as in sharpening a pencil, exposing more of the bristles. A very fine piece of work receives 18 coats; these never fade with time but rather improve, bear a high heat, and are totally unaffected by acids, spirits, and the like.

The Japanese method is not likely to be introduced into Europe or this country, because of the want of the natural material, which, when imported from there, becomes extremely costly; and the process is indirect and tedious, and, with the high price of wages, would be impracticable.

The Great Wall of China.

The Great Wall of China was measured in many places by Mr. Unthank, an American engineer, lately engaged on a survey for a Chinese railway. His measurements give the height at eighteen feet, and a width on top of fifteen feet. Every few hundred yards there is a tower twenty-four feet square, and from twenty to twenty-five feet high. The foundation of the wall is of solid granite. Mr. Unthank brought with him a brick from the wall, which is supposed to have been made two hundred years before the time of Christ. In building this immense stone fence to keep out the Tartars, the builders never attempted to avoid mountains or chasms to save expense. For 1,300 miles the wall goes over plain and mountain, and every foot of the foundation is in solid granite, and the rest of the structure solid masonry. In some places the wall is built smooth up against the bank, or canons, or precipices, where there is a sheer descent of 1,000 feet. Small streams are arched over, but on the larger streams the wall runs to the water's edge, and a tower is built on each side. On the top of the wall there are breastworks, or defences, facing in and out, so the defending forces can pass from one tower to another without being exposed to any enemy from either side. To calculate the time of building, or cost of this wall, is beyond human skill. So far as the magnitude of the work is concerned, it surpasses everything in ancient or modern times of which there is any trace. The Pyramids of Egypt are nothing compared to it.—*London News.*

Recent American and Foreign Patents.

Notice to Patentees.

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

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NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED MILLER'S PAINT STAFF.

Jacob Austine, Huntsville, O.—This is an improved form of miller's paint staff, or device for applying a color in a true plane to the face of a millstone to detect and locate the high places when the stone is "in wind," or has uneven places, and then permit the same to be trued up. It consists in a staff made in the form of an equilateral triangle, the advantages being partly in the facility and accuracy of construction (the same measurement of bar serving for all three sides), but more especially in the corrections of its results, the equilateral triangle being best adapted to the circular area of a millstone.

IMPROVED CAR WHEEL.

William Y. Cruikshank, Shamokin, Pa., assignor to John Cruikshank, of same place.—This invention consists of an oil chamber arranged in the hub of the car wheel, and connected by radial holes to an annular recess in bore of wheel or groove of axle. Ribs or elevations of the oil chamber arrest the oil, and feed it to the supply holes to lubricate the bearings, and pass the surplus back again to the oil chamber. The centrifugal force distributes the oil during the running or revolving of the wheel by the aid of the outer elevations around the outer surface of the oil chamber, while the side elevations conduct the oil and cause it to flow through the holes to the axles. When the wheel ceases to revolve the oil above the axle is guided along the ribs to the holes, and along or around the axle or shaft in the recess or groove back to the holes below the axle, and thence into the oil chamber again, saving thus all the oil which is not used actually in lubricating the axle or shaft. Sufficient oil adheres to the axle to run the wheel in either direction and lubricate the bearings.

IMPROVED DRY WOOD GRINDER FOR PAPER-PULP.

Isaac W. Bowers and David A. Curtis, Petersburg, Mich.—This invention relates to an improved machine for making dry pulp from dry wood in a cheap and simple manner, which pulp has the advantage of being readily shipped, not liable to freeze, and being converted with less labor into paper. The invention consists of a machine for grinding up the wood by exposing it to the action of a cylinder covered with a grinding surface of glue, ground flint, quartz, and emery, and conveying the pulp by a hopper and an endless revolving belt to a reciprocating screen. The wood pulp produced by a dry process with this machine is, in many respects, superior to that obtained by the wet processes hitherto in use, as it does not mold or freeze, and may be more conveniently shipped. The machine is cheaper and simpler in construction than those used in wet processes, and may be run without skilled workmen. A number of machines may be arranged side by side, according to the quantities of pulp to be manufactured.

IMPROVED AUTOMATIC CYLINDER COCK.

Joseph M. Graham, Bloomfield, assignor to himself and George Elliott Bedford, Ind.—This invention relates to cocks for discharging the water of condensation from engine cylinders, and it consists in the arrangement at each end of the cylinder, of cups of sufficient capacity to contain water accumulating during one stroke, and in small valves placed in the said cups that open upward and are connected with a lever which is held by a spring, so that the valves are both open when the pressure is removed, but admits of the valves being alternately closed by the steam pressure as it acts in the cylinder. As steam is admitted to the cylinder it closes one of the valves while the other remains open, and when steam is admitted to the opposite end of the cylinder, the valve which before was open is closed by steam pressure, and by virtue of the connection of the two valves with the lever, the valve which was closed is now opened, permitting the escape of the water from the cavity. The valves are automatic in their action, and the water escapes when the pressure is removed, so that the noise of escaping steam common to other devices for relieving engine cylinders of water is by this improvement entirely avoided, and the valves need no attention.

IMPROVED TREADLE MOTION.

Henry B. Barber and Clark J. Barber, Scott, N. Y.—The object of this invention is to furnish an improved treadle motion for sewing machines, lathes, and other like machines, by which the working of the machines is facilitated and produced with less effort of the foot; and the invention consists of the combination of the swinging treadle with a pitman of inverted V-shape, which is pivoted to the toe of the treadle and the supporting rod of the same, and at the apex or upper end of the crank rod of the flywheel. The elbow formed between the pitman and crank transmits the power in more effective manner to the flywheel, requiring less effort to run the machine, and rendering thereby the working of the same less fatiguing and trying.

IMPROVED FREIGHT CHUTE.

William C. Crompton, New York city, James Nicol, Newark, and Richard Hawley, Jr., Jersey City, N.J.—The object of this invention is to furnish a chute for lowering cheese and other freight in loading vessels, in warehouses, and in other places, in such a way that it will not be injured, and which shall be simple in construction and convenient and reliable in use. To the sides of the chute are attached guide bars which project inward and incline downward. The guide bars are made elastic, or have spiral or other springs placed between them and the sides of the chute, so that they may yield to allow the articles to pass, while at the same time they offer sufficient resistance to said articles to check or retard their descent, and prevent their acquiring too great a velocity and momentum.

IMPROVED ACCOMMODATING PULLEY FOR CABLES USED IN PROPELLING CARS, ETC.

Orlando H. Jadwin, Brooklyn, N. Y.—The object of this invention is to provide on effective means for the propulsion of cars, boats, or other bodies, and it consists, first, in the manner of connecting and disconnecting the car from the travelling cable; and, second, in the manner of supporting the cable on accommodating pulleys which allow a knot, swivel, or other bulky obstruction to ride over with ease. The connection between the car and traveling cable is so made that the cable is not pinched, but simply has its tension increased, so that neither car nor cable receives any sudden jar, as the motion of the cable slipping through imparts the motion gradually until the car has attained nearly the same speed as the cable, at which time the tension is made sufficiently tight to prevent slipping between the friction and tension rollers.

IMPROVED APPARATUS FOR OPERATING PUMPS.

John A. Hurley and Daniel J. Hurley, Oil City, Pa.—This invention relates to an improved pumping apparatus for oil and artesian wells, and consists of a rock beam operated by the pitman of an engine, and connected by ball joints with the ends of a cable or rope, passing over guide pulleys, and being attached by an adjusting device on the pump rod. The rock beam is connected at the lower end with the pitman of a steam or other engine, by which oscillating motion is imparted to the rock beam, which, by the cable and adjuster, gives vertical reciprocating motion to the pump rod, so as to work the well by a simple and reliable apparatus.

NEW MISCELLANEOUS INVENTIONS.

IMPROVED PANTOGRAPH.

Elijah Ware, Omaha, Neb.—The object of this invention is to provide a simple and inexpensive pantograph which may be adapted to large or small work, as may be required; and it consists of a pantograph of rectangular form, made of four bars, so placed as to assume a parallelogram. To one end of this parallelogram are pivoted, or attached by means of screws, three supplementary bars, two of which continue the parallelogram form of the instrument, while the third bar makes the end piece. These last named bars are used for copying, enlarging, or reducing large work. The size of the copy is varied by shifting the last named end bar toward or away from the pivot of the instrument, and by moving the bar so as to change the position of the pencil or tracing point. When the instrument is used for smaller work the bars are disconnected, and it is used as a common pantograph.

IMPROVED POCKET RIFLE.

Marcus L. McCord, Nashville, Ill.—The object of this invention is to furnish an improved sight for pistols and other firearms, which shall be so constructed that it may be readily extended to the rearward to give a longer range to the sight and greater accuracy of aim. To the rear end of the barrel, or to a projection or support attached to the barrel, is hinged the end of a bar in such a way that the bar may be turned back into a position parallel with its former position. This bar, when turned back, rests upon a support attached to the stock, and which enters a guide socket formed in the bar. The bar is made of such a length that when turned down upon the barrel its forward end may abut against the forward sight, and may be secured in place by a spring catch attached to the bar, and which engages with the recessed rear side of the said sight. The rear sight, when the bar has been turned down upon the barrel, enters a transverse groove in the barrel. The bar may be pivoted to the rear end of the barrel, so that it may be swung around from one position to the other; or it may be slid into a dovetail groove in the upper side of the barrel.

IMPROVED COMPOSITION FOR DRESSING COTTON YARNS.

William H. Perkins, Fall River, Mass.—The dressing consists of unslacked lime, sal soda, soap, and water, and is prepared in the following manner and proportions: Two and one half pounds of unslacked lime, two and one half pounds of sal soda, one ounce of common soap, and one gallon of boiling water, which are thoroughly stirred together until the parts are mixed. Five gallons of salt water are then added, and the whole left standing for twenty-four hours, when the compound is ready for use. It is applied in the same manner as other dressing, but is considerably cheaper. It imparts a bright and glossy finish to the fabrics dressed therewith, and stands unchangeable in any weather or atmosphere.

IMPROVED HOSE COUPLING.

Frederick Stewart, St. Louis, Mo., assignor to himself and Oscar F. Scudder, of same place.—This invention relates to an improved hose coupling that is tightly connected with the hose ends, so as to resist a considerable pressure on the coupling parts with less liability to blow out or disconnect the hose ends, as the connection of coupling and hose will be drawn tighter the greater the pressure exerted thereon. The interior sleeve of the coupling is made with a slight taper. The hose end is placed in position on the same, and rigidly secured thereon by a diagonally split and tapering band, having a screw thread cut on the outside, and by an outer sleeve, with corresponding taper, having an interior screw thread. The screwing up of the outer sleeve on the split band closes the latter, and clamps the same and the hose tightly on the inner sleeve. The clamping or wedge connection of the inner sleeve, split band, and outer sleeve with the intermediate hose end produces a tight fastening of the hose, that gets tighter the greater the pressure, so as to remove any liability to blow out by the pressure of the water on the coupling.

IMPROVED BED PAN.

Clark S. Merriman, New York city.—In this invention the ordinary bed pan is used, to one side of which an air cushion is attached. The air space in the annular part is separate from that in the cushion. When the device is used it is placed under the body, and one or both parts are inflated, as may be required. The cover is then placed in position with the pocket in the cavity of the bed pan. After use the cover may be removed and cleansed and replaced; or two may be used in alternation. The advantages claimed for this improvement are that the body is supported in an elevated position, so that the excrements, when ejected, will not flow down the back. It is more comfortable to use, and is easily cleaned.

IMPROVED COMBINED CANE AND UMBRELLA.

Thomas F. Darcy, New York city.—This invention consists in a combined umbrella and cane, formed of the ribs, the handle, the stretchers,

the runner, and the tubes and cap, constructed and arranged to operate in connnection with each other. When the umbrella is extended, and it is desired to adjust it for use as a cane, the handle is drawn down through the tube until the collar reaches, and is secured to, the lower end of the tube. As the handle is being drawn it slides down through the runner until the stationary ferrule strikes the said runner. The stretchers are then pressed upward by the end of the tube, which closes or folds the umbrella upward, and the whole umbrella passes down into said tube. Another tube is then drawn upward and locked, and the cap is secured to its upper end, and the device is ready for use as a cane.

IMPROVED REMOVABLE TOP FOR SHOWCASES.

Thomas H. B. Parks, Arkadelphia, Ark.—This invention is a detachable front or cover designed for application to boxes containing goods. For example, when a grocer receives a box of crackers, raisins, or other articles whose contents he wishes to display, and at the same time to protect them from dust, also from thieves, and yet render them accessible for the purpose of removal of a portion to supply customers, the top of the box may be removed and the detachable front or cover applied to the same. In such case the box may be turned on its side, so as to better display the goods. By use of this improvement the dealer avoids the necessity of placing the goods in separate boxes for the purpose of exposing yet protecting the goods. In practice the dealer will keep on hand a number of the detachable box fronts or covers, and will transfer them from one set of boxes to another as occasion requires.

IMPROVED MEDICINAL COMPOUND.

Mary Catharine Peden, Caverna, Ky.—The object of this invention is to furnish an improved medical compound for purifying the blood and effectually curing scrofulous diseases. The inventor says: In preparing this compound I take burdock root, one and a half ounces; poke root, one and a half ounces; sarsaparilla root, one and a half ounces; and sulphur, one ounce. To these ingredients I add proof whisky, one pint, and allow it to stand twelve hours. I then add such a quantity of water that there will be one pint of the mixture when drawn off. The compound is then allowed to stand in a cool place for one week, when it is drawn off and bottled, and is ready for use and market.

IMPROVED STOPPER FASTENER.

John L. Stewart, Ellicott City, Md.—This is an improved form of bottle stopper, more particularly designed for bottles for holding aerated liquids, such as beer, ale, soda water, etc., but applicable to other uses. It belongs to that class of stoppers in which a yoke made of bent wire is screwed about the neck of the bottle to receive a swinging bail, which bail carries a rubber stopper that is forcibly pressed against or into the mouth of the bottle. The improvement consists of a tilting cam provided with a thumb piece and combined with the bail, the rubber stopper, and the support to which said cam is pivoted, whereby the fastening is made more secure, and the manipulation of the stopper is facilitated by permitting the same to be removed or applied with ease and rapidity.

IMPROVED STAKE HOLDER FOR PLATFORM CARS.

Owen Miner Avery, Pensacola, Fla.—This invention relates to an improved socket and stanchion for railway platform cars. The object of the invention is to obviate the difficulty usually encountered in removing the stanchion from the sockets when the car is to be unloaded. As ordinarily constructed, the stanchions have to be lifted vertically from their sockets, and when the car is loaded with lumber or other similar freight the lateral pressure exerted by the same against the stanchion jams the latter in the socket so that they can be removed only with difficulty. This invention consists in pivoting the stanchions in such a manner that they may be quickly turned laterally to a horizontal position and then down, or entirely detached if desired, and yet be locked in a rigid vertical position while upon the route.

IMPROVED COMBINED COFFEE ROASTER AND COOLER.

Joseph B. Underwood, Fayetteville, N. C.—This is an improved device for carrying out the method of roasting coffee for which letters patent were granted the same inventor May 16, 1876, by which method the volatile products that arise from the coffee being roasted are utilized by being conveyed to a closed communicating chamber for cooling the coffee, where said flavoring and aromatic exhalations, which are being given off from the roasting coffee, and restored to the hot roasted coffee as it is cooled, the method serving to preserve the roasted coffee and render it less susceptible to the managing influences of the atmosphere, and at the same time preserving the full strength of the flavor and obviating loss in weight. The means consist generally in a revolving roasting cylinder arranged in combination with a revolving cooling and condensing cylinder, and so connected as to admit of the transfer of the generated volatile products of the first to the latter without condensation in transit, and finally of the transfer of the entire charge of roasted coffee from the roasting chamber to the cooling chamber. The improvement also consists in other details of secondary importance.

IMPROVED ANIMAL TRAP.

John Crawford, Vanlue, O.—This invention covers certain improvements in animal traps of that form in which a cage or box is allowed to drop upon the animal enticed by a bait beneath the same. The improvement consists in a central axially-turning rod having notches formed in the same which are adapted to support a cage or box moving upon vertical guides until said central rod is turned axially by the animal in removing the bait from an arm attached to the same, when the notches will be removed from the catch on the cage and the latter allowed to drop bodily upon its guides over the animal.

IMPROVED VENTILATING BARREL FOR SHIPPING FRUITS, VEGETABLES, ETC.

William Crowell, Dennis, Mass.—The object of this invention is to provide, for the packing and shipment of fruits, vegetables, and other articles of perishable nature, an improved barrel or other package that is sufficiently ventilated at the center to prevent the decaying of the articles; and the invention consists of a barrel, box, or other package having a grooved center piece or partition for admitting air, and a sectional removable head, secured by a conical nut, binding on the head sections and turning on the threaded end of the center piece. As the decay of the articles commences generally in the center of the barrel, on account of the lack of air, this objectionable feature of the packing of fruits, vegetables, and other articles is prevented by the use of this ventilating center piece, post, or partition. By unscrewing the nut the head sections may be readily detached, and the contents of the barrel removed, and *vice versa*.

IMPROVED HORSESHOE ATTACHMENT.

George W. Price, Lakeland, assignor to himself and William H. Sanford, Hauppauge, N. Y.—The object of this invention is to provide calks for horseshoes that may be attached and detached at pleasure, and also to provide a device for preventing balling. An ordinary horseshoe is attached to the horse's hoof in the usual way. The calks, that are fitted to the horseshoe just in front of the usual heel calks, are each provided with an inwardly projecting arm, at the end of which a nut is formed. They are also provided with a lip that engages the edge of the horseshoe. The calks of the attachment, being longer and sharper than the calks of an ordinary horseshoe, prevent slipping, and by means of a plate balling is entirely prevented.

IMPROVED WEIGHING ATTACHMENT FOR HAND TRUCKS.

Daniel A. Beam, Newark, N. J.—This invention consists in the combination of scale levers and scale beam with an ordinary two-wheeled hand truck having an axle fitted in slotted bearings of the truck frame, so as to enable the latter to have a vertical motion relatively to the axle when weight is applied. The invention is mainly designed for use where an approximation to the weight of several packages is required, when it would be impossible to weigh each package accurately upon regular scales.

NEW AGRICULTURAL INVENTIONS.

IMPROVED MILK PAIL.

William Heuermann, Sedalia, Mo.—This invention has relation to strainers for buckets, and the nature of the invention consists in combining, with the pouring spout of a bucket, a removable strainer, a hinged retaining cap, and a hinged cover. From the hood of the pail springs a pouring spout, near the end of which is formed a ring, forming a seat for a strainer. This strainer is preferably composed of gauze wire, suitably secured to a ring, and when it is adjusted on its seat is retained in position by means of a shoulder formed on a hinged cap. This cap forms the nozzle of the pouring spout, and its reduced end has a cover hinged to it, which cover will automatically open when the bucket is tilted, and close when it is set upright. The strainer can be quickly removed when it is necessary to clean it, and it can be quickly replaced.

IMPROVED FENCE.

Nelson B. Gunn and Timothy Gunn, Elwood, Ind.—This invention relates to rail or worm fences, and the object is to afford greater strength and security to the fence at the angles thereof by rigidly tying the crossed ends of the rails together with wire or its equivalent, held under strong tension by means of a wedge. Instead of using posts or stakes at the points of the crossing of the ends of the rails, the rails of each section are firmly bound together by means of a strong wire loop, which may encompass all of the rails or only a few of them. A single band or loop will in all ordinary cases be found sufficient, although two loops may be used and arranged closed to the points where the rails cross each other.

IMPROVED STUMP PULLER.

Henry M. Stitzer, Cochranton, Pa.—This invention relates to an improved device for pulling stumps, rocks, and other bodies in simple and effective manner, by making use of another stump or fixed body, close to the one to be pulled; and it consists of a single or double beam, attached at one end by a chain to a stump or other object, and of a draft link, connected by a chain to another stump and pivoted to a hand lever, combined with pivoted pawls and wedge links, of peculiar construction, that work the link forward on the beam by the rocking of the lever. These links being loosely arranged, also, they turn upon their recessed seats in the pawls in their progression along the plain bars, so that in advancing alternately along the bar to take a new hold they slip freely over the same; but when strained in the opposite direction, in exercising the draft, they turn and cramp against and bind with the bars, and thus give a purchase for the draft strain.

IMPROVED CATTLE-WATERING DEVICE.

William H. Hayes, Salisbury, Mo.—This invention has reference to an improved device for watering stock in stock cars or yards, in a superior and automatic manner from a common tank, without waste; and the invention consists of a bucket hung to a fulcrumed and weighted lever, with curved end, that is pressed by the weight of the water in the bucket against the hose, connecting tank, and bucket, so as to cut off the water supply and re-establish the same when the bucket is getting empty. The raising of the bucket takes off the pressure from the hose, and re-establishes the supply of water from the tank, until the weight of the water in the bucket overcomes again the balance weight and cuts off the supply. In this manner a continuous and automatic water supply for stock in cars and yards is obtained.

IMPROVED SULKY AND GANG PLOW.

John H. Goodwin and David Woodard, Lamar Station, Mo.—This invention relates to improvements in gang plows, and consists mainly of an axle with swinging plow beams that are raised or lowered by a pulley frame, chains, and lever to the required depth. The pulley frame is jointed, to admit the raising of the plow beams into upright position after work, The plow beams are retained in position by curved metallic brace pieces, that are hinged to the axle in front of and above the turning points of the plow beams, and seated in notches of the same, according to the higher or lower position of the beams. The pulley frame is made of two sections, of which the lower stationary part is secured, at suitable inclination, to the axle, while the upper section is pivoted, by its fork-shaped ends, thereto, in such a manner as to rest on a supporting extension or bearing of the lower part when the plows are dropped for work. After use, the plows are raised and thrown, with the upper section of the pulley frame, into nearly vertical position on the axis, so that the gang plow may be carried to and from the field with great facility. The shape of the plow beams produces a light draft, and the ready adjustment or entire raising of the same a gangplow of convenient construction and use. The plow may also be used as a sulky plow by using one plow only, taking off the others, the plow being thus a gang or sulky plow, as desired.

IMPROVED GATE.

John W. Harvey, Farley, Iowa.—This invention relates to gates which, when opened, will close by their own gravity; and the nature of the invention consists mainly in a foot plate for a swinging gate post having a convex bottom and crossed slots through it, in combination with studs on a post driven into the ground, which studs enter the said slots and keep the gate in proper position. A lever is pivoted to the post and connected to the gate by a pin and slot, so that a person can raise the gate bodily with very little exertion. This allows the gate to be opened and shut over snow drifts.

IMPROVED BEEHIVE.

Isham B. Burroughs, Tuscaloosa, Ala.—The object of this invention is to furnish improved beehives, which shall be simple in construction and convenient in use, enabling all the operations necessary in taking care of bees to be easily and conveniently performed, and thoroughly protecting the bees from moth. A drawer in the lower part of this hive is divided into compartments, in which are formed holes to allow the millers to pass through. With this construction the moths enter a forward dark compartment of the drawer, see a little light entering through the holes in the partition, and pass through said holes into the inner compartment of said drawer, where they lay their eggs, and from which they cannot find their way out.

IMPROVED WHEEL PLOW.

Stephen M. Harris, Forest Grove, Oregon.—The object of this invention is to furnish an improved plow, which shall be so constructed that either wheel may be raised and lowered, as required; which will turn under and thoroughly cover stubble; which will clear itself of vines and weeds, and may be readily thrown out of the ground when desired. Upon the outer arms of the crank axles revolve the wheels, which are unequal in size, the furrow wheel being the larger. Spring pawls are placed in such positions as to engage with the teeth of ratchet wheels, and thus hold the wheels securely in any position into which they may be adjusted. The plowed land end of the cross bar has a slotted crosshead formed upon it, to receive a bolt which passes through the slot of a bar, so that the said bar can be inclined forward or rearward, to adjust the cutter to take or leave land, as may be required. To the furrow end of the roller is attached a flange, which projects over the edge of the furrow, so as to bend down the projecting weeds and stubble into said furrow, and thus insure their being fully covered.

IMPROVED CENTRIFUGAL MACHINE FOR CREAMING MILK.

Wilhelm C. L. Lefeldt and Carl G. O. Lentsch, Schoeningen, Germany.—This invention consists of a revolving cylinder or drum, provided with a fixed or detachable top flange or ring and with radial detachable partitions. The drum is inclosed by a guard casing or jacket, and revolved at uniform speed, being slowly started and stopped by means of a weighted idler bearing on the driving belt. The spindle revolves in a cushioned bearing of radial arms of the safety jacket and in a base step. The cream is separated from the milk by centrifugal force, and drawn off after the drum has been slowly brought to rest by taking off the idler from the driving belt. The apparatus is operated as follows: The milk is placed, in fresh state, in the drum, and the drum then gradually set in motion by pressing the idler first lightly against the driving belt until the maximum velocity is obtained. The milk is allowed to revolve with the drum for about twenty minutes, during which time the separation of the cream from the blue milk is obtained by the greater specific gravity of the latter, which is thrown up along the wall and against the top flange, while the lighter cream collects nearer to the center. The success of the operation depends now on the stopping of the machine in such a manner that this separation of the milk and cream is kept up, so that they may be separately drawn off. This is accomplished by stopping the drum slowly without jerks, which is obtained by raising the weighted arm of the elbow lever, so that the idler clears the belt and takes off the tension of the same. This causes the revolving the drum and spindle by their own *vis viva*, and the gradual decrease of the speed of the same until they assume a state of rest. After a few minutes of rest the cream may be skimmed off, the partition walls being first carefully taken out for facilitating taking out of the cream. The cream may be churned sweet or sour. The extraction of cream from the milk is best done just after milking, and excepting the want of the creamy matter, say the inventors, after the extraction the milk will not be discerned from fresh milk.

IMPROVED HORSE HAY RAKE.

Adolphus W. Stevenson, Xenia, O.—The teeth of this rake are curved in the usual way, the points being bent upward, so that they will slide along, but will not scratch or catch upon the ground. The bodies of the teeth are flattened a little just below they reach the axle to give them greater elasticity and render them less liable to break should their points strike an obstruction. A spring latch rests against the convex surface of a curved bar attached to the axle, so as, when the teeth are in working position, to engage with a notch, shoulder, or catch formed in the said bar to prevent the teeth from rising and passing over any of the hay. When a sufficient quantity of hay has been collected the driver presses the upper end of the lever forward with his foot. The first effect of this movement is to draw the spring latch back from the bar to allow the teeth to rise. The next effect is to push the clutch outward to engage with the clutch teeth of the wheel to cause the said wheel to turn the axle and raise the teeth, leaving the hay in a windrow.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED THILL COUPLING.

John W. Anderson, New York city.—This invention relates to certain improvements in thill couplings of that class in which the thill iron is made in the form of a hook, and is fastened to the pivot pin by being hooked over the same in a certain position and afterwards turned to the working position in which the parts cannot be separated. The improvements consist mainly in constructing the hooked or open slotted thill iron with a notch upon its rear side, and combining the same with a rubber block and a detent held between the ears of the clip, whereby the devices are prevented from being accidentally detached if the position of the thill iron should be changed from the falling of the horse or from other causes. The improvement also consists in forming the clip with a lip just above and outside of the edge of the ears, for the purpose of retaining and holding the rubber block and locking detent in place. The improvement also further consists in combining the hooked thill iron with an oblong tumbler located upon an eccentric pin or rivet, whereby the thill iron is made to bind against the spring and rubber block when in the working position, and thus increase the tension to prevent rattling, the eccentric location of the pin serving to better adapt the parts to each other.

IMPROVED SHUTTER FASTENER.

George M. Mudgett, Edgartown, Mass.—This invention relates to fasteners for shutters, doors, etc., and it consists of a button upon the opposite sides of which nibs or catches are formed, which engage automatically with a pin in the window stool when the shutter is closed, or with an L-shaped hook projecting from the wall when the shutter is open, there being also a sector-shaped portion. The operation is as follows: As the shutter is closed the plate strikes the pin and is moved so as to throw the nib over the said pin. When the shutter is open the nib is made to engage with a hook that projects from the side of the building in a similar way. The plate not only moves the button, but it also limits its motion as it strikes the sides of the screw.

NEW HOUSEHOLD INVENTIONS.

IMPROVED BED BOTTOM.

William M. Ward, Eureka, Ill.—This invention relates to that class of bed bottoms in which the bed bottom is connected with and supported on the posts and end rails of the bedstead, so as to dispense with the strips on the side rails, and take off all strain from the same. The bed fastenings are provided with hooks, cast therewith, on which are hung by end eyes longitudinal rods, which are lengthened or shortened, to be exactly adjusted to the bedstead by a swivel connection, that turns on the flanged head of one rod section and the threaded end of the other. By shortening the rods the bedstead is braced and made firmer. In this manner a threefold spring action is obtained, namely, in the rods, in the slats, and in the springs at the ends of the cross pieces. The slats "give" just enough to make the bed easy to rest on, and settle all alike whatever weight is placed thereon. No strain is thereby thrown on the side rails of the bedstead, but all on the posts, which are stronger and better fitted to bear the same. The bed bottom may be readily taken out for cleaning the bed, and forms, when in position, a connecting part of the same, being cheap, durable, and strong, and readily applied to old and new bedsteads with little additional expense.

IMPROVED WATERPROOF CELLAR BOTTOM.

James R. Anthony, Cedar Rapids, Iowa.—This bottom is designed for wet or any springy ground and for quicksand. In constructing the bottom, the timbers are first laid and upon them tapering boards are placed, a small distance apart. Laths are nailed transversely to the said boards, and upon the laths a layer of waterproof mortar or cement is laid, into which the bricks are embedded. The spaces between the boards lead to the well, and the water that rises while the bottom is in process of construction escapes to the well, and may be removed in any convenient manner. The wall should be continued upward above high water line, and it may with advantage be carried to the same height as the outer wall.

IMPROVED WASHING MACHINE.

Oscar Jurden, Ackley, Iowa.—This invention consists in the arrangement, in a suitable frame, of two vertically reciprocating pounders and gearing for operating the same. The clothes to be washed are placed in the tub and the pounders are rapidly moved by turning the wheel by means of a crank attached to its shaft. The tub containing the cloths is turned, as occasion may require, either by hand or foot. If there should be a greater quantity of clothes in one side of the tub than in the other, the rubber springs yield, and prevent straining any part of the machine or injuring the clothes.

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Wanted.—A place to Manufacture Patent Improved Spring Fish Hook. Address Robert J. Perry, Steuben Corners, Oneida Co., N. Y.

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

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Notes & Queries

(1) J. V. asks: 1. How to color brass or rolled plate chains, etc. red or copper colored, without a battery? A. Steep in warm dilute oil of vitriol for a short time. 2. In making chloride of gold, is it best to heat to dryness? A. It should be carried as nearly to dryness as possible, but a very moderate heat only should be applied, so as not to cause the decomposition of the salt.

1. Would you advise sulphurizing a fertilizer before or after drying, to fix free ammonia? A. The fixation should be before drying, or otherwise the ammonia will be lost. 2. Would not sulphur fumes do? A. No.

(2) Mrs. J. M. D. asks for some simple method of preserving autumn leaves so they will retain their color? A. Dry the leaves perfectly, immerse them for a short time in a solution of clear gum arabic in 20 parts of water, and dry. The colors cannot be so fixed that long exposure to light will not alter them. If protected as above and kept in the dark, the colors will suffer little alteration.

(3) W. H. H. asks for a recipe for making yeast or baking powders? A. Baking powders are usually composed of bicarbonate of soda, mixed with cream of tartar, tartaric or citric acids, or a mixture of these. Dry at a moderate temperature, grind separately to finest powder, and then mix thoroughly 20 parts bicarbonate of soda and 50 parts cream of tartar; or 20 parts bicarbonate of soda, 30 parts of cream of tartar, and 10 parts of tartaric acid. As the cream of tartar of commerce is often of variable character, it may be necessary to use it slightly in excess of the above proportions.

(4) K. X. says: I have a half lb. of phosphorus in a bottle which by exposure to heat has melted and formed a solid cake. How can I reduce it again to sticks, or to any shape convenient to use in small quantities? A. Unstopper the bottle and immerse it carepletely in a large vessel of water: heat the water over a water bath until the phosphorus is liquified; then draw it into tapering glass tubes (previously moistened and warmed) of suitable size, close the upper end of the tube, quickly invert it under water and transfer to a vessel of cold water. When cold the phosphorus may easily be shaken or forced out of the tube (under water).

(5) A. J. G. asks: 1. Is a heavy driving wheel, say of 150 lbs., an advantage on a common lathe not back geared, or would a lighter one, 75 or 80 lbs., be better for all purposes? A. For common light work a wheel of 80 lbs. is sufficiently heavy. For heavy work one of 150 lbs. might be at times preferable. One disadvantage of the heavy wheel is in starting and stopping. 2. Should the wheel be counterbalanced, so as not to stop on dead centers, or would the lathe run steadier without? A. It is well to counterbalance the wheel for convenience in starting, but the lathe will not run any steadier for so doing.

(6) Mrs. M. A. C. asks: What compound would be the most durable as a paint for gravestones, that would stand all kinds of weather? A. Use a turpentine solution of pure asphaltum mixed with a sufficient quantity of willow charcoal ground to impalpable powder.

(7) C. J. H. asks: 1. How can I best stiffen the ends of sewing silk or thread, so as to readily pass through a fine capillary tube without bending? I want the ends about as stiff as shoemaker's bristles and impervious to water. I have tried dipping in shellac and solution of rubber. A. Try the following: Fuse together equal parts of gutta percha and resin. This may be dissolved in carbon disulphide.

1. Is the "plume miraculeuse" made of aniline color? If so, how can I best copy writing done with it without a press? A. Yes. Slightly dampen the tissue in the usual manner, place in contact with the writing between sheets of unglazed paper and pass, with moderate pressure, a suitable rubber-covered roller over the whole. 2. What is the best fluid gold for illuminating on parchment and paper? A. Rub up fine gold leaf with a little honey, dissolve out the honey with warm water, and mix the fine gold dust remaining with sufficient gum water and a few drops of oil of cloves.

(8) K. M. R. asks for the preparation that is used at the laundries to give goods a glossy appearance? A. Starch, 1 oz.; paraffin, about 3 drachms; white sugar, tablespoonful; table salt, tablespoonful; water, q. s. Rub up the starch with soft water into a thick smooth paste. Add nearly or quite a pint of boiling water, with the salt and sugar dissolved in it, and, having dropped in the paraffin, boil for at least half an hour, stirring to prevent burning. Strain the starch and use while hot. Sufficient bluing may be added to the water, previous to the boiling, to overcome the yellowish cast of the starch, if necessary. Spermaceti may be used in place of paraffin. Starched linen can only be properly finished by hard pressure applied to the iron.

(9) J. H. P. asks how to take the bitter taste from crab apple vinegar? A. Warm a sample of the vinegar and agitate it with a little egg albumen. If this does not improve it, distillation must be resorted to.

(10) A. G. asks how the hair can be permanently removed from a person's forehead, on which it grows very low, without injury to the person? A. Preparations called depilatories are used for this purpose. Delcroix's Poudre Subtile consists of orpiment (sulphide of arsenic) 1 part; finely powdered starch and quicklime each, 11 parts. These are mixed together, made into a paste with warm water, and applied to the part closely shaven. As soon as it becomes dry it is washed off with water. Ryder's depilatory consists of lime, 1 oz.; carbonate of potassa, 2 ozs.; charcoal powder, 1 drachm; used as above. All of these preparations are more or less pernicious, and those containing arsenic, when improperly applied, are dangerous. They speedily destroy the vitality of the capillary bulbs, but, if allowed to remain too long in contact with the flesh, are apt to disorganize it.

(11) D. E. H. says: Please give me information as to method and cost of preparing farina from potatoes for market, cost of machinery, etc.? A. Potato flour is simply fine potato starch ground to powder between millstones. Suitable mills may be had for from $300 to $1,000. For a concise description of the process and machinery for extracting starch from potatoes, you should consult Wagner's "Chemical Technology."

(12) P. B. C. asks for a recipe to make mock silver, to resemble that metal in color and ring? A. Copper, 71 ozs.; zinc, 7 ozs.; nickel, 16½ ozs.; iron, 1¼ ozs.; cobalt (oxide), 1¾ ozs.; tin, 2½ ozs. First fuse the zinc with 12 parts of the copper; then fuse the nickel with its own weight of the zinc alloy in a good blacklead crucible, and and the iron, the remainder of the copper, and the oxide of cobalt mixed with charcoal. Cover the mass with charcoal, lute, and expose to a high heat. When properly fused, allow the heat to subside and add the remainder of the copper-zinc alloy when the temperature is just sufficient to fuse it. Remove the crucible from the fire and stir its contents well with a hazel stick. Wrap the tin in several thicknesses of dry paper, drop it into the alloy, stir for a moment, and run into the moulds. When cold, it is ready to be wrought like silver, which it resembles in every respect. The zinc is nearly all volatilized during the process of fusion.

(13) J. E. asks (1.) how hydrargyrum bisulphide (bisulphide of mercury) is manufactured? A. It is made by treating mercury, or its oxide, with sulphuric acid. 2. Also, which is the best solution for carbon batteries used for electric bells? I have used bichromate solution, but it will only work a few hours. A. The Leclanché or Prudhomme battery is best for this purpose. Use one twentieth of sulphuric acid with your bichromate solution, but the bichromate battery will require cleaning more than once a year.

(14) S. H. M. asks: 1. Can the Grenet battery be used for silverplating? A. Yes; but it is not good for this purpose as it is accumulative; it is better to use a sulphate of copper, or Smee's battery. 2. If so, how many cells of No. 1 will it require? A. That depends on the amount of surface; one cell will answer to plate an article, such as a teaspoon. 3. How shall I connect the wires of the battery with the silver and the article to be plated? A. Connect the zinc of the battery with the article to be plated; and the copper to the silver anode. 4. Also how to give the articles plated a fine polish? A. Polish with pulverized chalk.

(15) R. K. T. and C. E. F. ask: 1. Of what gauge and length should the fine silk-covered wire be as used in the Bell telephone? A. The wire used is No. 40 silk covered. 2. Should the poles of the magnet be the same on each instrument, or should one be north and one south? A. The poles are the same in each instrument. 3. Of what strength should the magnet be? A. Magnetized to saturation. 4. Of what thickness should the iron disk be? A. About one hundredth of an inch.

(16) A. B. writes: I have five jars of a Lockwood battery. I wish to make a permanent magnet magnet; will you please give me directions? A. Wind a spool of 800 feet of No. 19 copper wire, "magnet insulation," on a half inch round rod of hard wood, covered with two layers of note paper; have the spool about eight inches long, and give the outside a coat of glue, to keep it from unwinding. When dry slip it off the rod. This is called the helix or spool; any piece of hardened steel is now placed inside the helix, and the poles of the battery are connected with the terminals of the helix; on breaking the battery connection and removing the steel, it will be found permanently magnetic.

(17) C. C. McC. says that he uses brass moulds to cast arms for chandelier work, but the molds do not fill. The castings are imperfect. A. Use zinc for the castings. Warm the moulds preparatory to using them. Pay attention to the ventilation. Confined air may cause the imperfect castings. Pour the metal slowly so as to allow the heated air to escape as the metal enters and fills the moulds.

(18) J. T. asks for a good steel pen ink? A. Digest in an open vessel 10 ozs. coarsely powdered nutgalls, 4 ozs. gum senegal, 4 ozs. sulphate of iron (free from copper), ¾ drachm of ammonia, 6 ozs. alcohol, 4½ quarts distilled or rain water. Continue the digestion until the fluid has attained a deep black color.

(19) D. T. S. asks: How is the filling made that is used in filling the pores of black walnut wood? A. Whiting, 6 ozs.; japan, ½ pint; boiled linseed oil, ½ pint; turpentine, ½ pint; corn starch, 1 oz.; a small quantity of burnt umber. Mix well together.

(20) A. S. asks for a recipe for making whitewash for woodwork that will not peel off? A. Alum is one of the best additions to make whitewash of lime which will not rub off. When whiting is used, thin glue water is good, but it will not do for outside work, exposed to rain.

(21) W. C. asks for a grease for boots that will turn water, and also make them soft? A. Beeswax, 2 ozs.; beef suet, 4 ozs.; resin, 1 oz.; neat's foot oil, 2 ozs.; lampblack 1 oz. Melt and mix well together.

(22) J. W. asks how to produce a regular shade on mixed cotton and woolen rags? A. For drabs, work for half an hour in a solution of 8 ozs. copperas and 4 ozs. tartar; lift and drain; then work for half an hour in 4 ozs. logwood and 1 oz. bichromate of potash; wash out and dry. By varying the quantity of logwood, and by introducing a little fustic in combination with the logwood, a great variety of drabs, slates or fawns can be produced.

(23) W. W. asks how to color woolen goods black? A. For an amount of goods equal to a lady's dress, if of a dark color or brown, take ¾ oz. of bichromate of potash in 3 gallons of water. Boil the goods in this 40 minutes; then wash in cold water. Then take 3 gallons water, add 9 ozs. logwood, 3 ozs. fustic, and 2 or 3 drops of oil of vitriol: boil the goods 40 minutes and wash in cold water. All colored goods with cotton warps should be previously steeped one hour in sumach liquor; and then soaked for 30 minutes in 3 gallons of clean water, with a small teacupful of nitrate of iron; it must be then thoroughly washed and then dyed as for woolen goods.

(24) A correspondent says: I have a fire alarm, the wires of which come in at the top of a third story window, go to the floor, thence along behind a bed, and down through the floor and to the indicator in the second story room. Is there any danger from lightning to an occupant of the second story room, or an occupant of the bed in the third story? A. There is a slight danger, but it may be obviated by the use of a lightning arrester. The parties who furnished the indicator can supply it.

(25) W. B. asks how to destroy bedbugs? A. Take five cents worth of quicksilver, and the white of one egg. Beat the egg to a froth and add the quicksilver. Brush upon the places where the insects frequent. Make the amount of the ingredients according to the surface to be brushed over.

(26) D. A. says: I am very much troubled by the tarnish and rust on brass and steel jewelry. How can I remove the tarnish and rust, or prevent it? A. The only method to remove the tarnish and rust is to re-polish or re-finish the articles, as when first made. Care in handling is the best preventative.

(27) F. M. E. asks for the number of vibrations representing the tones of the two middle octaves of the standard scale—natural? A. C has 264 vibrations, D 296, E 333, F 352, G 395, A 444, B 498, middle C 528, D 594, E 660, F 704, G 792, A 880, B 990.

(28) H. H. E. asks how to cut stencils on copper by the use of acids, and the method of doing so? A. Cover the copper with a thin coat of wax; with sharp cutting tools remove the wax on the portions of the metal where the cutting is to be done. If necessary surround the plate with a ledge of wax. Pour aquafortis over the plate and it will soon eat through the metal where unprotected by the coating of wax.

(29) J. S. asks how to melt or work over pure rubber, so as to make it into articles of use? A. Pure gum rubber is softened by immersion in boiling water so that it may be kneaded or forced into moulds—on cooling it contracts and hardens. It is completely dissolved by a mixture of carbon disulphide with 6 per cent of absolute alcohol, and on evaporation of the solvent regains its former properties. It is also soluble in chloroform or naphtha. It cannot be melted by heat without suffering partial decomposition.

Is the glycerin that is used for chapped hands, lips etc., the same as that used for making nitro-glycerin? A. Yes, but purer and stronger.

(30) A. R. L. and others ask: Is the Gramme magneto-electric machine made in this country? A. No. It is made by L. Breguet, No. 39 Quai de l'Horloge, Paris, France.

(31) L. D. D. asks: How could alcohol and water, used for making pickles, be made into good vinegar? A. Alcohol may be converted into vinegar by adding to it a little yeast and keeping in a moderately warm place until acetification is complete. In pickling, only strongest wine vinegar is used, mixed with the spices and sometimes a little olive oil.

(32) L. J. says: I have a brass hopper on my coffee mill which is badly fly-specked. How can I polish it? A. Remove from the mill and polish with fine emery applied with a woolen cloth moistened with oil.

Please give me a recipe for making a baking powder? A. Powder and thoroughly dry separately by gentle heat ½ lb. tartaric acid, ¾ lb. of pure bicarbonate of soda, and ¾ lb. of potato farina. Mix dry, pass through a sieve, and preserve as much as possible from air and moisture.

(33) W. B. N. asks how cavendish tobacco is prepared? If it is steeped in any liquor or any preparation? A. Tobacco, by the better class of manufacturers, is not steeped in any liquor, but after stripping, the leaves are sprinkled with licorice and white sugar, made into rolls and closely packed into oak boxes, and subjected to pressure, in which form it is sent to market.

(34) W. H. L. asks how to bleach or whiten ivory piano keys? A. Ivory is whitened or bleached by rubbing it with finely powdered pumicestone and water, and exposing it to the sun while still moist, under a glass shade to prevent desiccation and the occurrence of cracks. Repeat the process until the proper effect is produced. Ivory may also be bleached by immersion for a short time in water holding a little sulphurous acid, chloride of lime, or chlorine in solution; or by exposing to the fumes of burning sulphur, largely diluted with air. Where the ivory keys cannot be removed the polishing process may be the best.

(35) Star asks how to remove writing ink from paper? A. Apply muriatic acid diluted with five or six times the quantity of water, and after a minute or two wash with clean water. A solution of oxalic acid, citric acid, and tartaric acid may be applied where there is printing, as it will not attack the printed text.

(36) L. G. asks how to remove fruit stains from cotton and linen goods? A. Wash the stained portion clean and apply a weak solution of chlorine, chloride of lime, or oxalic acid. Lemon juice will frequently remove stains. Some stains may be taken out by dipping the cloth in sour buttermilk and drying in a hot sun. Thoroughly wash in warm water and dry.

(37) S. H. asks how to test a rough diamond and tell it from glass? A. Put the stone in a leaden cup with some powdered fluorspar and a little oil of vitriol. Warm the vessel over a fire where there is a copious draught to carry off the noxious vapors that will be evolved. When these vapors have ceased, stir the mixture with a glass rod to fish out the diamond. A genuine stone will remain intact, but a fictitious one will be corroded by the hydrofluoric acid that has been generated around it.

(38) C. H. D. asks how to Babbitt the boxes of an emery wheel shaft? A. Clean the boxes of

the old Babbitting and whatever grease there may be. If practicable heat the lower boxes quite warm. After removing them and while warm, put them in place, and adjust the shaft in the way it is to run. If there is any danger of the metal running out at the ends of the boxes, cut thick straw board and fit to the ends of the boxes and up to the shaft so as to retain the metal until it hardens. Heat the metal hot, and pour carefully so as to fill the box and come to the diametrical center of the shaft, remove the shaft and trim off the superfluous metal. Put the shaft again in place. Put on the upper box and pour through the oil hole. Remove the box, trim off, and drill out the hole for reception of oil.

(39) J. F. P. asks for the process of tempering edge tools, etc.? A. See SCIENTIFIC AMERICAN SUPPLEMENT No. 71, p. 1123.

(40) A subscriber asks: What is the simplest way of keeping the temperature of my greenhouse above 45° winter nights? It is ten feet square, and is well warmed by the sun during the day. A. Put in a few lengths of cast iron pipe, fill them with salt water brine, and connect them with a stove so as to bring a portion of the pipe in contact with the fire. Let the pipe be 4 inches in diameter and set at a grade, leaving the stove at a high point and returning to it at a lower one. This will insure a circulation, and by keeping a slow fire a permanently low temperature may be maintained. This apparatus can be constructed by your plumber, or a similar one may be ordered of any dealer in this city. The salt will prevent the water from freezing should the fire be suffered to expire.

(41) A. G. M. asks for information about the fruit called Aku? A. Guinea is the native country of this fruit. It was brought to Jamaica by Captain Bligh in 1791, where it grows well. The fruit is about the size of a goose's egg and has a sub-acid flavor. It is considered wholesome and nutritive.

(42) B. H. asks what or-moulu is? A. It is a name given to a particular alloy of zinc and copper, generally about 52 parts zinc and 48 of copper. It is so finished as to have the appearance of gold. The term is often applied in a general sense to works of art. The metal is sometimes finished by dipping in an acid, which helps produce the gold-like surface. Lacquer is often applied to prevent tarnish.

(43) E. G. M. asks how marquetry is made? A. It is different pieces of colored wood glued to a ground of some firm wood. It is now chiefly confined in its use to floors, in which the various pieces of wood are usually disposed in regular geometrical figures.

(44) H. C. D. asks how to weld tortoise shell? A. Provide a pair of pincers or tongs. File the tortoise shell clean and make so as to form a lap joint. See that there is no grease about it. Wet the joint with water, apply the pincers hot, following them with water, and the shell will be joined as if it were one piece. Be careful that the heat be not so great as to burn the shell. You can test it by trying it on a piece of white paper.

(45) M. G. asks how to make extract of cinnamon? A. Dissolve 2 drachms of oil of cinnamon in 1 pint of good alcohol; add gradually 1 pint of water, and then stir in by degrees 4 ozs. powdered Ceylon cinnamon; agitate for some time and filter through paper.

(46) T. H. asks for a good indelible ink to use with stamps? A. Mix equal parts black oxide of manganese and hydrate of potash, heat to redness, and rub with an equal quantity of smooth white clay into a paste, water being added for that purpose, or, sulphate of manganese, 2 drachms; lampblack, 1 drachm; powdered loaf sugar, 4 drachms; rubbed into a paste with water. After stamping, dry the linen and wash well in water.

(47) N. P. asks how to test castor oil? A. If the oil be adulterated with rape oil, it may be detected by its not dissolving in strong alcohol, and also by its density. Pure castor oil is soluble in an equal weight of alcohol, specific gravity 0·820.

(48) J. H. asks: The bluing on some of our try-squares and bevels has come off; how can I re-blue them? A. Remove the blades, polish them and blue by heat, immersing the blades in a pan of powdered charcoal while being heated. Remove from the fire when the desired color is obtained. Or use an application of thin shellac varnish colored with Prussian blue.

In purchasing a glazier's diamond, is there any way by which an inexperienced person can tell which are good? A. No.

(49) S. H. J. says: I wish to fasten photographs to glass for coloring. What perfectly transparent fastener can I use which will not crack? A. See answer to E. F. (25) No. 12, p. 187, current volume.

(50) J. M. asks how the power of a telescope is estimated? A. Divide the focal length of the objective in inches by that of the eye piece in inches. This will give the magnifying power of the instrument.

(51) T. G. A. asks: Would you advise the use of any hair-producing elixir on the face? A. No.

(52) G. F. S. asks: 1. What is the best method of mending articles of celluloid, such as jewelry, etc.? A. Dissolve good glue in a small quantity of strongest vinegar or acetic acid by aid of heat. 2. Is there no way to restore the bright coral red which celluloid loses after long exposure? A. No.

(53) J. B. asks: 1. Will the airo-hydrogen blowpipe produce as strong a heat as the oxyhydrogen blowpipe? A. No. 2. Is the first safer than the latter? A. In inexperienced hands, yes. 3. Is there an alloy of platinum known (to solder platinum) which would resist a greater heat than fine gold? A. No. With skillful manipulation and a good blowpipe (oxyhydrogen) platinum may be welded perfectly. 4. If so, will you please state whether such could be brought to melt by the illuminating gas and common blowpipe? A. No; the heat of an oxyhydrogen flame is requisite.

(54) G. A. says: Volatile oils cannot be used in public buildings at frontier posts, and candles do not give sufficient light for the post schoolroom. Can you suggest any simple contrivance for illuminating purposes that will produce a brilliant light, like the lime light, etc.? A. We do not know of such a device. Simple machines for making illuminating gas automatically from the vapor of light hydrocarbon oils are in the market. The electric lamp, using a small magneto-electric machine driven by some small motive power, affords a brilliant light; the first cost of the apparatus, however, is considerable.

(55) H. M. says: 1. I have a lens (double convex) 4½ inches in diameter and 26 inches focus. Will it answer for an objective for a telescope? A. Not very well. 2. What size and focus will the eyepiece need to be? A. The eyepiece may be an inch in diameter (leaving an aperture in mounting of about ⅜ inch), 1 inch focus, and placed at 27 inches from the objective.

(56) G. G. says: I wish to etch letters on glass. Have tried asphaltum varnish, shellac, etc. which all fail to keep the fluoric acid from spreading even after being dry a long time. What I wish is something which I could use to cover the whole glass, except the letters, and which will withstand the action of the acid? A. Beeswax or paraffin is used for this purpose; melt and apply it to the glass previously warmed; when cooled, cut out the letters and expose to the acid.

(57) J. D. asks: What are the fire-extinguishing chemicals composed of, also whether they are explosive by contact with steam? A. The materials used in the Babcock and similar fire extinguishers are carbonate or bicarbonate of soda dissolved in water and a small quantity of oil of vitriol contained in a leaden cup, the inversion of which brings the acid in contact with the soda solution. The chemicals are not explosive in any way.

(58) A. M. G. asks for a recipe for removing superfluous hair? A. Sulphuret of barium 3 ozs., water 12 ozs. A little powdered starch is wetted with this solution and immediately applied. When dry it can be removed and takes the hair with it.

(59) R. M. H. asks: 1. What causes animalculæ to appear in the vinegar, and do they always come when it is made of grain or fruit? A. Nearly all vinegars prepared by slow fermentation contain microscopic organisms, derived from the germs present in the ferment, and from the air. 2. What must I do to remove them from the vinegar? A. Add a little of solution of sulphite of soda, agitate, allow to stand for a few hours, and strain off into clean barrels. 3. About how long a time should elapse after making until it must be corked tight, or is it better to leave the bung out of the cask? A. As soon as the fermentation is complete, it may be drawn off into clean tight barrels for storage.

(60) G. T. L. asks: 1. If the vapor of bisulphide of carbon will have any deleterious effects upon a steam engine as ordinarily constructed, the vapor being used instead of steam to drive the engine? A. It would have no bad effect other than that of dissolving all oil or grease with which it might have contact. 2. Would there be any danger of explosion on decomposition of the liquid bisulphide on being evaporated in an ordinary steam boiler? Would the liquid have any effect on the iron of the boiler if the boiler were heated by steam? A. Bisulphide of carbon vapor is very inflammable, and when mixed with air, very explosive when ignited. It would suffer no decomposition by being heated to boiling, and, if pure, would have little effect upon the iron. 3. If water and bisulphide of carbon be mixed together, the water predominating, and the mixture be evaporated in a boiler, would there be an explosion or any chemical action of any kind, altering the character of the two mixed vapors? A. No, but the liquids would not mix, and the bisulphide would become entirely vaporized before the temperature of the water attained the boiling point. 4. Is the liquid bisulphide compressible to any appreciable extent, and what is its cost in large quantities? A. No. The price, we believe, is about 75 cents a gallon. 5. Would it be safe to let the exhaust escape through a blast pipe into the stack? A. No.

(61) W. N. H. asks for a recipe for good writing ink? A. Take Aleppo galls, well bruised, 4 ozs., clean soft water 1 quart. Macerate in a clean corked bottle for ten or twelve days with frequent agitation, add 1¼ oz. gum arabic dissolved in about 2 ozs. of water, lump sugar ½ oz. Mix well and add 1½ oz. of sulphate of iron crushed small. Agitate occasionally for two or three days, when it may be decanted for use. When time is any object boiling water may be used instead of cold, and the ingredients put at once into the bottle and agitated until the ink is made.

(62) C. A. J. asks how sound is transmitted by the telephone? A. The voice causes the diaphragm of the instrument upon which it is thrown to vibrate. Electric undulations are induced in the coil that surrounds the magnet, which are precisely analogous to the undulations of the air produced by that voice. This coil and magnet is connected to a similar one at the other end of the insulated line of wire, and these undulations travel through the wire and are received and resolved into air undulations upon a similar diaphragm of the instrument at the end of the line where they are received.

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

J. M. B.—The white specimen is agate—corresponding to the *Leucachates* of Pliny. The other specimen is a sanded agate pebble or an inferior opal.—J. Y.—No. 1 (powder) contains, besides gold and silver, silica, alumina, lime, and traces of magnesia. It would be called a gold-bearing quartzite rock, with, however, a large percentage of iron. No. 2 is cassiterite or tin stone.—J. B. J.—It is rich in manganese—an impure braunite.—G. M. C.—It is a calcareous deposit filled with the fossil remains of numerous species of trilobites, and some vegetable matter.—Minerals of J. C. and L. S. W. are missing.—E. R. A.—It is a variety of fluorspar—fluoride of calcium.—C. B. K.—Specimens not yet received.—F. P. L.—It is an argillaceous carbonate of iron; its value will depend upon the percentage of iron it contains.—A. H.—No. 1 is serpentine and trap rock. No. 2 is gneiss. No. 3 is quartzite containing graphite.—J. C. and M. S.—Specimens not received.—J. H. P.—It is an ocherous clay, but the amount of metallic base is small. It is not valuable.—J. F.—The incrustation consists of carbonate and sulphate of lime, magnesia, alumina, silica, sesquioxide and carbonate of iron, and a little organic matter.—A. R. P.—No. 1 is a limestone containing mica schist, hornblende, and malachite—carbonate of copper. No. 2 is lime carbonate. No. 3 is a shale rich in malachite. No. 4 is a shale containing much mica, also hornblende.

COMMUNICATIONS RECEIVED.

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

On Using Explosives for Deep Tillage. By J. R. C.
On the Keely Motor. By J. A. F.
On a Remedy for the Glutted Labor Market. By R.S.
On the Navy Yard Fire Test. By ——.
On Weak Eyes. By ——.
On Throwing a Ball in a Curve. By ——.
On Why are we Right Handed? By F. H. P.

Also inquiries and answers from the following:
M. H.—P. L. W.—J. G.—B. C.—W. L. B.—J. T. J.—H. McI.—R. J. K.—H. E. B.—H. H. A.—C. H. R.—J. C. E.—W. B. N.—C. F.—S. H. R.

HINTS TO CORRESPONDENTS.

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

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

Hundreds of inquiries analogous to the following are sent: "Who makes tile and brick making machines? Who makes models of boats?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained

OFFICIAL.

INDEX OF INVENTIONS

FOR WHICH

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

October 2, 1877,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

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

Aerial machine, J. B. Ward 195,860
Anchor, C. E. Marshall 195,769
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Apple cutter, T. B. East 195,750
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Water elevator, compressed air, D. C. Cregier ... 195,800
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Window frame etc., ventilating, A. K. Phillips .. 195,772
Yokes, ring and pulley for neck, S. M. Palmer 195,840

DESIGNS PATENTED.

10,363.—CARPETS.—Frank E. Allen, Yonkers, N. Y.
10,364.—LACE FABRIC.—Abraham G. Jennings, Brooklyn, N. Y.
10,365.—BRACELET.—H. Lang, Kennett's Square, Pa.
10,366.—POCKET BOOK CLASPS.—L. Messer, New York, N. Y.
10,367.—PRINTED AND WOVEN FABRICS.—W. Morris, London, Eng.
10,368.—DISH HANDLES.—S. Stevens, Jersey City, N. J.
10,369.—SHOW CARDS.—W. C. Wilson, & T. S. Harrison, Philadelphia, Pa.

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

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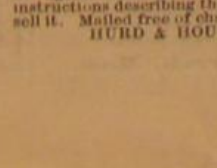
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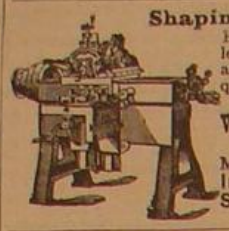

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Vol. XXXVII. No. 21. [NEW SERIES.] NEW YORK, NOVEMBER 24, 1877. [$3.20 per Annum. [POSTAGE PREPAID.]

THE 42D STREET SEWAGE TUNNEL, NEW YORK CITY.

The facility with which underground tunnels can be made beneath the streets of New York is strikingly exemplified in the boring of the now nearly completed tunnel which passes under East 42d street from between 3d and 2d avenues to the East river. The excavation has been made for sewerage purposes, and were it not for the small area of thoroughfare occupied by the enclosure about the shaft openings and the surface machinery, no one would be aware, so far as outside indications go, that the work was in progress. The cutting of 42d street through Prospect Hill is simultaneously proceeding, and while this extensive operation has been carried on on the surface, the tunnel has been run many feet below, so that most people, not being informed of the tunnel's existence, naturally infer that all the machinery, etc., visible, relates to the opening of the upper cut. So far as producing discomfort to the neighborhood is concerned, the last-mentioned work has proved a serious annoyance, and although when finished it will materially enhance the value of property, since its beginning it has rendered neighboring houses almost unrentable. The tunnel, on the other hand, while likewise benefiting property, has been productive of no inconvenience whatever.

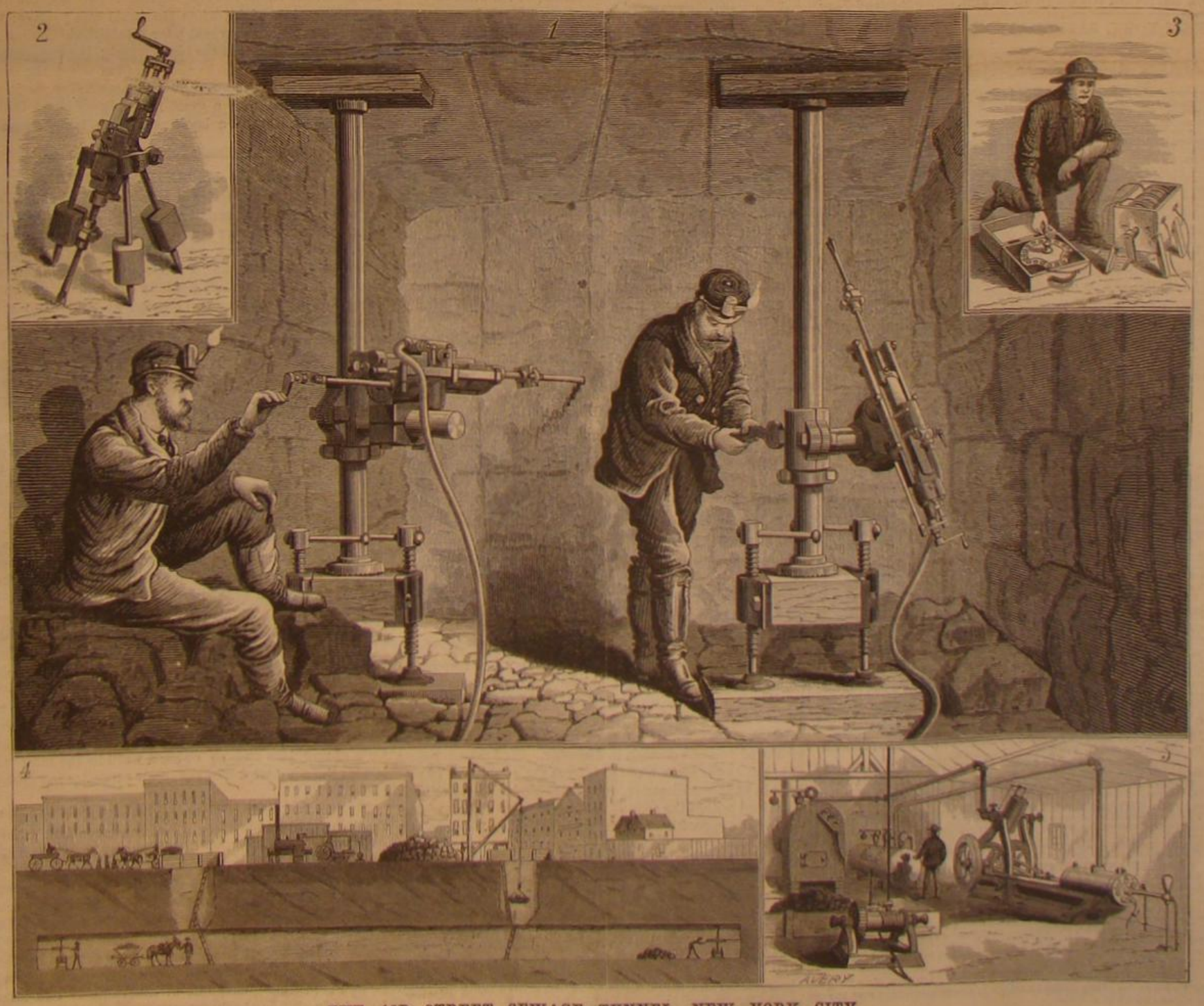
There is another remarkable feature about the subterranean work, and that is the rapidity with which it has been executed. It is eight feet square in section, and to be eighteen hundred feet in length. Twelve hundred feet are now finished, and have been accomplished in the short space of seven months. The rock is gneiss and quartz, and the machinery employed is the Rand Little Giant rock drill, driven by compressed air supplied by the Rand & Waring compressor. Five drills have been used, three constantly in action and two under repair. Fourteen holes are made in the headings before blasting, and the average advance is 6 feet per hole in 10 hours.

In the accompanying engraving we illustrate the Rand drill in operation in Fig. 1, the drill separately in Fig. 2, the exploding battery for firing blasts, Fig. 3, a section of the tunnel under 42d street in Fig. 4, and the interior of the compressor house, showing the compressor, etc., in Fig. 5. The compressor consists of a steam cylinder and its piston connected with a double-acting compressing cylinder and its piston, the connection being made to one and the same revolving shaft by a crank pin common to both. The steam end consists of an oscillating steam engine placed obliquely and so arranged that at the moment of greatest resistance of the compressed air, the greatest effort of steam is applied. The air compressing cylinder is composed of three concentric shells, which form two annular spaces around the working cylinder; the outer space affords a passage for the air after compression, and also a vessel for collecting any moisture that there may be in the air; the inner space forms passages for the water used in cooling. The heads of the cylinder, the piston and piston rod, are also hollow, to admit a flow of water through them. The essential feature of the entire machine is the system of circulation, which places a current of flowing water behind every part of the compression machinery with which the air comes in contact during compression, while cold water is continually supplied as fast as it is required.

The principal point in the construction of the Rand drill is its simplicity. It is claimed to have a less number of parts than any other machine of its class. By a simple device the valve is thrown in the same direction as the piston is moving, without the use of a connecting rod, or any cumbrous machinery outside the steam chest or cylinder, thus obviating the constant stoppages for replacement. The port is not closed until the drill has made the full stroke, thus bringing to bear the full force of air or steam in doing the required work.

The drills are intended to be used with either the column or tripod. In vertical work the latter is more suitable. Its legs are arranged to telescope, and can be lengthened or shortened at will, thus allowing holes to be bored in very difficult places and at almost any angle. Another advantage claimed for the drills possess over the old system of hand work, is not only in the economy of time and labor, but in the saving of material used. The drill, or bit, being an integral portion of the blow-delivering power, is exhausted only at one end instead of having both flattened—one by the resistance of the rock and the other by the powerful blows from a sledge hammer, which last itself enters into the list of materials consumed.

The Rand drills weigh from 150 to 900 lbs., there being six sizes, the smallest drilling from ½ to 1 inch holes, and especially for plug and feather work, the largest boring 3 to 4 inch holes, 30 feet deep, and intended for deep cuts, large apertures, and the heaviest class of rockwork. The machines may be driven by either steam or compressed air, but the tunnel above referred to is an instance of the advantages attending the use of the latter underground. In so confined a space, where there is no exit for the exhaust steam, it would be practically impossible for men to work;



THE 42D STREET SEWAGE TUNNEL, NEW YORK CITY.

compressed air, on the contrary, suffers no such diminution of pressure on being carried over long distances, as does steam; and its escape serves to ventilate the tunnel.

The Rand drill is in use in a large number of mines, etc., throughout the country, notably those in Port Henry, N.Y. the Comstock mine in Nevada, the Lehigh and Wilkesbarre Coal and Iron Company's mines in Nevada and elsewhere. For further information, address RAND & WARING DRILL Co., 21 Park Row, N. Y.

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$80,000 REWARD FOR A CURE FOR CHOLERA.

By a will dated August 28, 1849, a French gentleman named Bréant left to the Paris Academy of Sciences the sum of $80,000, to be awarded as a prize to any person who should either discover a cure for Asiatic cholera, or the cause of the disease. He further directed that the interest of this fund, until the principal was finally awarded, should be donated as premiums to investigators who should contribute important information tending to advance knowledge relative to the malady. The rules of the French Academy, under which the prize will be awarded, are as follows. The competitor is required:

(1). To point out a system of medicine that cures cholera in the immense majority of cases; or

(2). To indicate, in an incontestable manner, the causes of Asiatic cholera, so that, by suppressing these causes, the epidemic will cease; or

(3). To discover some certain prophylactic as evident for cholera, as, for instance, vaccine is for small-pox.

(4). To become entitled to the annual prize (derived from *the interest* on the $80,000), the competitor will have to demonstrate, by rigorous processes, the existence in the atmosphere of substances that may play a part in the production or propagation of epidemic diseases; and

(5). In case none of the above conditions have been fulfilled, a competitor may take the annual prize by finding a radical cure for tetters, or enlightening the world upon the etiology of that disease.

The existence of this reward has been the cause of an immense amount of medical research, and hundreds of papers have been submitted to the Academy. The great prize has never been awarded, and probably it never will be, for before the cause or the cure of Asiatic cholera can be discovered, the malady itself, owing to our constant progress in knowledge of preventive sanitary precaution, will probably, like the plague, have disappeared altogether.

During the present year, we learn from the English *Magazine of Pharmacy*, nine papers have been sent in. None have been adjudged worthy of the $80,000, but as the interest may be bestowed annually upon any person "who shall have caused science to progress, as regards cholera or any other epidemic disease, either by giving better analyses of the air, and showing therein some morbid element, or by discovering some process enabling us to become acquainted with, or investigate, the animalculæ which, up to the present time, have escaped the eyes of the learned, and which may be the cause, or one of the causes, of the disease."

Portions of the revenue have been awarded—on two of the nine papers. The first of the successful pair is by Dr. Duboué, of Pau, and he endeavors to demonstrate that the primitive lesions consist in a disquamation of the endothelium of the small vessels, and of the epithelium of the various membranes, particularly that of the intestine, and he attributes this disquamation to the influence which the morbific agent of cholera, after it has penetrated into the system by the capillaries of the lungs, exerts upon the epithelial cells and the intercellular substance. For explanation of the various phenomena of cholera, according to this theory, Dr. Duboué was awarded a prize of $400. The other fortunate competitor was Dr. Stanski, of Paris, who forwarded a large number of pamphlets, wherein he endeavored to demonstrate that contagion at a distance by miasma, or, in other terms, infection by means of a volatile principle, has no existence in any disease whatever. For this contribution a prize of $200 was given.

We believe that the existence of this prize is little known in this country, and as cases of cholera have been of frequent occurrence in some localities South, and also have been closely and intelligently studied by the physicians of that section, we have no doubt but the American medical profession, if it does not possess some member who may secure the prize, at least numbers many who can contribute materially to general knowledge concerning the disease.

SUN SPOTS STUDIED BY SOLAR PHOTOGRAPHY.

M. Janssen has obtained magnificent photographs of the sun, measuring some 12 inches in diameter, on which the granular solar surface can be as clearly distinguished as by regarding the sun through the largest instruments. He obtains these by diminishing the time of exposure to less than $\frac{1}{1000}$th of a second and employing special means for the development of the image.

On April 14th last, M. Janssen states that a photograph of the sun showed no spots, and it was therefore reasonable to presume that none existed, as spots as small as one second in diameter were always registered. On the next day, at about 8 A.M., another photograph showed, near the center of the sun, a considerable group of spots, the largest of which measured some 20 seconds in diameter. M. Janssen points out that, as the earth when seen from the sun is but 18 seconds in apparent diameter, our globe could easily have been contained within the area of the largest spot. The suddenness of the apparition and the grandeur of the phenomenon led the observer to predict the prompt disappearance of the spots and frequent changes in their configuration. He further concluded that the idea that, when the sun (as at present) exhibits few spots, that it is undergoing a period of repose is inexact, but that the truth is rather the reverse, as spots then form and vanish with a rapidity much greater than at any other epoch.

Of course these views of M. Janssen have led to many observations and much discussion by and among astronomers. M. Denza cites a small spot which appeared on March 6th and disappeared before the 12th; the same observer notes the fact that the spot of April 15th formed on the afternoon of the 14th. M. Ventosa at Madrid also saw the spots form at 5 P. M., on the 14th, and mentions seeing other smaller spots appear and vanish rapidly during previous months.

M. Gazan dissents from M. Janssen's views, and regards sun spots as the result of eruptions in the solar mass. Before the spot, however, there are faculæ which should have been seen. In the photograph of April 14th, however, faculæ are altogether absent, but this M. Gazan explains by assuming that the faculæ were too near the center to be visible. According to him the spot in question will not disappear any more rapidly than spots during the maximum epochs, and he thinks that it will return. M. Janssen, however, replies that fifteen days afterward, when the sun had more than completed his semi-rotation, the spot should, according to M. Gazan, have reappeared, whereas it did not.

M. Tacchini does not coincide with M. Janssen in the idea of the present activity of the sun, but on the contrary considers that an actual period of repose exists. He points out that there were 290 spots observed within five months in 1871, while but 24 were noted in the same period in 1876.

M. Janssen states that the first mentioned total is exaggerated, for several spots which appeared three or four times were counted as frequently, and that numerous small spots could not appear and disappear rapidly, as is the case now, without producing excessively violent movements in the solar mass. This very great activity would militate against the formation of spots and be favorable to the disappearance of those already produced.

CEREBRAL THERMOMETRY.

At a recent meeting of the French Medical Association at Havre, M. Broca laid before it the results of a prolonged investigation into the temperature of the surface of the head in health and disease. He employed an instrument of which the bulb was maintained in contact with the cranium, whilst its opposite surface was thoroughly insulated from external air. As a rule, he placed three of these thermometers on each side of the head, and thus obtained readings at six different points. A normal standard was obtained by experiment from healthy individuals. Twelve persons were taken. The maximum temperature was 94·73° F., the minimum 91·04°, giving a mean temperature of 92·87.° The thermometers on the left side registered two degrees higher than those of the right, when the brain was passive; when active an equilibrium was at once established. From this, Mr. Broca inferred that the blood supply is more abundant to the left than the right hemisphere; but when the brain is called into activity, the [illegible] hemisphere, being, as it were handicapped, calls for a greater supply of blood than the left. The reading of a book raised the temperature one degree.

LESSONS IN MECHANICAL DRAWING.

The very admirable series of Lessons in Mechanical Drawing which have been serially published in the SCIENTIFIC AMERICAN SUPPLEMENT is now approaching its termination. The first of these lessons appeared in No. 1 of the SUPPLEMENT and in it the author, Professor C. W. MacCord of the Stevens Institute (himself perhaps the ablest mechanical draughtsman in the country) entered upon his subject in a manner not only entirely novel but in a way which could not but prove to the student that the subject was to be treated with a comprehensiveness and thoroughness never before attempted in any work, and certainly never essayed in any periodical journal. Professor MacCord began by teaching the beginner how to make his own instruments, starting out with a couple of triangles to be cut out of pasteboard, and showing how much might be done with these simple aids. Then followed instructions how to make lines and angles and to combine them into various geometrical patterns. In lesson 7, he reached the employment of the compasses and the first introduction of circular forms, and thus he proceeded, taking up the various instruments and clearly elucidating their uses. The first thirty-two lessons completed the elementary portion; and whoever had mastered the principles and faithfully practiced the exercises presented in the large number of drawings, which were accurately prepared by the author himself, was then in a position to place the knowledge acquired of mechanical drawing to the test of practical application in its legitimate sphere, namely the actual draughting of machinery. The new series began with the draughtsman's scale and its uses, and the learner was at once inducted into the drawing of simple forms, such as bolts, nuts, links, and all the various parts of machines and so onward until in the most recent lessons the construction of the screw propeller has been elucidated.

That the lessons have proved of practical value we have the direct evidence of a number of correspondents who have written to us telling us of their progress, and also by their questions showing how intelligent an interest they feel in the same. Some have sent us capitally executed drawings as proof of their attainments. One writer informs us that he has practised but for two months on the lessons extending to No. 5 in the second series, and that, although he had no previous knowledge of draughting, he has acquired sufficient skill to enable him to prepare patent office drawings, so that he now is making money out of the valuable education he has obtained from the SUPPLEMENT's pages.

The aggregate material we have furnished, with the engravings, would fill a good sized volume, which alone would cost more than the subscription price of the SUPPLEMENT for the period over which the lessons have been published, or much more than the cost of the numbers of that journal containing the lessons, which can now be separately or collectively furnished.

THE GLANDULAR THEORY OF DISEASE.

Some ten years ago Doctor B. W. Richardson made the discovery that the fluids secreted during the various stages of some forms of communicable disease could be made to propagate disease. This he practically proved by producing hospital fever in an animal by introducing into a wound purposely made the secretion of a wound from a person suffering from surgical injury. Subsequently the secretions from that animal transmitted the disease to another, and it was thus propagated through four generations. Dr. Richardson then essayed to isolate the poisonous matter and succeeded in producing a darkish somewhat powdery half glistening mass closely resembling that obtained by drying the fluid which exudes from the cut poison sac of any venomous snake. To this substance he gave the name *septine* and classified diseases produced by it as *septinous* diseases, and in searching for a theory to account for the phenomena observed he came to the conclusion that the secretions of the animal body are the sources of the septinous diseases and that the latter are all of glandular origin; that in every case of disease the poison producing it is nothing more and nothing less than a modified form of the salivary, gastric or some other secretion. The diseases so produced are small pox, measles, scarlet fever, diphtheria, typhus, yellow, hospital, typhoid and puerperal fevers, erysipelas, cholera, ague, glanders, boils and carbuncles, and infectious ophthalmia. Dr. Richardson's other chief conclusions may be briefly summed up as follows: So long as a person is affected with these organic poisons and is giving off vapor at a certain temperature he is poisonous. The poisons are mechanically carried and distributed by the vapor. They are harmless in the dry state but commence to resume their activity in water. They may all be destroyed by extreme dilution, by heat, by exposure to moist oxygen, to chlorine, iodine, bromine, sulphurous acid and nitrous acid in less degree. Bright sunlight is a potent means of their destruction. They are preserved by cold and by sulphur, creasote, and arsenic, so that they keep their active properties. They do not multiply like germs, but each particle possesses the property of converting certain secretions of the living animal into itself. The poison may travel as dry solid matter in sewage, or be wafted through the air, or in linen saturated with secretions, or may exist in water or watery vapor.

In a recent address, before the Sanitary Congress at Leamington, England, Dr. Richardson reverted to this theory and brought forward the result of his most recent investigations in its support. He states that he has noted that the number of closely communicable diseases is intimately related to the number of secretions. The poison of hydrophobia is from the salivary secretion, of diphtheria from the mucous glands of the throat, of scarlet fever from the lymphatic glandular secretion, of glanders from the mucous secretion of the nasal surface; of typhoid from the mucous glands of the intestinal surface, and so on. In some instances the blood itself is infected and the corpuscular matter becomes the seat of a catalytic change.

Dr. Richardson now thinks that the poisonous particles instead of being living are dead, and that their evil effect depends on their so being. He also advances the view that, under certain influences affecting glandular action, the poisons may be made to originate directly through nervous impression without the necessary intervention of an infecting particle. An extreme nervous impression (such as is the case where a prevailing disease can only be traced to extreme fear or anxiety) acts on the glandular nervous supply, paralyses the glandular function, and thereupon produces the same phenomena as is produced in other instances by the action of a specific poison This accounts for disease and poisonous glandular product under conditions of starvation and cold when the nervous tension is reduced, as well as under special atmospheric conditions in which the activity of the atmospheric oxygen is reduced in sustaining power. The poisons act first on the nervous fiber and the irritation caused gradually extends to the nervous center. This is what slowly takes place in hydrophobia. Another conclusion is that the communicable diseases are hereditary, and still another sequence of Dr. Richardson's researches leads to the explanation of the phenomenon of non-recurrence of the diseases after they have once attacked a person susceptible to them. They who are susceptible are born with a nervous impression tending to the production of a glandular secretion easily changed into poisonous secretion under the direct action of contact with poisonous matter or even under the influence of a central nervous derangement whereby the glandular function is deranged. But when such a person has passed through the ordeal, the tendency, for a time at least, disappears, owing to the complete modification of the glandular function that has been induced, to the free elimination that has been established and probably to the change in the nervous matter itself that has resulted from organic modification.

Dr. Richardson considers that if this theory be true we have complete mastery over the diffusion of the poisons of all the communicable diseases. A man or animal affected with a contagious disease is as deadly as the cobra, and he should be isolated and care be taken that his secretions, volatile, fluid or solid, do not come in contact with the secretions of susceptible healthy persons, and the danger is over. The theory, says the author in conclusion, suggests a profitable line of research on the subject of the production and reproduction of some of the poisons by the inferior animal and their transmission in that course to man. It brings all the inferior animals, in respect to their health and comfort, under our especial human care, not only for their sakes, but for our own self-preservation.

Finally, the theory suggests to those who are engaged in treating diseases of a communicable kind the best means of arresting the progress of a communicable disease even when the phenomena of it have been developed in an individual. It leads physicians to take a precise view, in each such case, of the nervous and glandular processes that are out of the natural order of work; it suggests seeking for remedies among chemical agents which affect special secretions; and it shows how to place the sick under such conditions that the secondary absorption of their own poisonous secretions—that deep absorption which is the actual cause of death in the great majority of cases of contagious disease—may be avoided.

NOTES OF DECISIONS OF THE COURTS.

ARTIFICIAL TEETH.—The bill of complaint filed by the Goodyear Dental Vulcanite Company against Charles G. Davis and others, for an infringement of the Cummings patent for "an improvement in artificial gums and palates" has just been dismissed by Judge Shepley.

It will be remembered that the Cummings patent is not for a process or art, but only for the product or article made by the process described. This product is a set of artificial teeth, consisting of a plate of hard rubber or vulcanite, with teeth or teeth and gums secured thereto by imbedding the teeth and pins in the vulcanized compound, so that it shall surround the teeth and pins while the compound is in the soft state before it is vulcanized. When the compound is vulcanized, the teeth are firmly secured by the pins embedded in the vulcanite, and there is a tight joint between the vulcanite and the teeth.

The plate is formed by filling a plaster mould with soft rubber, care being taken that the soft rubber shall completely fill all the cavities, and fit around the protuberances, including the pins projecting from the teeth. The soft rubber thus inserted in the mould is then subjected to sufficient heat to vulcanize or harden it.

The defendants use, in making their set of artificial teeth, a plate made of "celluloid," substantially a new material, discovered and patented since the date of the Cummings invention. This substance is compounded of cellulose or vegetable fiber and camphor. No rubber or other equivalent gum, and no sulphur or equivalent for sulphur in the process, enter into its ingredients. It is not a vulcanizable compound, and contains no vulcanizing agents in its composition. The camphor in its composition, instead of being a vulcanizing agent, causes the composition to soften instead of harden under the influence of heat. The product, when compounded, and before being subjected to heat, is not soft, like soft rubber under like conditions, but hard. In the manipulation of this material, the process of making a set of teeth, composed of the plate and teeth and gums, is an entirely different process from that used under the Cummings patent. The material is not placed in the mould in a soft, plastic condition, but in a hard, rigid condition, like horn, or bone, or ivory. It is then subjected to heat, not to vulcanize or harden, but to soften it. It afterwards, on being cooled or restored to its original temperature, returns to its original condition as a hard substance, as when first placed in the mould. No vulcanizing process, or even process of hardening by heat, and no equivalent for any such process, is practiced.

The court, in the light of such facts, holds that the Cummings patent for a plate of hard rubber or vulcanite is not infringed by a plate made of celluloid.

DYNAMITE. The Atlantic Giant Powder Company have been successful in maintaining their suit against George W. Mowbray and others for infringement of the so-called dynamite patent of Nobel. This patent was for an improvement in explosive compounds, consisting of the combination of nitroglycerin with infusorial earth or other equivalent substance.

For a long time after the invention of nitroglycerin by Sorbrero in 1847, in fact until 1863, when Nobel's inventions began, although nitroglycerin was well known to be a very powerful explosive as compared with gunpowder and gun cotton, it was very little used for blasting purposes. This delay in the introduction of nitroglycerin as an explosive to practical use was due apparently, first, to the enormous danger to life and property attending its manipulation, transportation, and use, in its fluid state; and secondly, to the practical difficulty, amounting almost to an impossibility, of exploding the whole mass of fluid nitroglycerin, as no instantaneous decomposition of the whole mass follows from the application of heat or of a blow, as in the case of gunpowder or gun cotton when fire is applied. The object of Nobel's dynamite patent was to remedy the first objection of enormous danger to life and property, and to combine the nitroglycerin with some absorbent substance, whereby the condition of the nitroglycerin is so modified as to render the resulting compound more practically useful and effective as an explosive, and far more safe and convenient for handling, storage, and transportation, than nitroglycerin in its ordinary condition as a liquid. The invention is described in general terms to "consist in mixing with nitroglycerin a substance which possesses a very great absorbent capacity, and which at the same time is free from any quality which will decompose, destroy or injure the nitroglycerin or its explosiveness." A certain kind of silicious earth, known under the several names of silicious marl, tripoli, rotten stone, etc., the preferred variety being infusorial earth, is described as the inert matter to be mixed with the nitroglycerin.

The defendants used mica powder, which is prepared by pouring tri-nitroglycerin at a temperature of 70° over mica scales prepared by triturating mica into scales of about one thousandth of an inch in thickness, and of exceedingly minute surfaces, in such a manner that the surfaces of the minute mica scales are painted or coated with the tri-nitroglycerin.

It is true that the infusorial earth is described as a porous substance, and is supposed to hold the nitroglycerin suspended in the pores by capillary attraction, but it must also hold it in suspension by coating and adhering to the exterior surfaces of the particles. The mica scales, on the other hand, are supposed to hold the nitroglycerin in suspension only as it is painted or coated on the exterior surfaces of the minute scales; but they each perform the same function as an absorbent of the nitroglycerin. They each take up and hold, by cohesive or molecular action or reaction, the nitroglycerin. The mixture is a mechanical one, and it is not material to the functions of the compound or its properties whether the liquid is held absorbed or suspended in the inner surfaces of minute capillary tubes, or on the outer surfaces of minute scales. Each one of the properties and qualities, ascribed by Nobel to the inert matter in his compound, pertains to the mica scales in the mica powder, and the functions are the same in each. In regard to the nitroglycerin used, Nobel used mono- or di-nitroglycerin, while the defendants used pure tri-nitroglycerin. In strictness, either by the old or the new system of chemical nomenclature these substances would be differently described or represented, but for the purposes of the compound they must be regarded as substantially the same in kind, though differing in degree.

Mica powder is therefore an infringement upon Nobel's dynamite.

The Relation Between the Diameter of Cores of Electro-Magnets and Their Length.

M. du Moncel has recently communicated to the French Academy of Sciences a paper on the above subject, the conclusions reached in which are as follows: 1. The dimensions to be given to an electro-magnet should essentially depend upon the electric force which is to affect it and upon the resistance of the circuit in which it is interposed. When the circuit is long and the electric source weak, the cores should be long and of small diameter: when, on the contrary, the circuit is short and the electric force intense, the core should be of large diameter. 2. For equal circuit resistances, the diameters of an electro-magnet established under maximum conditions should be proportional to the electro-motive forces. 3. For equal electro-motive forces, these diameters should be inversely as the square root of the resistance of the circuit, the resistance of the battery being included. 4. For equal diameters, the electro-motive forces should be proportional to the square roots of the resistances of the circuits. 5. For a given electro-motive force and with electro-magnets placed in their maximum conditions, the electro-motive forces of the batteries which excite them should be proportional to the square root of the resistances of the circuit.

A Simple Method of Ventilating Rooms.

Dr. H. N. Dodge informs us that he has found the following plan very satisfactory for the ventilation of rooms that are much used during cold weather: Nail or screw a neat strip of wood, from one to two inches high, upon the window sill, just inside of the sash and extending entirely across from one side of the window frame to the other Upon the top of this strip fasten a piece of ordinary "weather strip," so that there will be formed an air-tight joint between the "weather strip" and the lower sash of the window, whether the latter is shut down tight or raised an inch or two, the lower cross-piece of the sash sliding on the rubber of the "weather strip" as the sash rises. With this simple fixture in place, the lower sash may be raised enough to admit a stream of air between the lower and upper sashes, where they lap over each other at the middle of the window, without admitting the least air at the window sill. The air admitted between the sashes is thrown directly up toward the ceiling, and there mixes with the heated air at the upper part of the room. The room is thereby ventilated in a thorough and agreeable manner without drafts of cold air upon the persons in the room. The fixture should be applied to several windows in a room. The amount of ventilation may be regulated by the distance that the lower sash is raised. This arrangement is cheap, simple, and effective.

Cast Engravings.

A cheap way of reproducing engravings is to use cast plates, which may be worked off on a common printing press. An alloy of tin 1 part, lead 64 parts, and antimony 12 parts, is poured, while in a state of fusion, over the engraved plate, which is raised on suitable supports.

IMPROVED TILE-MAKING MACHINE.

The annexed illustrations, which we take from the *Agricultural Gazette*, represent a new continuous-feed, brick, pipe, and tile making machine of English construction. Machines of this pattern for solid bricks only have been in use for a considerable period; but in the present apparatus not only solid, but perforated, hollow, or tubular bricks, roofing tiles of all descriptions, paving bricks, and drain pipes up to 12 inches in diameter, may be made.

The clay is both ground and pugged in the upper part of the machine. Thence it passes to the lower horizontal cylinder, whence it is expressed around a core, if for tiles or other curved forms. The material then slides upon the table on the surface of which are horizontal rollers, and passes (if in the form of solid bricks) between the vertical rollers shown. The tiles or bricks are separated by means of the wires placed in the movable frame shown.

Fig. 1 shows the arrangement of the machine for producing solid bricks, and Fig. 2 the construction for tile making. The apparatus is self-contained and can be put down anywhere in a very short time without skilled labor. It is mounted on wheels so as to render it portable; and can be opened by simply removing a few bolts so that the interior of the mill is readily accessible. The power required is stated to be 4 horse power nominal, and the capability of the machine 15,000 bricks per day.

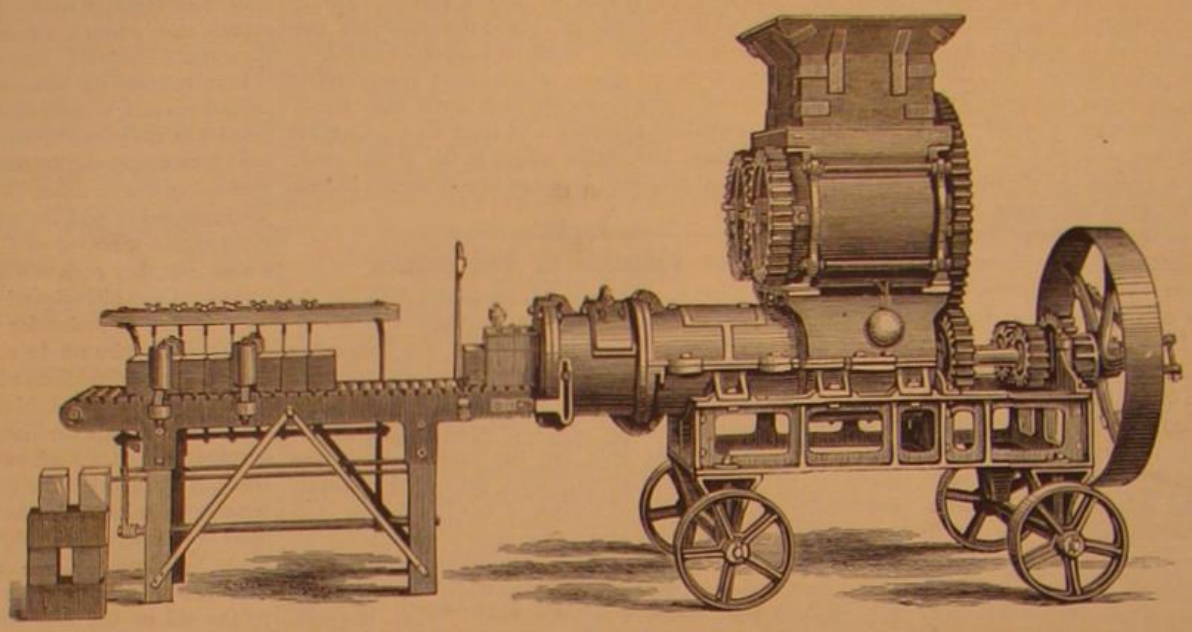


Fig. 1.—NEW TILE-MAKING MACHINE.

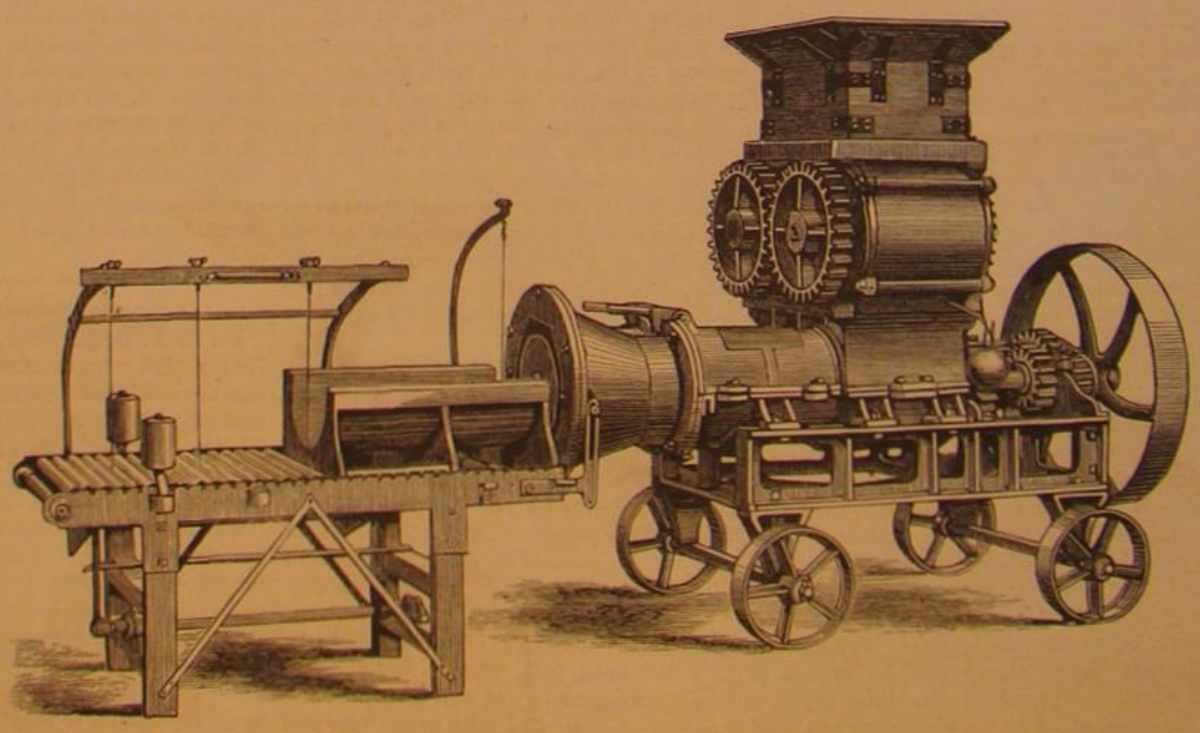


Fig. 2.—NEW TILE-MAKING MACHINE.

The Increase of Near-sightedness.

It is undoubtedly true that there are far more near-sighted people in proportion to numbers at the present time than there was fifty or a hundred years ago. This increase is due to greater habits of reading, the necessities of education, lateness of hours kept, gas light, and many other causes which our forefathers did not have to contend with. Advanced civilization makes every day greater demands on the resources of human nature, and yet we are no richer in merely physical wealth than the generations before us. Unless civilization shall teach us methods of husbanding our strength, or of increasing its power, we may in the end come to a dead stop, for our faculties will no longer be able to do the work required of them.

Dr. E. G. Loring lately delivered an address before the New York County Medical Society on the subject, "Is the Human Eye gradually changing its form under the influence of Modern Civilization?" He points out that constant study creates short-sightedness, and heredity often perpetuates it, hence the number of short-sighted persons must necessarily increase in a nation devoted to intellectual pursuits. In considering the effect of prolonged use and overtensions of the eyes, Dr. Loring examined 2,265 eyes of scholars in the New York public schools. The proportion of normal eyes was 87 per cent among those under seven years of age, and 61 per cent in those above this age but under twenty-one. The proportion of near-sighted eyes in the younger was 3·5 per cent, and in the elder 26 per cent. In St. Petersburg, among the same classes, the proportion is respectively 13·6 per cent and 43·3 per cent, and in Königsberg, Germany, 11·1 per cent among the younger, and the enormous figure of 62·10 per cent among the elder class. Thus there is an increase of near-sightedness with the advancing years of the school term. It is more common in Eastern and older cities than in Western ones, and among the cultivated classes than the uncultivated. In New York city the percentage is 24 among Germans, 19 among Americans, and 14 among the Irish. Poor food, bad ventilation, and disregard of other hygienic requirements and a sedentary life—all of these conduce to a laxity of tissue which finds its expression in the eye.

The English are less troubled than other nations, probably because of their passion for outdoor games, which are decidedly beneficial to the sight. Near-sightedness is a disease of childhood, and rarely begins after the fifteenth or eighteenth year. The reason why there is less near-sight among people using their eyes in minute mechanical work is because of this rule. Different examiners have found about 10 per cent of near-sighted people among watchmakers and 70 per cent among the studious. "The only method," said Dr. Loring, in conclusion, "of preventing near-sight is to lessen the amount of work done by school children during the period of life from eight to sixteen years. It is by complying with these conditions that the English have become so eminently a literary people."

These suggestions are certainly worthy of consideration by parents, who may be hereafter more indulgent to their children when nature prompts them to avoid what it knows to be injurious. After the sight is firmly established an increased amount of study may make up for lost time.

New Mode of Purifying the Water of Condensation.

Water from the condenser aboard sea-going vessels, although fresh, is often found unsuited for both the purposes of drinking and as feed water. Under the influence of highly heated steam, the oil which lubricates the slides becomes saponified, yielding glycerin and fatty acids, and among the latter oleic acid. Water tainted with oleic acid is extremely disagreeable to the palate, and it also has the property of attacking boiler iron, forming an oleate, which in two French government vessels has recently been found to develope at the rate of over 400 lbs. a day. This substance causes very rapid deterioration of the boilers, and produces deposits, the evil effects of which are well known.

M. Etais has lately conducted some experiments on board of a French man-of-war, which indicate that a method he has discovered of avoiding the above difficulties is both practicable and useful. He simply passes the water of condensation into a reservoir containing lime water. The oleic acid then enters into the formation of oleate of lime and the water is purified.

PORTABLE corrugated iron huts, capable of accommodating each from 25 to 500 men, are in use instead of tents, by the Russian army.

Drawings for the Workshop.

Construction drawings after use in a workshop are liable to be soiled and torn and rendered undesirable for filing in the systematic drawers of a drafting office. Hence in many establishments it is deemed expedient and economical to make duplicates, so that a clean drawing can be always had for reference and office use. When a duplicate is desired, an easy and good method is to make it on good tracing paper (not tracing cloth or vellum) and to mount this tracing in the following manner: Prepare a board, well cleated on the back and smoothly planed on its surface, of a size in length and breadth a little larger than the tracing. Give this surface a coat of white shellac varnish, which will be found to dry in a few minutes. Then laying the tracing with the drawing lines downwards on a smooth table or board, give a similar coat of varnish, and immediately after transfer the tracing to the prepared board. This has to be carefully done, as the varnished tracing must be kept extended by the four corners and laid down just where it is to remain. It will present a very uneven surface at first, but a gentle rubbing over with a cloth in the form of a round pad, beginning at the center and stroking to the edges, will remove the air from under it, and as the varnish dries and contraction takes place, the tracing will present a uniform smooth appearance, and the drawing will look as if drawn on the board. Another coat of varnish applied over the drawing, when the tracing is fixed and dry, will prevent the lines from being washed out or removed. It is then ready for the workshop, and can be carried about and used without damage. When a drawing is to remain in a workshop for several weeks or months, the delineation can be made on a smooth, well planed, squared board, which, after being sand-papered and washed over with a thin sizing of glue and water, will take pencil and ink lines, and pencil shading, like paper. When the drawing is completed, a coat of white or ordinary shellac may be applied. The latter plan is much used in English machine shops, and answers the purpose in an admirable manner.

The preparation of construction drawings always involves more or less expense, requiring, as they do, time, study in design, and attention to accuracy. Therefore, when completed and deemed ready for permanent use, their preservation becomes of great importance, and it is poor economy to allow such drawings to get soiled, greasy, and mutilated, a practice, however, too prevalent in many of our machine works and manufactories.

A Good Idea for House Numbering.

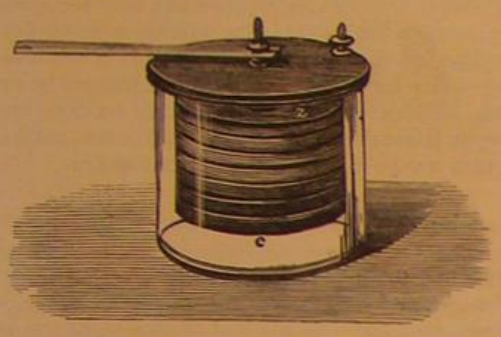
An excellent method of affixing the street numbers on houses has lately been introduced in Paris, the object being to render the numbers plainly visible by night as well as by day. On the front of the building is placed a small three-cornered lantern, one side resting against the wall and the angle projecting outwards. This is made of blue glass, with the number in white, the blue flashing being simply cut away in the usual manner by graving tool, acid, or sand blast. A gas burner serves as the means of illumination. In this city, especially in the up-town streets, some system similar to this is very much needed, as numbers when painted on fanlights become invisible when there is no illumination in the hall, making it a matter of no small difficulty to find a given address late at night, more especially when intervening empty lots break up the regular sequence of the numbers. Four hundred and fifty public buildings in Paris have already been numbered in this way.

WORK on the St. Gothard tunnel is progressing favorably. On October 14 last the distance completed was 5·6 miles.

M. TROUVE'S NEW MOIST BATTERY.

M. Trouvé's new galvanic battery is a Daniell cell, which has the advantage of working without liquid, or at least without free liquid, capable of escaping from the cup. Each element, as shown in Fig. 1, consists of a circular disk of zinc, Z, and a disk of copper, C. These are placed parallel and separated by a number of paper disks somewhat smaller in diameter. This mass of paper is capable of absorbing considerable water and hence of remaining moist for a long time. The lower half of the layer of paper disks is soaked in a saturated solution of sulphate of copper, the upper half in a solution of sulphate of zinc. It will be seen that all the elements of a Daniell cell are present, and that the two liquids remain separated better than they would be by porous vases. The sulphate of copper becomes used scarcely any except during the passage of the current, and there is almost no work expended in the battery itself—a constant fault in the ordinary Daniell battery. The copper disk is

Fig. 1.



held in the center by a rod, insulated from the paper and zinc disks, which extends up through the slate cover. The latter fits hermetically over the glass vessel and thus evaporation is prevented. *Les Mondes* states that this battery remains constant for a year, needing no attention whatever. To renew it, it is sufficient to resoak the lower part of the paper in sulphate of copper. The sulphate of zinc being constantly formed by the action of the battery never needs replenishing. When the zinc is used up, a new disk is inserted, and it is best then to put in new paper. The copper, if freed from the pulverulent deposit of the same metal due to the current, lasts indefinitely. The electromotor force is is the same as that of the Daniell element. The resistance varies with the diameter of the metal disks and with the thickness of the paper layers. M. Trouvé has made many applications of this battery, notably to medical apparatus and to the purposes of military telegraphy. In Fig. 2 is represented its disposition in the latter instance. The battery is composed of three hard rubber boxes, superposed, and each containing three elements. This has sufficient power to work a sounder over several miles. It may be carried upside down or in any position.

HARRISON'S NEW PORTABLE FLOURING MILL.

The annexed engraving represents a portable flouring mill manufactured by Mr. Edward Harrison, of New Haven, Conn., in which is combined all the necessary machinery for making flour, namely, grain scourer, grinder, and bolter. Its dimensions are, length 10 feet, diameter 3 feet, size of burrs 20 inches; capacity claimed about a barrel an hour, and weight 1,200 lbs. It is divided into three parts for shipment, the heaviest weighing about 500 lbs.

The bolter or mill case is made in cylindrical form, of wooden staves held together by cast iron heads, into one of which its grinder is fitted, and the scouring machine connected to it. The middlings and bran discharges are fixed in the head of the bolt reel at the opposite end, the bolting cloth being fastened to the reel, which runs the entire length of the mill.

The grinding machinery is supplied with all the improvements peculiar to Mr. Harrison's mills, which we have described in previous articles, including vertical burr and rigid runners, which have the effect, the manufacturer states, of cool grinders. Mills for grinding corn have long been used successfully by farmers and others not skilled in the art of milling, while the manufacture of flour has been done mainly by the large millers, and those running so called custom mills, furnished as a rule with horizontal grinders, by which means Mr. Harrison considers, that heated and damaged flour is produced.

Relative to the present machine, Mr. Harrison shows many testimonials to the effect that the best flour is made in paying quantities, that it received the highest consideration and award at the Centennial Exposition, that its use is being extended all over the world, and that it possesses superior advantages. Its construction is so simple that it does not require a scientific miller to superintend it, and its parts are not likely to become broken because of inexperience in operating it. It includes the necessary process of scouring the wheat before it is ground, which operation removes nearly half a pound of dirt from every bushel of wheat, and affords the means whereby every farmer can have his choice wheat made into flour without the necessity of going long distances to mill.

For further information address the manufacturer, Mr. Edward Harrison, 135 Howard avenue, New Hoven, Conn.

Lighting Cities by Electricity.

In the City of Providence, R. I., 220 street lamps, within a district over nine miles in length, are now lighted and extinguished in less than fifteen seconds by electricity, and the system is controlled by one man. After a trial of several months the practicability of the plan is assured, and if the whole of the 2,500 lamps in the city were lighted in this way, it is estimated that a net saving in expenditure for gas and labor would amount to about $25,000 per annum.

An "Industrial Wood Yard."

Last year some philanthropic individuals in Boston, desirous of helping able bodied unemployed men by giving them work, opened a woodyard for preparing kindling and stove wood. This plan directly and indirectly was the means for relieving the suffering of some two hundred and fifty persons, who were willing to work rather than to tramp and beg. The results proved so satisfactory that this method will be put in operation during the ensuing winter.

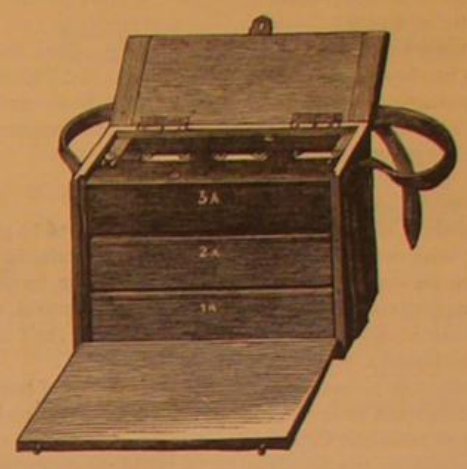
An Aromatic Pipe that Colors in Thirty Seconds.

There will be two opinions as to whether M. Gisclon, in removing some of the troubles of pipe smoking, has or has not done a philanthropic work. If his invention tends to promote pipe smoking he has not; but if we consider that people will smoke despite all the preaching to the contrary that can be done, M. Gisclon deserves credit for obviating some of the expense, much of the annoyance, and possibly some of the dangers of the tobacco pipe. He soaks a pipe of common porous clay, worth a few cents, in a mixture of ether and alcohol, to which a little rose essence is added and in which is dissolved 10 per cent (by weight) of camphor, and 10 per cent of borax or other flux. With this is combined a trace of nitrate of silver. In this preparation, as above stated, the pipe may be soaked or the compound can be applied with a brush over the parts which it is desired to color. The advantages of this treatment, M. Gisclon says, are that the pipe is made to look like meerschaum and to have a fine gloss; the smoke perfumed by the rose and camphor is agreeably aromatic, the pipe is cheap, and it will color nicely either by smoking or by exposing it to the light; in the latter instance thirty seconds' exposure is stated to be quite sufficient.

The Congo River.

Mr. W. Milner Roberts calls our attention to several references to the size of the Congo, made in Stanley's report and quoted by us, which he finds it difficult to reconcile. They are these: "It certainly exceeds the Nile in volume, and possibly also in area of drainage." "Where Livingstone was stopped, the Lualaba was a noble stream from 2,000 to 6,000 yards wide." That is one mile to three miles

Fig. 2



wide. "Near the equator, it developes into a still broader stream from two to ten miles wide, choked with islands."

"Then [referring to the Congo] at the cataracts, where the river breaks through the Coast Mountains, the stream narrows to 500 yards or less; then spreads out into a broad stream from two to four miles wide, with a current flowing about three miles an hour. The volume of water discharged is enormous; Captain Tuckey's estimate—2,000,000 cubic feet a minute—is probably not far from the truth."

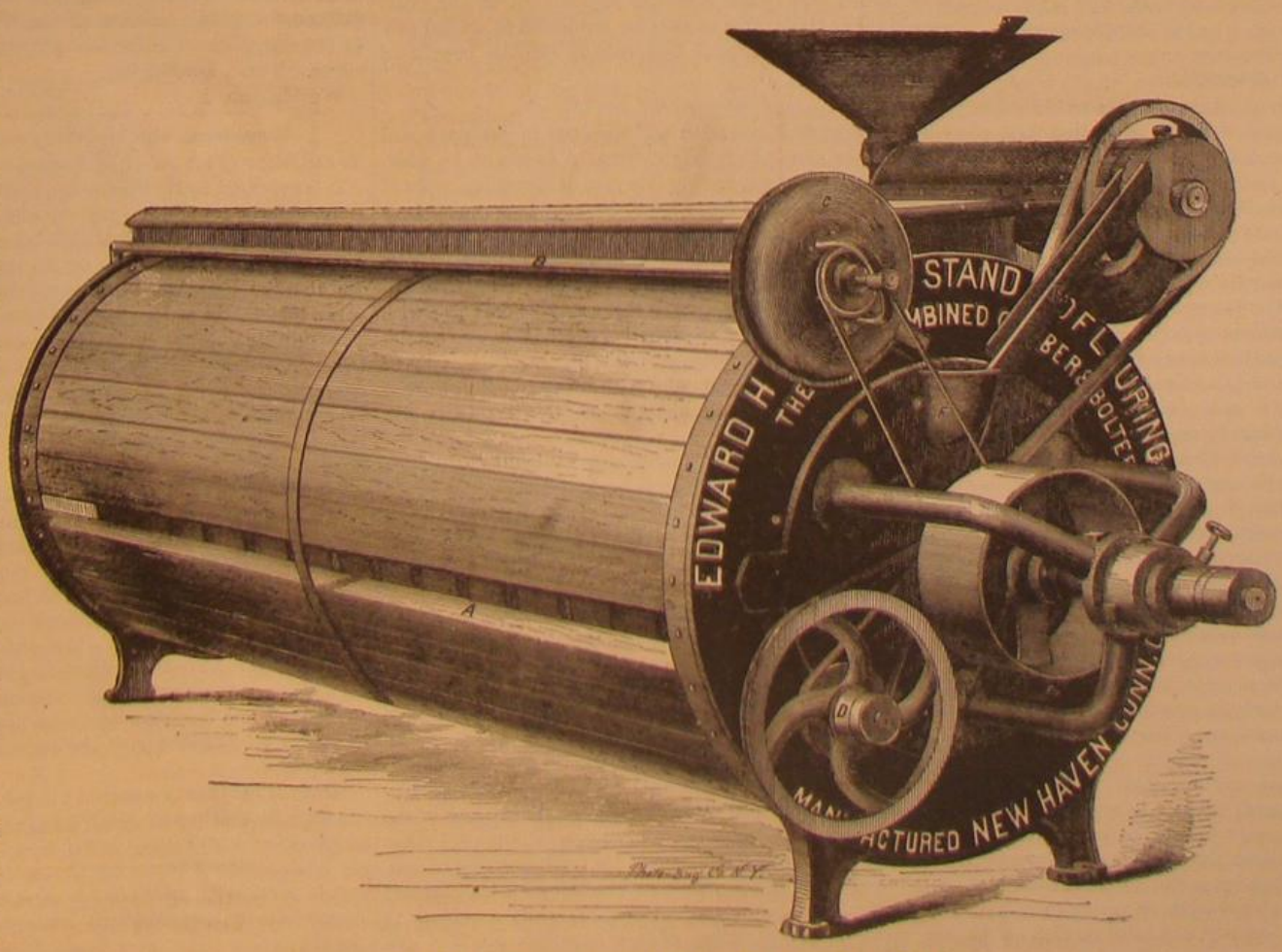
"At its mouth the Congo is a thousand feet deep." "The tide is felt as far as the first cataract, 40 miles up the river."

The quantity assigned for the discharge—2,000,000 cubic feet per minute—in a river two to four miles wide, flowing about three miles an hour (for a width of say three miles) would require a depth of less than six inches. So that either the width and rate of flow must be largely overestimated, or the quantity of water assumed must be very much too little. The flow of the Nile is at least ten times greater than the above, and the flow of the Mississippi must be thirty times greater than 2,000,000 cubic feet per minute.

Now if the Congo were a thousand feet deep at its mouth, with the width above mentioned (three miles) it is obvious that the current could be only about two thousandths of a mile per hour to correspond with the depth further up of only six inches, as the calculation shows; which would be nearly still water. In that case the other phenomena mentioned could hardly occur. The sea would not be freshened forty miles out.

A stream only 100 yards wide and 26 feet deep would, at the rate of three miles an hour, flow a little more than 2,000,000 cubic feet per minute. The Mississippi, just above the head of the passes, with a greater depth, is thirty times wider than that, being nine thousand feet across; and where it is narrowed to three thousand feet it has a depth of a hundred feet or more.

More accurate information than we now have in connection with the Congo river is desirable; and if the details of Stanley's observations do not afford something more definite, the next explorer of the river at the coast should be requested to make more careful notes. It would be interesting to know what the actual discharge of the Congo is—both in its high and low stages.



HARRISON'S NEW PORTABLE FLOURING MILL.

Communications.

Our Washington Correspondence.

To the Editor of the Scientific American:

A late issue of the New York *Tribune* published what purported to be a synopsis of the Annual Report of the Commissioners of Patents, for the year ending October 1, 1877, containing a number of figures as to the amount of business done by the Office during the "business year," which might possibly have been true if the Commissioner had written any such report, which he had not, and will not do until after the close of the year ending December 31. I propose to wait until a report is written before sending a synopsis of it, leaving this style of enterprise to your fast neighbors of the daily press.

During the past week 379 applications for patents were filed, and 224 cases allowed. The receipts of the Office amounted to $12,501.

The trade mark treaty with Great Britain, which the cable reports has been signed by Lord Derby and Mr. Pierrepoint, will probably bring a large accession of business to the Office, as hitherto English merchants and manufacturers could not register trade marks here.

PATENT LAW AMENDMENTS.

The Patent Office Bar Association have agreed to present to the Congressional committees on patents certain amendments to the statutes, which they desire to have passed for the more harmonious working of our patent system, which amendments are said to have the approval of the Commissioner of Patents, and are mainly as follows:

Patents to be issued on the day of their date, not later than the second week after the final fee has been paid; and until the day of issue the Commissioner to have jurisdiction over the application, but no patent to be withheld from issue because of interference with any application filed subsequent to the payment of the final fee. Re-issue applications may be made and specifications sworn to by the owner or owners of the entire interests. The section requiring forfeited applications to be renewed within two years (if at all) to be struck out. All assignments, licenses, powers of attorney to sell or license, to be recorded within two months. The selling of interests in patents not vested in the vender to be punished by imprisonment or fine. Patented articles to be marked "Patented," with the year and number of the patent. The right to file caveats not to be limited to citizens. After the final decision in an interference suit the successful party is not to be put into another interference with any application filed subsequent to the closing of the testimony of the successful party; but after the patent is issued an interference may be had with said patent. Interferences to be appealable to the Supreme Court of the District of Columbia. The re-issue section to be changed, as shown by italics in the following:

SEC. 4,916. Whenever any patent is inoperative or invalid, by reason of a defective or insufficient specification, or by reason of the patentee claiming as his own invention or discovery more *or less* than he had a right to claim as new, if the error has arisen by inadvertence, accident, or mistake, and without any fraudulent or deceptive intention, the Commissioner shall, on the surrender of such patent and the payment of duty required by law, cause a new patent for *such invention as was shown in the model or drawings, or described in the original specification or its amendments, and might have been claimed in the original patent*, and in accordance with the corrected specification, to be issued to the patentee, or, in the case of his death or of an assignment of the whole or any undivided part of the original patent, then to his executors, administrators, or assigns, for the unexpired part of the term of the original patent. Such surrender shall take effect upon the issue of the amended patent. The Commissioner may, in his discretion, cause several patents to be issued for distinct and separate parts of the *things shown or described in the patent*, upon demand of the applicant, and upon payment of the required fee for a re-issue for each of such re-issued letters patent. The specifications and claim in every such case shall be subject to revision and restriction in the same manner as original applications are. *In the case of re-issues no interference shall be declared with any patent of later date than that sought to be re-issued, except when the original application for such subsequent patent is shown by the Office records to have been of prior date to the application of the patent sought to be re-issued; nor with any application for a patent filed subsequent to the date of the patent sought to be re-issued; but if desired by such subsequent applicant or patentee on an application for re-issue, an interference may be had with the re-issued patent, after the same shall have been issued.* Every patent so re-issued, together with the corrected specification, shall have the same effect and operation in law, on the trial of all actions for causes thereafter arising, as if the same had been originally filed in such corrected form; but no new matter shall be introduced into the specification, nor in case of a machine shall the *specification be amended except by the model or drawings.*

Since the fire the Commissioner has paid great attention to the preservation of the burnt models in order to save, as much as possible, all that could be of use in reproducing them; and a recent examination shows that many thousands of them are almost as good as ever for the uses for which they were designed, although not quite as pretty to look at. It is proposed to clean up, identify, and label all that can be of any use.

THE FRENCH EXPOSITION IN CONGRESS.

Notwithstanding the published reports that American citizens desiring to participate in the Universal Exposition in Paris can do so upon simple presentation by our Minister in Paris, the French Minister again informs our Government that foreign exhibitors cannot be admitted to the Exhibition except through the intervention of a special delegate officially designated by their Government and accredited to the French Commissioner General. In view of this it would appear that nothing will be done until Congress shall act in the matter, which will probably be soon, as a bill has been introduced by Mr. Hewitt, of your city, for this purpose, which authorizes the President to appoint a commissioner general to represent the United States, and appropriates $150,000 to pay expenses, of which not more than $50,000 are to be expended for salaries. The bill also requests the Governors of the different States to invite their people to assist in the proper representation of their handiwork and to take such further steps as they may think necessary to secure to their respective States the advantages to be derived from their exhibits.

Among the avalanche of new bills just introduced into Congress is one offered by Mr. Hunter, of Indiana, authorizing an expedition to the arctic seas. This is essentially the same bill as the one reported favorably by the Naval Committee of the last session, and embodies what is known as the Howgate plan. Another bill proposes to establish a department of commerce under a commissioner with a salary of $3,000 per annum, who shall be charged with the supervision of the commercial, manufacturing, and shipping interests of the United States, so far as they may be confided to the general Government. A third bill, introduced by Mr. Wallace, provides for the coinage of $400,000,000 in value of a coin metal, patented by W. K. Hubbell, of Pennsylvania, called "goloid," consisting of one part of gold, twenty-four parts of silver, and three fourths of a part of copper.

All the divisions of the

HAYDEN GEOGRAPHICAL SURVEY

have returned to this city from their explorations of the western wilds, and have begun the work of reducing their examination to the form of a report for official transmittal to the Interior Department and Congress. About 25,000 square miles were covered by primary triangulation by Mr. A. D. Wilson, who established 26 stations, upon which monuments were built, besides locating a great number of other points by foresight intersections, upon which the parties carrying on the secondary triangulation have built monuments. The division in charge of Mr. Henry Garnett surveyed about 12,500 square miles and erected 104 monuments. The division directed by Mr. Beckler surveyed about 6,000 square miles and built 40 monuments. As soon as the office work of the survey will admit, a chart will be prepared showing the location of all the monuments in relation to the public lands suitable for available purposes.

OCEAN EXPLORATIONS.

The coast survey schooner Palinurus has just returned from making a series of scientific observations in regard to the density of the water and character of the bottom of the Chesapeake Bay, with the special object of determining the quality of the water and the kind of bottom in which oysters reach the greatest perfection. Specimens from the bottom of the bay were obtained at 148 stations between Havre de Grace and points fifteen miles outside the capes, which are to be turned over to the chemical department of the coast survey for analysis, just as soils are subjected to similar processes by the Agricultural Department for the benefit of agriculture.

A NEW NIGHT SIGNAL.

The Bureau of Navigation will soon put in use on board our navy the new "Very Night Signal," invented by Lieutenant Very of the navy. By this plan of signalling, colored fire stars are projected from 200 to 300 feet into the air by a pistol, so that a commander in-chief may readily communicate with all his fleet in a crowded harbor, by a series of signals which may be seen and read by officers of all his vessels, notwithstand the space between them may be crowded with other craft. By firing a single red or green stars, or a combination of them, all the sentences in the navy code may be communicated. The stars burn with brilliant red and green lights, and can be seen at a distance of from ten to twelve miles.

The Spanish, Portuguese, and Dutch navies have signified their intention to co-operate with the Chief Signal Officer in extending his system of international meteorological reports, and the Portuguese Minister of War has ordered that these observations be taken during the Government exploration of Helonga, in Central Africa.

General Benet, Chief of the Ordnance Bureau, in his annual report states that, owing to the failure of the army appropriation bill for the present fiscal year necessitates the closing of the National Armory and the discharge of the operatives employed there, cutting off the supply of small arms, so that on the 1st of October the reserve was only 8,552 rifles and 5,983 carbines, and asks that an appropriation be made sufficient to manufacture at least 50,000 during the coming year. The General also recommends the passage of the Senate bill of the last Congress, giving the Court of Claims jurisdiction of claims for damages for infringements of patents. Under the law as it now stands, officers using patented articles are liable in their private means, while a refusal to use them under the orders of their superiors would render them liable to court martial.

FIREPROOF PUBLIC BUILDINGS.

An estimate is to be submitted to Congress for an appropriation to erect a new fireproof observatory, as the commission for examining the Government buildings have reported that the old one is so old and so much worn as not to be capable of being remodeled into a fireproof structure. The importance of making immediate provision for the safety of the valuable books and instruments can at once be seen when it is considered that many of the books and papers could never be replaced, and that the glass of the great telescope, although so large, is so clear that if a hundred of the same kind should be cast not one of them might be as good as this one, so that there would be great difficulty in replacing it if destroyed.

The building commission recommends that the Printing and Engraving Bureau be removed from the Treasury to a separate fireproof building to be erected for that purpose, to prevent the danger of destroying the records of the Treasury from the inflammable material constantly used in that bureau. This can be readily done out of the savings during the current year effected by the efficient head of this branch of the Treasury Department, as there has been saved out of the appropriation for it during the first three months of the fiscal year no less than $150,000, and it is believed that the aggregate saving for the current fiscal year will not be below $600,000. Besides this saving the work to be done by the bureau upon internal revenue stamps will cost about $120,000 less than was paid for the same work last year.

THE COTTON CROP.

The cotton report of the Department of Agriculture for October makes the average condition nearly as high as in 1876. It is 81·1 this year against 82·7 last year, and 88 the year before. The decline in condition during September was less this year than last. In portions of Texas and Arkansas heavy rains prevailed in the early part of that month, and from the 16th to the 20th a violent storm swept through the cotton belt, doing great damage by beating out the fibre and rotting the bolls. A loss of at least 20,000 bales is reported from the overflow of the Black Warrior and Tombigbee in in Alabama. The caterpillar has done less damage than was feared, the most serious losses from this cause being in Texas and Louisiana. In the more northern States of the cotton belt they will accomplish quite as much benefit as injury by reducing redundant growth of foliage and hastening maturity of fruitage.

Accounts received here from all parts of the United States show that the wheat crop this year is the largest that has ever been produced in this country.

COMMERCIAL STATISTICS.

From the report of the Chief of the Bureau of Statistics, it appears that the total commerce of the United States for nine months, ending September 30, was $796,000,000, in merchandise, showing an increase of $58,000,000 over the corresponding period of 1876. The movement of specie in the nine months of this year amounted to $60,000,000 or $2,000,000 more than last year. The balance of trade still remains largely in our favor, it being $53,000,000 in our favor during the nine months, although it does not equal our balance for the corresponding period of last year, when it was $77,700,000. About five eighths of this enormous foreign trade appears to have been transacted through New York. It is estimated that the yield of gold and silver for the current fiscal year in the States of California and Nevada will be as follows: Nevada—Comstock lode, $20,000,000 silver, $17,000,000 gold; balance of the State, $6,000,000 silver, $1,000,000 gold. California—$15,000,000 gold, $1,000,000 silver. Total, $60,000,000.

Washington, D. C. OCCASIONAL.

Repairing the Washington Monument.

To the Editor of the Scientific American:

It is reported by the engineering board which has recently examined the foundation and soil underlying it of the Washington monument, that it is built on a compressed clay that has now to sustain a weight of five tons to the square foot and that the completed structure will exert a pressure of seven tons to the square foot. The only way to make the structure stable is to increase the area of its base—excavations in clay are dangerous at the best, as they expand as well as contract, and when it is already under a great pressure, it is very difficult to handle. I propose the following method of increasing the bearing surface, which can be done without risk.

First: A ditch is dug entirely around the foundation and at a proper distance from it. This ditch is to be filled with beton of high tensile strength, and is so to be constructed as to form a monolith.

From this circumscribing wall tunnels are run in to the base of the foundation and under it. These tunnels are narrow and are to be filled with beton as fast as the excavation is made. You have then something in the shape of a wheel, the felloes and tire being the circumscribing wall, the ribs the spokes, and the monument being the hub. By putting an invert between the ribs, the new foundation becomes a a saucer.

Beton is the proper material for this purpose, as you can obtain a monolith and get a greater benefit from the circumscribing wall as well as fill completely all excavations. By this process of removing the earth and stone and replacing it section by section, the area of the base can be enlarged without risk, the new foundation forming part with the old one.

Brooklyn, N. Y. JOHN C. GOODRIDGE, JR.

PRACTICAL MECHANISM.

BY JOSHUA ROSE.

NEW SERIES—No. XXXIX.

GEARING.

The term gearing is generally understood as meaning toothed wheels, which are said to be in gear, or geared together, when the teeth of one engage with those of another. The expression "a gear" always implies a toothed wheel. The term gearing, however, is frequently applied in connection with other qualifying words to distinctive parts of an engine or machine, as valve gear, slide gear, reversing gear, but in neither of these cases is it to be understood that those mechanical parts contain any toothed wheels or indeed wheels of any description. Wheels which communicate motion one to the other by simple contact of their surfaces are turned friction wheels, or friction gearing. Thus in Fig. 234 let A and B be two wheels that touch each other

Fig. 234.

at C, each being suspended upon a central shaft; then if either be made to revolve, it will cause the other to revolve also, by the unassisted adhesion of the surfaces meeting at C. The degree of force which will be thus conveyed from one to the other will depend upon the character of the surface and the length of the line of contact at C; if the material is very hard and the surface highly polished, the force transmitted would be quite inconsiderable, but would be largely increased if the surfaces revolving against each other were of a rough character, as in the latter case the minute projections causing the roughness would act upon each other.

In this class of gearing great strain is put upon the bearings; and as the latter wear, the frictional contact becomes diminished, and the usefulness of the device soon becomes impaired. To obviate this defect, and to further increase

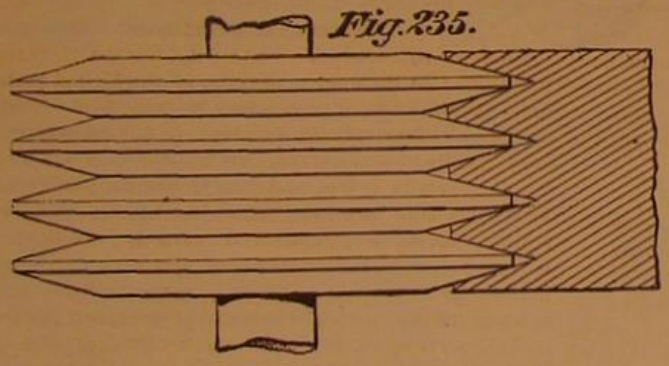


Fig. 235.

the power transmitted, the line of contact is increased by what is known as the "wedge and groove frictional gearing" which is shown in Figs. 235 and 236. In this case, not only

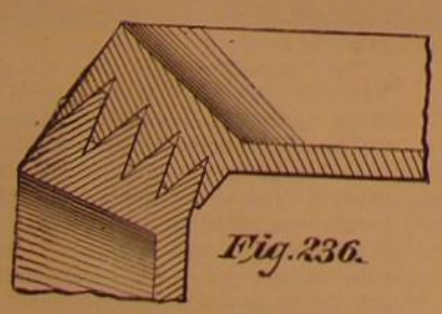


Fig. 236.

is the line of surface contact increased, but the strain due to the contact is so placed as to, in a great measure, counteract itself. Let us, for example, consider the strain placed upon one groove as shown in Fig. 237. The surface pressure on

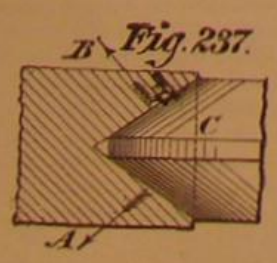


Fig. 237.

each side will be at a right angle to the face, or in the direction described by the arrows. A and B, one being in exactly opposite direction to the other. The surface contact acts to thrust the bearings apart. The line of surface acting to thrust the bearings apart being denoted by the dotted line, c. The relative efficiency of this class of wheel, however, is not to be measured by the length of the line, c, as compared to that of the two contacting sides of the groove, because it is increased from the wedge shape of the groove, and furthermore, no matter how solid the wheels may be, there will be some elasticity which will operate to increase the driving power due to the contact. It is to preserve the wedge principle that the wedges are made flat at the top, so that they shall not bottom in the grooves even after considerable wear has taken place. The object of employing this class of gear is to avoid noise and jar and to ensure a uniform motion. The motion at the line of contact of such wheels is not a rolling, but, in part, a sliding one, which may readily be perceived from a consideration of the following. The circumference of the top of each wedge is greater than that of the bottom, and, in the case of the groove, the circumference of the top is greater than that of the bottom; and since the top or largest circumference of one contacts with the smallest circumference of the other, it follows that the difference between the two represents the amount of sliding motion that occurs in each revolution. Suppose, for example, we take two of such wheels 10 inches in diameter, having wedges and grooves ¼ inch high and deep respectively; then the top of the groove will travel 31·416 inches in a revolution, and it will contact with the bottom of the wedge which travels (on account of its lesser diameter) 29·845 inches per revolution.

A spur wheel is one which has the breadth of the teeth parallel to the shaft axis, as in Fig. 239. The dotted line denotes the breadth referred to, and A represents the axis. A bevel wheel is one which has its teeth at an angle with the axis, as in Fig. 240. A crown or face wheel is one having its teeth at a right angle to its axis, as in Fig. 241. A miter wheel is one having its teeth at an angle of 45° to its axis, as in Fig. 242. An annular or internal wheel is one having its teeth convergent to its center. The roots of the teeth being at the largest diameameter. Spur wheels act upon each other in the same plane. Bevel wheels act upon each other at an angle.

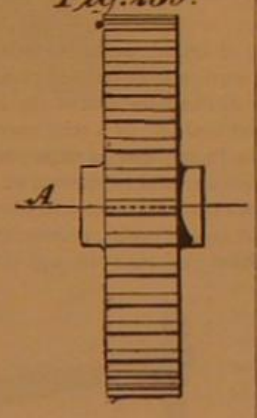


Fig. 239.

When the tooth of a wheel is made of different material from that of the teeth of the wheel with which it gears, it is termed a cog, but if in a pinion it is sometimes termed a leaf, while in a trundle it is termed a stave. A wheel which impels another is termed the driver or leader. The wheel impelled is termed the driven wheel or follower. A series of wheels geared together is termed a train. When two wheels are geared together the larger is termed the wheel, and the lesser the pinion. When a wheel is formed of a continuous web instead of having arms, it is termed a plate wheel.

The length of a tooth is the distance from its base to its extremity. The breadth of a tooth is the distance it extends across or upon the face of the wheel. The pitch line of the wheel is the circle upon which the pitch is measured, and it is the circumference by which the diameter or velocity of the wheel is measured. The pitch of a wheel is the distance of one tooth from the other, measured on the arc of the pitch circle, or pitch line, as it is usually called. The line of centers is the line between the centers of two wheels The radius of a wheel is the semi diameter, extending to the periphery, but in referring to the radius of a wheel, the pitch line is always, in practice, referred to. The radius is understood to be the distance from the center to the pitch line of the wheel.

The teeth of a wheel should be as small and as numerous as is consistent with the required strength. It is desirable that the number of teeth in a wheel should be prime to the number of the pinion, that is, the number of teeth in the wheel should not be divisible by the number in the pinion without leaving a remainder. This is advisable in order to prevent the same teeth coming together so often as to cause an irregular wear to the teeth. For this purpose an odd tooth is often introduced into a wheel, which is termed a hunting tooth. As an illustration of the desirability above referred to, suppose a pair of gear wheels are employed to drive a machine in which, as in the case of shearing machines for cutting plate iron, the duty is very severe, but lasts during, say, for example, one twentieth of the revolution of the gear wheel. If then the same teeth are always in gear or contact at the time the heavy duty is being performed, those teeth will rapidly wear away, because they sustain continuously this heavy duty, whereas by the employment of a hunting tooth, or by a prime number of teeth in the wheel, the heavy duty will be distributed over the various teeth. If, however, the revolutions of one wheel must be divisible without any remainder by the revolutions of the other, the number of teeth also must be so divisible.

We may now proceed to consider the principles that are to guide us in giving to the teeth of wheels their correct form or outline, so that the wheels when moved by them shall at as uniform a velocity as they would by the simple contact of their circumference. It is conceded by all authorities that there are an infinite number of forms of teeth which will enable one wheel to communicate equable motion to another, and it can be shown, say Willis and others, that within certain limitations, if any form of tooth be given, another may be determined which will work correctly with it. In actual machine practice the epicycloidal and involute curves have been universally adopted for wheel teeth on account of the facility and accuracy with which they may be mechanically described, and perhaps because they admit

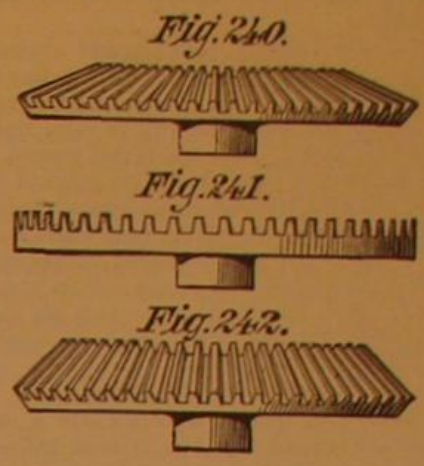


Fig. 240.

Fig. 241.

Fig. 242.

of ready and independent demonstration of their possessing the properties required for their duty.

Why Milk Sours during Thunderstorms.

BY MALVERN W. ILES, PH. D.

There have been various surmises in regard to this subject; none, so far as we have been able to learn, have been substantiated by experiments.

In order to see if milk did really sour during heavy thunderstorms, I made several observations which proved to me that this was not an erroneous opinion which is so commonly held by the dairymen. My experiments to arrive at the cause of the phenomena thus observed may be stated as follows:

I took skimmed morning's milk, filled a eudiometer tube (300 c.c.), then introduced 100 c.c. pure oxygen gas.

Then by the use of an ordinary battery, and a small Ruhmkoff coil, caused sparks of electricity to pass through the oxygen for five minutes. The current was then broken, the tube shaken up and allowed to stand for five minutes. The milk does not appear quite as opaque, and shows a noticeable acid reaction.

On continuing the current for five minutes longer, making in all 10 minutes, the milk curdles very perceptibly, and shows a decided acid reaction.

The contents of the tube on standing for twenty minutes had reached the consistency of ordinary sour milk or bonny-clabber.

From the above experiments it will be seen that the oxygen was converted into ozone, which we think may be stated as the cause for the rapid souring of milk during thunderstorms.

The increased acidity is due to the formation of lactic acid, and most probably some acetic acid, by means of the ozone. One or both these acids, then, causes the casein to be precipitated.

Submarine Explosions.

An interesting paper by Lieut. Andic, on the effects of submarine explosions, appears in the *Revue Maritime et Coloniale* for September. He concludes *inter alia* that gun cotton can develop in water pressures twenty times greater than a charge of powder of the same weight. It may be likened, for rupture of hulls, to 3·75 times its weight of powder. The measurement of the wheat-sheaf jets of water leads to no plausible result in investigation of the sphere of action. Apart from the advantage of its less volume, and its harmless character in handling, gun cotton is less advantageous than 3·75 times its weight for charging fixed torpedoes. Powder may be used at much greater depths than those which have been fixed as limits. Beyond certain depths, it takes considerable charges to obtain at the surface a sphere of action of 7·50m. An immersed torpedo of 2,000 kilogr. of powder, 40m. from the bottom, is capable of making a hole 6 meters in diameter in a ship above it. There is a considerable difference between the lateral and the vertical effects of a torpedo, and in England attention is directed mainly to utilizing the vertical effect, by uniting torpedoes in groups to be fired simultaneously.—*English Mechanic.*

Submarine Cable Statistics.

Of submarine cables, private parties own 149; miles of cable 59,547; miles of wire 65,535. Governments own 420 cables; 4,442 miles of cable and 5,725 miles of wire. Norway has 193 cables, Sweden 4, Denmark 29, Holland 18, Russia 3, Germany 46, Turkey and Greece 13, Italy 12, Spain 6, France 26, and Great Britain 52. The Anglo-American company has the longest submarine cable in the world, 2,585¼ nautical miles, and has five Atlantic cables in all, besides twelve other cables, a total length of 12,315 miles. The Eastern Telegraph Company has 48 cables, with 21,883 nautical miles.

A New Autographic Process.

In the Belgian *Bulletin du Musée*, M. Hannot describes the following new autographic process. The writing or drawing is made upon any kind of paper, which should, however, not be very thick. A special ink is used, composed of gum arabic or gelatine ½ ozs., water saturated with bichromate of potash 1 quart, and sufficient Indian ink to color the whole. The gum is first dissolved in the solution and the ink afterwards added. The preparation must be kept sheltered from the light, and when used a portion should be poured out in an inkstand of black glass. When the drawing is finished it is exposed to light, whereby the lines are rendered insoluble.

A plate of zinc or a stone is then prepared and polished with emery, and the drawing is placed upon it face downward. Above the latter is laid a sheet of paper covered with gum arabic, and above this two or three sheets of dampened blotting paper. The whole is then pressed. The moisture in the blotting paper reaches the gummed paper, and the gum, dissolved, traverses the autographic paper and affects the zinc or stone everywhere except where the insoluble lines of the design have prevented its passage. A roller of greasy ink may then be passed over the plate, and the grease will adhere only to the lines which are not covered with moisture. Printing is then done in the usual way.

Phosphorescence of Quinine.

If some sulphate of quinine is strewn over a sheet of smooth paper and exposed to a heat of from 120° to 140° Fahr., by means of a plate of metal, it becomes phosphorescent when stirred with a glass rod. Valerate of quinine exhibits the same phenomenon without heat being applied, if the crystals are rubbed in a mortar. It is said that the appearance is only noticed when the valerate contains an acid prepared directly from the root of valerian.

IMPROVED BORING MACHINE.

Machinery of some sort for boring is almost indispensable in all wood-working establishments, and some of the contrivances in every-day use for that purpose are no longer economical in view of the improvements now made in this as well as the other branches of wood-working machinery.

The boring machine illustrated herewith is one of several sizes and styles built by Walker Brothers, Philadelphia, and is a heavy and substantial, yet easy working machine, designed for straight and angle boring of all kinds, the spindle carrying bits up to 2 or more inches in diameter, and having a capacity for boring to the depth of 12 inches.

The frame or standard is a coned casting in one piece, having a broad base, and is quite firm and rigid throughout. The work remains stationary upon the table, which may be adjusted to the proper height or angle, and the bit is brought down and fed through by the foot of the operator on the lever or treadle below. This treadle is provided with a stop to regulate the depth of cut, and with the upward stop the travel of the spindle may be regulated for thick or thin stuff.

The spindle is balanced by means of the adjustable weight on the lever above, and will return when the pressure of the foot is removed. The table is provided with two adjustments for angle boring, and a gage that may be removed when not in use, the whole being raised and lowered by simply turning the hand wheel underneath.

The proper range of speed is given for large or small bits by means of cone pulleys, and the countershaft may be set so as to run the belt from any direction and not interfere with parts of the machine.

This boring machine is furnished when desired with a full set of auger bits, including a small universal chuck for holding all kinds of straight shank bits or drills. For further information address the manufacturers, Messrs. Walker Brothers, Nos. 73 and 75 Laurel St., Philadelphia, Pa.

Preparation of Celluloid.

Paper is treated by a continuous process with 5 parts of sulphuric acid and 2 of nitric acid, which converts it into a sort of gun cotton. The excess of acid is removed by pressure, followed up by washing with abundance of water. The paste when thus washed, drained, and partially dried, is ground in a mill, mixed with camphor, ground again, strongly pressed, dried under a hydraulic press between leaves of blotting paper, cut, bruised, laminated, and compressed again in a special apparatus suitably heated. It is said to be hard, tough, transparent, fusible, becoming plastic and malleable at 125°. It ignites with difficulty, is decomposed suddenly at 140° without inflammation, and gives rise to reddish fumes. It is inodorous, and does not become electric on friction.—*English Mechanic.*

IMPROVED LABEL HOLDER.

The invention herewith illustrated is particularly intended for use in sending butter, eggs, fruit, or other articles by return package or crate.

Attached to the box or crate is the card holder, A, made of sheet metal or other suitable material, in the shape of an

Fig. 1

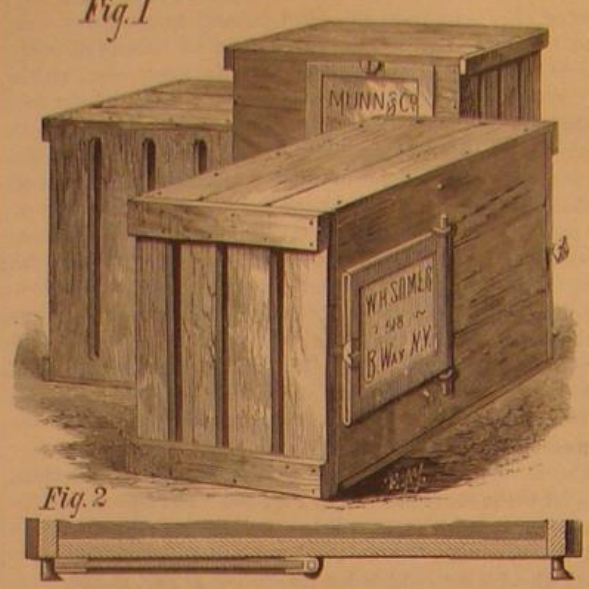
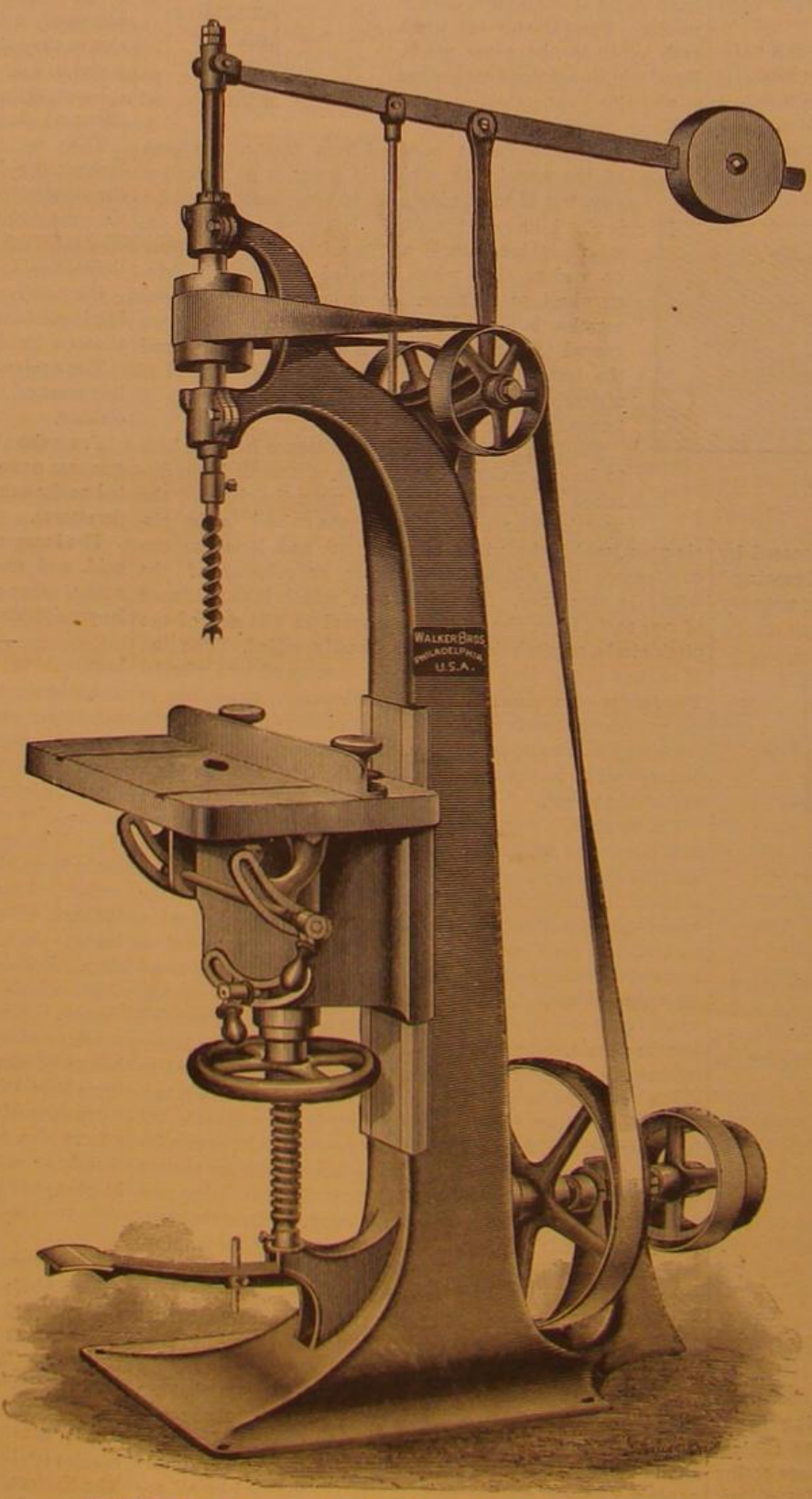


Fig. 2

open frame, the frame being grooved in such a manner that a card may be slipped into it from the outer end.

At the inner end of the holder are pins projecting at top and bottom; or a wire may be fastened in the inner end of the frame, and its ends project to form such pins. These pins are held to the box or crate by means of staples driven into the same over said pins, thus hinging the card holder to the box in such a manner that the holder may be turned with either side outward, and it is held by means of half-headed screws or hooks. The card of any house to which the box or crate is to be shipped may be inserted in the holder, and on the obverse side of the card the return address is written. All the consignee has to do when he desires to return the package is to turn the screw or hook on one side, reverse the holder, and fasten it by the screw or hook on the other side. For further information, address W. H. Somers & Co., Hume, Alleghany County, N. Y.



WALKER BROS.' VERTICAL BORING MACHINE.

Dr. Isidor Walz.

Isidor Walz, Ph.D., died in New York city on October 25. He was born in Bavaria May 5, 1846. He emigrated to the United States in 1859, and graduated at Columbia College in 1864. He studied chemistry under Bunsen and Erlenmeyer at Heidelberg, and received the degree of Ph.D. in 1867. He practiced his profession in this city, and in 1870 became editor of the *Manufacturers' Review and Industrial Record*. He conducted this paper with marked ability until October, 1876, when his declining health caused him to undertake a trip to Europe. Last month on his homeward journey he contracted the disease, pneumonia, which terminated his life.

Recent Investigations on Hydrophobia.

Hydrophobia has of late been extraordinarily prevalent in in London. Hardly a day passes, says the *Lancet*, without some fresh cases being recorded, and the attention of the medical profession has been closely directed to the nature of this most terrible disease. The data thus far gathered are valuable, not so much as establishing new facts, but in corroborating and shedding more light on some which have hitherto received little notice. From the conclusions now reached it appears that a sharp distinction is drawn between mental hydrophobia and the genuine disease. An adult, when bitten by a dog supposed to be rabid, passes through a period of intense mental perturbation, suffering all the agonies of doubt, apprehension, and foreboding. These mental disturbances induce symptoms closely resembling those of the genuine disease. The manifestations of hydrophobia in man are perversions of the nervous centers, and disturbances of the reflex center and highest psychical organs. The former is tolerably uniform, the latter extremely variable. In one case reported by the *Lancet*, there was little mental disturbance, very slight wandering at the close, and none of the wild paroxysmal furor which is commonly so conspicuous and so terrible a feature of the disease. In another case the psychical disturbance was so predominant that the patient was taken to an asylum as a simple lunatic.

The symptoms of true rabies are not always alike. Its approach may generally be detected by some alteration in the manner and habit of the tainted animal. In some, which are naturally bright and lively, unusual dullness, whilst in others, which are of the opposite disposition, unnatural vivacity are occasionally the premonitory symptoms. There is a remarkable variation in the period of incubation. The disease may be latent in the system for as long as three years. This accounts for the outbreak of the disease in apparently healthy dogs. The popular idea that a person once bitten has a peculiar liability of developing the disease at intervals of seven years after the occurrence is sheer nonsense. Three years seems to be the longest period of incubation known.

The "respiratory spasm" is a conspicuous feature in every case. It is compared by one to the "hurried or intermitting gasping one sees in a child attempting to drink when sudden thirst has been induced by recent violent exertion," and by another to the inspiratory spasms witnessed "when a cold shower-bath is administered to an individual." It is excited not only by an attempt to drink liquids, but also by mental impression, and the sight of water, or sound of running water, will bring it on.

Underground Telegraphs.

Between Berlin and Halle an underground telegraph wire has been in use for one year, and underground wires are about to be laid between Berlin and the cities of Cologne, Frankfort, Strasbourg, Breslau, Hamburg, Kiel, and Königsberg, thereby dispensing with posts and insulators, and avoiding the cost of their maintenance. The copper wires which convey the electric current are enclosed in wrought iron pipes, and are hermetically enclosed by insulating material, which protects them from the action of air and water, and prevents oxidation.

A CHEAP vinegar consists of 25 gallons of warm rain water with 4 gallons of molasses and 1 gallon of yeast. The mixture can be used after it has been allowed to ferment.

Coloring Zinc Roofs.

Among recent German inventions is a simple process, depending on the use of acetate of lead, by which every kind of color is applicable to sheets of zinc. By mixing black-lead, for instance, with the salt, a very agreeable light brown hue is obtained. It is by this process that the cupola of the synagogue at Nuremberg has been painted. A sufficient length of time has already elapsed, it is said, to show that the atmosphere had no influence on the zinc sheeting of the roof, thus showing the practical value of the process in such cases. By the addition of other coloring matters light or dark shades of yellow or gray may be produced.—*English Mechanic.*

THE NEW FRENCH EXPOSITION PALACE.

The annexed engravings afford an excellent idea of the magnificent palace which has been erected in Paris for the Exposition of 1878. The palace stands on the summit of the hill, and its terraces look down not only on the Exhibition and the Champ de Mars opposite, but over the greater part of the city. The palace extends along the whole width of the Trocadéro, nearly 1,300 feet. It consists of a grand Central Hall, the axis of which coincides with that of the Exhibition, and of two wings, which, spreading east and west from the vestibule behind the hall, extend in a curve for a distance of 650 feet on each side. It contains one large theater of a horseshoe form, measuring 164 feet in one direction and 230 feet in the other. It will accommodate 7,000 persons, and will be fitted up with private boxes and the various tiers of seats necessary for public accommodation. The main entrance will not be from the Trocadéro grounds, but from the other side on the Place du Trocadéro. The entrance will consist of a large vestibule wider than the hall itself, and extending on both sides into spacious antechambers, which enclose the hall itself, as far as the stage in the latter. These chambers lead into the two wings before spoken of, and the axes of which intersect the back of the hall just to the rear of the stage, while the tower which terminates each wing stands forward 285 feet from that axis, so that the hall is thrown comparatively far back, partly subdued by the extended and advanced wings, but by reason of its great height and striking architectural features the most prominent characteristic of the palace. The wings contain a covered gallery 42 feet wide, and in front an open promenade about 18 feet wide, the roof of which is carried by elaborately carved stone columns. Similar terraces or colonnades surround the Central Hall on its Trocadéro front, and rise tier above tier to the upper gallery of the building. The two wings terminate in vestibules, thrown forward as already stated, and reached from the Trocadéro by flights of steps, for the difference between the ground level where the vestibules are placed, and the floor of the palace, is about 26 feet. The wings form approximately a semi ellipse, each being struck from four different radii. It is intended that this structure shall remain as a permanent monument of the Exhibition of 1878. We are indebted to *Engineering* for the engravings.

A CURIOUS RESULT OF DENUDATION.

In a paper on the volcanoes of the Haute Loire and the Ardèche, in the *Popular Science Review*, Rev. W. S. Symonds refers to an isolated rock, some 30 feet high, of twisted basaltic columns resting on granite which he found in the villages of Antraiques. This rock, an engraving of which is

herewith given, is a most remarkable monument of denuding powers of atmospheric influences: as it is evident that the basalt had flowed into a fissure in the granite, and that the granite walls have since been denuded. It is rarely that a mork striking example of the rapid changes which are being made on the earth's surface by the slow action of atmospheric causes has been presented. The red color of the planet Mars has been ascribed to this same agency, it being suggested that red sandstone has resisted the denudation better than other geological formations, and hence gives its color to the general planetary surface. The rock represented in our illustration is locally known as the "Pain de Fromage," or "Cheese Loaf."

New Telemeters.

According to an Austrian paper, two new systems of telemeters have recently come into use in German coast batteries. They are based, like all others, on the principle of measuring a base line and of angles at the base, in order to determine, with the aid of tables, the height of the triangle. Without giving details of construction, it is simply stated that the two observers communicate their results obtained at either extremity by electricity, and they are also in electric communication with the place where the commander of the battery is. In the one instrument, that of Garlt, the electricity merely communicates by telegraphic signs the angles obtained. In the other, constructed by Siemens and Halske, the electric current transmits automatically, by an instrument situated at one point, the angle measured by the altitude at the other. But the latter, though made with great precision, is liable to grave errors, and though much more rapid than that of Garlt, is less liked.—*English Mechanic.*

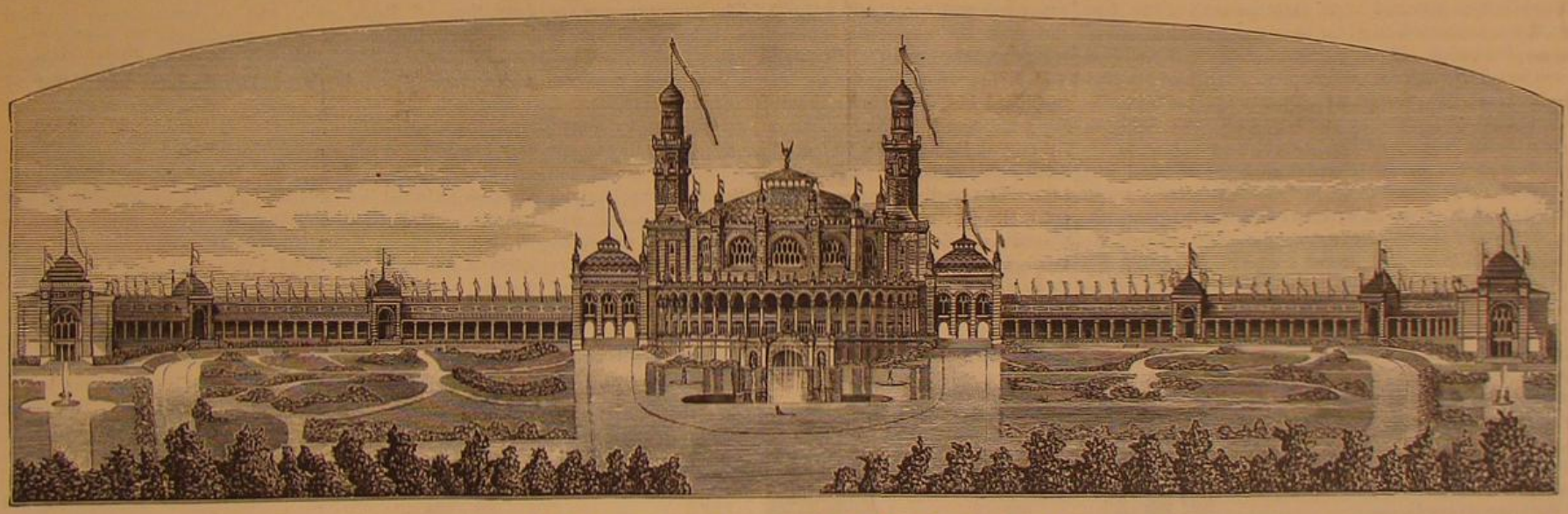
Medical Harmony.

A late number of the *Lancet* contains an article on the healing of difference between the old allopathic and new homeopathic schools, which is significant of a great change in medical opinion and the possible future fusion of the two schools. After briefly reviewing the origin of the homeopathic schism, and the subsequent warfare, the writer, Dr. Richardson, F.R.S., says that many of the allopathic physicians have renounced all the heresies of the past in the treatment of acute diseases; while homeopathic physicians have, on their side, almost entirely abandoned the use of globules, and have substituted doses in tangible form, their rule being to give a dose sufficiently large to effect its purpose, but not so large as to discomfort the patient. Both schools now use alike anodynes, aperients, opiates, anesthetics, tonics, galvanism, hydropathy, Turkish bath, and mineral waters. In short, he says, we define our practice as rational medicine, including the application of the law of contraries, but *plus* the application of the law of similars.

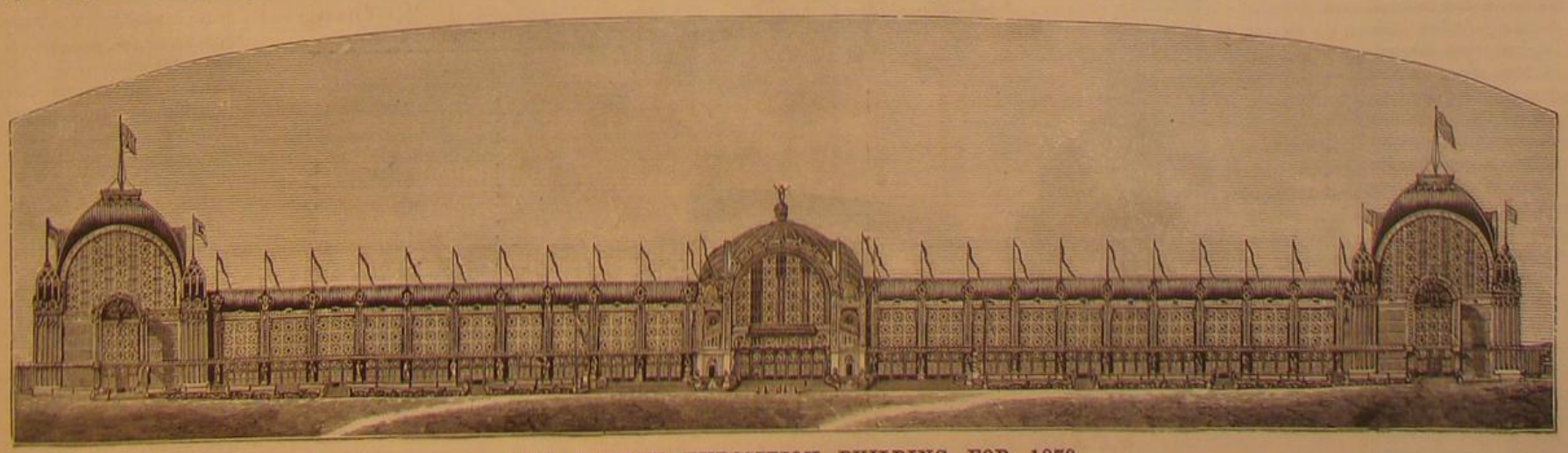
Parisian Copying Ink.

The best kinds of copying inks are, as is well known, prepared by adding a percentage of alum, sugar, and glycerin, or salt, to the extract of logwood. Such inks have a violet tint, and gradually become blacker on paper. The copy is, however, very pale at first, and is often indistinct. The Parisian copying ink is distinguished from the common kinds by its appearance more or less yellow in a liquid state, and by producing a distinct bluish-black on paper. It has the additional advantage of preserving its fluidity, while the common kinds soon thicken. Professor Gintl recommends the following method of preparing an ink which has all the advantages of the Parisian: A strong solution of logwood extract is treated with 1 per cent of alum, and then with as much lime water, so that a permanent precipitate is formed. Some drops of weak chloride of lime are then added, so that a perceptible bluish-black color is attained, and hydrochloric acid is added by drops till a red solution is obtained. A little gum is then added, with 0·5 per cent of glycerin.—*English Mechanic.*

In Yucatan and Honduras musk is extracted from alligators. Their fat is used for oil, and their skin for shoe leather.



THE FRENCH EXPOSITION BUILDING FOR 1878.



THE FRENCH EXPOSITION BUILDING FOR 1878.

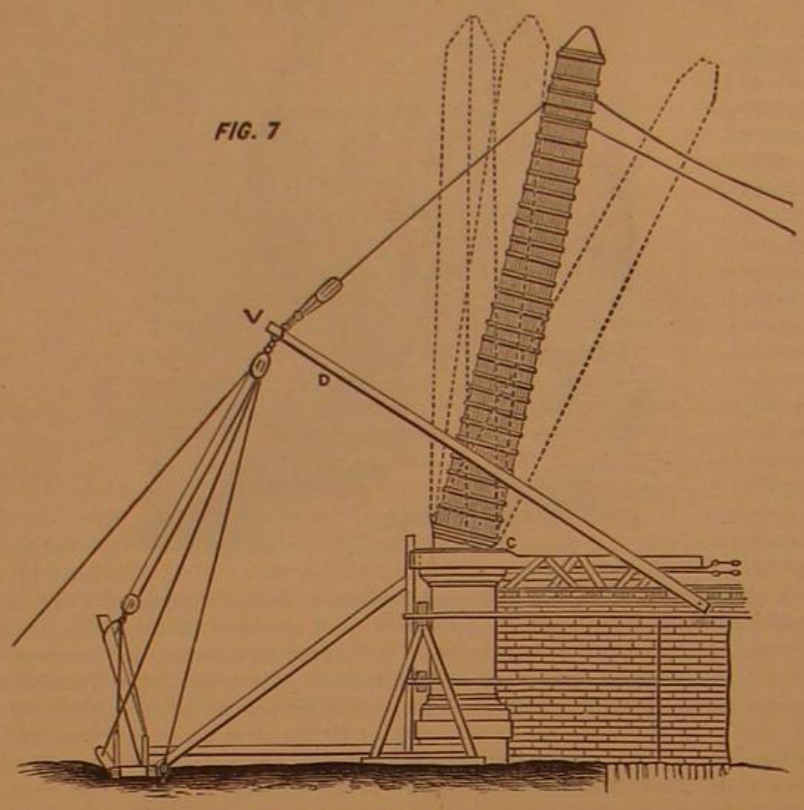
RAISING OBELISKS.

Now that New York is to possess an obelisk, it will soon become a question among engineers as to the best means of transporting and erecting the great mass of stone after it is landed at our docks. The most instructive examples of this class of work with which we are acquainted are supplied by the raising of the great obelisk in front of St. Peter's at Rome, by Domenico Fontana, and the putting in place of the Luxor obelisk in Paris. Both operations are thus described by Cresy:

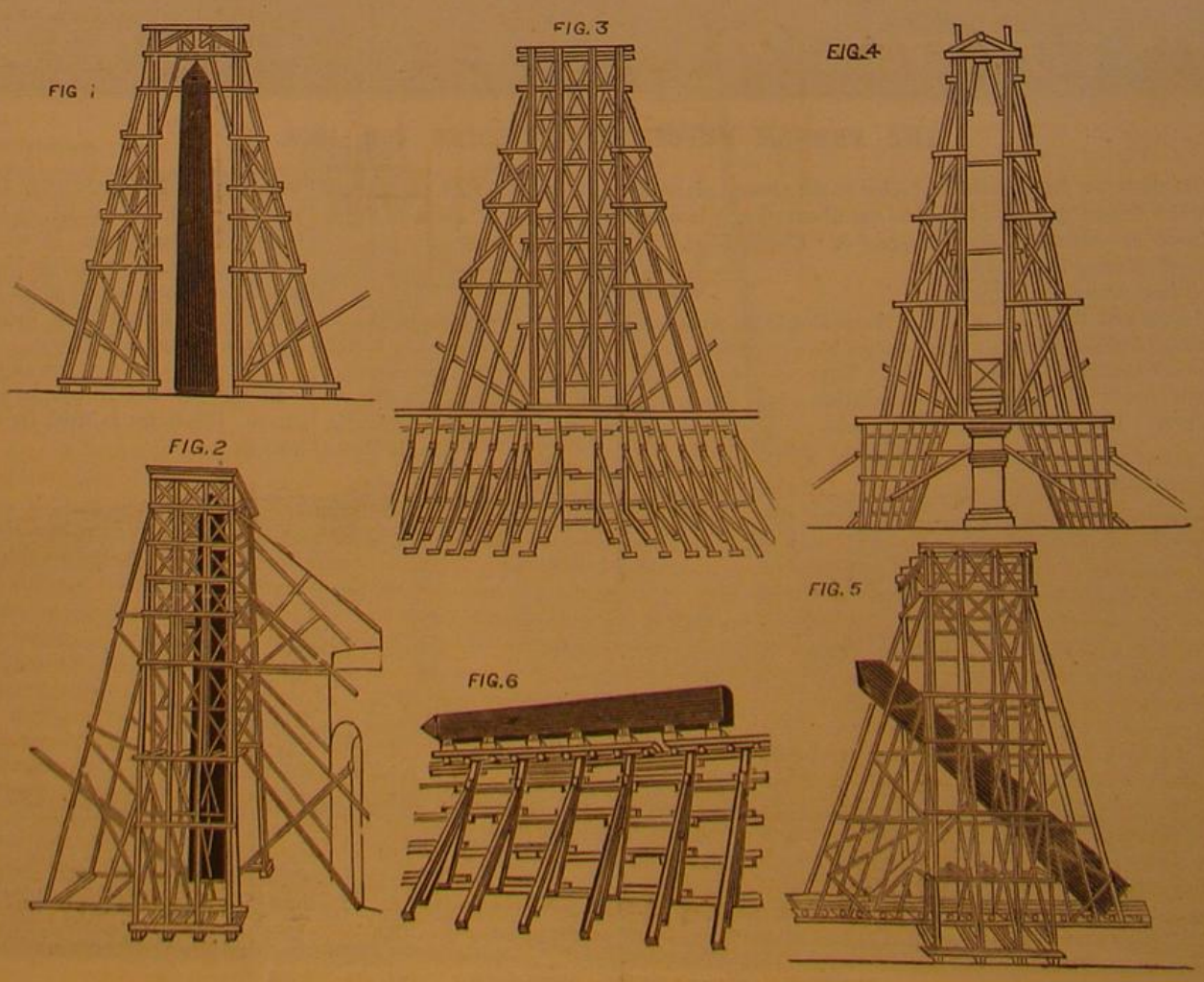
The St. Peter's monolith was estimated to weigh 993,537 lbs.; the height is 180 palms, but without the apex, 77·2 English feet; the transverse section at the middle contains an area of 7·6 superficial feet; the solid content may, therefore, be taken at upwards of 166 cubic yards, weighing about 332 tons; if to this be added 4 tons for the weight of the apex, the whole weight of the obelisk raised is upwards of 336 tons. The length of each of the sides at bottom is 12¼ palms, and at top 8¼ palms, the palm being equal to 2·7 English inches. Forty-six cranes, 600 men, and 140 horses were employed in removing it, and the timber, ropes, and iron made use of cost 20,000 crowns. The operations for removing it, which were conducted with the greatest skill, were as follows: A scaffold, called a castellum or shears, Fig. 1, was first constructed, 7 feet higher than the top of the obelisk when mounted on the pedestal. The eight principal timbers, four on each side, were 89 feet in height from the foundation; they were each built of oak and walnut, four beams in thickness, and banded at every 9 feet with strong iron hoops, and bolted together in several parts. The whole was so arranged that it could be easily put up or taken down, to suit the several positions in which the obelisks might be placed. Where this castellum was to be used, four holes 3 feet square were prepared in a platform of travertine stone, into which the four posts were dropped or secured. The obelisk was cased over with double mats to protect it from injury; was then covered with 2 inch planks, and longitudinal iron bars, 4 inches in breadth, were attached to it, three on each of the four sides: these, connected together by nine iron hoops, served to attach the tackle. This coating of mat, wood, and iron was estimated to weigh as much as one twelfth of the obelisk. Thus entirely covered the obelisk was lifted from the pedestal on which it stood by means of capstans and blocks attached to the iron hoops, and the blocks hanging to the cross beams of the shears; after it was lifted up 2 feet perpendicularly, a platform of timber was introduced beneath it, which rested on wooden rollers 9 inches in diameter, their ends being secured by iron hoops. The ropes of the blocks attached to the four lower angles of the obelisk being drawn, the platform which supported the weight moved on the rollers, and the ropes of the blocks attached to the upper part of the obelisk being slackened, the obelisk gradually descended, and was laid horizontally on the platform prepared to receive it; during its descent it was found necessary to support it in the middle by two shores, Fig. 5, made movable on an axis attached to its center, and which prevented any very great strain on the tackle. The inclined plane along which it was moved to its destination was formed of a mound of earth strengthened with timbers, and extended from the Circus of Caligula, afterwards called that of Nero, to the position where the obelisk now stands. Its former site is still marked by a stone in the passage leading from the sacristy to the choir of St. Peter's. After the obelisk had been moved along this plane upon wooden rollers, Fig. 6, the forty-six capstans placed round the mound of earth were prepared for their work of raising; they were fixed in the ground on each side, and each had four arms or handspikes; the first and third arms were worked by a horse, and the other two each by from six to ten men; four of the capstans acting upon as many blocks were used for drawing the foot of the obelisk forward, one block to each angle; the other capstans were employed to raise the obelisk into a vertical position. The whole operation is amply described in a work compiled by Fontana, and in which are engravings of the entire machinery. The foundations prepared to receive this enormous weight were carefully executed. An excavation 43 feet square, and to the depth of 24 feet, was made, and the bottom being found a clay, it was piled entirely over with oak and chestnut, with piles 18 feet in length and 9 inches in diameter, the bark being previously removed from them; upon these was laid a bed of concrete, composed of basalt broken into small fragments, and mortar composed of lime and puzzolana. The total cost of the entire removal was about $45,000. The arrangements are shown in the accompanying figures, 1, 2, 3, 4, 5, and 6, which we take from *The Engineer*.

M. Lebas, an engineer of the Marine in France, was commissioned in 1831 to bring from Luxor, in Egypt, one of the granite obelisks, and raise it on a pedestal to ornament the city of Paris. It is 75 feet in height, containing about 3,000 cubic feet, and was estimated to weigh nearly 258 tons. The obelisk was cased with timber throughout its entire length; underneath its base, at the lower side, was placed a wooden roll or cylinder, C, Fig. 7, upon which the whole obelisk turned as upon a hinge during its movement; there were five stays on each side, formed of masts, one of which is shown at D; these were all united at their summit between two others laid at right angles with them, the whole being bound round with ropes. The ten masts rested on a level platform, and their ends being rounded, they worked in a hollow channel prepared to receive them, and together could be moved upwards or downwards, in the manner of a hinge, so that, when the ends at E were pulled down by the ropes of the windlass attached to them, the obelisk was advanced further into its perpendicular position; 480 artillerymen worked ten capstans, forty-eight being placed to each. Iron chains were placed around the top, and four others passed to capstans at the extremity of the inclined plane, for the purpose of holding the obelisk steady, and rendering its motion regular as it advanced. The whole of the operations were admirably conducted, and some improvements were adopted which we do not find made use of by Fontana; the application of the lever, D, is a decived advantage.

FIG. 7



RAISING OBELISKS.



RAISING OBELISKS.

The Cause of Putrefaction and Lactic Fermentation.

In delivering the recent inaugural address at King's College Medical School, Professor Lister adopted a novel course towards such an audience, and instead of occupying the time at his disposal with the usual recommendations to the students about to enter upon their medical curriculum, he preferred to treat of a special subject in the hope that he might be able to say something which should interest and possibly instruct his audience. The subject chosen by Professor Lister is one that has long been of deep interest to the cultivators of several branches of science, and his own efforts to make a practical application of the knowledge acquired by studying the phenomena of fermentation have given to that subject a wider significance than it had before.

The particular kinds of fermentation which were the subject matter of Professor Lister's address were those which take place in blood and in milk, the question to which his attention had been directed having regard to the cause of the change which takes place when either of these liquids is kept for some time in contact with the air. In the case of blood the fermentation which ensues under these conditions is of the kind termed putrefaction; in the case of milk it is characterized by the formation of lactic acid, and is consequently termed lactic fermentation. In the experiments by which Professor Lister sought to illustrate the nature of the changes which took place in these liquids, care was taken to collect both the blood and milk in such a manner as to exclude the access to them of living organisms. It is unnecessary here to enter upon a description of the precautions observed to attain this result, the important fact being that blood so collected had been kept for six weeks without undergoing putrefaction, and that the air in contact with it was quite sweet. From this observation Professor Lister inferred not only that blood has no inherent tendency to putrefy, but also that atmospheric oxygen is not capable of causing it to putrefy, as has been supposed. Some kind of action was exercised by the oxygen upon the blood, as was indicated by the change of color from that peculiar to venous blood to the crimson color of arterial blood, but it was not until the blood thus preserved had been touched with an extremely minute quantity of putrescent blood on the point of a needle that putrefaction commenced.

The result in this case was exactly parallel to that which takes place in alcoholic fermentation, and the inference is that putrefaction is in fact a kind of fermentation characterized, like the alcoholic fermentation, by the reproduction of the ferment by which the change is produced.

As is well known, there is a conflict of opinion on the point whether the bacteria, which are unquestionably constant concomitants of certain kinds of fermentation, are also the cause of the change or merely accidental. It was suggested by Professor Lister that one of the causes of doubt as to the influence of bacteria in causing fermentation is the extreme minuteness of the organisms.

With the object of investigating this question more fully, experiments were made with another form of fermentation, that

of milk, which, on exposure to the air, turns sour and curdles: the sugar it contains being converted into lactic acid. At the same time microscopic observation always reveals the presence of minute organisms of the nature of bacteria in the coagulated milk. By collecting a number of samples of milk in separate glass vessels, with suitable precautions to prevent the access of organisms, the milk in a few of the glasses was found, after some weeks, to be entirely free from change, destitute of any acid reaction; and under the microscope, no indications of the presence of bacteria were to be found.

The next step in the investigation was to find evidence to decide whether the particular bacterium found in sour milk was or was not the cause of the lactic fermentation. For this purpose, Professor Lister endeavored to estimate the number of bacteria in a given quantity of sour milk, by placing one fiftieth of a minim of the milk on a slide, and counting the number of bacteria in the field; then by diluting the milk to such an extent that a single drop of the liquid would probably contain, on the average, one bacterium, a liquid was obtained, with which a number of separate quantities of boiled milk were inoculated, by adding a single drop of the liquid. The result was that out of five glasses of milk treated in this way only one was curdled, and on examination the one was found to contain the *bacterium lactis*, while the four others, which did not curdle, had no bacteria in them.

In another series of experiments, five specimens of milk were each inoculated with a drop of the liquid, calculated to contain two bacteria; other five specimens were inoculated with drops calculated to contain one bacterium; another set of five open glasses were inoculated with drops calculated to contain one bacterium; and one with a drop calculated to contain four bacteria. The result was that the last specimen curdled in a few days, and all those calculated to have two bacteria curdled in a few days. Of the five glasses calculated to have one bacterium, three remained liquid. On opening one of these glasses the milk was found to be perfectly sweet; it had a slight flavor of suet, similar to that which Pasteur has described as resulting from the oxidation of the oleaginous constituent of milk.

The result of these experiments proves conclusively that the ferment which caused the curdling of the milk was not in solution but in the state of suspended particles, otherwise every drop of the inoculating liquid should have produced the same result. Again, the fact that some drops were destitute of the ferment proves in like manner that it was not in solution.—*Pharmaceutical Journal.*

The Ancestry of Insects.

In his new work on "Our Common Insects," Mr. A. S. Packard gives an excellent chapter under the above caption. He considers that the natural system is the genealogy of organized forms; and when we can trace the latter we establish the former; and he concludes that there is a strong genetic bond uniting the worms, insects and crustacea in one grand sub kingdom. Many of the most interesting facts pointed out by Mr. Packard are presented in condensed form below.

The lowest form of insect life is the parasitic mite, the highest is the hive bee. Between these two there is an ascending scale of being, a continuity of improving organizations, which affords strong arguments for the theory of evolution. The mite is called the pentastoma, and lives in the manner of the tape worm a parasitic life in the higher animals. It is found in the nostrils of dogs, sheep, and horses. It is a little higher than some worms but lower than others. Young mites when hatched have but three pairs of feet, while their parents have four. If these early stages of mites and myropods are compared with these of the true six-footed insects as the cicada, or dragon fly, it will be seen quite plainly that they all share a common form. By simple modifications of parts here and there, by the addition of wings and other organs in these simple creatures, Nature has rung numberless changes on the elemental form. Starting from the simplest kinds, such as the poduras, spiders, grasshoppers, and May flies, allied creatures which we know were the first to appear in the earlier geologic ages, we rise to the highest, the bees with their complex forms, their diversified economy and wonderful instincts. In this progress upwards the beetles are higher than the bugs and grasshoppers, and the butterflies and moths more highly organized than the flies. In the egg nearly all insects agree most strikingly in their mode of growth. The earlier stages of the germ of a bee, fly or beetle bear a remarkable resemblance to each other, and suggest that a common design or pattern at first pervades all. At a certain period in the life of the embryo, we notice that all agree in having the head large, and bearing from two to four pairs of mouth organs resembling the legs; the thorax is merged with the abdomen and the general form of the embryo is ovate. The first to discuss the subject of the ancestry of insects was Fritz Muller, who suggested that the larva of crabs, zoëa, was the common ancestor. Haeckel and Friedriech Brauer have partially sustained this idea. The latter declared his belief that, though it seemed premature after the discovery of highly organized winged insects in rocks so ancient as the Devonian, to even guess as to the ancestry of insects, yet he would suggest that, instead of being derived from some zoëa, "the ancestors of insects must have been worm-like and aquatic." Mr. Packard rejects the zoëa origin of insects, and says the only refuge is in the worms. But how to account for the transmutation of any worm into a form like the leptus, with its mandibulated mouth and jointed legs, seems at first well nigh impossible. We have the faintest possible indication in the structure of some mites, and of the tardigrades and petastoma, where there is a striking recurrence to a worm-like form, readily noticeable. In the demodex we see a tendency of the mite to assume, under peculiar circumstances, an elongated, worm-like form. The mouth-parts are aborted, while the eight legs are not jointed and form simple tubercles. In the tardigrades, a long step lower, we have unjointed fleshy legs armed with from two to four claws, but the mouth-parts are essentially mite in character. A decided worm feature is the fact that they are hermaphrodites, each individual having ovaries and spermaries, as is the case with many worms. When we come to the singular creatures of which pentastoma and linguatula are the type, we have the most striking approximation to the worms in external form. They lose the rudimentary jointed limbs, which some have well marked in the embryo, and from being oval, rudely mite-like in form, they elongate, and only the claws remain to indicate the original presence of true jointed legs.

Professor Ganin, a Russian naturalist, made some remarkable discoveries in regard to the early stages of the platygaster, a parasite on a gall fly. He established facts which bear strongly on the theory of evolution by "acceleration and retardation." In the history of many early larval stages we see a remarkable acceleration in the growth of the embryo. A simple sac of unorganized cells, with a half-made intestine, so to speak, is hatched, and made to perform the duty of an ordinary, quite highly organized larva. Even the formation of the "primitive band," usually the first indication of the germ, is postponed to a comparatively late period in larval life. The different anatomical systems appear at longer or shorter intervals, while in one genus the respiratory organs are not developed at all. Thus some portions of the animal are accelerated in their development more than others, while others are retarded and in some species certain organs not developed at all.

That the cylindrical form of the bee grub and caterpillar is the result of modification through descent is evident in the caterpillar-like form of the immature caddis fly. In like manner the caterpillar form is probably the result of the leaf-eating life of a primitive larva, and the soft-bodied maggot of the weevil is evidently the result of its living habitually in cavities in nuts and fruits. So the organs of special sense in insects are in most cases simply altered hairs, which are themselves modified epithelial cells.

NEW ARRANGEMENT OF THE AIR RESERVOIRS IN PUMPS.

The object of the air reservoir in pumps and hydraulic machines is to equalize the movement of the water and to deaden shocks. Its action will be more efficacious in proportion as (1) the head of water is low; (2) the movement slow; (3) the section of pipe and valves large; (4) it is itself large, and (5) as the mass of water is small. Given the pressure and dimensions of the pump in order that the reservoir may operate to best advantage, it is further necessary that it contain as much air as possible, that the water pipes be completely isolated, and that it be disposed as near as possible to the point where shocks and other disorders are most likely to occur. We illustrate herewith a new arrangement of air reservoir which we extract from *Dingler's Journal.*

Fig. 1.

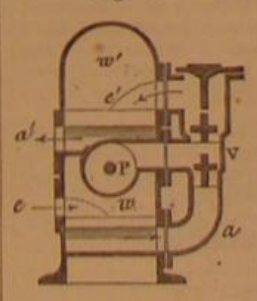
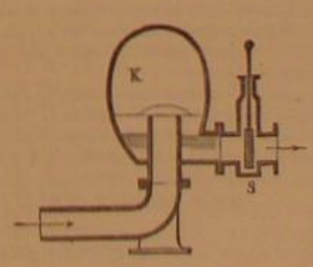


Fig. 2.



P is the section of the pump, V the valve box, *w* the reservoir of aspirated air, and *w'* that of compressed air. The dotted lines indicate the highest levels, full lines the minimum normal level. The entry pipes, *e e'*, are placed exactly above the maximum level, and escape pipes, *a a'*, are situated as low down as possible.

By this arrangement it is claimed that sudden shocks are impossible. Even if the valve, S, be opened suddenly, so as to allow of the escape of considerable water at once, the perturbation affects immediately only the small column of water comprised between the air reservoir and the escape orifice. The water in the tube remains as before, as it is only after the air pressure in the reservoir, K, is diminished that the flow progressively becomes more rapid.

The Melting Point.

The theory that iron in a cupola is melted all up through the stock is wrong, for every cupola has a certain point at which the iron is melted, and there is not a pound of iron melted in any cupola until it comes down to the melting point. The melting point in a cupola is generally from six to eighteen inches above the tuyeres, but it may be raised or lowered a little by increasing or diminishing the amount of fuel in the bed; but if we get the bed too high it throws the melting point too high, and the result will be slow melting. If we get the bed too low, it will allow the iron to get below the melting point, and the result will be dull iron; and in order to do good melting in any cupola, it is very essential that the melter should know the melting point of his particular cupola. The melting point of a cupola is at the point at which the most intense heat is created by the action of the blast upon the fuel. This intense heat at the melting point will cut the lining more than at any other place in the cupola, and the lining will generally be found to be cut out more just above the tuyeres than at any other point, which indicates the melting point of the cupola. If the tuyeres are put in so as to distribute the blast evenly through the stock, and the charges of iron and fuel are put in evenly, and every charge leveled up properly, the heat will be even all through the cupola, and the lining will be cut out in a regular belt at the melting point all around the cupola. On the other hand, if the tuyeres are not put in so as to distribute the blast evenly through the stock, or the charges of iron and fuel are not put in even and level, or if the fire is all on one side of the cupola, the heat will not be even through the cupola, and the lining will not be cut out in a regular belt at the melting point, but will be cut full of holes, which shows that the cupola is not melting all around, but is only melting in spots. By this irregular charging and melting in spots, the cupola may be reduced to half its melting capacity, which accounts for a cupola melting fast on one day and slow on another day. As before intimated, the melting point in a cupola is the point at which the most intense heat is created by the action of the blast upon the fuel. When the blast enters the cupola it is cold, and as it passes through the heated fuel it becomes hot, and as it becomes hot it creates heat by combination with the fuel, and makes an intense heat. If we have a very strong blast it will travel fast and will pass through the fuel rapidly, and it will have to pass through more fuel before it becomes heated sufficiently to make an intense heat by combination with the fuel. On the other hand, if we have a mild blast, the blast will pass through the heated fuel slowly, and is more heated, so that it does not have to pass through so much fuel before it becomes sufficiently heated to make an intense heat by combination with the fuel; so that when we have a strong blast the melting point of a cupola is higher than when we have a mild or weak blast; and the bed has to be put in higher in a cupola with a high melting point than in a cupola with a low melting point, which accounts for one cupola requiring more fuel in the bed than another cupola does. When the cupola is in blast, the bed or fuel in the bottom of the cupola is constantly burning up, and the unmelted iron will get down below the melting point. To prevent this, the melter has recourse to charges of fuel between the charges of iron, and as the charges of iron are melted and drawn out at the tap hole, the charges of fuel come down and replenish the bed and again raise the melting point; the next charge of iron comes down and is melted and drawn out; the bed is reduced and is again replenished by the next charge of fuel, and so on through the whole heat. If we supply too much or too little fuel between the charges of iron, the melting point will be raised too high or reduced too low, or in other words, if we have a melting point of ten or twelve inches in height in our cupola, and we supply twenty or twenty-five inches of fuel, this extra fuel must all be burned up before the iron can come down to the melting point; and we will not have a continuous melting, but will have a delay between each charge of iron. If, on the other hand, we have only five or six inches of fuel between the charges of iron, when we should have ten or twelve inches, this small amount will not more than half replenish the bed, and the unmelted iron will get down too low and will not make hot iron, and the iron may not be melted at all; and in order to do either fast or economical melting, we must not use either too much or too little fuel, and we must have the fuel distributed so as to suit the particular cupola in which it is used; for, as before explained, there are scarcely two cupolas that will melt exactly alike on account of the melting point being higher or lower, which is caused by a stronger or weaker blast, or by more or less draft; and in order to do good melting, the melter should not charge his cupola just the same as some other cupola of the same size is charged because that cupola does good melting charged in that way; but he should vary the height of the bed and the amount of fuel between the charges of iron, and the amount of iron on the bed and on each charge of fuel, until he finds the exact proportions that will do the best melting in that particular cupola.

Melters, in changing from one cupola to another, will generally have trouble in making hot iron, and they will often make a complete failure of melting in a strange cupola. This is simply because they undertake to charge that cupola the same as some other cupola that they have been melting in, and they never pay any attention to the draft, blast, or the melting point of the cupola, which is the cause of their failure in melting in a strange cupola. When a melter takes charge of a strange cupola, his first object should be to study the draft of the cupola, the nature of the blast, and to ascertain the melting point of the cupola. He can generally tell where the melting point is by noticing where the lining is cut out the most, and he can tell whether the cupola is melting evenly, or is only melting in spots, by noticing whether the lining is cut out in a regular belt all around the cupola, or is only cut out in holes, as before explained. He can tell whether the bed is too high or too low by noticing how the cupola melts. He can tell whether he is using too much fuel between the charges of iron, or if he is putting in the charges of iron too heavy, by noticing whether the cupola melts regularly or not, and by noticing if it

makes regular iron; for if the iron is very hot in one part of the heat and dull in another part, it is a sure indication that the fuel is not properly distributed through the iron, and it should be remedied by increasing or diminishing the weight of the charges of fuel or iron.

In melting with coke, the melter cannot put in his iron in as large charges as he can with coal, because the coke is more bulky than coal, and he has more bulk in the same weight, and if he puts the same weight of coke between the charges of iron as he does of coal, the bulk of the coke will raise the iron above the melting point, and the iron cannot be melted until part of the coke is burnt up so as to allow the iron to come down to the melting point, and the result is that he does not have a continuous melting, but he has a delay between each charge of iron, and the iron will probably be dull in the latter part of each charge; but the melter can do equally as regular melting, and can do faster melting with coke than he can with coal, by putting in the coke and iron in smaller charges, and more of them, which proves conclusively that good melting can be done with almost any fuel and in any cupola, if the melter understands his business; but he may not be able to do as economical melting in a poor cupola as he can in a good one.—*From Founding of Iron, by Edward Kirk.*

[For the Scientific American.]

HOW TO ADJUST ENGINE GUIDE BARS.

A correspondent says; "I am about putting new guide bars to my 16 horse power stationary engine, and desire instructions how to adjust them true with the bore of the cylinder, that the wrist pin will stand in the same line with the driving shaft." He adds: "The bars are bolted to the cylinder cover at one end and to pedestals at the other." Drill holes in the ends, leaving about $\frac{1}{32}$ inch to ream out after the bars are set and in their place. Screw the bottom bars temporarily in their places beneath the crosshead. The gland should be screwed up well into the stuffing box; the piston rod, crosshead, and guide bars cleaned and the rod oiled to cause it to move freely. Then take a spirit level and try if the driving or main shaft of the engine stands horizontal; if not it is as well to true it up with pieces of the requisite thickness inserted under the journal box which requires lifting to make the shaft stand level. If the bottom half of the box has flanges upon it so that the packing piece or liner cannot slip out, it will be retained by being simply laid in position, otherwise it may be required to be pinned or riveted to the bottom of the box. If, however, it is decided not to adjust the main shaft, the spirit level may be placed upon it and a slight mark made to denote where the center of the bubble stands. At the same time, note which end of the spirit level stands toward the engine crank. This being done, pass to the guide bars and move the piston in and out to ensure that it moves freely. If the cylinder cover is off, it will pay to take out the piston rings to facilitate setting the guides.

The next procedure is to place the piston in about the middle of the cylinder and bolt up one of the bottom bars until it just touches the face of the crosshead guide and stands at the same time true with the bore of the cylinder, as tested by the spirit level. The bore of the cylinder being level the bar must be set level, but if the bore stands out of level the bar must be set to correspond. The guide bar being thus adjusted to lightly touch the guide on the crosshead, the other bottom guide bar is adjusted in the same manner. The spirit level must be placed across the two bottom bars and the latter adjusted until the bubble stands in the same position as it did when placed upon the horizontal part of the engine shaft. This is necessary to ensure that the axial line of the wrist pin (which is of course supposed to stand true with the bottom faces of the crosshead guides) shall be adjusted to stand parallel with the axial line of the engine shaft, which is an important consideration because otherwise the connecting rod would be twisted when its brasses were keyed up. The next operation is to move the crosshead once or twice up and down, and if it binds unduly at either end the spirit level should be placed across the bars at that end and the bar or bars lowered, to maintain the same spirit level adjustment. When the crosshead will move from end to end of the bars, having contact with both their entire length, the bars may receive a very light coat of red marking. Shove the crosshead up and down them two or three times, and the marks upon the bars will denote if the bearing between the crosshead guides and the surface of the bars is even from end to end. During this adjustment the fit of the flanges of the crosshead against the edges of the bars requires watching, the marks being a sufficient guide. When properly fitted, get out the liners (as the small pieces, which are placed between the ends of the bars and the supports, are termed). To get the thickness of these liners, take wedges made of iron, wood or lead, and insert the thin end between the end faces of the bars and their seating upon the supports, forcing the wedges in with sufficient force to leave a mark upon them. By chalking the faces of the wedges they will exhibit the marks more plainly. The wedges should be inserted at each end and on both sides of the bar, the liners being got out a little thicker to allow for fitting.

In filing up the liner use either a surface plate or a straight edge, and file the liner faces hollow rather than rounding, for if filed rounding the guide bar may cant to one side in the bolting up, while if hollow the bar will be sure to bolt up solid. When the four liners are ready, put them in position between the bars and their seatings. Bolt the bars firmly in place, wipe them clean, and test them lengthways with the spirit level to ascertain if they are parallel with the bore of the cylinder. Place the level across the bars to test parallelism with the engine shaft. Note where further adjustment is necessary. Put marking upon the bars and move the crosshead up and down to ascertain how much the respective liners require reducing. After filing all the liners it is better before putting them in for the next adjustment to give them a light coat of marking, to show where they bear. At each trial of the bars the spirit level and the straight edge should be applied. The crosshead should be moved up and down the bars to ascertain by the bearing marks upon the surfaces how the crosshead guides fit. The fitting marks are a finer test than the spirit level, hence the last part of the fitting should be performed with strict reference to the bearing marks, both upon the bars and the crosshead as well as upon the liners; the crosshead flanges being adjusted and fitted at the same time as the face fitting.

The adjustment is correct when the gland is equally free and has an equal amount of play in the stuffing box at whatever part of the stroke the piston rod may be. In bolting up the bottom bars during the last part of the adjusting process, it is necessary to screw up the bolts to the same degree of tightness, for a little extra tightening in some of the bolts may cause the bars to spring out of true, if the ends of the bars or the seating for the liners is not practically true. To set the top bars place the crosshead in the middle of its stroke and lay the bars upon the crosshead guides. Then, with the wedges applied as before, ascertain the required thickness of the liners, one at a time, leaving them as previously a trifle thick, testing them on both the flat and the edge faces by marking placed on the surfaces, and moving the crosshead up and down, dispensing with the use of the spirit level and straight edge, and working entirely by the bearing marks. J. R.

To renew manuscripts, take a hair pencil and wash the part that has been effaced with a solution of prussiate of potash in water, and the writing will again appear, if the paper has not been destroyed.

NEW BOOKS AND PUBLICATIONS.

"FRET SAWING FOR PLEASURE AND PROFIT." H. T. Williams, Publisher. New York: Illustrated. Price 50 cents.

This is a complete handbook of fret sawing, valuable alike to the amateur and skilled artists for the hints and suggestions contained therein. It describes the various kinds of woods with their uses, and treats of each mechanical and artistic detail in the most minute manner. It is printed on fine paper and profusely illustrated throughout.

MONEY AND LEGAL TENDER IN THE UNITED STATES. By H. R. Linderman, Director of the Mint. G. P. Putnam's Sons. New York.

This volume contains in a brief and convenient form a complete history of the money used in the United States, of the various acts of Congress in regard to it, of the establishment of the mint, of the variations of the money standard, and the change from the double standard of gold and silver to the gold standard. Foreign coins, the paper currency, national currency, and the re-monetization of silver are all considered. As Mr. Linderman says, "until recently, the subject of bringing this currency from a credit to a specie basis has not received the attention which its great importance demands." The work will be found very timely and useful to the public in the examination of these financial questions.

Recent American and Foreign Patents.

Notice to Patentees.

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

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

NEW AGRICULTURAL INVENTIONS.

IMPROVED FENCE.

Franklin Fulkerson, Frankfort, Ind.—This is a new and ingenious fence, so constructed as to prevent cattle from putting their heads between said boards and riders and throwing off said riders. The general design is strong and substantial.

IMPROVED COTTON PLANTER.

Daniel W. Reed, Allenton, Ala.—The object of this invention is to provide for use in planting cotton a simple but highly efficient machine, in which the whole quantity of seed in the hopper will be agitated, and a portion thereof also rubbed between opposing surfaces for the purpose of separating its interlacing fibres and enabling it to discharge, in the desired manner, at the bottom of the hopper into the open furrow. The invention consists in employing vertically and reversely reciprocating seed-rubbers and dischargers, the same being arranged on opposite sides of the hopper and working in suitable guides. The invention also consists in providing the sides of the hopper with adjustable pieces or sections for regulating the quantity of seed discharged within a given time.

IMPROVED PLANT AND TREE PROTECTOR.

Julius O. Antisdale, Lake Harbor, Mich.—Ordinarily tubes of sheet metal, paper, and other opaque substances are used for protecting plants against the ravages of worms. The present inventor suggests an excellent improvement in the shape of a glass cylinder composed of two half sections, which are forced a few inches into the soil, so as to surround the plant. The earth is pressed closely about the cylinder to keep the two sections together without the use of a band.

IMPROVED FRUIT DRYER.

William S. Plummer, Portland, Oregon.—This invention consists in a case provided in its lower part with a lining set at a little distance from its walls, the large door, the small door, the cleats or sides to receive the fruit frames or trays, the doors, and the cover and cap to allow the moisture-laden air to escape, to adapt it for use in drying fruit. It dries the fruit rapidly and evenly, and is so constructed that it may be readily taken down, set up, and moved from place to place.

IMPROVED DROPPING ATTACHMENT FOR CORN PLANTERS.

Jacob W. Oberholtzer and Charles E. Wilcox, Hiawatha, Kan.—This is an attachment to corn planters that will mark the rows and drop the corn simultaneously. The apparatus is used by making a mark across the ends of the field and starting the dropping in the mark at each end of the field. Uniformity in the rows is thus secured. The construction is quite ingenious and novel.

IMPROVED DITCHING AND TILE-LAYING MACHINE.

Robert E. Nevin, Enon Valley, Pa.—This is an improved machine for tile ditches, laying the tiles, and filling the ditches. It may also be used for digging open ditches and making other excavations. A number of excellent improvements are embodied.

IMPROVED SEEDER AND PLANTER.

Uriah Baldwin, Isaac T. Shumard, and William K. Shumard, Stewartson, Ill.—This is an improved machine so constructed that it may be readily adjusted to plant the seed in drills or rows. A number of useful improvements are embodied, all of simple and ingenious construction.

IMPROVED VENTILATING GLASS SHADE AND COVER FOR PLANTS.

Semon J. Pardessus, New York city.—This is an ordinary glass shade having an opening in the top closed by a hinged plate in which are openings which can be open or shut at will. Its object is to protect plants while growing, and to aid in the development of buds and flowers.

IMPROVED ROAD SCRAPER.

James H. Edmondson, Valparaiso, Ind.—This road scraper is of the sulky type, and is so constructed that it may be easily operated by the driver from his seat to load and unload it. When loaded it may be swung beneath the axle and carried to any desired distance. It is an excellent machine for use upon roads in parks and country places.

NEW MISCELLANEOUS INVENTIONS.

IMPROVED FIREPLACE GRATE.

Robert L. Mitchell, Huntsville, Ala.—This invention relates to certain improvements in open fireplace grates, and it consists in the particular construction of double back and sides, and in the combination with the inner back and sides of a detachable back plate for the fire pot which operates as a key to lock and hold the other parts in proper position.

IMPROVED STOPPING MECHANISM FOR LOOMS.

John Megson, South Adams, Mass.—The object here is to stop the motion of a loom in the event of the weft or filling running out or breaking, if such motion of the loom is permitted by the fork being operated by the end of the thread which has been left by the shuttle. Such weft or thread permits the motion of the loom to continue in two ways, namely, by getting entangled on the fork and also by lying in the box in such a position as to cause the fork to move. In both cases the loom will run as if there was filling in the shuttle, and if more than one kind of filling is being used an imperfect pattern will be produced, or it will be necessary to adjust the pattern chain. The new attachment breaks the thread off, and when it lies in the box it slackens it, taking away its resistance to the fork.

IMPROVED MACHINE FOR GUMMING LABELS.

Lazarus Morgenthau, New York city.—This consists essentially of an endless feed belt that conducts the labels to be gummed to an endless supply belt, to which the adhesive substance is fed from a suitable receptacle below by distributing rollers. A circular brush exposes all parts of the label to the action of the supply belt. A second revolving brush clears the labels from the pressure brush, and conducts them to an inclined clearing plate, and from the same to the place of use. These machines are excellently suited for applying paste to wall paper, stamps, labels, etc. One is in operation at the fair of the American Institute, and its working well substantiates the inventor's claims.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED CAR COUPLING.

William Harrison, Linneus, Mo.—This invention relates to an improvement in the class of safety car couplings, that is to say, couplings which are so constructed that the device for locking the link may be raised or lowered without requiring the operator to enter between the cars. The invention consists chiefly in providing a sliding case for each drawhead and constructing it with inclined shoulders and notches, whereby it is adapted to raise, and lock in the elevated position, the device that engages the link.

IMPROVED MACHINE FOR MAKING BARRELS.

William K. Hoback, Bentonville, Ark.—The staves are set at each end in a ring, or annular guide, and an iron band is lowered to surround and enclose the hoops about the middle of their length. The said band is adjustable and serves to clamp or compress the hoops tightly together. An annular anvil or heavy iron ring is lowered inside the barrel or hogshead to a point nearly opposite the outer adjustable band, and it serves to hold the staves in position, while a central hoop is being nailed on, and the points of the nails that secure the hoop are turned and clinched on the annular anvil.

IMPROVED RE-SAWING MACHINE.

John Lamb, Ottawa, Ontario, Canada.—This is a new resawing machine for splitting slabs, boards, or plank. It embodies an ingenious arrangement of adjustable feed works. The lumber is carried against a circular saw by rotation of rollers which follow the inequalities of board without imposing any undue strain on the feed.

NEW HOUSEHOLD INVENTIONS.

IMPROVED EXTENSION BED LOUNGE.

William E. Buser, Chillicothe, O.—This manufacturer has devised an improvement in the class of bed lounges having a sliding top. The object in view is to render the head of the false bottom self-supporting when the lounge is extended; to attach the false bottom to the true bottom, and support it by such means and in such manner as will enable it (when raised) to extend over the foot of the body of the lounge; to provide improved stops for preventing the top being detached from the body of the lounge when slided off the same to allow the false bottom to be raised.

IMPROVED WASHING MACHINE.

Aaron M. Cornelius, Oregon City, Oregon.—This machine has a corrugated roll that revolves over a bed consisting of two or more smaller corrugated rolls. There is a new arrangement of spring followers for carrying the smaller rolls up against the larger rolls, an improved arrangement of supports, and a device for fastening the machine in the tub. The principal advantages claimed are durability, the various parts adjusting themselves to wear, and superior strength.

IMPROVED CANDLESTICK.

Jesse Failing, Umatilla, Oregon.—This consists of an ordinary candlestick, but split centrally at its cylindrical part, so as to form two halves, that clasp the handle. The split stick is held together by a spring placed immediately below the rim, and retained there by suitable rests. The spring-acted top rim of the stick holds the candle firmly in place until it burns down to the stick, when, by the gradual heating up of the rim the pressure is relaxed, and thereby the interior spring forces the candle up gradually until entirely consumed.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion.

For Sale.—Brown & Sharpe U. Milling Machine; one 5 ft. Iron Planer and Turret Lathe. W.E.Lewis, Cleveland, Ohio.

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

For Sale at $150.—New 12 in. Swing, 8 ft. bed, back geared, screw cutting, ind. feed, foot or power Lathe. W. E. Lewis, Cleveland, Ohio.

Wanted.—Light Second-hand T iron to lay ¼ miles track. Send prices to Potsdam (N. Y.) Lumber Co.

The Varnishes and Japans of Hyatt & Company, are, in the success they meet, noted for color, purity, and durability, with cheapness, giving them pre-eminent merit. Send for circulars and price list. Office 246 Grand street, New York.

Safety Linen Hose for factories, hotels, and stores, at lowest rates. Greene, Tweed & Co., 18 Park Place, N.Y.

New Lathe Attachments, such as Gear Cutting, Tap and Spline Slotting. W.P.Hopkins, Lawrence, Mass.

Steam Yachts, Engines, Boilers, and the Celebrated Central City Propeller Wheel. Wm. J. Sanderson, 21 Church street, Syracuse, N. Y

To Millwrights and Parties in want of Engines, Boilers, Shafting, Gearing, Pulleys, etc., upon receipt of specifications we will give you promptly bottom prices for same. B. W. Payne & Sons, Corning, N. Y.

For Sale.—18 in. Screw Cutting Lathe, $195; 17 in. do., $185; 16 in. do., $150; 6 ft. Planer, $275; 7 ft. do., $350; Heavy Punch and Shear, $600; at Shearman's, 132 N. 3d St., Philadelphia, Pa.

Bolt Forging Mach. & Power Hammers a specialty. Send for circulars. Forsaith & Co., Manchester, N. H.

For Town & Village use, Comb'd Hand Fire Engine & Hose Carriage, $350. Forsaith & Co., Manchester, N. H.

Kreider, Campbell & Co., 1030 Germantown Avenue, Philadelphia, Pa., Machinists and Steam Engine Builders, Millstone Manufacturers, Contractors for Mills for all kinds of Grinding. Estimates furnished.

Paris Fair.—A Manufacturer and Exporter of Hardware and Agric'l Imps., exhibiting his own goods at the Paris Exposition, will exhibit and introduce into Foreign Markets for a moderate compensation, articles of Hardware, Woodenware, Iron, Agric'l Tools, and Machinery. Only one firm in each line of goods. Highest references given. Address "Exporter," P.O.Box 3,715, N.Y.

Improved Wood-working Machinery made by Walker Bros., 73 and 75 Laurel St., Philadelphia, Pa.

Best and Cheapest Wagon Tire Upsetter, only $12. Circular free. H. W. Seaman & Co., Millport, N. Y.

C. C. Phillips, 4,048 Girard Ave., West Phila., manufactures Vertical and other Burr Mills adapted to all kinds of grinding; also Portable Flouring Mills.

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

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

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

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

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

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

Small Fine Gray Iron Castings a specialty. Soft and true to patterns. A. Winterburn, 16 De Witt street, Albany, N. Y.

Tin Foil.—J. J. Crooke, 163 Mulberry St., N. Y.

For the best Gate Valves of all kinds, apply to D. Kennedy & Co., 88 John St., N. Y.

Plumbers—Address Bailey, Farrell & Co., Pittsburgh, Pa., for the best and cheapest iron case street hydrants.

Magic Lanterns and Stereopticons of all prices. Views illustrating every subject for public exhibitions. Profitable business for a man with a small capital. Also lanterns for college and home amusement. 74 page catalogue free. McAllister Mf. Optician, 49 Nassau St., N. Y.

"Little All Right," the smallest and most perfect Revolver in the world. Radically new both in principle and operation. Send for circular. All Right Firearm's Co., Lawrence, Mass., U. S. A.

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

Felt of every description for Manufacturers' purposes, especially adapted for Polishing, can be furnished in any thickness, size, or shape. Tingue, House & Co., Manufacturers. Salesroom, 69 Duane St., N. Y. Factory at Glenville, Conn.

Models made to order. H. B. Morris, Ithaca, N. Y.

Skinner Portable Engine Improved, 2 1-2 to 10 H. P. Skinner & Wood, Erie, Pa.

Best Machinists' Tools. Pratt & Whitney, Hartford, Ct.

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

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

More than twelve thousand crank shafts made by Chester Steel Castings Co. now running; 8 years constant use prove them stronger and more durable than wrought iron. See advertisement, page 334.

Emery Grinders, Emery Wheels, Best and Cheapest. Hardened surfaces planed or turned to order. Awarded Medal and Diploma by Centennial Commission. Address American Twist Drill Co., Woonsocket, R. I.

Notes & Queries

Correspondents are reminded that we cannot notice anonymous communications, and that letters signed "constant reader," "old subscriber," or mere initials come under this rule. In many instances we prefer to reply to queries, especially when they are of a personal nature, by postal card addressed directly to the inquirer, and it is obvious that we cannot do so unless the full address is given. Many correspondents whose questions are not answered will find the reason in the foregoing.

(1) J. O. asks: What is the cheapest and most effectual method of separating iron from brass, when the two metals have become fused together? A. If small quantities of the alloy are to be operated upon, perhaps the following method will best serve the purpose: Fuse the alloy with an equal quantity of sulphur (or add the sulphur after fusion) and digest the cooled mass with a sufficient quantity of oil of vitriol, mixed with three parts of water and warmed for some time. This will dissolve the iron and remaining zinc, leaving the copper as a dark powder, which may be dried, roasted, mixed with an equal quantity of sal soda and charcoal, again roasted, and finally heated to whiteness to reduce and melt the copper. If it is desired to recover the iron, boil the solution, add a sufficient quantity of caustic lime in powder, or chalk, allow to settle, decant the liquid, mix the precipitate with twice its weight of charcoal powder, dry perfectly and fuse at a strong white heat. Fusing the alloy with the proper quantity of clean quartz sand at a white heat will slag the iron, volatilize the zinc, and, if a little copper be added, separate the copper.

(2) J. A. W. says: 1. I made an electro-magnet with 25 feet of the size of the wire sent (not insulated with either silk or cotton) on each bobbin, with ⅞ inch round Ulster iron for the cores; they were 1¾ inches long and would hold up 1½ lbs. I made the magneto-electric engine described on p. 201 SCIENTIFIC AMERICAN SUPPLEMENT, using the above magnet, but it would not work. What was the matter with the engine? Was the magnet long enough? How many feet and of what number of silk-insulated wire will I need to make the engine? A. Make the cores of ½ inch soft iron, about 2 inches long, and use enough of No. 28 silk-covered copper wire to make the helices an inch and a quarter in diameter. 2. Could I not make one that would work a small lathe with about 2 lbs. of wire on the magnet? A. No. 3. How would sal ammoniac do for the zinc fluid in the Bunsen or bichromate battery, with two cells of the bichromate battery? A. Dilute sulphuric acid is preferable.

(3) A. H. G. wishes to know (1) the manner of photo-engraving? A. There are several photo-engraving processes in use, generally based on the property possessed by certain compounds—as that of gelatin with chromic acid—of being insoluble when exposed in thin films to light. The films may be spread directly on the plate, slightly coated with wax or asphaltum, and after drying in the dark, exposed under the photo-negative; or on transfer tissue, and, after exposure, transferred to the plate. Treated with hot water the parts of the image unaffected by the light are dissolved, leaving in those portions the surface of the plate, or waxed surface, bare. The film may then be hardened by immersing the plate in alum water, after which the exposed surface may be etched with an acid, or acid salt (if the plate is of zinc), as sesquichloride of iron: first having removed wax or asphaltum with benzole. After etching, the image may be removed with hypochlorite of lime and boiling water, and the engraving perfected. The photograph is usually in line drawing. The name of nature-printing is applied to several processes. 2. How is nature-printing done? A. You should consult Vogel's "Chemistry of Light and Photography." 2. Can the impressions be made in gutta percha and paper, instead of wax and plaster? A. As we understand you, yes, in some cases.

(4) A. B. asks how he can have his hair restored? It has fallen out in patches all over his head. A. The following preparation for stimulating the scalp is recommended by Fox: Glycerin 3 drachms, lime water liniment 4 ozs., cantharides—tincture—3 drachms. Brush into the scalp with a stiff nail brush until irritation is set up.

(5) N. S. asks: What is the cheapest manner of making oil of salmon heads, liver, etc., and clarifying or refining same? A. The scrap may be thrown into a deep narrow cauldron filled with boiling water, and hot steam injected at the bottom for about fifteen minutes, transferred to an hydraulic press, and what oil there is expressed. The pressed scrap may be used as a fertilizer. The oil may be purified by agitation with hot water containing a few per cent of tannin, next with hot water and steam alone, and filtration through animal charcoal; or agitate with a dilute solution of blue vitriol and common salt, wash, and filter as before. Ordinarily, exposure to sunlight in shallow glass-covered trays will bleach it.

(6) I. C. G. asks: Why does the moon appear larger and less brilliant at the horizon than at the meridian? A. Larger because of comparison with terrestrial objects; less brilliant because of being seen through the denser or more hazy atmosphere close to the earth's surface.

Considering the difference between equatorial and polar radii of the earth, it would seem that the flow of the Mississippi river from its source to its mouth would be about 2½ miles up hill; how is it? A. If "up hill" means more or less distance from the earth's center, the Mississippi would present the paradox noted; but "up hill" is really elevation above the ocean level—which must be taken as the standard. In reality the river descends about 2 feet per mile, the elevation of the source being some 8,000 feet above the sea level.

(7) N. W. G. asks: What is the best way to bend plow handles? We have some trouble owing to their splitting. A. Cut a fine groove around the handle and bind them with copper wire.

(8) J. W. R. asks: 1. How can I make a mould for electrotyping from a wood cut, and how is it prepared? A. Use wax, melted sufficiently so as to take a fine impression of the cut. Dust the mould thickly with graphite, and suspend freely in the bath. 2. What can I do when sufficient copper has attracted the mould, to make it ready for mounting on wood blocks? A. Fill in the back of the electrotype with type metal and turn the edges neatly.

(9) F. F. W. asks: What will prevent black oil (say natural W. Va.) "Globe A" brand from working destructively on a sulphur joint under the bed plate of an engine? A. Give the joint a thick coat of equal quantities red and white lead mixed with varnish.

(10) C. D. N. asks: Does a toad throw off its skin? A. Yes, at intervals.

What position, east or west, north or south, is the best for the bed of a sleepless person? A. Beds in many hospitals are placed north and south, parallel to the magnetic meridian.

1. What will remove the effects of a wasp's sting? A. Ammonia. 2. How can we drive wasps from a house? A. You might try any insect powder, or smoke from burning coffee.

Can you give me a simple method for illustrating to a class of children the movements and phases of the moon? A ball hanging on a thread and moving round the head with a candle for the sun is simple, but is hardly satisfactory. A. We know of no simpler method than that suggested.

Has the sun any kind of a movement, and what is it? A. Three—an axial rotation, a motion about the center of gravity of the whole solar system, and a progressive motion in space toward the constellation *Hercules*.

What is the use of the dominical letter? A. For the purpose of determining when Easter falls and for other similar problems concerning the day of the week and the day of the year. It was early found convenient to place the first seven letters of the alphabet in succession against the days of the months, putting A to January 1 and repeating the seven letters as often as necessary until December 31. The letter which falls against the first Sunday in January will fall against every Sunday in the year and thus is the dominical letter for the year unless it be leap year. Finding the dominical letter enables one determine what day of the week a given date in the year is. See introduction in Episcopal Book of Common Prayer.

Does the expression W. by S. (west by south) mean west near the south? What does (S. S. W.) south-south west, mean? A. W. by S. is the first point of the compass to the southward of due west, and S. S. W. is the second point to the westward of due south. Other questions have been repeatedly answered in back numbers.

(11) W. K. R. asks: Would it be practicable to make a small steam boiler, 20 x 30 inches, of galvanized iron? If so, what thickness of iron would be required, and at what pressure would it be safe to run it? A. Such construction is very common. If the iron is ⅛ inch thick, a safe working pressure will be about 50 lbs. per square inch.

(12) Z. B. says: A. and B. are building an 18 inch pipe that is to have a fall of 60 feet. B. maintains that if the pipe is made taper, that with the same sized outlet he will have more pressure than if the pipe is 18 inches diameter the entire length. A. says not. Which of the two is right? A. We think A. is right; but the meaning of the question is not very clear as it is expressed.

(13) L. J. B. asks: Which, on a half mile curve of railroad track, is the longest rail, the inside or outside, or are they equal in length? A. The outside.

(14) F. E. C. asks: Is the point of cut-off equalized in the stationary engine? If so, how? A. It can be equalized by allowing a variation in the steam lead at the two ends of the stroke.

(15) H. M. A. says: I think of running a 1 inch pipe from my 30 horse power boiler into and up a 70 feet brick chimney, and attaching a whistle thereto. Would the apparatus be safe as a lightning conductor? A. Certainly not. Such attachments should terminate in the ground; never in the structure they are designed to protect.

(16) J. E. C. ask: Will I have to pay a government license to run a small skiff with a small engine on the Chemung river, which is not navigable or used for any commercial purpose? A. The steamers coming under the provision of the law are those "navigating any waters of the United States which are common highways of commerce, or open to general or competitive navigation," and "all coastwise sea-going vessels, and vessels navigating the great lakes" (extracts from sections 4400 and 4401 of the Revised Statutes of the United States).

(17) J. E. L. asks for a simple and easy way to set a safety valve on a steam boiler, or how to go to work to find where to hang the pea? A. Take off the lever, balance it on a knife edge, and observe how far the point at which it balances is from its fulcrum. Lay off this distance from the center of a bar of uniform section. Place the center of this bar on a knife edge, lay off from the center, on the opposite side, a distance equal to the distance from the center of the valve stem to the fulcrum. At this point attach the valve and a weight equal to the pressure acting on the valve when it is to open. Attach the lever at the first point marked, and move the pea along the bar until it is balanced. See also question (9), p. 236.

(18) W. H. C. asks (1) how to take the tubes out of a locomotive boiler when the tubes are badly covered with scale, produced from lime water, without injuring the tube sheets? A. The tubes must be cut loose from the sheets, and then they can be drawn out by inserting rods in them, each rod having a washer at one end, and a thread at the other, passing through a crowfoot placed against the sheet. 2. Is there a scale extractor that will remove the scale from the tubes by using it in the boiler before undertaking to take the tubes out? A. The scale may be softened by filling the boiler with fresh water, heating it and then allowing it to cool slowly. If there is much scale, it may be very difficult to remove the first tube, but after that is out, a tool can be introduced to clean the second tube.

(19) A. H. asks how many feet the earth varies from a straight line per minute in its orbit? A. Considering the earth's orbit as a circle of average radius 91,500,000 miles, the variation would be roughly 700 miles, or 3,696,000 feet per minute. 2. Also how many foot lbs. of velocity it is supposed to have? A. About 35 thousand million trillions of foot tons per minute.

(20) W. P. R. asks how shoemaker's wax is prepared? A. Beeswax, 8 ozs.; tallow, 1 oz.; melt and add powdered gum arabic, 1 oz., and lampblack to color. We know of no special uses.

(21) N. A. W. asks for combination colors, not aniline, for wool goods, for green, blue, red, black, and yellow? A. *Black* for 50 lbs.—Prepare with 2¼ lbs. of chrome; boil ½ hour and wash in two waters. Dye with 20 lbs. logwood and 2 lbs. fustic. Boil ½ hour: 1 water, then a slight sour moderately warm; 1 cold water and finish out of a warm one softened with a little urine. *Yellow* for 40 lbs.—2½ lbs. bark, 2 lbs. tartar, 2 quarts muriate of tin. Enter at 150° Fah.; boil 30 minutes. *Grass green* for 50 lbs.—Boil 20 lbs. fustic, 7 lbs. extract of indigo, 1¼ lb. tartar, 3 gills sulphuric acid. *Scarlet* for 50 lbs.—Boil 4 lbs. cochineal and 1¾ lbs. of bark. Add 3 lbs. tartar, 2 quarts scarlet spirits. Enter at 200° Fah.; boil 1 hour, wash well. Sour before dyeing either cold or warm. *Blue* for 50 lbs.—1 gill sulphuric acid, 3 ozs. extract of indigo, 1 lb. alum. Enter cold with one half of the extract; give the other half when the boiler warms. Bring to the spring.

(22) C. E. S. asks: What chemicals may be used for writing on colored paper which will take the color out, leaving a white line where the ink touches? A. 1 part muriatic acid and 20 parts starch water. Very dilute oxalic acid may also be used. Write with a stee pen.

(23) O. B. M. asks: What is the best and cheapest way to make lampblack? A. A conical funnel of tin plate, furnished with a small pipe to convey the fumes from the apartment, is suspended over a lamp fed with oil, tallow, coal tar or crude naphtha, the wick being large and so arranged as to burn with a full smoky flame. Large, spongy, mushroom-like concretions of carbonaceous matter form at the summit of the cone, and must be collected from time to time. The funnel should be united to the smoke pipe by means of wire, and no solder should be used for the joints of either.

(24) F. D. asks for a recipe that will remove rust, grease, and dirt from a gun barrel? A. Try turpentine. 2. Also a recipe to prevent the barrel from rusting when exposed to the weather? A. See reply to L. S. W., this issue.

(25) J. M. asks: What is rubber cement, and how to soften clothes wringer rolls, so that in putting them on they will not fit so tight as to rub all the cement off the spindle? A. Rubber cement is gutta percha dissolved in bisulphide of carbon. Try dipping the rolls in hot water.

(26) A. M. C. asks for a recipe for polishing shells, such as tortoise and sea shells? A. Marine shells are cleaned by rubbing with a rag dipped in hydrochloric acid till the dull outer skin is removed, washing in warm water, drying in hot sawdust and polishing with chamois leather. Those shells which have no natural polished surface may either be varnished or rubbed with a little tripoli powder and turpentine on wash leather, then fine tripoli alone, and lastly with a little fine olive oil, bringing up the surface with chamois as before.

(27) C. E. H. asks: What is the best article to use in connection with sal soda in the manufacture of washing crystal? A. The alkaline matter is reduced to a coarse powder and stirred up with liquid size, or with a decoction of linseed, Irish moss or British gum. It is then dried and crushed.

(28) Several correspondents inquire what relations parts specified in a recipe bear to the weights of the ingredients. We have repeatedly explained that parts mean "parts by weight." Thus a cement for cracked wood is composed of 1 part slacked lime paste and 2 parts rye meal—that is, any given weight of the paste and twice that weight in rye meal.

(29) L. S. W. asks for a formula for practical use, to prevent small articles of iron or steel from rusting? A. Warm the iron or steel and rub it with clean white wax. Heat again until wax is absorbed—then rub over with a piece of serge.

(30) F. G. asks: What kind of varnish is used, and how prepared, to varnish chromos, etc.? A. Any good picture varnish will answer for chromos. A coat of clear size is usually first applied.

(31) I. M. H. asks: What will preserve rope, on flag pole, from rotting, and at same time be flexible? A. Tar the rope or oil it with whale oil. Paint the pole with white lead.

(32) T. P. G. asks for a cement that will resist the action of vitriol, to coat pickle troughs? A. Use a concentrated solution of water glass.

(33) W. H. N. asks: What causes the different shades of gold jewelry, some being deep and others pale yellow? A. The different alloys used affect the color. Thus where silver alone is used with gold a green tinge results; copper alone produces a red tinge; but the copper and silver are more commonly mixed in one alloy, according to the taste of the jeweller. There are various mixtures for heightening the color of gold. For red gold use 4 ozs. melted yellow wax, and add in fine powder 1½ ozs. of red ocher, 1½ ozs. verdigris calcined till it yields no fumes, and ½ oz. of calcined borax. Mix well together, dissolve in water, and use as required. Etruscan gold coloring is obtained from a mixture of alum, 1 oz.; table salt, 1 oz.; saltpeter, powdered, 2 ozs.; and hot water sufficient to make the solution when dissolved about the consistence of thick ale; then add sufficient muriatic acid to produce the color desired. The article to be colored should be from 14 to 18 carats fine of pure gold and copper only, and free from coatings of tin or silver solder.

(34) J. W. S. asks for a cement for uniting leather and cloth nearly or quite waterproof? A. Dissolve gutta percha in bisulphide of carbon to thickness of molasses. Press the parts well together.

(35) D. R. E. asks for a glossy paint that will not taste in water pails? A. Use paint prepared with water glass.

(36) T. L. D. and other correspondents ask what should be the proportion of core to wire in magnets for an electro-motor, and what size wire should be used? A. Core and wire should weigh the same. No. 16 gauge (American) wire is commonly employed.

(37) M. S. asks how to wind wire on the cores of a number of electro-motor magnets? A. Fasten in the toolpost of a lathe a piece of iron having a groove cut in it to receive the wire. Set the change gearing for the screw feed of the lathe to the pitch of thread corresponding to the thickness of the wire. Wind the magnets by running the lathe in one direction and reverse the motion of feed at each traverse.

(38) P. L. F. asks how to deodorize rubber? A. Cover the articles with charcoal dust, place them in an enclosed vessel, and raise the temperature to 94° Fah., and let it remain thus for several hours. Remove and clean the articles, when they will be found free from odor.

(39) J. S. says: I have a quantity of pure rubber ¼ inch thick, that has been used for thumb cuts for taking the hair from skins, such as beaver, nutria, etc. Can you tell me what I can do with the rubber, as it is all pure? I want to melt it and run into moulds for making the same kind of thumb cuts again. A. Cut the rubber into small pieces and place in the proportion of 100 lbs. in a well closed boiler with 10 lbs. bisulphide of carbon and 4 ozs. absolute alcohol, well stirred; then close the boiler and leave the material to soak for a few hours. It becomes a soft doughy mass, which, after being ground and kneaded, is fit to be formed with any shape, when the solvent will evaporate.

(40) M. T. wants to know the proper weight of a chipping hammer, and how long the handle should be? A. Weight 1¾ lbs. for heavy chipping, 1 lb. for light chipping; length of handle 15 inches.

(41) L. G. A. says: My sledge hammer comes off its handle; how can I prevent this? Iron and wood wedges do not answer. A. Make the eye of the hammer smallest in width at the middle, when either a wooden or iron wedge will hold it permanently.

(42) B. F. asks: What is the best material for grinding brass plugs? A. The burnt sand from the middle of a brass casting core.

(43) H. N. M. asks: How can I prevent taps from splitting and hardening? A. Heat the water in which they are quenched to 100°.

(44) H. E. M. asks: What material can I use to braze a brass flange on a copper pipe? A. Commercial brazing spelter mixed with borax and water.

(45) J. R. inquires for a good waterproof varnish for harness? A. India rubber, ½ lb.; spirits turpentine, 1 gallon; dissolve to a jelly, then take hot linseed oil equal parts with the mass and incorporate them well over a slow fire.

(46) E. T. C. asks: How can I take old wine and fruit stains out of linen? A. Rub the part on each side with yellow soap. Then lay in a mixture of starch in cold water very thick, and expose the linen to the sun and air till the stain comes out. If not removed in three or four days, rub that off and renew the process. When dry, it may be sprinkled with a little water.

(47) T. B. asks: What will temper steel when the metal will not temper readily when dipped at red heat? A. Add salt to the water.

(48) M. C. asks how to case harden nuts? A. Finely powder prussiate of potash. Get the nuts red hot, coat them with the powder, put them again in the fire until the powder fuses, and then dip them in water.

(49) E. T. L. asks how he can test to discover whether his planer planes true? A. Take a fine finishing cut on a long casting, turn the casting on its edge and adjust it to touch the point of the tool at each end. Then try the point of the tool in the middle, when any hollowness or roundness will become at once apparent.

(50) A. F. inquires how he can cut out a deep, square, small hole, true? A. By drifting with a square serrated hardened steel plug driven through with a hammer. Lubricate freely.

(51) F. S. asks for a varnish to restore faded rubber goods? A. Use black japan varnish diluted with a little linseed oil.

(52) M. C. H. asks for the best manner of cleaning watch pinions? A. Pith from the stalk of the common mullen is the best material, and is better than cork. It should be obtained from the dry stalk in winter.

(53) B. R. asks what the "liquid foil" is that is used for silvering glass globes? A. Lead, 1 part; tin 1; bismuth, 1. Melt, and just before it sets add mercury 10 parts. Pour this into the globe and turn it rapidly round.

(54) M. C. asks for a recipe for liquid black lead polish? A. Black lead, pulverised, 1 lb.; turpentine, 1 gill; water, 1 gill; sugar, 1 oz.

(55) I. L. asks: Will carbon points do to use in a brace, to mark sheet iron through a templet, to make a mark same as a center punch? A. Yes.

(56) R. J. F. asks if the pendulum can be accelerated one second per day, by putting on an ounce weight? A. Not without virtually shortening the pendulum, that is, by a different distribution of the weight on the bar. For pendulums of the same length, the time of oscillation is independent of the nature or weight of the material—pendulums of metal, glass or wood, all being of the same length, under like conditions will oscillate in the same period of time.

(57) C. H. D. says: I have a machine for running emery wheels, the boxes of which are so worn by continual use as to need re-Babbitting, though the shaft is still smooth and good. Can you give directions for doing this in the most approved way? A. First set the shaft up in its place, close up the ends of the bearing with putty, and pour the lower half of bearing, the Babbitt being at a low red heat, and there being a small piece of rosin placed beneath the shaft to make the Babbitt flow well. Then put a piece of paper on the joint of bottom bearing, put on the cap, stop up the end with putty, and pour the Babbitt through the oil hole. It will aid the flow of the Babbitt to heat the shaft.

(58) J. E. G. asks how to temper gun lock springs? A. Make the springs red hot and cool them off in water, then fry them in lard oil over a fire until they will blaze freely.

(59) C. L. asks if there is any way to remove old grease that has become hard and dry on the bright parts of our engine? A. Scrape off the grease with a triangular scraper.

Also for a good recipe for making a cement to fill the holes and seams of millstones? A. Try crushed stone grit 20 parts, litharge 2 parts, quicklime 2 parts. Mix with linseed oil.

(60) M. L. C. asks for a good paint for blackboards? A. Mix together common glue, 4 ozs.; flour of emery, 3 ozs., and just lampblack enough to give an inky color to the preparation. Dissolve the glue in 1½ pints of warm water, put in the lampblack and emery, stir till there are no lumps, and apply to the board with a smoothly rolled woolen rag. Three coats are needed.

(61) F. T. asks how to remove burrs easily from the heads of cold chisels? A. Rest the head upon a block of iron and strike the burrs from the under side, and they will break readily and easily off.

(62) M. H. inquires how he can true up his carpenter's grindstone? A. Use a ¾ inch bar of iron or a gas pipe for a turning tool, held below the center of the stone.

(63) E. T. P. wants to know how to remove rust from small hollow castings? A. Dip in dilute sulphuric acid, 1 part of commercial acid to 10 water: wash in hot lime water, and dry in the tumbler with dry sawdust.

(64) M. T. says: How can I reduce the elasticity of a bar spring? A. File off a very thin scale from the surface.

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

C. A. S.—The asbestos is of good quality, and will bring a fair price in the market. Asbestos is used for fireproof feltings, varnishes, cements, paints, for engine and boiler packing, and in the manufacture of a fireproof cloth and paper, etc. Dealers will address you.—S. D. H.—It contains large percentages of copper and zinc, and small amounts of iron, antimony, and alumina. The natural occurrence of this alloy (brass) is doubtful. You should send larger specimens and further particulars if possible.—C. P.—Send a sample of the magnesia salt.—O. F. F.—The sulphide contains a little copper, nickel, and arsenic. Silver was not detected. It is not of much value.

HINTS TO CORRESPONDENTS.

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

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

WANTS AND BUSINESS INQUIRIES.

Almost any desired information, and that of a business nature especially, can be expeditiously obtained by advertising in the columns of "Business and Personal," which is set apart for that purpose subject to the charge mentioned at its head.

We have received this week the following inquiries, particulars, etc., regarding which can probably be elicited from the writers by the insertion of a small advertisement in the column specified, by parties able to supply the wants:

Who makes electric lights?

Who sells carbon points?

Who manufactures ornamental iron work, such as brackets?

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INDEX OF INVENTIONS

FOR WHICH

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

October 16, 1877,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

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

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10,274.—HAT AND COAT RACKS.—J. R. Palmenberg, New York, N. Y.
10,275.—CIGAR BOX.—G. Fuchs, New York, N. Y.
10,276.—HANDLE FOR POTTERY OR GLASS WARE.—T. Haviland, New York, N. Y.
10,277.—DESSERT SET.—W. J. Miller, Chicopee, Mass.
10,278.—INKSTAND BASE.—B. Brower, New YorkN. Y.

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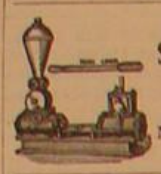

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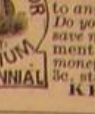

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Vol. XXXVII. No. 22. [NEW SERIES.] NEW YORK, DECEMBER 1, 1877. [$3.20 per Annum. [POSTAGE PREPAID.]

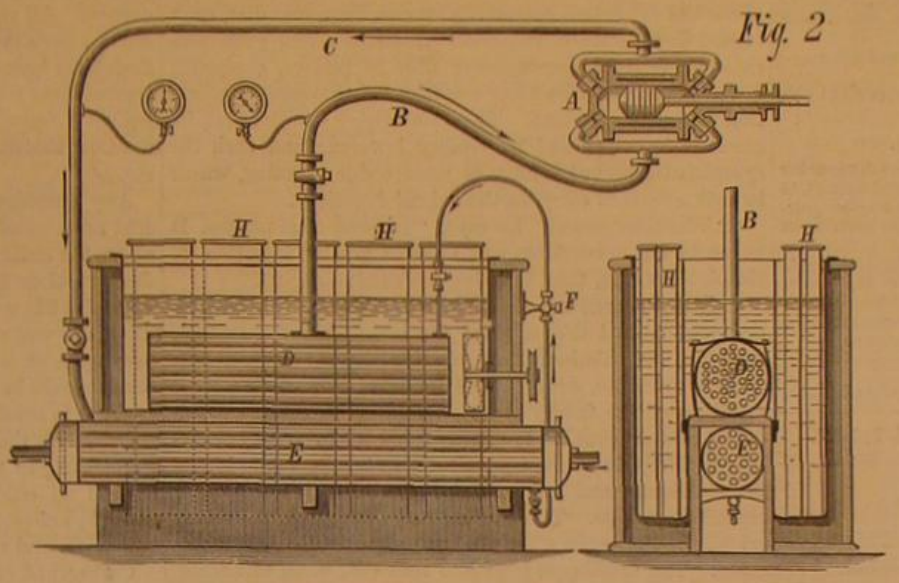
THE PICTET ICE MACHINE.

Ice machines are commonly classed with reference to the mediums they employ for abstraction of heat, hence they are distinctively known as air machines, ether machines, ammonia machines, and so on. A more logical and simpler classification, however, is to refer them to but two general classes, namely, machines which involve the use of a volatile liquid or freezing mixture, and those which do not. Under the first heading would be grouped ammonia, ether, and like machines, under the latter only those wherein air is compressed, then cooled without expansion, and finally expanded, thus causing the abstraction of large quantities of heat. It is not deemed necessary here to enter into the relative advantages and disadvantages of these various different devices, inasmuch as the subject is open to considerable argument on both sides.

The ice machine, or rather the system of artificial refrigeration, invented by M. Raoul Pictet, is based upon the refrigerating properties of anhydrous sulphurous oxide. This substance is a colorless liquid having a specific gravity of 1·6, and remaining fluid under a pressure of from 2 to 3 atmospheres. When allowed to escape in air it vaporizes rapidly, producing a decrease of temperature of 135° Fah., and if a teaspoonful of the liquid be placed in a wine glass of boiling water, the latter instantly freezes solid. It is imported from Europe in copper cylinders each holding about 200 lbs., and the cost of the material delivered in New York is about 65 cents a pound.

The manner in which the system operates will be clearly understood from Fig. 2, which represents the disposition of a small apparatus, such as is illustrated in Fig. 3. At A is the compression pump, the valves of which are so arranged that at one stroke the gaseous oxide is aspirated through the tube, B, and on the return it is compressed through the tube, C. Tube B connects with the refrigerator, D; tube C with the condenser, E. The oxide is introduced at the plug lock, F, and is drawn by the pump in the direction of the arrow into the copper tubular refrigerator, D, the liquid filling the space between the tubes. Here vaporization and consequent production of intense cold takes place, and the temperature of the non-congealable mixture of glycerin and water which surrounds the refrigerator is so far reduced that water placed in the metal boxes, H, immersed in the tank becomes rapidly frozen. The propeller wheel, shown on the right, determines a current of the glycerin solution through the tubes and thus hastens the refrigeration. The vapor of the oxide is drawn out of the refrigerator, as already noted, by the pump, carried through the latter, and forced into the space between the tubes of the condenser, E. Through the tubes a cold stream of water is constantly pumped, which determines the condensation of the vapors, and the re-liquefied oxide passes into the admission pipe and once more enters into circulation as already described.

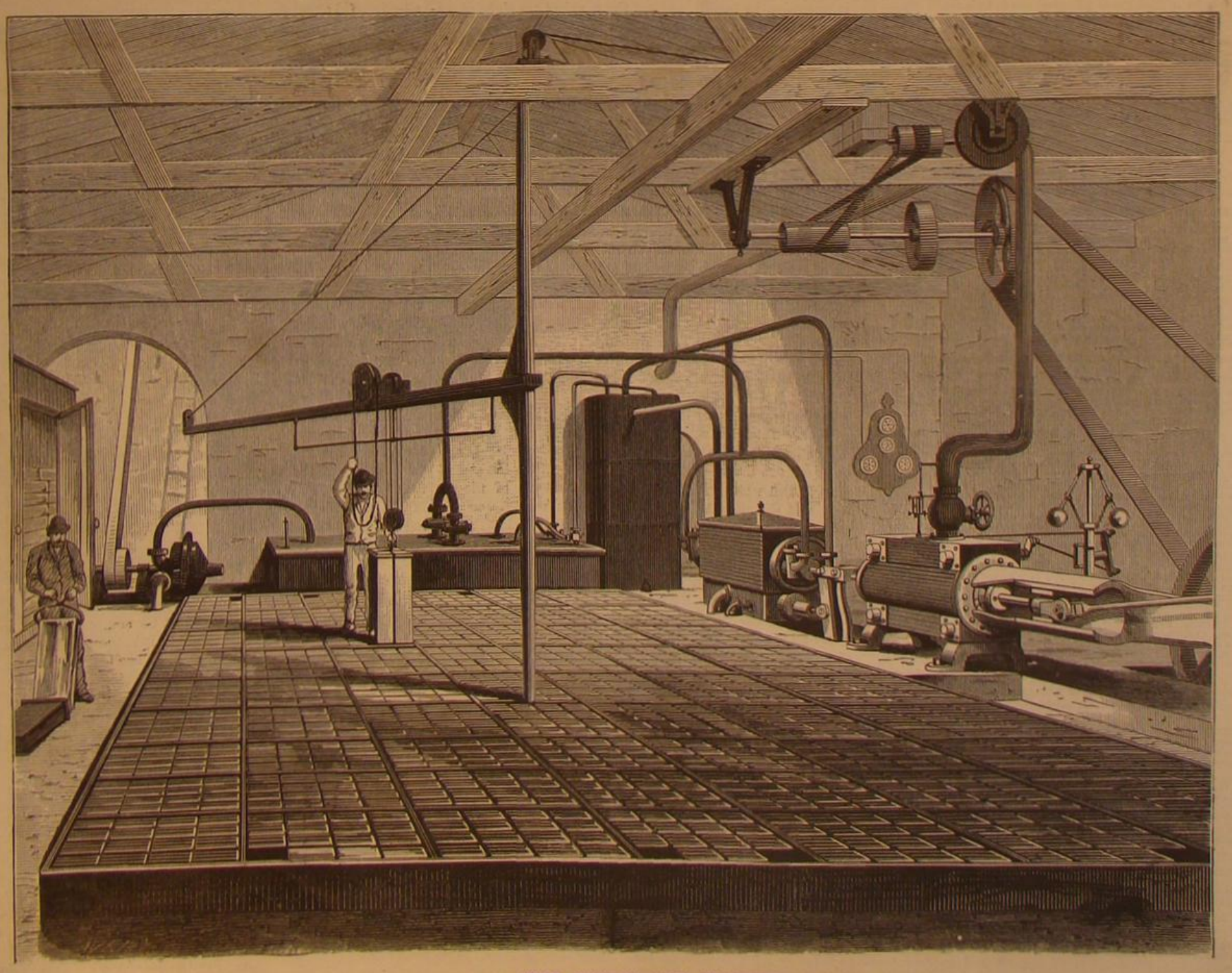
Fig. 2



THE PICTET ICE MACHINE.

In the large illustration, Fig. 1, is represented the arrangement of machinery now in operation in this city. Here the freezing tank, which is very large, is separate from the conden-

[*Continued on page* 338.]



THE PICTET ICE MACHINE.—Fig. 1.

Scientific American.

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NEW YORK, SATURDAY, DECEMBER 1, 1877.

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VIII. CHESS RECORD.—Biographical Sketch of Dr. R. L. C. White with Portrait and one of his Problems.—Problem by S. LOYD.—DE LA BOURDONNAIS and MACDONNELL. Two Games between these noted Players.—Prize Problem by W. A. SHINKMAN.—Solutions to Problems.

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THE CURE OF DIPHTHERIA.

Dr. E. N. Chapman, of Brooklyn, N. Y., has discovered an antidote to the poison of diphtheria, by which the percentage of deaths is reduced to less than one in fifty. Statistics show that the percentage of recoveries in cases treated under the usual practice is about thirteen, or eighty-seven out of a hundred sufferers succumb to the fell disease.

Diphtheria first appeared in this country in 1858. Dr. Chapman, in 1859, lost several cases, and became distrustful of the regular methods. He had been using alcohol in the cure of ship fever, and he determined, though contrary to all rules, to try it in diphtheria. To his surprise, several of his patients recovered. He then tried quinia, and found it acted well, but not so quickly. At last he settled on a combination of the two, alcohol and quinia, and with these remedies, he claims that diphtheria is more amenable to treatment than many common diseases. In an epidemic, such as diphtheria, all are affected by the morbific agent; but a few only yield to it. Mature, vigorous persons have vitality enough to resist the disease. Children and weakly adults are its usual subjects. Dr. Chapman considers that there is, almost always, super-added a local and direct exciting cause, such as defective exercise, improper diet, dark rooms, damp houses, imperfect ventilation, and poisonous emanations from decomposing filth in privies, cesspools, sewer pipes, etc. To such agencies the strongest constitution will soon succumb. The blood being deteriorated, its crasis is impaired and its vitality lowered; and then the sympathetic nerves, failing to receive due stimulus, waver in their efforts to carry on the animal functions.

"All local treatment," he says, "is worse than useless. It exhausts the nerve force and induces greater injection of the blood vessels, thus favoring the exudation.

"Alcohol neutralizes the diphtheritic poison, sets free the nerves of animal life, subdues the fever and inflammation, destroys the pabulum that sustains the membrane, cuts short the disease, conquers its sequelæ, and shields other members of the family from an attack. Upon the subsidence of the fever, as is usually the case in from twenty-four to thirty-six hours, a purulent secretion begins to loosen the membrane, and soon, thereafter, to detach it in flaky, ragged fragments. This process may take place, and recovery be possible, even when the larynx and trachea are implicated. The membrane is seldom renewed, when this secretion is maintained by a steady use of the remedy. Alcohol is as antagonistic to diphtheria as belladonna to opium, or quinia to malaria. Like any other antidote, it must be given promptly at the outset, or otherwise its potency will be lessened, perhaps lost altogether.

"Alcohol does not act as a stimulant, nor induce any of its ordinary effects. Enough may be given to cause profound intoxication in health, and yet there exists no signs of excitement or odor in the breath."

Quinia is an efficient alloy to alcohol. It energizes the ganglionic nervous system, and thus enables the organism to right itself and resume its function.

Dr. Chapman sustains his position by citing numerous cases in which this treatment was successful. He states that, in his long experience, he only knew of one case where a drunkard had diphtheria. He generally gives the alcohol in the form of whiskey.

THE GEOLOGICAL RELATIONS OF THE ATMOSPHERE.

The gaseous envelope which surrounds our globe plays a very considerable part in the chemical changes ever going on in rock formations, whether actually at the surface—as in what is called the "weathering of rocks"—or in the less apparent, but perhaps more powerful, action carried on below the surface. In a late number of the *Quarterly Journal of Science*, Edward T. Hardman, F.C.S., has a very exhaustive paper on "The Atmosphere Considered in its Geological Relations," from which we extract the following interesting facts:

Perfectly pure water has a very appreciable solvent effect on rocks, which is immensely augmented when it is chemically charged with carbonic acid, oxygen, nitric acid, and other matters derived directly or indirectly from the atmosphere. But while on the one hand the influence of the atmosphere disintegrates and destroys rock masses, on the other it is mighty in building them up. Without the small percentage of carbonic acid contained in the air there could be no vegetation, and there would be none of the coal beds which form such important members of our rock formations. The immense masses of limestone found everywhere, and the coral reef of the present day, must owe their being indirectly to the carbonic acid of former atmospheres. A drop of rain water absorbs a trace of carbonic acid from the atmosphere, falls on a rock containing lime in some form, dissolves the lime as bicarbonate, carries it down to the ocean, and finally gives it up to become part of the skeleton of a coral or mollusc, which in its turn may form a portion of an immense mass of limestone rock.

The bulk of the atmosphere is made up of oxygen and nitrogen, but these do not take so active shares in geological matters as the almost infinitesimal trace of carbonic acid present. The amount ranges from 3 to 10 volumes in 10,000 volumes of air. The principal sources of increase are, volcanic and other subterranean exhalations; respiration of animals; combustion of fuel and vegetable decay.

The series of rock-metamorphisms due to the simple absorption of carbonic acid by a plant is very interesting. The carbon is assimilated by the plant, and it dies and becomes thus a part of a coal bed or lies embedded in sediment of some kind. Decomposition sets in; and if there be a reducible compound near it, chemical changes result. If the strata contains sulphate of iron, it is reduced to sulphide, commonly known as iron pyrites or false gold. The reduction is effected by the carbon of the plant abstracting the oxygen from the sulphate. The resulting carbonic acid either is taken up by percolating water and penetrates farther into the heart of the rock, effecting new changes, or it finds its way to the surface through some crevice, or by aid of a mineral spring, and once more mingles with the the atmosphere, to be perhaps again absorbed by vegetation and pass through a similar round of changes afresh. In many cases the action of the carbonic acid changes a metallic ore from an insoluble to a soluble compound, thus reducing the ancient crystalline rocks. The metals carried away by streams were deposited along their beds, and valuable beds of ore were formed.

The atmosphere in the carboniferous age contained a much larger portion of carbonic acid. This has been gradually absorbed into the earth, until the amount stored in the earth is estimated at 6,620 times as much as there is in the atmosphere, although the latter contains 1,250,000,000,000 tons of carbon. All animal carbon is derived from the atmosphere. Say a tiger dines off a cow, the carbon and nitrogen of her flesh have been obtained from vegetation, which in turn extracted them from the air; so that we have a kind of physiological "House that Jack built," "This is the Tiger that ate the Cow that devoured the Grass that absorbed the Carbon," etc.

Any considerable difference in the volume of carbonic acid must result in diminution of animal life. Very little above the ordinary standard carbonic acid in air becomes a deadly poison to all warm-blooded animals. If diminished vegetable life would languish, graminivorous animals would die of starvation, and finally the carnivora, being obliged to prey upon each other, would of course become extinct. The result would be a completely barren and desolate planet, perhaps in some degree resembling the moon.

Oxygen is the next in importance as a geological agent. Percolating in rocks, dissolved in rain water, it quickly reacts on all oxidizable substances. Carbonates and protosalts are converted to peroxides; sulphides are changed into sulphates, and sometimes alums are formed.

Carbon and oxygen are thus antagonistic in their action on rocks and minerals, and are thus keeping up a circulation between the earth and the air. The carbon always reduces the oxides, and the oxygen replaces the carbonic acid of carbonates with the same inveteracy.

The ammonia existing in the air is absorbed by plants, and by their decomposition forms nitrates. "And now," Mr. Hardman says in conclusion, "it will be seen what an all-powerful agent the atmosphere we breathe is. Without its aid we should know never a stratified formation, and would simply form a ball of truly primitive rock. We should have no coal, no metalliferous deposits, no rivers or seas, and no rain—consequently no denudation by rain and rivers—for the vapor of waters could not ascend into empty space. We should have—but, last and worst of all, there would be no "we." Life would be impossible, and the earth would finally degenerate into a pale-faced moon." That this is probably her mission cannot be denied; and probably before Saturn and Jupiter have cooled down to a habitable temperature, the senescent earth will roll through space—cold, void, and airless.

VENERABLE JOURNALISTS.

In the December issue of *Godey's Lady's Book* appear the valedictories of both the editor and the publisher of that magazine, which with the beginning of the new year is to pass into other hands. Much has been written and said about the exhaustive nature of the journalist's profession, and the general deduction has been made that as a rule literary people are neither long-lived nor are they able to withstand the mental labor incumbent upon them, over any very extended periods of years, comparison being had with members of other callings. No better examples demonstrating the contrary of the commonly accepted opinion could be found than in the careers of Mrs. Sarah Josepha Hale and Mr. L. A. Godey. Mrs. Hale states that she began the editing of the *Ladies' Magazine*, in 1827—fifty years ago—nine years later that periodical was consolidated with the *Lady's Book*, of which Mrs. Hale assumed the editorship, the active duties of which she has subsequently continuously performed. A half century of steady journalistic labor is in itself phenomenal, more so when it be considered that a woman has accomplished the task and it becomes still more remarkable when we are told that it has been done not early, but late in life, Mrs. Hale now having attained the venerable age of 90 years. Certainly no one would imagine that the editor of the sprightly periodical before us, a journal which pre-eminently deals with fashion and art, and is addressed especially to the young, is the same editor who wrote in the same brilliant way and made up the same interesting papers for our grandmothers, but the fact remains that she of late years has been writing for a third generation of readers. The same is true of Mr. Godey, although he is a mere youth as compared with Mrs. Hale, being but seventy-three years of age. He began literary work when but fifteen years old, and hence his journalistic life has extended over fifty-eight years, during all but the first ten of which he has uninterruptedly published the *Lady's Book*.

Both of these venerable members of the press—and with the exception of William Cullen Bryant, we can recall

none whose years of labor equal theirs—have long since earned the public gratitude for their good works. To Mrs. Hale was largely due the successful completion of Bunker Hill Monument. She is the inventor of Thanksgiving day, for she first suggested the idea of an American national thanksgiving in 1846, and her efforts toward the advancement and education of women have been untiring and fruitful with beneficial results. Both herself and her associate may look back with justifiable pride over the 571 numbers of the *Lady's Book*, which they have prepared, in the consciousness that their labors have tended always toward the promotion of education, culture and refined taste.

WATER SUPPLY FOR NEW YORK CITY.

The last plan submitted to the Special Committee on Water Supply for New York city is by a Brooklyn engineer, who claims a cheaper mode of getting water than by going fifty or sixty miles for it. His plan is the construction of a close canal or conduit, on a low level, of sufficient width and depth, commencing at Harlem river, running through Westchester, following the lowlands and keeping the depth below the well level. This conduit, he states, would always be full of the purest water, supplied from the great underground water basin of Westchester, and would in its course intercept all the springs and streams. Having studied the water supply of Brooklyn he was led to make a proposal to furnish that city with a future supply at a much cheaper rate than could be obtained by building reservoirs, and he thinks the same plan would be applicable to New York, although the soil is very different. The soil of Long Island is of such a nature that it readily absorbs all the rainfall. What streams there are come from springs fed from the higher grounds. The soil of Westchester is different from that of Long Island; it is harder and more compact, and much more of the rainfall runs off the surface; that which is absorbed remains longer in the soil. Hence a long drought would not affect the wells in Westchester as much as those on Long Island. The Brooklyn conduit, which carries the water to the pumping wells, was built as low as possible in order to collect the water from the different springs, yet built above the well level; and by extending it, sufficient elevation to the mile was given to impart the necessary current to send the water to the pumping wells, till now, in seventeen miles, it has risen above the springs and no more water can be obtained without building reservoirs, or adopting the plan he suggests. The conduit for New York was built high in order to get an elevation without pumping, and was carried back forty miles to the high ground of the Croton, passing many streams and getting no advantage from the many valleys in its course, or from the great water shed lying within thirty miles of New York—resources sufficient, if improved, to give an abundant supply for all time.

It is contemplated to build more reservoirs on these high elevations at a cost of $10,000,000, and to build a new conduit between New York and Croton Dam at a cost of $10,000,000 more. In regard to this, he says, to keep building expensive reservoirs on these high elevations is a waste of public money, and will naturally prove a failure as to a future supply, for, as the line is extended, it must keep rising, although already it is above the springs. What water may be obtained in this way is from storm flows, collected during the time of freshets, and retained in their shallow basins, stagnant pools, exposed to the rays of the sun and infected by vegetable decomposition, with no circulation whatever until it is let off into the conduit, thus distributing the seeds of malaria. The best place for reservoirs is where you can get the purest water, and that is at the foot of the hills. Here not only the surface flow is got, but as much more pure spring water, filtered through the upper lands. The expense of pumping will not compare with that of building costly reservoirs on such high elevations; but, even if it did, the sanitary advantages would more than compensate. As the land naturally rises from Harlem river, a conduit could be built on a slight elevation to the mile, of sufficient width and depth to bring to the city as much water as would be needed for all future time. The water in the canal would be spring water and a running stream. The pumping engines could be placed at the Harlem river, and pump directly into the pipes, under pressure, giving the water sufficient force to carry it into the top story of the houses on Murray Hill, leaving the old aqueduct, with its reservoirs, to supply the lower portion of the city.

In brief, the plan is to have one main conduit, commencing at a point west of King's Bridge or east of Central Bridge on the Westchester side of the Harlem river, extending up through Westchester, with lateral branches, running right or left as the nature of the ground may indicate; smaller ones to be built in each of the different valleys, and a cross tunnel made to intercept them all. By this means a large amount of water could be obtained, and the conduit could be extended according to the growth of the city. The main conduit at the commencement would not be less than twelve feet in diameter, or of sufficient capacity to deliver two hundred million gallons daily; it could be diminished as extended. The side walls of the conduit would be of heavy stone laid dry, backed up with small ones, the bottom paved with cobble stone, the top arched with brick laid in cement. The pumping wells and buildings could be erected on the New York side of the Harlem river: the river to be tunnelled with either an iron or a brick tunnel of the same dimensions as the conduit, the top to be twelve feet below low water mark. All the overflow would empty into Harlem river.

An approximate estimate of the cost of such works, with five compound steam pumping engines of the most approved kind, with their boilers, fixtures, and buildings to pump one hundred million gallons of water per day at $9,500,000, exclusive of the right of way, which would not cost much, as the conduit would be mostly underground. Much of the tunnelling could be done without disturbing the surface. The principal and only damage would be the surplus earth left in places. As the conduit would follow the low lands, their drainage would mitigate damages.

THE GREEN CORN CASE.

The celebrated "Green Corn Case," which was argued last September in the Circuit Court at Baltimore, before Judges Bond and Giles, has recently been decided, and the bill for the injunction dismissed. This case was an application by John Winslow Jones for an injunction against Louis McMurray, of Baltimore, for an injunction to prevent him infringing the re-issued patent No. 7,061 (original patent No. 35,274), covering a process of canning green corn, and re-issue No. 7,067 (original patent No. 34,928), for the product of said patented process. The original patents were declared invalid by the Supreme Court of the United States. They were then surrendered and the re-issued patents obtained, which formed the basis of this suit. The complainant avers that the decision of the Supreme Court was given against him because of his "defective specifications," which have been cured by the re issues obtained since the decision referred to. The circuit judges, however, in the present case, have a different opinion of the Supreme Court decision than that entertained by the plaintiff, and state that, "while we are of opinion that the decision of that court is much broader than the complainant admits, and that it goes to the whole invention then and now claimed by Jones in the patents we are here considering, and that it determines that both the process and product now claimed by Jones was the invention of Appert, in France, and Durand, in England, more than sixty years ago, and held that Jones' patents were void for want of novelty, and not merely invalid for want of a proper specification and description of Jones' claims, nevertheless, since the Commissioner of Patents has issued the patents to Jones, we would give him the benefit of them could we discover in what respect they differed from the originals, which the Supreme Court has decided were void. There is no essential difference, however, between the process described in the first patent and the re-issue. The first recites that, after some difficulty found in preserving green corn without drying, the inventor removed the corn from the cob and boiled it, but that by this process the corn, being broken by removal from the cob, dissolved out the juices and made the corn insipid, and then he finally removed the corn from the cob, packed the kernels in cases, hermetically sealed them, and boiled them until the corn was cooked." The Supreme Court, in the case of Sewell *vs.* Jones, says this is not new. Complainant, in his re-issue, states he pursues another plan, whereby he separates and retains the nutritious and edible parts of the corn, boiling them in a liquid of their own juices. No one ever cut green corn from a cob who did not do exactly what this claim describes, and no one under the process described in the patent, which requires the corn to be removed from the cob, could so remove it without breaking the kernels, and when he cooked it in a can, as the patent required, he would find necessarily more or less of the juices with it. The process described in the re-issue is substantially that of the original patent. But if we admit there is something new and patentable in the re-issued patent, which was not in the original, the patent is void, because it is not for the same invention as the original. * * * * It cannot, therefore, be claimed that the re-issued patent contains anything which the original did not, and the original, says the Supreme Court, is void for want of novelty." The patents also described the use of a curved knife to remove the corn from the cob, but this does not appear to add any novelty or patentability to the alleged invention, for the knife differs nothing in principle and little in construction from some styles of spokeshaves or paring knives, and even if the validity of these patents could be admitted on reference to this point, the court could find no evidence that the defendant, McMurray, has infringed them by using the knife of complainant, but, on the contrary, the proof shows that he used a different knife entirely. For these and other objections to the complainant's case, the bill for the injunction was dismissed, with costs. Numerous other suits have been entered by Jones against other parties in New York, Boston, Portland, Chicago, and other parts of the country, which will probably be influenced to a considerable extent by this decision.

HOW TO MAKE HOMES HEALTHY.

Most cases of infectious diseases have, in addition to the common epidemic influence, a direct exciting cause. This will be found, when contagion is excluded, to be poisonous emanations of some kind in the house, or on the premises, or in the drinking water; in cities generally sewer gas. Dr. Chapman, of Brooklyn, to whom we refer in another article, after experiments, has settled on the following plan as a sure relief from sewer gas: The soil pipe running from the cellar passes through the house and opens into the kitchen flue at the top story. The pipe should be four inches in diameter. It will be freely ventilated by the draft of the flue. Into this soil pipe or ventilator, the waterclosets and basins on the different floors empty through traps. The water from the upper closet, running past the opening of the lower closet, would be apt to suck its trap dry, and to prevent this a separate ventilating pipe is run from the traps of the lower closets to a point in the ventilator above the upper closet. In this manner all foul gases at once pass upwards and empty at the top of the house. In several houses where malarial disease had been frequent, since the introduction of this plan the residents have been free from all disease due to blood poisoning.

BREAKAGE OF A STEAMBOAT BEAM.

The Harlem, a passenger steamboat plying between New York and Harlem, recently broke the working beam of her engine. The break took place between the eye of the main link and the main center of the beam. The beam is of the usual American type, having a cast iron skeleton frame bound round with a strap of wrought iron. The fracture of the lower part of this strap shows that a flaw has existed for some time but was not perceptible, being covered by a vertical strap. The fracture of the cast iron skeleton frame and the upper part of the wrought iron strap showed a good quality of iron, the former being of a gray color and close grain, and the latter of a fibrous nature. The rectangular cross section of the strap, where the flaw is, and where the break first commenced, is in size 5 by 3¼ inches. The length of the beam is 15 feet 6 inches by 8 feet wide.

The point of interest is the fracture of the wrought iron strap where the flaw is, and the iron shows crystallization. As the flaw was concealed from view it becomes a matter of speculation how long it has existed, and whether it resulted from inferior iron or from crystallization gradually taking place as the result of constant vibration. The excellent appearance of the iron in the upper part of the beam strap seems to indicate that the iron when first put round the skeleton was all of good quality, and that a change took place in the lower half or some portion of it.

The experience as to iron undergoing a gradual deterioration under certain circumstances is too universal to be discredited. The multitude of theories put forth to account for it bear witness to the fact, although an explanation of the phenomenon is still required. Mr. Roebling, the late distinguished engineer, assumed that the drawn out fiber of wrought iron is "composed of an aggregate of pure iron threads and leaves, enveloped in cinder. Wrought iron thus becomes brittle under long-continued vibration under tension, because the iron threads and laminæ become loosened in their cinder envelopes."

The Northern Lights.

The Finland observations of northern lights in the years 1846–1855, numbering 1,100, have recently been compared by M. Fritz, in the *Wochenschrift für Astronomie*, with auroral phenomena of the same period in all other regions. This comparison leads to results which are interesting as bearing on the theory of the phenomenon. The table shows that of 2,035 days of the months August to April, on which northern lights were seen, 1,107 days were days of northern light for Finland. On 794 days northern lights were visible simultaneously in America, and mostly also in Europe; on 101 days only in Europe, and on 212 days only in Finland. They were on 958 days visible in Europe and America, and not visible in Finland. The conclusion is thus reached that a large portion of the polar lights have no very great extension, or that the causes producing them must often be of a very local nature, while in another portion of the phenomena the regions of simultaneous appearance are very considerable. The number of those phenomena which are limited to Finland is very small. With the increase of frequency of the phenomena, at the time of maximum, their number observed in Finland and America on the same day increases; while those observed in Finland and only in Europe, or those in Finland only, decrease. These relations correspond to the known law, that with the frequency the intensity and extent of the polar lights also increase.

Yellow Fever Infectious.

Many medical men hold that yellow fever is not infectious. Mr. Jasper Cargill, of Jamaica, W. I., relates, in the *Lancet*, several instances which came under his notice in which there would be no doubt whatever that the disease came from infection. The sufferers were colored people fully acclimatized to the Jamaica climate, so that there was no pobability of the fever having bred in themselves; besides the place of infection was very clearly ascertained.

Lead Explosions.

Many mechanics have had their patience sorely tried when pouring lead around a damp or wet joint, to find it explode, blow out, or scatter from the effects of steam generated by the heat of the lead. The whole trouble may be stopped by putting a piece of resin, the size of the end of a man's thumb into the ladle and allowing it to melt before pouring.

THE famine in India has quadrupled the death rate in the city of Madras. The death rate in July was 1,150 weekly. During the week ending August 17th, 1,051,000 persons were receiving relief in the Madras presidency. In thirteen affected districts the annual death rate in the week was equal to 483 per 1,000, signifying that if this rate continued for a year scarcely more than half the population would survive.

TO COAT iron with emery, give the metal a good coat of oil and white lead; when this gets dry and hard, apply a mixture of glue and emery.

[Continued from first page.]

ser, and its refrigerator holds about 1,700 lbs. of oxide. The non-congealable liquid is a saturated solution of chloride of magnesium, which has given better results than the glycerin and water mixture. The tension of the oxide vapor varies from 14·7 to 13 lbs. about, and on the return stroke the gas is compressed to ½ or ⅓ its original volume, having its temperature raised to 200° Fah. The cold water current reduces this temperature to about 61° at the outlet, and then, under the pressure of from 3 to 3½ atmospheres, the gas returns to liquid state. When the ice in the freezing boxes is formed, the workmen, by means of the crane shown in Fig. 1, which moves around an axis in the center of the large tank, lifts out the boxes one by one, and dips them in hot water, so that the block of ice within may become detached. The block is then removed and the box, replenished with fresh water, is replaced. The pressure in the condenser, we are informed, does not exceed 35 to 37 lbs. per square inch above atmospheric pressure—the average absolute steam pressure in the engine cylinder is 30 lbs. maximum. No difficulty is experienced in keeping tight joints, and the loss of oxide per week does not exceed ½ lb. The magnesium chloride or glycerin solution rarely needs renewal and is always cheap.

It is claimed that 1 lb. of acid by volatilization produces nearly 1 lb. of ice. From the apparatus illustrated in Fig. 1 the following data have been obtained: Average horse power of engine, 73 to 75, of which 23 horse power is used for the condensing pump, circulating pump, boiler feed pump, air pump, and acid pump. The quantity of ice produced was 18 to 20 tons in twenty-four hours; coal burned, 2½ tons per day; the average production of ice is claimed to be from 9 to 10 tons per ton of coal. The cakes of ice measure 12 inches by 6 inches by 36 inches, and weigh 83 lbs. each.

The following data show the inflammability and explosibility of various substances used in ice-making.

Names of substances used in ice-making.	Boiling point at atmospheric pressure in degrees Fahrenheit.	Pressure of vapor in lbs. per square inch at 65° Fahrenheit.	Specific gravity of liquid at 40° Fah. water = 1.	Specific gravity of vapor at 40° Fah. Air = 1.	Latent heat of vapor by equal weight.	Relative latent heat of vapor by equal volume.
Chymogene, gasolene, and other derivatives of petroleum*	30 to 50	12 to 17	0·6	3·9	170	663
Methylic ether*	—6	90		1·617	240	384
Ammonia†	—30	120	0·76	0·59	900	511
Anhydrous sulphurous oxide‡	14	52	1·49	2·25	170	392

*Inflammable and explosible. †Explosible. ‡Extinguishes combustion, not explosible.

The manufacturers furnish us the following estimate of maximum cost to produce 250 tons per day of 24 hours. Employees, $51.00; oxide, at 4 lbs. per week, 37 cents; oil, $2; coal, 22½ tons at $4.25 per ton, $105.63. Equivalent to 63¾ cents per ton actual cost of manufacture.

Estimating capital at $250,000, and adding taxes, office expenses, wear and tear, insurance, etc., the total cost comes to $1.05 per ton of ice.

Attention is called to the advantage of the low boiling point of sulphurous oxide, which is 14 Fah. as compared with chymogene, which is 30° to 50°. Also the advantage of the pressure of vapor of the oxide at 65° Fah., namely, 52 lbs., instead of the very low pressure of chymogene, 12 to 17 lbs., which results constantly in the pumps using the latter working almost in a vacuum. The disadvantage on the other hand of the high pressure of ammonia is obvious.

For further information address the Pictet Artificial Ice Company, room 51 Coal and Iron Exchange Building, corner Courtlandt and Church streets, New York city.

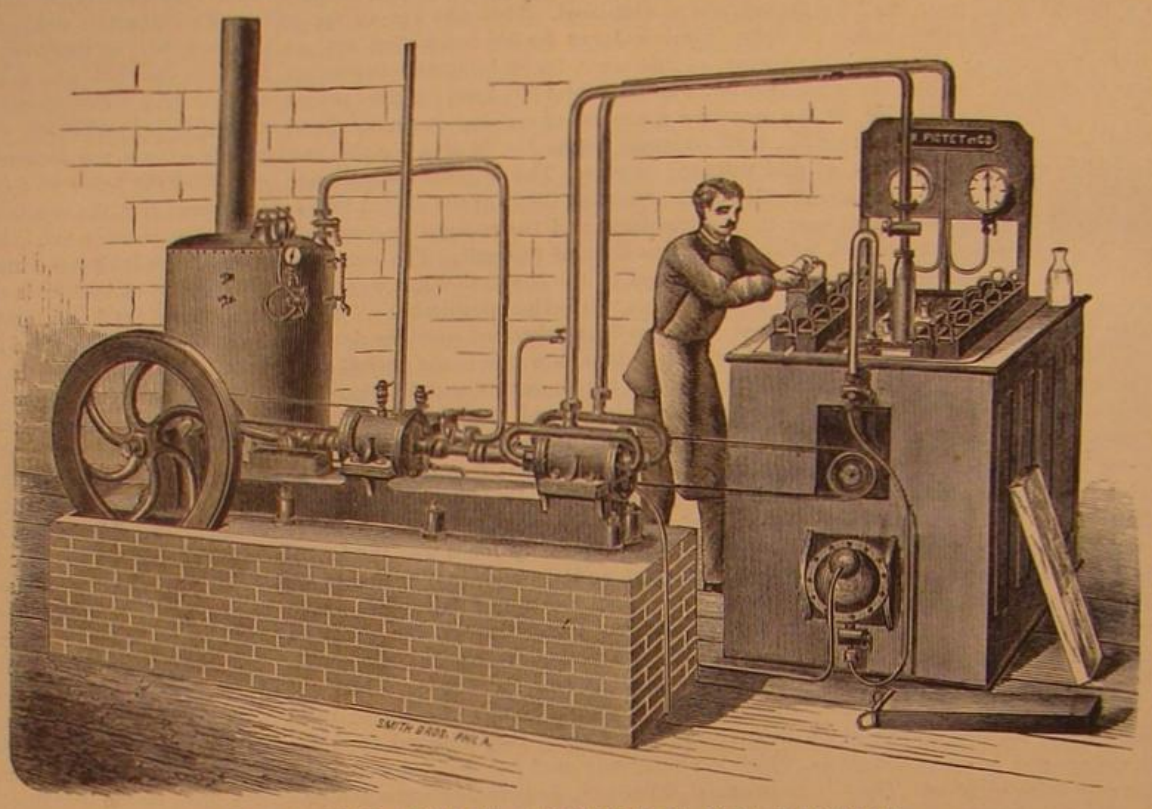


Fig. 3.—THE PICTET ARTIFICIAL ICE MACHINE.

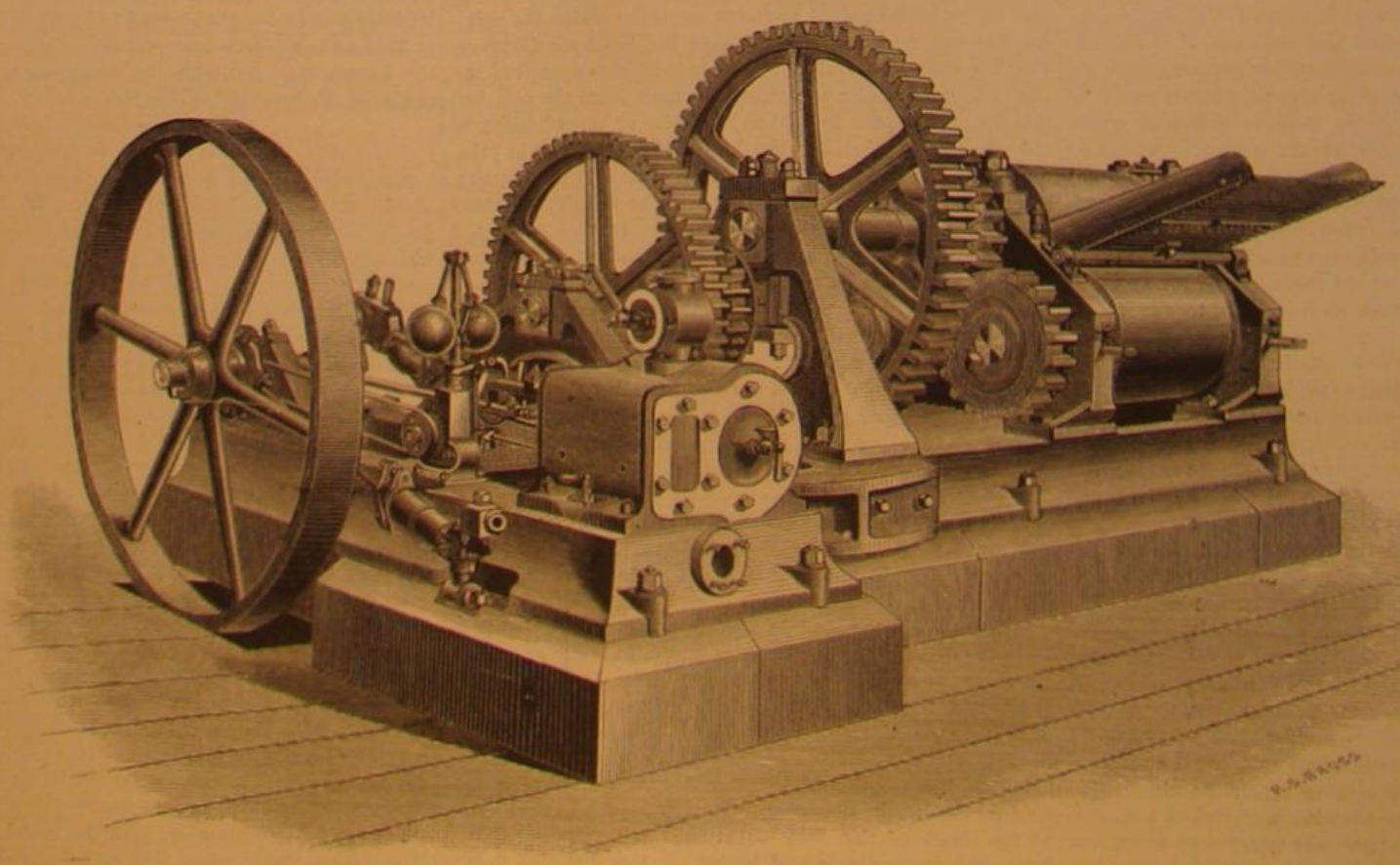
Keeping Fruit Fresh.

The following is said to be a good process for keeping fresh fruit through the winter: Mix rosin 2 lbs., tallow 2 ozs., beeswax 2 ozs., slowly over a fire in an iron pot, but do not boil. Rub each fruit separately with pulverized chalk and dip it in the mixture. Hold it up for a moment to permit the coating to set, and pack away carefully in a cool place.

COMBINED ENGINE AND SUGAR CANE GRINDING MILL.

We select from *Iron* the accompanying cut of a combined engine and sugar cane grinding mill, manufactured by Messrs. Robey & Co., of Lincoln, England.

The mill is especially designed for small plantations. The rollers are three in number and are placed horizontally, one over the other two. These rollers are 20 inches in diameter and 30 inches long, and are keyed on to their respective shafts. On one end of these shafts are pinions, which are driven by a train of strong gearing actuated by the horizontal engine, which is of 8 horse power nominal, but capable of working more than that power. The whole is fixed on strong foundation plates, by which arrangement the fitting up is much facilitated. For the sake of greater ease in transit, these plates are made in two parts. The cane is conveyed to the rolls by a carrier worked from the mill, consisting of chains on a series of wooden rollers.



COMBINED ENGINE AND SUGAR CANE GRINDING MILL.

Vitality of Ants.

Several interesting observations have been made by the Rev. H. C. McCook on the endurance of extremes of heat and cold by ants. This year a formicary of *F. pennsylvanica* was cut from an oak bough and exposed out of doors to the rigor of a mountain winter, and survived. A number were dropped separately upon ice, and were found alive after forty-eight hours, each in a little depression. *F. rufa* was found active in its formicary at 34° F., sluggish at 30°. The extreme of heat seemed also to be endured by *F. pennsylvanica*; they did not suffer at all from the heat of stones walling in a camp fire, having been driven into this position out of a burning stump. A community of agricultural ants (*M. molefaciens*) lived in a mound upon which some smiths in Texas made their fires for heating wagon tires. Numbers of ants were seen at work by Dr. Lincecum, cleaning out the entrance to their city, before the entire extinction of the fire just used for heating tires. They had learnt all about the fire, and knew how to work in and around the dying embers without injury. A quantity of mason ants (variety of *F. rufa*) observed by Mr. McCook were accidentally flooded under five inches of water, and they appeared to be quite dead, and floated about in this condition for many hours. But subsequently most of them recovered full activity. In Texas Mr. Lincecum found that the agricultural ants are seen in great numbers in wells, forming a sort of floating mass as large as an orange, clinging together. In this condition they get drawn up in the bucket, and though they may have been in the water a day or two, they are all found alive. Yet individuals cannot survive under water more than six minutes; and life in these balls can only be preserved by the mass revolving, either by the continued struggles of the individual insects, or by an instinctive and orderly movement of the outer tier of ants.—*Proc. Acad. Nat. Sci., Philadelphia.*

Boring Power of Magilus.

We have received from Mr. Charlesworth a preliminary note giving briefly a result of his study of the genus magilus, the remarkable testaceous gasteropod that is found immersed in the large hemispherical corals of the genus meandrina. The current belief, as set forth by Sowerby, Owen, Woodward, and other authorities in molluscan biology who have treated of this coral-inhabiting mollusc, is that magilus in its young state effects a lodgment in a crevice of a meandrina, and that as the coral enlarges the magilus extends the margins of the mouth of its shell in the form of a cylindrical corrugated tube, the growth of this tube and of the coral proceeding together *pari passu*, and consequently that there is no penetration of the coral by the magilus at all. Mr. Charlesworth, however, finds that magilus not only drives through solid masses of coral in any direction with apparently the same facility that the bivalve teredo tunnels masses of wood, but he finds that it even surpasses teredo in its power of suddenly reflecting its shell and returning to the point from which it commenced its advance; and this bending back of the shell upon itself is not accomplished in such natural cavities as frequently prevail in large corals, but in the solid coral.—*Nature.*

The Electric Light.

A special division of the Paris International Exhibition will be devoted to electricity, so that all the systems of electric lighting may be tested comparatively. The electric light continues to create the greatest interest in Paris. The experiments which we mentioned some time ago have been conducted during forty consecutive days at the Lyons railway station. A force of about 40 horse power is sufficient to keep going twenty-eight electric lamps, each of which gives a light equal to eighty gas lamps, and works with regularity for ten and a half hours. The effect is splendid, the whole of the station, except the waiting room, being lighted *à giorno*. The question of economy, however, is not yet settled. It is not known whether the company will agree to pay a somewhat higher price in order to multiply the power of its illumination. These experiments have been tried on Lontain's system, a modification of Wilde's and Siemens' principle. M. Lontain has contrived to send the current generated by an ordinary Wilde's machine into an electro-magnetic engine called a distributer. The central part being strongly magnetized by the current from a Wilde's machine, a number of electro-magnets are influenced by its rapid rotation, and in each of these an induction current is generated. These induction currents are powerful enough to feed three electric lamps; and as there are two series of twelve magnets, a single machine could, theoretically, feed seventy-two lamps. Actually, however, it feeds only twenty-eight. Lontain uses a new regulator, which works very well by the dilatation of a small silver wire. By its dilatation this part of the apparatus works a lever system, and brings the carbon electrodes into contact. The French Northern Railway has purchased a number of Gramme magneto-electric machines. They intend to use them at their goods terminus and stores.—*Nature.*

A New Indicator for Alkalimetry.

E. Luck proposes to employ, as indicator for volumetric estimation of acids and alkalies, phenolphtalein, a new dye stuff, prepared by Baeyer by heating together phenol (carbolic acid), anhydrous phtalic acid and sulphuric acid. In dilute aqueous or acidified liquids this dyestuff is colorless, but the addition of the slightest excess of alkali produces an intense purple red color, which is destroyed again by a trace of acid. For use, 1 part of phenolphtalein is dissolved in 30 parts alcohol, and 1 or two drops of this solution added to every 100 c. c. of liquid to be titered. If the liquid is acid it becomes opalescent at first, but clears on stirring. One drop of dilute soda lye or acid is more than sufficient to cause the change of color.

THE ROSS BURR STONE GRINDING MILL.

The annexed illustrations represent the Ross burr stone grinding mill, which is adapted for the grinding of flour, corn meal, paints, spices, and other dry materials, besides printers' ink, chocolate, paste blacking, and other substances of similar consistence. It runs at high speed, is claimed to grind fine and fast, and to consume but little power. The chief feature in the construction is that the grinding is done at the circumference and near to the center of motion instead of by the flat face of the stone.

Fig. 1 represents the mill with mixer attached, by which the materials to be ground are thoroughly mingled before entering the mill. In grinding paint the addition of the mixer is considered advantageous, the paint is thus kept cool, owing to the top of the mill being open so that the heat escapes instead of being absorbed by the paint. From the sectional view, Fig. 2, the internal arrangement of the machine will be clearly understood. The contents of the hopper are drawn down between the stones by the screw, A. The moving stone, B, is in the shape of a conical frustrum, and is attached to a vertical shaft which is rotated by the gearing shown. The outer stone is inclosed in the casing and is of a shape to receive the stone, B, in internal contact, adjustments of the latter being effected by the nut, C. As D is a small pipe to conduct the lubricating oil to the shaft bearing. The entire construction is simple and strong. The manufacturers claim that the mill now grinds nine tenths of all the printers' ink made in the country, and submit to us records of numerous premiums received (notably two gold, seven silver, and two bronze metals from the American Institute) besides many excellent testimonials from parties experienced in its use.

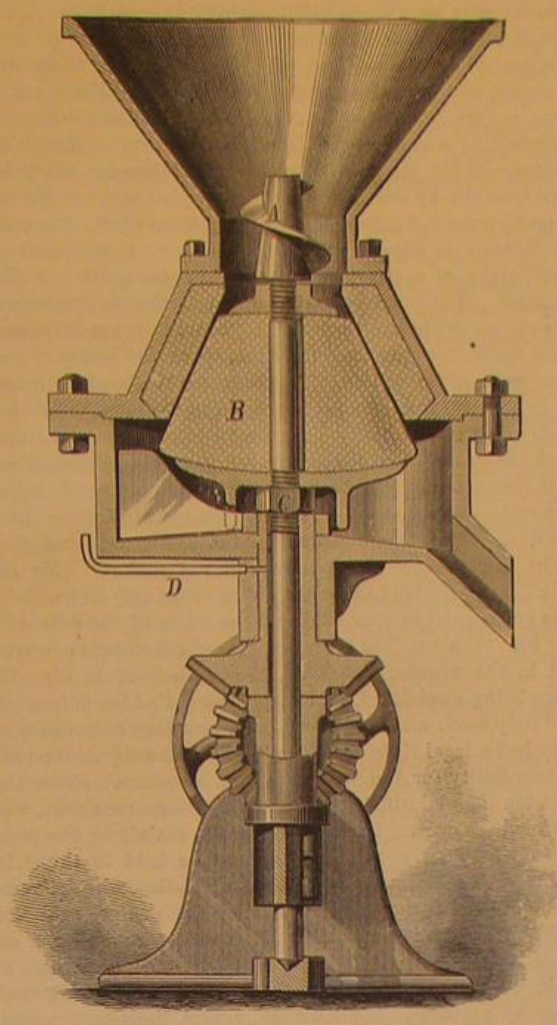
For further information address the manufacturer, Mr. Charles Ross, Jr., 81 and 83 First street, Williamsburgh, N. Y.

Restoring the Color of Lace.

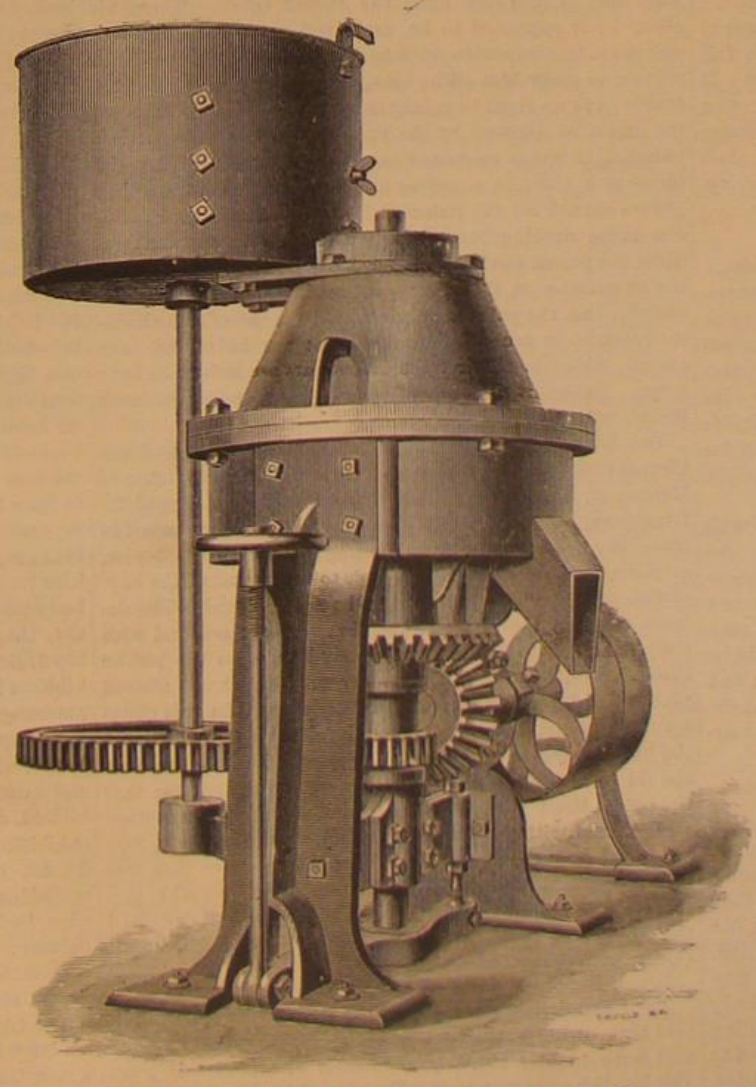
LACE may be restored to its original whiteness by first ironing it slightly, then folding it and sewing it into a clean linen bag, which is placed for twenty four hours in pure olive oil. Afterwards the bag is to be boiled in a solution of soap and water for fifteen minutes, then well rinsed in lukewarm water, and finally dipped into water containing a slight proportion of starch. The lace is then to be taken from the bag and stretched on pins to dry.

Electricity for Sleeplessness.

That galvanization of the head has an hypnotic effect has long been known: hitherto, however, it has not been used to counteract sleeplessness. Vigoureux asserts (*Allg. Wiener Med. Ztg.*) that he has daily obtained the finest results in this direction, and has failed only in exceptional cases, as, for instance, when sleep has been disturbed or prevented by severe dyspnœa. His method is to place the broad, flat electrodes (carbon covered with chamois leather) on both temples, and allow the current of from three, at the most five, Trouvé's elements to pass for a half or a whole minute. When the application is made in the morning, the patient experiences a more or less pronounced inclination to sleep. Occasionally the effect of the galvanization is prolonged after the first night, for a night or two.



THE BURR STONE GRINDING MILL.—Fig. 2.



THE BURR STONE GRINDING MILL.—Fig. 1.

Soup Kitchens.

Aside from the question of establishing soup houses for the poor in large cities, the question of the minimum amount of food at the lowest cost which shall be sufficient not to maintain life merely, but health and strength, is a subject of ffequent discussion at the present day, and in this connection some extracts from Professor Voigt's report to the Munich magistrates may prove of value. Professor Voigt's first problem was to determine the quantity of the chief constituents of food which a soup kitchen ought to give to each person for a noonday meal. He decided that a grown up laboring man required 59 grammes (910 grains) of albumen, 34 grammes (524 grains) fat, and 160 grammes (2,569 grains) or carbohydrates.

From the reports of several of these soup houses in various parts of Germany, and the bills of fare in them, he calculated the amount of each substance given by them, and found to his dismay that none reached the required standard, and some fell far below. We give his table of results:

	Albumen.	Fat.	Carbohydrate.
Required amount.....	59	34	160
Munich soup house.....	14	3	32
Leipsic Volk's kitchen	24	8	71
Dresden " "	37	10	100
Berlin " "	35	19	178
Egestorff's " in Hanover	35	8	110
Eating Institute of Hamburg	41	5	133
Hamburg Volk's kitchen....	50	11	187
Cologne " "	49	—	188
Carlsruhe eating house.....	58	16	180

Here is evidently a shrewd exception, says Voigt. Even if people are contented with the volume of the meal and feel sated, still they have not necessarily taken sufficient nourishment for noon. Only a small portion of the volks kitchens furnish a sufficient quantity for an old and feeble beneficiary or pauper, namely, 40 grms. albumen, 30 grms. fat, and 85 of carbohydrates, and none sufficient for a working man. In most cases, to be sure, the carbohydrates are in sufficient quantity, but not the albumen. In most cases throughout the list the fat is lacking to a surprising extent, and it appears as if they were ignorant of its importance: and yet a good suet soup is craved by the common people.

In these institutions it is evident that more attention has been paid to cheapness than to the proper composition of the food; it is just impossible for most of them to afford the necessary quantity at such low prices. It was only in Carlsruhe that the dinner came tolerably near the scientific requirements. Such food was prepared there for 30 pfennige (7½ cents), and Professor Voigt's model recipe could be carried out with twenty changes, in Munich, for that price. Voigt also calls attention to the actual nutritive value of the so-called relishes or seasoning, which impart an agreeable flavor to the food, and also to the animal gelatin to be extracted from bones and sinews, which protects the albumen in the body from decomposition. The excessive use of bread and potatoes should be combated by the broad influence of these people's kitchens.

In an able-bodied working man, the waste which should be supplied amounts to 118 grammes albumen, and 265 grammes carbon, partially in fat and partially in the carbohydrates. Of the carbon not more than 209 grammes should be carbohydrates, or bread, potatoes, and farinaceous food generally, and 56 grammes as fat.

The report concludes with Voigt's model recipes for the requisite amount of nutriment, but as these apply only to Munich, we will not reproduce them here.

The difficulty in prescribing any given regime, whether for health alone or for economy combined with health, is the great diversity of tastes which exists among every class and makes true the saying that "what is one man's food is another man's poison." It is seldom the case that the system is benefited by an article of food not demanded by the appetite, much less by food that provokes disgust or nausea, however perfect it may be from a scientific point of view.

Laundries Spreading Disease.

The London *Lancet* says that incidents confirming the belief that diseases are spread by laundries are constantly reported as occurring in England and on the continent. Clothing worn by diseased persons or persons who have died of infectious disease are washed together with other clothes. The germs thus sown soon propagate, until an epidemic is created, as has been several times the case. Too much care cannot be exercised in this respect. The clothing should either be burned or thoroughly disinfected and washed apart.

Cleaning Engravings.

Put the engraving on a smooth board, cover it thinly with common salt finely powdered; squeeze lemon juice upon the salt so as to dissolve a considerable portion of it; elevate one end of the board, so that it may form an angle of about 45 or 50 degrees with the horizon. Pour on the engraving boiling water from a tea-kettle until the salt and lemon juice be all washed off; the engraving will then be perfectly clean and free from stains. It must be dried on the board, or on some smooth surface, gradually. If dried by the fire or sun, it will be tinged with a yellow color.

Communications.

Our Washington Correspondence.

To the Editor of the Scientific American:

Notwithstanding the delay of business and various embarrassments resulting from the late fire, the receipts of the Patent Office for the month of October from all sources amounted to the large sum of $55,134.03, as against $53,147.82 received during the corresponding month of last year, an increase of $1,986.20. With two exceptions only, the receipts for the past month are larger than those for the same month of any year since the foundation of the Office. The grants of patents during the first ten months of the year do not, however, correspond with this, as the issues of all kinds fall over 1,500 short of those of the corresponding months of last year. The following shows the number granted during the year up to and including the last issue of October: Patents, 10,924; reissues, 481; designs, 604; trade marks, 1,042; labels, 291; total, 13,342, as against a total of 14,886 issued during the same period of last year.

PATENT MATTERS IN CONGRESS.

Some attempts are being made to shorten the life of patents, by the introduction of bills in Congress to accomplish this purpose. One was introduced by Mr. Pridmore, which enacts that "Every patent shall contain a short title or description of the invention or discovery, correctly indicating its nature and design, and a grant to the patentee, his heirs or assigns, for a term of seventeen years, unless the invention be upon an agricultural, horticultural, or mechanical implement or tool, in which case it shall only be for a term of eight years, of the exclusive right to make, use, and vend the invention or discovery throughout the United States, and the Territories thereof, referring to the specifications for the particulars thereof. A copy of the specifications and drawings shall be annexed to the patent, and be a part thereof. And no patent shall be reissued upon any article or improvement thereof to which the limit of eight years applies."

Another bill, introduced by Mr. Oliver, provides that hereafter patents shall be granted for ten years only, but may be extended for a further term of ten years under the provisions of the law regarding extension of patents formerly in force in extension cases. The total duration of any patent hereafter granted, however, must not exceed fifteen years.

THE COURT OF CLAIMS.

Senator Mitchell has introduced a bill extending the jurisdiction of the Court of Claims of the United States, which provides that, if the Secretary of War, Treasury, or Interior Departments, or the Postmaster General, or any other official of the United States, acting under authority from the head of any executive department or bureau, has used, or hereafter uses, in the public service, any invention upon which letters patent of the United States have been issued, by means of which the public service has been or is improved or benefited, the Court of Claims shall be vested with full and exclusive jurisdiction in and over all such cases. It further provides that either the complainant or defendant may appeal to the Supreme Court of the United States within ninety days after judgment or final decree shall have been made by said Court of Claims; such cases so appealed are to be preferred causes in the Supreme Court.

THE FRENCH EXPOSITION.

The House Committee on Foreign Affairs are holding daily sessions on the matter of the bill for providing for American representation at the Paris Exposition. The Secretary of State has sent a communication to the Committee, recommending an appropriation of $225,000, and suggesting also that the bill should contain a provision for transporting intended exhibits from interior cities to the seabord. Representative Hewitt has appeared before the Committee by invitation, and made some additional statements in advocacy of the legislation proposed by his bill on the subject.

Messrs. Salmon and De Stuckle, of New York, who claimed to represent many intended exhibitors, have also appeared and laid before the Committee the plans and regulations of the Exposition, and explained the location and dimensions of the American department. They also suggested that the number of skilled commissioners should be enlarged from fifteen to eighteen, allowing one artizan and one scientific man to each of the nine groups; and that the exhibitors should be given a voice in the selections of American members of the international jury.

PRESERVATION OF FORESTS.

Every now and then Congress takes a step in the direction looking to the preservation of the forests of the country, which are disappearing altogether too fast, but for some reason or other the bill hardly ever gets any further than the committee rooms, or if it should succeed in passing one house, it always fails to reach the other in time for action. Now, however, simultaneous action in both houses is proposed by the Forest Association of Chicago, which body presented memorials to both the House and Senate, setting forth the wisdom in appointing a commission to proceed to Europe to examine into the forests of European countries, with a view to make such adaptations of the Old World practices in regard to the preservation of forests and tree cultivation as may prove advantageous here. Some legislation, it is agreed by every one, is absolutely necessary to prevent the ruthless destruction of trees, and the Committee on Agriculture, to which the subject has been referred, can confer great advantage on the country by acting promptly, by reporting a bill of some kind, intended to further the objects of the association in the manner indicated in the memorials, or by some more direct legislation.

JUDICIAL CONSTRUCTION OF PATENTS.

An opinion of the Supreme Court of the United States has recently been made public, which appears to be important in view of the decisions of some of the circuit court judges, who seem to think that the proper way to construe a patent is by what is shown or hinted at in the specification, rather than what is covered by the claim. The case referred to was an appeal from the decision of Judge McKernan of the Eastern District of Pennsylvania, made in a suit brought by the Keystone Bridge Company *vs.* Phœnix Iron Company, for an alleged infringement of the first claim of Surville & Piper's patent of January 14, 1862, and the third claim of a patent issued to the same parties October 31, 1865. The point in controversy was the construction of the claims, which on their face appeared to cover only chord bars made, by upsetting the ends, when the bodies of said bars were *wide and thin*. The defendants' chord bars were of cylindrical form, so far as related to the bodies, but their ends were substantially like the plaintiffs', and the latter took the ground that they were not limited to the wide and thin construction, but to any form of chord bars in which the ends were upset like theirs. Judge McKernan, however, construed their patent in the exact terms of their claim, and as the defendants' did not make "wide and thin" bars, he held that they did not infringe; but waiving this ground, he further held that the claim of the patent being for "the use" in truss bridges, of chord bars constructed in the manner described, the method of making the same being disclaimed, and it appearing that the defendants had only *made* and *sold* chord bars, that they only did what they had a legal right to do, and did not thereby assume any responsibility for the wrongful acts of others. From this decision the plaintiffs' appealed to the Supreme Court, who affirmed the decree, but with reference mainly to the point as to whether the plaintiffs' should be held to the strict terms of their claims or not. Justice Bradley, who delivered the opinion of the Court affirming the decree, said that "When a claim is so explicit, the court cannot alter or enlarge it. If the patentees have not claimed the whole of their invention, they should have sought to correct their error by a reissue. They cannot expect the court to wade through the history of the art and spell out what they might have claimed, but have not. Since the act of 1836, the patent laws require that an applicant for a patent shall not only, by a specification in writing, fully explain his invention, but that he shall particularly specify and point out the part, improvement, or combination which he claims as his own invention or discovery. This provision was inserted in the law for the purpose of relieving the courts from the duty of ascertaining the exact invention of the patentee. * * * * This duty is now cast upon the Patent Office. There his claim is, or supposed to be, examined, scrutinized, limited, and made to conform to what he is entitled to. If the Office refused to allow him all he asks, he has an appeal. But the courts have no right to enlarge a patent beyond the scope of the claim, as allowed by the Patent Office, or the appellate tribunal, to which contested cases are referred. When the terms of a claim in a patent are clear and distinct (as they always should be) the patentee is always bound by it. He can claim nothing beyond it." The construction thus put upon the patent obviated the necessity of the court expressing an opinion on the other point made by the court below, namely, that the patents only covered the *use* of the chords in question in truss bridges, and not the *making* of such chords, which is all that the defendants are known to have done. The court therefore affirmed the decree of the court below, with costs.

The Supreme Court has also affirmed the decree of the Circuit Court for the District of New Jersey, in the case of Roemer *vs.* Simon *et al.* This was a suit for an alleged infringement of a patent to Roemer for an improvement in travelling bags, consisting in the application of two staples, or clamps, one at or near each end, to the frame of the bag, so that when packed the ends will remain closed. The defense was that the alleged invention was not original with the patentee, having been previously known to the public through a publication in London, from which it was alleged plaintiff had taken it and unjustly patented it in this country. The court below sustained the defense and dismissed the bill. It was contended in the appeal that the evidence should have been held sufficient to sustain the patent; that the patent itself is *prima facie* evidence that the invention was original with the patentee, which, supported as it was by a former adjudication, much stronger evidence than was adduced should have been required to overthrow the presumption in favor of its validity. Justice Clifford delivered the opinion of the court affirming the decree of the Circuit Court, with costs.

CROPS ABROAD.

The Commissioner of Agriculture has returns which indicate that, owing to the poor crops in England, that country will have to buy 104,000,000 bushels of wheat this year. The English crop was unusually poor this year, but on the continent of Europe there has been a fair general crop. In Eastern Europe the supply will not greatly exceed the demand, and it is certain the war will limit the exportation from Russia and Turkey. Egypt and India will have a larger surplus than usual, and will probably increase their shipments to Europe. Our export amounts now to 55,000,000 bushels, but the Commissioner thinks that this year we may be able to supply the entire British deficiency.

ENGLISH MANUFACTURES.

The State Department is constantly receiving reports from our Consuls, respecting the manufactures, commerce, etc., of the people where they are located. The Consul at Leeds, England, reports that our high tariff and home manufacturing have almost closed our markets against woolens and linens, which are their principal wares, the only demand being for a small quantity of the very highest class of woolens to meet the demand of those people who will have foreign goods no matter what price they have to pay for them. The decline of their exports, and the means to be taken to regain their former supremacy in this regard, are now the leading topics among the thinking people. Our Consul thinks that no effectual remedy can be applied, but that British commercial interests must decline, and that American interests will be affected in the inverse ratio. This is mainly owing to the perfection of our machinery, the style and finish of our goods, the results of the inventive genius of our countrymen, together with the acknowledged fact that our artizans will do a much larger amount of work in a given time than the English, which working together have not only shut out British manufacturers from our markets, but have enabled us to become a formidable competitor with England for the trade of other countries. A somewhat similar report comes from our Consulate at Lyons, France, which notes a decrease in the exports to the United States for the year ending September 30, 1877, as compared with the preceding year, of $1,522,835, which is a decrease of 15 per cent. The decrease in silk goods alone was more than 20 per cent of the whole export of these manufacturers. An increase in the export of raw silk to the United States of over half a million dollars (more than the entire export of the previous year) is noted as showing the large increase of our own manufactures. From our Minister to Holland we have a report containing some refreshing items in these days of bank and insurance failures, from which it appears that there has not been a bank failure in that country for forty years; that the paper money of the banks is equal to gold, and that, notwithstanding the rate of insurance does not average more than one half of one per cent, there is no such thing as a failure of a fire insurance company on record. First class railroad travel costs only a cent a mile, and yet the roads pay good dividends, as pilfering officials are scarcely ever heard of; and when they do shock the nation by turning up, they are severely punished and for ever disgraced. Dishonesty of any kind or failure in business means public dishonor, and utterly debars from any future public consideration. Four millions of people live within an area of 20,000 square miles, and all appear to be happy, prosperous, and contented; the secret of which appears to lie in the fact that all live within their income, and that industry and honesty are principles so firmly established that their violation is looked upon as an outrage on the national characteristics. From the Bahamas the consular report seems to show that our high tariff on salt and pineapples has a depressing effect on our trade with that region, as these articles have been hitherto the main export to the United States. The Consul thinks that if our high duties on these productions were abolished, an immense impetus would be given to the trade and industries of these islands, which would result in a large increase in our exports. Although it is not probable that under our present tariff any very great enlargement of the trade will be effected, yet even at present American manufactures are surely and steadily taking the ground of the British, and the islands rely upon us almost entirely for breadstuffs, salt provisions, tobacco, sugar, ropes, paints, oils, liquors, boots and shoes, and, latterly, American cottons are being exported. From our Consul at San Domingo we have a detailed account of the alleged discovery of the bones of Columbus in the Cathedral there, notwithstanding the fact that the bones of the great discoverer were believed to have been transferred to the Cathedral of Havana about 90 years ago, where they were supposed to have reposed ever since. If these are the true bones, the church authorities were guilty of fraud in palming off the bones of somebody else on the Spaniards for those of Columbus, and if not, they are trying to perpetrate one now. From Capetown, South Africa, it is reported that an International Exhibition is to be opened at that place next April, under the patronage of Governor Sir H. Bartle Frere, with an agricultural department organized on a grand scale. Diplomas of honor, with gold, silver, and bronze medals, will be awarded, and every facility will be given for the sale of articles exhibited, as well as for taking orders in the building. The exhibition will be divided into classes, which include foods, drinks, chemicals, perfumery, furniture, fabrics, sewing machines, domestic appliances, watches, jewelry, hardware, edge tools, cutlery, metals, agricultural implements, machinery, etc. Further information may be obtained by communicating with Edmund Johnson, delegate commissioner, at No. 3 Castle St., Holborn, London.

The Lighthouse Board gives notice that an automatic signal buoy has been placed off Cape Hatteras in 12 fathoms of water, Cape Hatteras bearing northwest by north, about 12 miles distant. The buoy is painted black and white in perpendicular stripes, and occupies the position of the buoy which disappeared from its moorings early in October.

Washington, D. C. OCCASIONAL.

TO MAKE hard tallow candles, use a mixture of mutton tallow 10 ozs., camphor ½ oz., beeswax 4 ozs., and alum 2 ozs.

New Inventions.

Setting up Music by Machinery is the subject of Mr. Hannibal Goodwin's (of Newark, N. J.) late invention. The idea is to produce plates by which in connection with any of the well known photolithographic processes music can be rapidly and economically printed. The music is set up on a grooved board and then photographed. The photograph is used for the production of photolithographic plates.

A new adjustable Rowlock has been patented by Mr. William B. Padgett of Batesville, Ark. The general arrangement is such that the oar works in a universal joint. The advantages are that the oar may be moved with less friction, lengthened or shortened as desired, easily attached and detached from the boat, and that it will not when left to itself catch on any obstruction.

An improved device for Measuring Beer and other liquors that foam when drawn has been patented by G. J. Cave and G. E. Nicholson of Elizabeth, N. J. In the bottom of an ordinary measure is a small box, in the top of which is a screw cap perforated with a small hole to allow the liquid to pass to the box. A short elbow is secured to the side of the measures and opens through a hole in the lower part into the box. A glass tube rests in the elbow, upon the upper end of which is placed a ring of rubber which is pressed down upon the glass tube by a plug. This plug has a hole formed through it, to allow the air contained in the tube to escape. The tube is surrounded by a case arranged with cross bars which serve as indices of the liquid within. If the tube is broken it can readily be replaced.

A useful as well as ornamental Cane patented by James Pool of Friendsville, Ill., is a curious combination of instruments. In the handle is a microscope, in the top a compass, in the center a spy glass, and on the outside a thermometer. All of these parts are readily detachable and fit snugly together.

A new Apparatus to Cleanse Feathers by steam has been patented by J. J. Van Alstine of Bristol, Wis. The feathers are placed in a double walled bottom chamber, having a series of perforations and containing perforated steam pipes and is provided with a double walled upper part. A reel agitates the feathers with a series of beater arms, which are held between flanged clamps on a prismatic shaft by means of transverse bolts.

An improved Counterfeit Coin Detector, patented by Mr. W. H. Rice of New York city, furnishes a convenient, compact and reliable device for pocket use, cash tills, etc. It has guide tubes gauged in length and width for coins of different denominations, in connection with a fulcrumed and weighted trip lever gauged to the weight of the genuine coins. A spurious coin if too large cannot enter the guide tubes, and if too light will fail to trip the trip-lever.

A new and useful Washing Machine patented by Louis Rivers of Auburn, Oregon, keeps the clothes supplied with fresh suds while being washed and also allows the dirty water to run off freely when squeezed out. By an ingenious combination of rollers, chains of slats, spring, etc., the machine washes the clothes, at a considerable saving of time and soap.

The forward end of an improved Last invented by J. R. Jacques of Hancock, Mich., is connected with the lower portion by means of dowels. The rear end of the upper portion is connected with a thumbscrew and the two parts are separated by wedges. This gives a simple yet strong construction.

A new Drawing Pen patented by Bethune Perry of Albion, Cal., makes a broken line instead of a dotted one. Upon the lower end of the handle is attached a spindle, upon the inner part of which is placed a sleeve to which a disk is secured. The middle part of the sleeve is fitted with a second disk which is held in place by a nut screwed upon the outer end of the sleeve. The two disks are placed with their concave sides opposite each other and are held apart by a rubber. Their edges have radial notches. By tightening the nut so as to prevent the sleeve revolving a continuous line is made; by loosening the nut, a broken line. A very useful implement for draughtsmen.

In an improved Sewing Machine Shuttle patented by H. J. Nott of St. Mary's, Texas, the shuttle case is fitted with a cap having a hook and catch for securing it to the shuttle, and a projection that holds the bobbin in place. The invention simplifies the operation of shifting bobbins and of threading shuttles.

A simple Button Swivel for connecting a tether with the ring of a head stall has been patented by Norman Brooks of Clifton, Kan. Upon the shank of the hook are two projecting arms forming a pivoted button. In using the device the button is turned lengthwise with the hook and passed through the ring of the headstall and the button turned sidewise.

In many Copying Books, the oil employed in making the leaves transparent soaks into the index and the back of the book, and spoils them. A new device has been patented by W. H. Ellis and W. McDonald of Brooklyn for obviating this. The body of the book consists of thin leaves, alternate ones being oiled to render them partly transparent. A half cover of enameled cloth is attached to the back cover which has elastic loops for envelopes. The index has a half cover of oilproof material to protect it from oil.

An improved Barrel Holder and Skid has been patented by G. W. Brown of Damariscotta, Me., which greatly facilitates the moving of barrels. The skid is made of two sections jointed and hinged so that they can be folded together, and is composed of cross bars and longitudinal bars rigidly connected together, so as to form an inclined plane. The upper section is hinged and pivoted inside of the curved side bars, forming a holding which receives and retains in place the barrel which has been rolled up.

An adjustable Switch for Ice Runs patented by H. F. Dernell of Athens N. Y., facilitates the handling of blocks of ice. At suitable points on both sides of the ice run flanges are omitted and lateral chutes constructed for conducting the ice into different houses, and fitted with flanged sides and grated bottom. The switches form a segment of a circle and are strongly braced.

A novel Top Prop for Carriages has been invented by Mr. Leonard Sawyer of Merrimac, Mass. The arrangement is such that the washers cannot turn on the bolt, and hence the nut and thimble will not be unscrewed by the action of the braces. The invention is an excellent method of securing parts very apt to work loose.

A simple and Automatic Wagon Brake is the invention of Messrs. W. L. Whitman and Ephraim Manes of Ringgold, Ga. The arrangement is such that the forward pressure of the wagon against the horses will apply the brake, while the wagon may be backed without the brake being thrown into action. The brake also acts as a clog to prevent the horses from starting.

Mr. Uel W. Armstrong of Evansville, Ind., has devised an ingenious Mosquito Net Canopy which consists of uprights to be attached to the bed which support a frame made in three pieces. The frame is easily folded into compact form, and the entire device may be quickly put up for use or taken down for storage. It has no detachable parts that are liable to get lost.

Mr. Henry Sutter of Baker City, Oregon, is the inventor of a new Breech-Loading Firearm in which one movement of the operating lever cocks the hammer, opens the breech block, and actuates the extractor, while the return movement of the lever closes the breech, locks the breech block, and pushes back the extractor. The barrels are fixed permanently in the stock.

A novel Vehicle Device for Checking Horses has been patented by Mr. Geo. L. Kenyon of Lonsdale, R. I. When it is desired to fasten the horse the end of the line is attached to a ring on a disk connected with the hub of one of the wheels. Should the horse start, the line is wound on reel arms and the bit pulled upon. Should the horse back, a pawl and ratchet connection prevents injury. This invention is both new and ingenious.

In a new Refrigerator patented by Mr. William P. Bradley of Mobile, Ala., there is a main box and an interior box forming an intermediate cold air space and closed by a water joint. The inner box contains ice chamber and water cooler, and by suitable devices the melted ice way may be drawn off. This refrigerator is claimed to reduce the consumption of ice to a minimum.

Mr. Frederick Dassori of New York city proposes a new Ceiling for Grain Vessels so as to make them safer and to protect the grain from damage or loss. The ceiling is carried up in a curve from water line to deck near the sides of the main hatchway and a lining of cloth or similar material is provided to prevent the grain sifting through and choking the pumps.

An improved Fire Escape that may be placed on the top or roof of a building and operated from below has been invented by Messrs. H. K. and Z. Warner of Lake City, Minn. On pulling a cord a catch is released, a platform drops, and a spool rolls down the chute thus formed and falls to the ground. A cord attached to this spool is now pulled and a rope ladder is thus hauled down. The object of the ladder is to furnish a convenient and readily adjusted means of access to the tops of buildings for the use of firemen.

A combined Sole and Toe protector for boots and shoes devised by Mr. Charles Nobs of Newark, N. J., consists of a sheet metal plate which covers and is screwed to the sole and has at its front end a tip portion. The object is to protect the sole and toe against wear and hard usage.

A new Meat Chopper by Mr. John C. Lloyd of Northumberland, Pa., embodies numerous ingenious improvements. The knives are adjustable so that they can be set forward as they wear, the springs may be adjusted so as to regulate the force of the chopping blow, novel contrivances rotate the meat box, and others turn the meat over to bring it into position to be operated upon by the knives.

Scientific Potato Culture.

A French agricultural journal, the *Basse Cour*, describes the result of some experiments in potato growing recently conducted by scientific men in Germany, in which it is demonstrated that the "eyes" at the top of the potato produce a much more vigorous offspring than those in the lower part, and the consequence is that those agriculturists who cut their potatoes in half before planting them are not well advised in cutting them vertically, but should always divide them horizontally, planting the upper half and using the other as food for cattle. But the best plan of all is to plant the tuber whole, cutting out, nevertheless, all the "eyes" except those in the top part.

Crystallized Boro-Manganese and the Action of Manganese in Blast Furnaces.

We find in *Comptes Rendus* a paper by Troost and Hautefeuille upon manganese, from which we abstract a few points, such as may prove interesting to our readers.

Manganese combines with boron more readily than iron does, for in making ferro-boron, or boride of iron, crystallized boron must be employed, while in making the boride of manganese it is only necessary to fuse boracic acid with carburetted manganese, Mn_3C, in order to obtain this substance in small grayish violet crystals. Analysis of these crystals showed them to be a definite compound of 1 equivalent boron and 1 of manganese; hence its formula is Mn Bo. The crystallized boro-manganese, if free from excess of manganese, dissolves in acid with the evolution of hydrogen gas. When heated to redness in hydrochloric acid gas it is but slightly attacked; it decomposes water only at 212° Fah. Alkaline solutions attack it at somewhat lower temperature. In contact with moist mercuric chloride (corrosive sublimate), in a few minutes it yields manganous chloride, boracic acid, and hydrochloric acid. Mercury cyanide also attacks it in the presence of water.

In a previous paper the authors stated (*Comp. Rend.*, LXXXI., 264) that their researches had established the fact that carbon and silicon form with manganese definite chemical compounds, while these same non-metals unite with iron only at higher temperatures and form far less stable compounds. Hence it would be interesting to ascertain whether boron, which is generally placed in the same group with carbon and silicon, acts in the same manner toward iron and manganese. Experiments upon the amount of heat evolved by the decomposition of boro-manganese and ferro-boron with mercuric chloride show that both of these substances are chemical compounds. Hence boron does not make such a distinction between iron and manganese as do carbon and silicon. (Here is an important distinction between boron and silicon, which also differ in quantivalence.) Experiments were made with two kinds of ferro-boron; the one which contained 11 per cent of boron was somewhat malleable, that with 23 per cent of boron was not malleable, but brittle and crystaline.

There are similar distinctions and analogies in the compounds of sulphur and phosphorus combined with both of these metals. We know that small quantities of sulphur or phosphorus combined with iron do not destroy its metallic lustre, but alter its malleability and ductility considerably. The sulphuretted and phosphuretted iron, which cannot be considered as sulphides and phosphides, act quite differently when considered thermetrically. Two kinds of sulphuretted iron, one with 1·8 per cent of sulphur, the other with 5·4 per cent, when treated with moist mercuric chloride, evolved respectively 810 and 840 units of heat per gramme. The metal with 1·8 per cent of sulphur, which is quite considerable from a point of view, evolved the same quantity of heat as pure iron, while the other with 5·4 per cent sulphur evolves more heat than the latter. Iron containing phosphorus acts totally different. Two samples of iron, containing respectively 5 and 10 per cent of phosphorus, when treated with mercuric chloride, evolved 790 and 480 equivalents of heat per gramme. From this it is evident that the combination of iron with phosphorus takes place with a great evolution of heat, and that a permanent chemical compound is formed. The sulphuretted iron is comparable to the silicuretted iron, which is formed without scarcely any evolution of heat. We know, too, that sulphur is far more easily eliminated from iron than phosphorus. The sulphur and phosphorus compounds of manganese, prepared from manganese that contains carbon, are attacked with difficulty by moist mercuric chloride, which is a sign that they are formed with a great evolution of heat, and are therefore more stable compounds than the corresponding iron compounds.

The results of these and previous experiments upon the thermic relations of iron and manganese compounds leads to the conclusion that the manganese used in treating impure iron forms with the foreign substances compounds which are dissolved in and distributed through the mass of metal, and they render purification easier because they impart to the elements which are to be eliminated the oxidizability of the corresponding manganese compounds. At all events, this is frequently the case; but the manganese also plays another and simpler part, namely, it acts at the same time as the reducer of the oxide of iron.* In different metallurgical operations the elimination of the sulphur and and phosphorus, if carried far enough, requires a long protracted oxidation, which produces an iron which contains oxide of iron. By adding ferro-manganese, which is always rich in carbon, the necessary amount of carbon is added to the iron, and at the same time the oxide of iron is reduced with an evolution of heat, both by the carbon and the manganese.* The oxide of manganese produced is distributed through the metal, but does not impart to it the injurious properties that oxide of iron would, for it passes almost completely into the slag and takes the impurities with it. Hence, whether the manganese is already in the metal to be purified, or is added during the refining, its importance always consists, first, in the formation of compounds, the formation of which is accompanied by more evolution of heat than the corresponding iron compounds, and second, in the ease with which these compounds go into the slag, because they oxidize with the evolution of more heat than those which contain an equal quantity of iron, especially when, as is always the case in metallurgy, they are mixed with a large amount of the metal in excess.

* Not only have manganese and carbon the power of reducing the oxide of iron in molten iron, but silicon likewise will perform this function, and but for the danger of introducing an excess of silicon, which would then remain unoxidized to the detriment of the iron, this element could be substituted for manganese in the Bessemer process, by making use of ferro-silicon instead of ferro-manganese. The question of the practical use of silicon in metallurgy cannot be considered settled yet, and offers an interesting field for investigation.

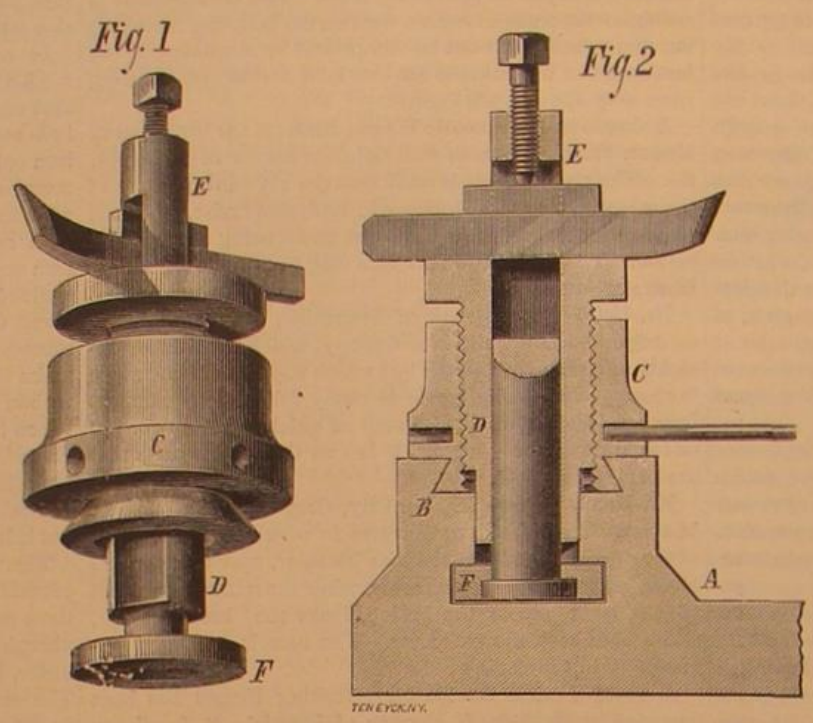
IMPROVED TOOL POST FOR LATHES.

We illustrate herewith a new tool post for engine lathes and similar tools in which the support is made in two parts, the upper part being screwed into the lower one and capable of being raised or depressed by turning said lower portion. The lathe tool is clamped by a set screw in the post in the usual way. Fig. 1 is a perspective and Fig. 2 a sectional view of the device.

A is a portion of the tool carriage of a lathe which is provided with the usual T-shaped slot, and with a V-shaped grooves, B, at the sides of the slot. C is a nut having a V-shaped flange to fit in said grooves, and turning therein. To the nut, C, an external sleeve, D, is fitted, which is flattened at its lower end and inserted in the T-shaped slot. It also has a flange at its upper end for supporting the tool. The post, E, has the usual mortise to receive the tool and set screw for binding the same. At its lower end a plate, F, is fitted and enters in the wider part of the T-shaped slot. By turning the nut, C, by means of a lever inserted in one of the holes made in the nut for the purpose. The sleeve, D, is raised or lowered as may be required, and the tool is clamped upon the top of the sleeve by the set screw in the post.

The device is of strong construction and the tool is rigidly held, while at the same time being easy of adjustment.

Patented through the Scientific American Patent Agency, October 2, 1877. For further particulars address the inventor, Mr. Robert Neasham, Mount Washington, Pittsburgh, Alleghany county, Pa.



NEASHAM'S TOOL POST FOR LATHES.

To Transfer Engravings on Glass.

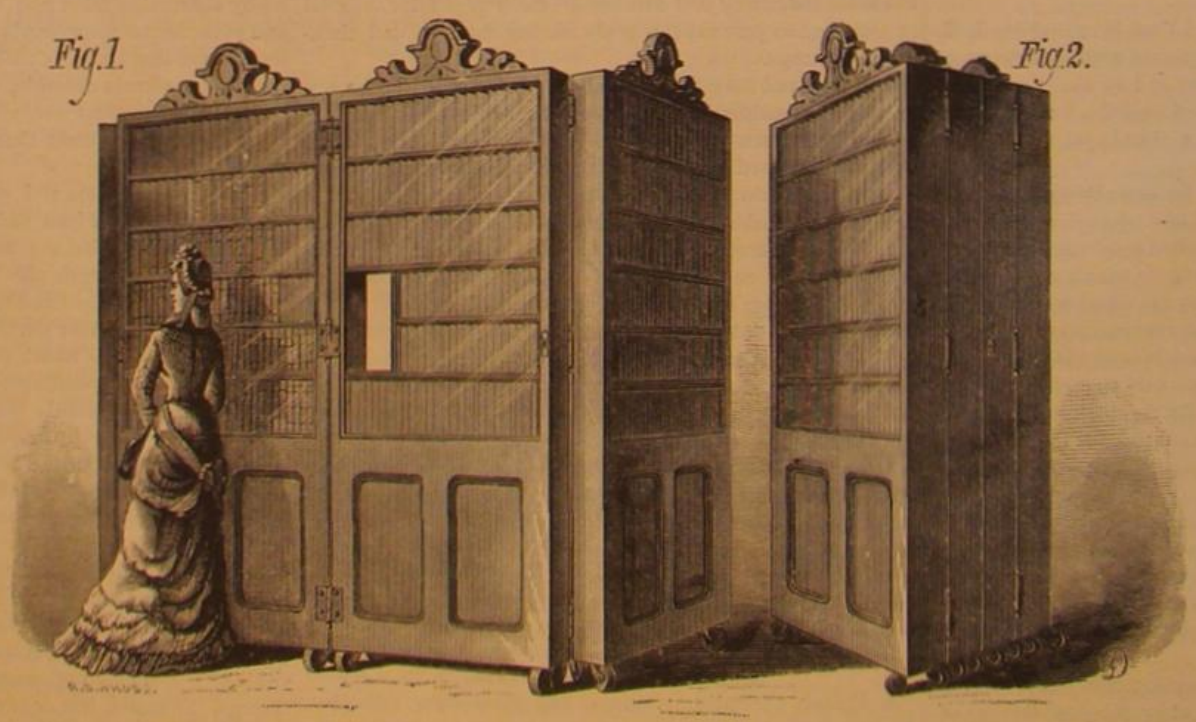
Metallic colors, prepared and mixed with fat oil, are applied to the stamp on the engraved brass or copper. Wipe with the hand in the manner of the printers of colored plates; take a proof on a sheet of silver paper, which is immediately transferred on the tablet of the glass destined to be painted, being careful to turn the colored side against the glass; it adheres to it, and so soon as the copy is dry take off the superflous paper by washing it with a sponge; there will remain only the color transferred to the glass, which will be fixed by passing the glass through the ovens.

HILL'S FOLDING BOOK CASE.

The folding book case, of which we present two views, consists of a central section and two end sections hinged to the former at the rear edge. The upper portion of each section of the case is divided by a series of horizontal and vertical partitions, into small compartments, each intended to receive a book, and each numbered to correspond with the number of the book for which it is the receptacle.

In front of these compartments each section is glazed. The books are arranged within with their backs to the front, so that the titles can be discerned through the glass. In the lower portion of each section are large compartments for books, papers, etc. The library is used by placing the side sections at right angles to the central section. The librarian stands in the inclosed space, removes books from the back and passes them through the aperture indicated in Fig. 1, to the applicant. Fig. 2 shows the book case folded up when not in use. The books are thereby protected from injury by dust, and the case itself is easily stored away, and being provided with strong casters is readily moved.

The invention is especially intended for circulating and Sunday school libraries, but would also be a convenience in private houses. For further particulars apply to the inventor, Charles F. Hill, Hazleton, Pa.



HILL'S FOLDING BOOK CASE.

On Bleaching Shellac.

BY JOSEF MARIA EDER.

The greater part of the colorless shellac which is used is bleached in the alcoholic solution, because these varnishes give a good polish, and warrant that the metallic articles covered with them will remain bright. There are, however, in the market considerable quantities of solid bleached shellac, and its practical preparation is not unimportant.

The method of bleaching with alcohol and chloride of lime, given by Field in the *Polytechnisches Notizblatt* (1852, p. 23), and by Wittstein in *Dingler's Journal* (1857, CXLIII, 467), as well as those of Lunning and Elsner, with alcohol and animal charcoal, are not applicable to solid shellac owing to the high price of alcohol and the difficulty of its recovery. Kressler's method is more practical, in which the shellac is dissolved in aqueous soda solution and bleached with hypochlorite of soda. Sauerwein modified Kressler's process by the addition of sulphite of soda to the above named reagents.

According to my experiments, the following process is practically especially to be recommended, and can also be carried out on a large scale, according to my directions.

Ten parts of pulverized shellac is dissolved with four parts of crystallized soda in 120 to 150 parts of hot water in a copper kettle, and the violet solution, the color of which is due, according to Marquart and Nees Von Esenbeck, to a coloring substance similar to carmine, is filtered through linen into a wooden vat. Ten parts of chloride of lime (containing about 30 per cent chlorine) is triturated with a solution of 10 to 20 parts of crystallized soda in 200 of water, and this bleaching solution filtered into the shellac solution. To the mixture when cold, dilute hydrochloric acid is added carefully until some shellac begins to separate in crumbs; in most cases only a very little acid is required. This little dodge, suggested by Sauerwein, in fact, hastens the bleaching in no small degree. After two or three days, whether the solution is kept in the dark or in the light, the bleaching is finished. The shellac is then precipitated by the addition of concentrated hydrochloric acid.

If a comparatively pure natural shellac is to be bleached, this white crumbly precipitate is at once collected upon coarse linen, thoroughly washed with frequent stirring, and then melted together. Impure shellac is left standing for several hours in the liquid, after having been precipitated with hydrochloric acid. The liberated chlorine acts very energetically; yet it is preferable to allow the bleaching to proceed in the alkaline solution. The finely divided shellac, if it remains very long in the acid chlorine solution, becomes brittle, and cannot be drawn out so well. Inferior grades of bleached shellac are obtained by using half the quantity of chloride of lime above prescribed.

The precipitated shellac is put into boiling water, when it becomes soft, and can be moulded in any desired form. At first it is porous and not transparent, but repeated warming, and strong kneading and pulling, impart to it a beautiful silky gloss.

In spite of the greatest cleanliness, which is absolutely necessary, it is scarcely possible to prevent the surface becoming yellowish; if the bleaching did not succeed perfectly the whole mass has a yellowish shade. To improve the appearance of the ware, the drawn and moulded shellac is put for some 24 hours in the acid chlorine liquid, from which the precipitated shellac has been strained out. It is used before being diluted by the wash water; if necessary, some more chloride of lime is added. By this means a chalk white surface is obtained. This white layer also possesses this advantage, that the shellac can be kept a long time without changing its appearance; for it does not change, as all bleached shellac will, and that too throughout the whole mass. Finally, the silky lustre is greatly enhanced by brushing the surface. This silky appearance cannot be obtained by chemical means. According to Berzelius, by a short immersion in strong ammonia, the surface swells, and when dry, has a strong lustre, but instead of being silky it is resinous. The white color of product changes under this treatment to yellowish, and cannot be restored by the above mentioned process of after-bleaching.

The shellac thus prepared dissolves rapidly in alcohol, and the solution is perfectly colorless. Previous sweiling of the shellac in ether is superfluous. With freshly bleached shellac, a milky turbid varnish is frequently obtained, which does not clear on standing a long time, as observed by Jacobsen and Peltz. The cause of this is the insolubility in alcohol of a resin which is contaminated in the crude shellac, as shown by Unverdorben (*Pogg. Annalen*, XIV, 119), and by the wax in the shellac (*Ann. Pharm.*, CXXXI, 286). The method proposed by Peltz, of extracting this substance with petroleum ether, I do not consider commendable, for the reason that such varnish dries brittle. Shaking the solution with pulverized chalk, or gypsum, accomplishes the clarification in a few hours, and the clear solution can readily be drawn off.

Polish prepared with such bleached shellac is more brittle than if it is bleached with spodium, and hence the latter is to be preferred for fine cabinet work. On the other hand, if the shellac is only sufficiently washed there is absolutely no rusting of metals varnished with it.—*Dingler's Journal.*

A Brilliant Meteor.

To the Editor of the Scientific American:

Thinking it to be of interest to you, I send you the following description of the fall of a meteor which I observed last evening, November 11, 6.30 P.M. Direction N. N. E. Altitude at commencement of course about 30°. Length of course from 10° to 12°. Time of falling about 8 seconds. It fell towards the west, making an angle in falling to the earth of about 65° with the vertical passing through the body. During the latter three fourths of its course, its length, including the luminous trail, was about one half of a degree. The nucleus was very brilliant; its color at first a yellowish-white, then a light green, and lastly a greenish yellow. Could its color have been due to boron, thallium, etc.? I find no record, in any of the numerous analyses of meteoric stones, of the presence of elements likely to give the green color.

ROBERT C. HINDLEY.

Racine College, Wisconsin, November 12, 1877.

Kangaroo Leather.

Kangaroo hides have already become an important article of export from Australia. They make the most pliable leather that is known, admirably fitted for bootlegs, gloves, and riding whips. The skins are sent to Europe, some tanned, and some simply dried.—*Fortsch. d. Zeit.*

A GOOD waterproof cement may be made by mixing glue 5, rosin 4, red ocher 3 parts, with a little water.

THE CAPERCAILZIE.

The capercailzie, or cock of the woods (*petrao urogallus*), is one of the largest and finest members of the grouse family. In size it is nearly as large as the turkey. The color of the male bird is a rich chestnut brown covered with a number of black lines irregularly disposed; the breast is black with a gloss of green, and the abdomen is simply black, as are also the lengthened feathers of the throat and tail. The female is distinguished by bars of red and black, which traverse the head and neck, and the reddish yellow barred with black of the under surface. The bird was once a common inhabitant of the highland districts of Great Britain, but in that locality it has become very rare, its habitat being restricted to the northern parts of the continent of Europe, Norway and Sweden.

The engraving of the capercailzie, given herewith, represents a male bird uttering the curious calls which it makes during the pairing season. Stationing itself on the branch of some lofty tree, at sunrise or just after sunset, it droops its wings, ruffles its feathers, and spreads its tail, like an angry turkey cock. The call is represented by the syllables "*peller peller*," and these are repeated at first at some little intervals; they gradually become more rapid until at last, after the lapse of a minute or two, the bird makes a sort of gulp in its throat, and finishes by a strong inhalation of the breath.

The nest of the capercailzie is made on the ground and usually contains from eight to ten eggs. When hatched, the young are fed upon insects, more especially ants and their pupæ. The adult birds feed mostly on vegetable substances, such as juniper, cranberries, and the leaves and buds of several trees.

THE CAPERCAILZIE.

Arsenic in Vulcanized Rubber Stoppers and Tubes.

It is well known that vulcanized rubber is unfit for several kinds of experiments, such as where it is required to determine the sulphur in gases and other substances, where the rubber may give up some of its sulphur to vitiate the results. Filhol has also found arsenic in rubber stoppers, which makes them unfit for use in testing for this poison. In Schneider's test the arsenic is converted into the volatile arsenious chloride by distilling the substances with a mixture of common salt and sulphuric acid. In making this test, in a flask closed with a perforated rubber stopper, through which the gas delivery tube passed, he found sulphur in the distillate. He suspected that the arsenic was derived from the rubber stopper, and therefore repeated the test without the use of any rubber, and found no arsenic. He also found that hydrochloric acid gas, when passed through vulcanized rubber tubes, also took up perceptible quantities of arsenic. The author does not state the color of the tube nor name of manufacturer, which is of some importance, as the arsenic was probably an accidental and not intentional constituent of that particular rubber, and was contained in the sulphur.

Burning Iron Castings Together.

The usual mode is by imbedding the castings in the sand, having a little space left vacant round about the joint where it is to be burned. Two gates must then be provided, one lying on a level with the lower side of this space and the other raised so that the metal; which must be very hot, is poured in at the higher one; it passes round, fills the space, and runs off at the lower gate. A constant supply of metal is thus kept up, till the parts of the casting are supposed to be on the eve of melting. The lower gate is then closed, and the supply stopped. When cool, and the superfluous metal chipped off, it forms as strong a joint as if it had been original.

Printing Pictures from Prints.

The page or picture is first soaked in a solution of potash and then in one of tartaric acid. This produces a perfect diffusion of crystals of bitartrate of potash through the texture of the imprinted part of the paper. As this salt resists oil, the ink roller may now be passed over the surface, without transferring any ink except to the printed part.

A LITTLE alum added to saffron in soft hot water makes a beautiful yellow ink.

Improved Air Pump.

In a new form of the Sprengel air pump, described in a paper at the British Association by C. H. Stearn and J. W. Swad, the mercury reservoirs at the top and bottom of the pump are closed, so that the external atmosphere exerts no pressure on the surface of the mercury contained within them. In consequence of this the fall-tube may be much shortened while the efficiency of the instrument is retained. At the commencement of the exhaustion of a receiver the mercury supply reservoir is filled to the top and closed by a stopper; a small exhausting syringe attached to the reservoir at the bottom of the fall-tube is then set in action, which removes a considerable portion of the air from the receiver to be exhausted, and also very much reduces the pressure on the mercury in the lower reservoir; the flow of mercury through the pump rapidly completes the exhaustion. A small vacuum tube with aluminium wires a quarter of an inch apart was exhausted in twelve minutes to such an extent that an induction coil, giving sparks half an inch long in air, failed to produce the faintest luminosity, the fall-tube of the pump being only nine or ten inches long.

Restoring Burnt Cast Steel.

The following recipe has been well recommended: Borax 1¼ lbs., sal ammoniac ¼ lb., prussiate of potash ¼ lb., resin 1 oz. Pound these ingredients finely together, add a gill each of water and alcohol, and boil all to a stiff paste in an iron kettle. Do not boil too long or it will become hard when cool. The burnt steel is dipped while hot in the composition and slightly hammered.

Plaster Casts.

Not long the Prussian Ministry of Commerce and Manufactures offered prizes for the best and most simple methods of so treating ordinary plaster of Paris casts, by chemical or other means, as to render them capable of being washed, and at the same time to close the porous surface of the plaster, that dust might not penetrate its mass.

Plaster casts, even after having been thoroughly treated with stearin, are soluble in water to a very considerable degree. One need but tint the water with bluing or some similar color, and the gradual softening and solution of the plaster can be readily followed by the eye. A more striking illustration is had by stirring together a thick cream of plaster with gelatin previously treated with chromic acid, and letting them harden. When soaked a while in water the plaster wholly disappears, is dissolved away, and leaves a sponge-like substance of the insoluble gelatin. From these experiments it is seen that plaster casts, though saturated with stearin, should never be washed.

A method hitherto much used is to paint the plaster with oil color; but, apart from changing the appearance, the paint fills up the cavities, and, especially when the cast is a relief, blurs and destroys all its delicacy and exactness. On architectural plaster ornaments for interior decoration, capitals, cornices, etc., painting may be tolerated; but on all reproductions of sculpture, even a single coat of paint is inadmissible. Dr. Reissig, of Darmstadt, has, by two different processes, succeeded in transforming plaster of Paris into chemical combinations entirely insoluble, not only in water but in soft soapsuds. The first method, simplest and cheapest, is based on the fact that sulphate of lime (plaster of Paris) is changed by baryta water into sulphate of baryta, and a caustic lime gradually transformed by the action of the air into a carbonate of lime, as we know from the similar action in plaster and mortar. Baryta water is prepared by slacking together in a securely corked bottle, one part crystallized hydrate of baryta, with about twenty parts rain water, thus forming a saturated solution. After it has cleared, it is sponged or is poured over the plaster as long as this continues to absorb it. If after the cast has been dried by a moderate heat, the plaster continues to accept the wash, the sponging may be repeated; but this is seldom the case. This treatment, besides hardening the cast, gives it a whiter and clearer appearance.

The second method consists in changing the sulphate of lime, by the use of a weak alkaline silicate of potash, into lime, an exceedingly hard and durable substance. To obtain the potash silicate, water containing about ten per cent of caustic potash (pure and free from iron) should be heated to the boiling point, when so much silicic acid is added as will dissolve itself therein. In cooling, pipe clay and silicate of potash are generally precipitated in some degree. The liquid should be preserved in corked bottles until entirely clarified. Immediately before its use a small piece of pure potash should be thrown into it; or in its place, one or two per cent of potash may be added. The silicification itself is effected by dipping the plaster for a moment into the bath thus prepared; or, if the cast is immovable, by applying it with a sponge or an atomizer. When the surfaces to be covered are large, the liquid may be diluted with rain water. After the almost instantaneous chemical change has taken place, the superfluous solution should be carefully removed by washing with soapsuds. Some little experience is necessary to decide the exact time of exposure to the solution of this second method; but by practice it may soon be judged by the smoother and firmer appearance of the plaster, and by its hardness as felt by the finger nail. The fresher the plaster, and the more porous the cast, the more quickly should the bath be employed. Casts made of old plaster cannot be silicified to advantage. After having been treated by either of these processes, plaster of Paris casts will not be in the least dissolved by washing with water or soapsuds; but, though their surfaces are no longer sulphate of lime, yet they still retain their original porous nature, and readily absorb dust and the dirty water of the first washing. To obviate this, they are finally coated with an alcoholic solution of common soap, which, after the evaporation of the alcohol, entirely stops up the pores, and much facilitates the washing. It may be prepared by dissolving one part of bar or Castile soap in ten or twelve parts of alcohol; or it may be had of apothecaries under the name *spiritus saponatus*. This latter, however, is generally prepared with alcohol of a low grade. A little more expensive, but much better filling, is to be had by dissolving steatite of sodium in pure spirits of wine; this gives a really beautiful transparent tone to the plaster, and is highly to be recommended. The application of both is the same, it being necessary, if possible, to warm the cast, that the solution may be well absorbed; a repetition of the process is desirable. With the evaporation of the alcohol the operation is completed; the cast is in effect vitrified without coating its surface.

THE PROBOSCIS AND LANCETS OF THE STABLE FLY.

BY J. MICHELS.

During one of the annual plagues of the house flies, I was much surprised to notice one of these little creatures escape from my hand, which had just received quite a sharp wound, such as would be delivered by some lancet-bearing dipterous insect.

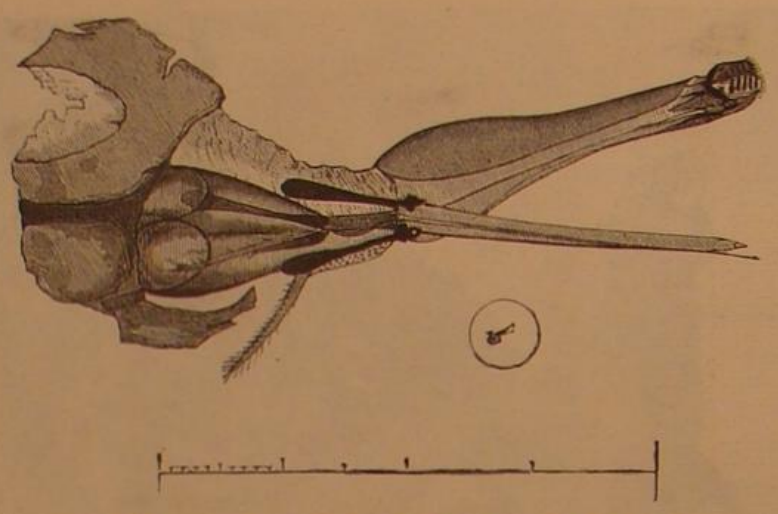
Being very familiar with the anatomy of the common house fly (*musca domestica*), and knowing it to be incapable of such an act, I determined to secure the next specimen that informed me of its presence in this emphatic manner.

The following day the opportunity came, and when my little visitor had recovered from the alarm caused by the rather sudden withdrawal of my hand, he soon returned when my wrist was courteously placed at his disposal, and he now, without interruption, leisurely regaled himself at my expense.

I now made my observations and found that, although the fly closely resembled and, to the casual observer, would probably be mistaken for one of those with which we are all but too familiar, and whose apparent hostility to the nervous, the irritable, and bald has furnished "Leech" and other caricaturists with a subject for many a sketch, still, on closer observation, the well known proboscis of the house fly, terminating with a lobe, was absent, and in its place a sharp pointed tube-like instrument was seen.

Death by an overdose of chloroform, followed by a dissection of the parts that appeared novel, was soon accomplished, and the same, after proper preparation, permanently mounted in balsam in the usual manner.

A microscopical examination, with a good 1 inch objective, at once revealed the formidable nature of the apparatus at the command of this innocent-looking fly.



THE PROBOSCIS AND LANCETS OF THE STABLE FLY.

As a good drawing saves a long description, I offer one made by "*camera lucida*," which faithfully represents the proboscis and lancets thus prepared, the object in the small circle showing its real size.

I would direct attention to the strong bayonet-looking lancets, and the powerful muscular levers that propel them at the will of the insect; these lancets, called "*setæ*," vary in number from 8 to 2. After dissecting many specimens of the fly in question, I never observed more than two. The proboscis is doubtless a powerful sucking apparatus, the ferocious-looking jaws with which it terminates being arranged to expand and fasten upon the wound made by the lancets.

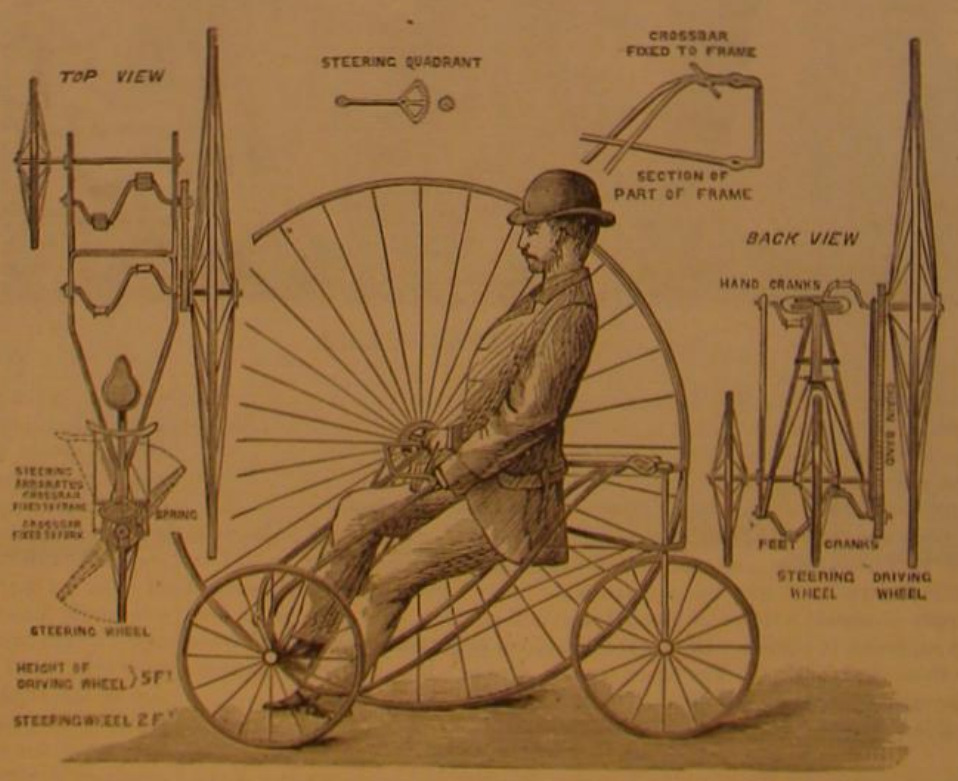
The brush-like appendages, called "*maxillary palpi*," will also be noticed, one of which, in the drawing, is somewhat hid at the base of the proboscis.

I apprehend this fly is the stinging stable fly (*stomoxys*) which sometimes goads horses almost to madness by their severe and incessant punctures. They are clearly not particular in their diet; and wandering into private dwellings and horse cars, attack the first they approach.

IMPROVED TRICYCLE.

We select from the *English Mechanic* the accompanying sketch, with its details, of the Bradford tricycle. It is operated by both hands and feet. The feet rest upon cranks that drive a shaft placed in the lower portion of the framework, and as this shaft is rotated, it communicates motion by means of a chain band to the large 60 inch driving wheel. The shaft of this driving wheel has two cranks, which, being engaged by the hands of the rider, materially assist locomotion. A steering wheel 24 inches in diameter is placed in the rear, being attached to a vertical rod; its upper end being provided with a small gear wheel meshing into the geared arc of a lever, the opposite end of which, formed like a fork, partially encircles the body of the rider. By inclining the body to the right or left, this lever, turning on its pivot, produces a corresponding turning of the steering wheel.

By the arrangement of the tricycle, it may be propelled by either hands or feet, at the option of the rider, or the simultaneous action of both hands and feet may be employed.



THE BRADFORD TRICYCLE.

Separation of Nickel and Cobalt.

The separation of nickel and cobalt has hitherto been a somewhat difficult operation, but by the new method, which I made known a short time ago, this is effected easily and rapidly. The following method of detecting and isolating minute quantities of nickel in commercial chloride of cobalt, supposed to be pure, will give an idea of its practical nature: A few grains of that salt are dissolved in water, and the whole of the cobalt precipitated, with the nickel, by xanthate of potash employed in slight excess, and previously dissolved in a little distilled water. A few drops of ammonia are then added, just sufficient to render the liquid slightly alkaline, and the dark green xanthate of cobalt is collected on a filter. The whole of the nickel is in the filtrate, and the whole of the cobalt in the filter. The nickel in the filtrate is precipitated by a few drops of sulphide of ammonium.

Character of xanthates.—Besides the yellow precipitate which the soluble xanthates give with salts of copper, all the insoluble xanthates, on dissolving in nitric acid, give rise to nitrous ether, which is readily recognized by its odor. —*Dr. T. L. Phipson, in Chemical News.*

Repairing Gas Bags.

When small leaks occur in bags used for gas to supply a magic lantern, they can be closed with thick boiled glue mixed with glycerin, in the proportion of 1 part of glycerin to 4 of glue, applied warm to the bag while filled with air. If too much glycerin is added the cement will be sticky, which can be overcome by strewing powdered soapstone over it; if too little glycerin is added, it is too hard. If the holes or rents are large, the glue is made quite stiff and applied to strips of soft leather and this applied as a patch. Glue is better for this purpose than caoutchouc or gum.

New Mechanical and Engineering Inventions.

An improved form of Tubular Bridge has been devised by Mr. George E. King, of Des Moines, Iowa. The posts, counter braces, and lateral braces, are connected to a tubular arch by pins passed through angle irons rigidly secured to the arch, and also to eyes formed on the posts and braces. The advantage of this arrangement is that the tube is not weakened, nor so perforated that moisture can enter between the joints of the plates.

In the Manufacture of Twist Drills, it is required to clear them or reduce them in diameter from the cutting edge of the spiral. The drill is held in a spindle. A finger engages the spiral slot in the drill as the latter is moved downward, so that it is always kept in proper relation with the cutter, the inclination of which may be varied as desired.

Messrs. George and Samuel Isaacs, of New York city, propose a new Rail Cleaner for cars, which consists of improved bushes, which are held down by levers, upon the track in front of the wheels. Arrangements are provided to prevent the brush head turning out of true, and the tufts are so fastened in the heads that the bristles are prevented from becoming cut or broken. This device is well suited for use on street cars.

An improved Hand Loom has been devised by Messrs. W. P. Clements and Jas. H. Cagle, of Davidson River, N. C. The new features include a shuttle box and throwing apparatus, and a new heddle construction. When the batten strikes the cloth, the weight of the shuttle and clamp piece relieves all pressure from the shuttle, so as to facilitate the throwing of the same, and the arrangements are such that when the operator has to stop, to tie a thread or for any other cause, he can instantly go on with the work without being required to find the treadle in which he left off work.

An improved Pipe and Bar Cutter, which cuts off the pipe or bar very quickly and smoothly, has been patented by Mr. Jesse Astall, of Galveston, Tex. By simply turning a hand nut the cutter is fed forward. There is a device for holding the pipe very securely as the piece is cut off.

A new Zinc Smelting Furnace has been devised by Mr. Octavius Lumaghi, of Collinsville, Ill. The new feature consists in constructing the back wall of the furnace with holes through it. Removable plates are provided in combination with retorts through their butt ends, for allowing a circulation in them when desired. In smelting, all that can be got in the form of spelter is thus obtained, and then all the zinc that remains in the retorts in the form of oxide is extracted.

Mr. James Craik, of La Cross, Wisconsin, proposes a new Bail and Driver for Millstones, which carries the stone with a positive motion, and at the same time permits the stone to poise itself with the utmost freedom on the top of the spindle. The construction is both simple and ingenious.

A new Car Brake, devised by Mr. Jacob J. Anthony, of Sharon Springs, N. Y., comprises a cylinder containing pistons, which are forced apart by steam, water, or air, under pressure. By this means levers are moved so as to force the brake shoes against all the wheels simultaneously, and with an equal pressure on both sides of each wheel.

A new Leather Rounding Machine has been devised by Mr. Thomas S. Reed, of Calais, Vermont. The upper roll has one of its journals supported in a pivoted and the other in a sliding box. This facilitates the purpose of the machine, which is gradually to compress the leather by passing it through different grooves until it has attained the required diameter.

For moving cars about in car shops, yards, etc., over short distances, Mr. Andrew Lebus, of Flora, Ill., has contrived a simple and powerful Jack. A clamp is secured to the car sill, and a plate having a V-shaped notch is applied to the rail. A lever is then moved, throwing a rod forward, which propels the car. The lever is then moved backward, the plate takes a new hold, and the operation is repeated. This invention will doubtless prove of much utility.

A new Ballast Distributing Car, for ballasting a railroad track with broken rock, gravel, sand, etc., has been devised by Mr. Adam B. Dockstader, of Sherman, Tex. In the bottom of the car are a number of spouts, which are closed by a series of pivoted boards, which may be moved simultaneously by a lever from the platform. With this construction the ballast can be discharged as desired while the train is in motion. This will doubtless materially facilitate labor.

A novel Mail Bag Catch, for taking mail bags and delivering them from a car while the latter is in motion, has been patented by Mr. George F. Shaver, of Westfield, N. Y. A rod on the car seizes a bag suspended from the roadside crane, while another rod on the latter, at the same time, takes a bag suspended from a frame attached to the car. The bag entering the car slides inward and strikes a curtain, so that it is subjected to no injurious shock.

Those of our readers who may desire further information concerning any of the above described inventions, can obtain the same by communicating with the inventors at the addresses named.

New Building Inventions.

A novel Eaves Trough Machine, devised by Mr. William J. Barber, of Covington, Ind., forms the trough of metal by causing the sheet to pass through suitably shaped rollers, which give it the necessary turns and beadings. This is a very simple and ingeniously constructed machine.

A new Vault Cover and Railing has been invented by Mr. Clarence H. Straight, of Bryan, Ohio. It consists of racks, which may be turned downwards to rest upon the pavement or floor, and so to close the opening, or to turn upwards to serve as a railing for the same.

For Holding Window Sashes in any desired position, Mr. Zelotes Curtis arranges toothed eccentric cams, that are pivoted to the casing of the fastener and operated by bell crank levers, which turn on a common pin, and are acted upon by a spiral spring. This device retains the sash securely and is very easily operated.

Mr. Daniel T. Keeffe, of Glens Falls, N. Y., also has devised an improved Sash Holder, which sustains the window at any height without the use of cords or weights. A roller is provided with a flanged bearing frame that is acted upon by a helical spring. This is combined with a screw-threaded plug, which enters the casing. The roller, by friction, holds the sash as desired.

Those of our readers who may desire further information concerning any of the above described inventions, can obtain the same by communicating with the inventors at the addresses named.

SCIENTIFIC AND PRACTICAL INFORMATION.

BY MR. T. C. PLELSEY, OF IQUIQUE, PERU.

NEW SOURCES OF SUPPLY FOR TANNING MATERIAL.

The Liverpool Chamber of Commerce recently stated that the supply of material for tanning leather was falling short in England, and called for information as to where fresh sources of supply might be discovered. In the province of Baldivia, in Chili, there exists almost impenetrable forests of trees of considerable variety, among which there are not only such (as the "lorontilla" and the "ulma") as would make a splendid addition to the beauty of English—and other moist temperate climates—parks and gardens, but great numbers of a fine large tree, the "luigue," considered to be a species of oak, the bark of which is used for tanning leather at a German tannery of some importance, long established on the river bank opposite the city of Baldivia. It might be profitable to search in that locality for the required supply of tanning material, as there is a good prospect of success, and the certainty of finding other elements both of utility and ornamentation. Inducements are held out by the government for colonization, and labor at present is not dear.

PREPARATION OF BROMIDE OF AMMONIA.

Place in a good sized bowl containing some liquid ammonia a teacup containing bromine, covering all with a sheet of glass. The bromine vapors first settle down, and are followed by the more expansive ammonia; they become rapidly converted into the bromide, whose pure white crystals form round the edges of the bromine. The whole operation only occupies a few minutes.

PYROXYLIN.

Finding, after taking every precaution to rid my gun cotton of acid, that the sensitizers employed with the collodion I made with it underwent slow decomposition, I resolved to boil it, when I found that after the acid flavor disappeared an intense bitter principle became extracted by the operation. Washing well then, between each boiling, I continued the latter until the bitterness gradually diminished, and after some twenty odd boilings disappeared. The collodion made with this was always stable, it did not discolor, even by exposure to the light, and worked well to the last drop, even after being kept for years. Pyroxylin made with mixed acids only, I presume, would not require this treatment. I made mine with a mixture of sulphuric acid and nitrate of potash, and am persuaded that the source of the annoyance was the resulting sulphate of potash which formed in the fiber of the cotton. The cotton thus prepared has the advantage of so high a degree of solubility that it is possible to make and sensitize collodion and take a good negative with it within an hour.

QUICK CAMERA PRINTING.

Photographs for subsequent painting on in oil may be prepared by floating the prepared and sensitized surfaces with a pyrogallic and acetic acid developer before exposure. The operator is thus enabled to see his pictures coming out, and stop them at the right stage for fixing. This has been attended with the most satisfactory results. It is only necessary to have a lighted candle in the room, stationed behind the canvas, and, covering up the mouth of the camera, approach it occasionally to note progress. Life-sized pictures, or thereabouts, from ½ plate negatives, require about 30 seconds to print suitably.

DURABLE AND STEADY QUICKSTUFF FOR DAGUERREOTYPING.

Slake quicklime with water until it is so completely hydrated as to remain quite damp—as far, in fact, as possible, just to avoid actual coherence between the particles—and saturate with bromine charged with a sixteenth part of pure iodine, when it will be found to coat, after iodizing the silver plate to a light rose, in from ten to twenty seconds in the mild temperature required in a daguerreotype gallery; work with great steadiness, in spite of considerable variations in temperature and frequency of drafts during the day upon the vapor; give beautiful, delicate, bright, clear, vigorous impressions, allowing of a full strength solution of hyposulphite of gold to fix; and work equally well for months without the necessity of renovation. The plates thus prepared require about one fourth the time over the iodine bath, for the second as compared with that occupied by the first coating. This method admits of considerable latitude to the operator, so as to modify, without prejudice to success, the character of the results obtained, the proportion of the iodine to that of the bromine, may be varied, or chloride of iodine even used instead, for mixture with the bromine (though with the latter I was not quite as well satisfied); but the hydrate of lime must be as stated in order to obtain the full benefit of the process.

AN ICE MONOPOLY.

The high degree of temperature experienced throughout a great portion of the year in Chili and Peru would seem to point them out as good fields for the exportation of such machines. It is well, therefore, they should be advised that such restrictions are placed on the trade in ice or frozen snow, which have been made the subjects of a monopoly by the municipalities that no one is permitted to supply the articles except with the consent of these bodies, and after paying very heavy demands, according to the importance of the locality, for the privilege.

SOFTENING STONE.

I have seen some ingenious laborers on the Oroga railway, who had made a contract for excavation in very hard ground, make a good thing of it by digging a narrow treach and leading water on to it. There are certain kinds of metallic ores which, from their hardness or toughness, are tedious and troublesome to pulverize, yet which, from the fact of their containing saline or other more or less soluble or easily softened constituents, might be advantageously treated by immersion for a time in water, previous to grinding. It is known that the stones in the old palace of the Incas in Cuzco fit so closely together, without any binding material, as not to admit a knife edge between them; and it has been supposed that they were possessed of the secret of softening the surface of stone preparatory to working it. A circumstance which has come to my knowledge gives a coloring to this supposition. A friend of mine, travelling a long way into the interior to the north of Peru, came across an Indian who was engaged in making a preparation for the purpose of softening some silver ores he was working. It consisted of urine, the juices of the leaves and stalks of three kinds of plants, and those extracted from the roots of two others. The leaves of one of the plants were about a foot long, and resembled those of the common dock leaf. This was all he was able to ascertain, as the Indian was chary of communication, and took pains to conceal the elements of his preparation.

THE IQUIQUE EARTHQUAKE.

Iquique was not "destroyed" by the earthquake of May 9th last, and succession of tidal waves which occurred, commencing about a quarter of an hour or twenty minues afterwards, and continuing until late in the day on the 10th. At about half past five P.M. of the 9th, or three hours before the earthquake, the pivoted reflector employed in the office of the Submarine Telegraph Company in this city turned suddenly round, and persisted in such a manner in maintaining this reverse position that the operator at work at the time had to reverse it (by turning the little hollow metallic plug it is swung in on its center) to be able to continue his communications.

The highest of the waves here did not exceed twenty feet, its mark having been left at about that height above the level of the water in a salt water well close to the beach; but it is said to have reached the height of sixty feet at Pabellon de Pica, and also, I believe, the port of Megillones, in Bolivia. I do not, however, place perfect reliance on these reports.

New Agricultural Devices.

An improved Baling Press for baling cotton, hay, and similar articles, devised by Mr. Solomon S. Laird, of San Obispo Cal., embodies a powerful mechanical arrangement. Upper and lower pawls actuated by levers alternately engage ratchet bars and cause a follower to move forward. Then, when the bale is sufficiently compressed, it is tied and forced out at the end of the press by continuing the movement of the levers.

A new Farm Gate, by Mr. Malcom J. McPherson, of West Campbell, Mich., may be raised vertically before being turned on its hinges, to clear it from snow or other obstructions. It also may be raised and fastened without turning, so as to allow small animals to pass under it, while the escape of large cattle is prevented. Useful for pasture lots.

A Roof and Stock Pen for Platform Scales, by Mr. Adam E. Karsner, of Florida, Ohio, includes a structure which covers the platform scales and protects it from the weather. The pen may be arranged to receive stock when being weighed, and it may be turned back when loads of hay, etc., are put upon the scales.

A new Cotton Harvester has been invented by Mr. William J. Powell, of Marshfield, Mass. As the machine is drawn forward over a row of cotton plants, aprons are rotated and wire teeth thereon remove the ripe cotton and deliver it to boxes. One set of aprons work on the sides, another on the top of the plants, and they may be adjusted as desired There is great demand for machines of this description, and the present device will, we think, be found well worthy of examination and trial by planters.

Mr. Mastin C. Randol, of Huntington, Tenn., has invented a novel Corn Planter, which may be adjusted to plant the seeds at any desired distance apart, and any desired amount in a hill. It opens the furrow, drops the seed, cultivates the soil on both sides of the furrow, covers the seed, and rolls the ground.

For Stretching Wire Fence, Mr. Hubert Schülgen, of New York city, attaches a U-shaped clamp to each wire. In connection with this there is a winding up roller, turned by a key and locked by recesses in the clamp binding on an inclined projecting tooth of the roller. This is a simple and effective contrivance for extending wires of trellises for vines.

A very convenient form of Butter Package, which may be commended to the notice of dairymen, has been devised by Mr. George Kater, of Northville, Mich. It consists of a cylindrical wrapper of wood with overlapping edges, which is prevented from opening by detachable top and bottom covers. Within is a loose partition wall for separating the prints.

A new Harness for Breaking Horses, which is so constructed as to enable the operator completely to control the horse without being liable to injury himself, is the invention of Mr. Charles H. Bowin, of Rocheport, Mo. Ropes are connected with the fore and hind legs, and so arranged that the animal may be easily thrown upon his belly. The harness prevents the horse from running, rearing, or kicking, and admits of his easy control.

The new feature in an ingenious Corn Planter devised by Mr. Alfred F. Hammond, of Berlin (Loramies P. O.), Ohio, is an arrangement whereby the same devices that press down and flatten the loose earth above the seed also act upon buffing and friction wheels that are pivoted to rods, by which the said slides are vibrated. Said rods are connected with the seed slide levers. The marking devices, transporting wheels, and hoppers are arranged in line.

Mr. William H. Mellon, of Fern Valley, Iowa, has devised a new Rotary Cutter for plows, which is so constructed that the sand cannot get into or wear its journal. An ingenious device is added for bending down weeds, grass, etc., so that they will be turned under and fully covered by the furrow slice.

Mr. Joseph P. Terry, of Lake City, Florida, has devised a new Plow and Cultivator, the novel features in which are as follows: The shanks of the curved iron standards are bent upward and laterally at right angles, and also provided with a lateral flange to adapt them to be secured to the beams. The beams are three in number, and one of them is hinged to adapt it to be set at an angle to the others.

Those of our readers who may desire further information concerning any of the above described inventions, can obtain the same by communicating with the inventors at the addresses named.

Manganese Bronze.

Manganese bronze, the new alloy, has been found to greatly exceed in tensile strength both Muntz or yellow metal and gun metal. At recent experiments made at the Royal Gun Factories, England, a cold rolled rod was found to have remarkable strength, sustaining a strain of 34 tons before stretching, with an ultimate strength of nearly 40 tons per square inch, and an elongation of 11·6 per cent, of its length places it on a level, and, in respect of its elastic limit, above the best steel used for constructive purposes. The weakest quality is 50 per cent stronger than Muntz metal, and at the same time sufficiently ductile to be rivetted cold. It has been successfully converted into sheets and plates, wire and tubes, in all of which forms it possesses a great superiority over brass, being twice as hard and twice as strong. The *Engineer* says that the greatest heat it is likely to be subjected to in a locomotive, or other high pressure boiler, does not in the least reduce either its strength, toughness, or hardness, so that it would appear particularly suitable for boiler and condenser tubes.

Damages of Illuminating by Gas.

Professor A. H. Church states, in the *Chemical News*, that the injurious influence of the products of combustion of coal gas upon the leather bindings of books is only too well known. Vellum seems unaffected; morocco suffers least; calf is much injured, and Russia still more so. The disintegration is most rapid with books on the upper shelves of a library, whither the heated products of combustion ascend, and where they are absorbed and condensed. By comparing specimens of old leather with specimens of new it is quite clear that the destructive influence of gas is due mainly to its sulphur. True there are traces of sulphates in the dye and size of new leather bindings, but the quantity is insignificant, and there is practically no free sulphuric acid. That leather may be destroyed by the oil of vitriol produced by the burning of gas in a library is proved by the following observations and analysis:

The librarian of one of our public libraries forwarded to me the backs of several volumes which had been "shed" by the books on the upper shelves in an apartment lighted by gas. The leather of one of these backs (a volume of the "Archæologia") was carefully scraped off so as to avoid removing any paper or size from beneath. This task of scraping was easy enough, for the leather was reduced to the consistence of Scotch snuff. On analysis of the watery extract of this leather the following figures were obtained: Free sulphuric acid in decayed leather, 6·21 p. c.; combined sulphuric acid in decayed leather, 2·21 p. c.; total, 8·42 p. c.

Iodide of Starch.

The iodide of starch is a definite compound, its composition being represented by the formula $(C_{12}H_{10}O_{10})_3I$. It is decomposed, with regeneration of the original starch, by all sources of nascent hydrogen, and is again produced by the limited action of oxidizing agents in the cold, even by the mere action of the atmosphere. Except when present in excess, iodine is not eliminated by its solvents, such as potassium iodide, benzol, carbon bisulphide, etc., except alcohol, whilst these solvents separate it from the red compound which it forms with dextrin α. If kept suspended in water for a year it is slightly decomposed; a portion becomes soluble in water, which then contains dextrin α, colored red by iodine, and hydriodic acid, but no glucose. The insoluble portion retains the same composition.—*M. Bondonneau.*

Solidification of Carbon Bisulphide.

M. Mercier finds that if bisulphide of carbon be added to a mixture of a drying oil and protochloride of sulphur at the moment of mixing, it is entangled in the jelly formed by the oil and protochloride. With boiled linseed oil and ten per cent of the protochloride a transparent elastic mixture can be obtained containing 70 per cent of bisulphide of carbon. The substance ignites only with difficulty, and loses the contained bisulphide but slowly.

THE CURIOUS LIFE-HISTORY OF OUR BLISTER BEETLES.

BY PROFESSOR C. V. RILEY.

Along with the honey bee, the silkworm, and the cochineal, the Spanish fly, or cantharis, ranks among the insects most useful to man. Everyone is familiar with this last insect, as it is found in our drug stores, and with its blistering properties; but the fact is not so well known that we have in this conntry several allied species which have the same valuable vesicatory property. Their curious habits in the preparatory stages formed the subject of a recent communication of mine to the St. Louis Academy of Science, the substance of which I propose to lay before the readers of the SCIENTIFIC AMERICAN in two papers, first narrating what has been made public of the habits of the family, and afterwards what has been recently discovered by myself.

The larval habits of the European cantharis of commerce, as also those of its congeners in our own country and other parts of the world, have remained a mystery, notwithstanding the frequency with which the beetles occur, their great abundance at times, and their commercial value and interest. The same remark holds true of all the blister beetles in this country. Some of these species are very common in the United States, and quite injurious to vegetation, swarming at times on potato vines, beans, clematis, and other plants. Their great numbers and destructive habits make it all the more remarkable that so little has hitherto been discovered of their early life. Harris, who evidently had hatched the first larva of the ash-gray blister beetle (*macrobasis unicolor*, Kirby), says: "The larvæ are slender, somewhat flattened grubs, of a yellowish color, banded with black, with a small reddish head, and six legs. These grubs are very active in their motions, and appear to live upon fine roots in the ground; but I have not been able to keep them till they arrived at maturity, and therefore know nothing further of their history."

Latreille states that the larvæ live beneath the ground, feeding on the roots of vegetables, but the statement is evidently founded on conjecture. Ratzeburg, who well describes the method of oviposition of the European *cantharis vesicatoria*, and roughly figures the first larva, believed that it was a plant feeder in the immature state. Audouin, who studied the cantharides profoundly, making them the subject of his thesis in his medical examination, was obliged to confess that absolutely nothing was known of their larval history; and Mr. Wm. Saunders, of London, Ont., in a paper on the same subject, read at the 1876 meeting of the American Pharmaceutical Society, could add nothing more definite. Among the older writers, the opinion was general that, like their parents, the blister beetle larvæ were vegetable feeders.

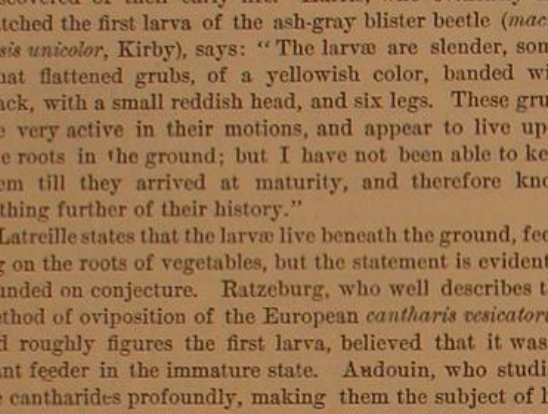
M. J. Lichtenstein, of Montpellier, France, has endeavored to discover the larval habits of the European species, and in 1875 he succeeded, after many fruitless attempts, in causing the first larva to feed on honey kept in glass tubes, and to undergo one molt. He afterwards kept two other specimens in the same way until they were nearly full grown.

These facts, as well as analogy, point to a parasitic life and partly carnivorous, partly mellivorous diet for our own common species, since the life-history of genera in the family, namely, *meloe*, Linn., and *sitaris*, Latr., has been fully traced. Indeed, the young of all the insects belonging to the *meloidæ*, which includes the blister beetles, so far as anything has yet been known of them, develop in the cells of honey-making bees, first devouring the egg of the bee and then appropriating the honey or bee-bread stored up by the same. They are all remarkable, in individual development, for passing through seven distinct stages, namely, (1) the egg; (2) the first larva or *triungulin*; (3) the second larva; (4) the pseudo-pupa or coarctate larva; (5) the third larva; (6) the true pupa; and (7) the imago.

HISTORY OF MELOE.

The history of *meloe*, popularly known as the oil beetle, may be briefly summed up as follows: The newly hatched or first larva (now generally called *triungulin* from its characteristic three claws to the tarsus), was first mentioned in

Fig. 1.



SITARIS:—*a*, triungulin or first larva; *g*, anal clasps and spinnerets of same; *b*, second larva; *e*, coarctate larva; *f*, third larva; *c*, pupa; *d*, female beetle—hair lines showing natural size.

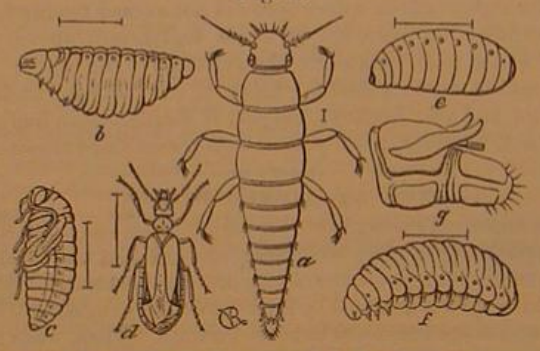
1700 by the Holland entomologist Gœdart, who hatched it from the egg. Frisch and Réaumur both mistook it for a louse peculiar to bees and flies. De Geer, who also obtained it from the egg, mentions it in 1775 as a parasite of hymenoptera. Linnæus called what is evidently the same thing, *pediculus apis*. Kirby, in 1802, described it as *pediculus melittæ*, and Dufour, in 1828, named it triongulinus andrenetarum. Newport, in 1845, first rightly concluded that it was carried into the nests of bees, and described in addition the full grown larva from exuvial characters, and the coarctate larva and pupa which he found in the cells of a mason bee (*anthophora retusa*). He failed, however, to fill the gap between the first and the full grown larva, and this Fabre first did, inferentially, in 1858, by tracing the analogous stages in sitaris.

The female *meloe* is very prolific. She lays at three or four different intervals, in loose, irregular masses in the ground, and may produce from three to four thousand eggs. These are soft, whitish, cylindrical, and rounded at each end. They give birth to the triungulius which, in a few days after hatching—the number depending on the temperature—run actively about and climb on to Composite, Ranunculaceous and other flowers, from which they attach themselves to bees and flies that visit the flowers. Fastening alike to many hairy Diptera and to Hymenoptera which can be of no service to them, many are doomed to perish; and only the few fortunate ones are carried to the proper cells of some *Anthophora*. Once in the cell, the triongulin falls upon the bee egg, which it soon exhausts. A molt then takes place and the second larva is produced. Clumsy and with locomotive power reduced to a minimum, this second larva devours the thickened honey stored up for the bee larva. It then changes to the pseudo-pupa, with the skin of the second larva only partially shed; then to a third larva within the partially rent pseudo-pupal skin; and finally to the true pupa and imago. These different changes of form are known by the name of Hypermetamorphoses, the term first given them by Fabre to distinguish them from the normal changes from larva to pupa and imago, experienced by insects generally.

HISTORY OF SITARIS.

The history of *Sitaris* is also well known, and agrees very closely with that of *Meloe*. The complete life history of the genus was first given by Fabre in 1857, who studied the *S. humeralis*, Fabr., while that of *S. colletis*, V-M, has been more recently given by Valery-Mayet of Montpellier, France.

Fig. 2.



MELOE:—*a*, triungulin or first larva—hair-line showing natural size; *b*, its claws; *c*, antenna; *d*, *e*, palpi; *f*, mandible; *g*, lower border of an abdominal joint; *h*, female beetle; *i*, antenna of male.

The first larva, or triungulin (Fig. 2, *a*), agrees very much in the head, tarsal and general characters with that of *Meloe*, but differs in several important particulars, and especially in having a pair of pre-anal spinnerets, from which is secreted a serous, sticky fluid which aids the animal in holding firmly to the bee that is to carry it into the nest. The hypermetamorphoses are very similar to those of *Meloe*. The The triungulin, after absorbing the contents of the bee egg, molts, and thereafter floats upon and devours the honey; the the pseudo-pupa, third larva, and true pupa all forming in due time with the second larval skin. The female does not feed, and on account of her heavy abdomen, travels but a short distance from the bee burrows where she developed.

Test on the Covering of Steam Pipes.

The building committee having in charge the erection of the several structures on the Trinity College site, at Hartford, Conn., recently instituted on the premises some experiments with materials at present extensively used for covering of steam pipes, whereby radiation of heat is prevented and condensation and freezing prevented. As there are about 8,000 lineal feet of pipe, varying in diameter from two to six inches, in the buildings, the question regarding the best and most suitable non-conducting material for this purpose became an important one. After the reception of tenders by competing firms for the covering of the pipes, it was deemed best to make an exhaustive test upon a portion of the pipe. Accordingly samples of pipe covering were put on by the following companies: The H. W. Johns' Manufacturing Company, the Asbestos Felting Company, the United States and Foreign Salamander Felting Company, and the Chalmers-Spence Company, all of New York.

The samples were placed around a six inch pipe to the satisfaction of the respective parties. A wooden box was constructed with an open bottom and two of the sides cut in a semicircle to fit closely to the covering. A light of glass was fitted in one side of the box, through which a thermometer could be seen suspended from the top until it hung within an inch of the pipe covering. This done, all cracks or openings were securely fastened up so that the box was perfectly airtight. The H. W. Johns Company's covering consisted of one and a half inches of asbestos mixed with other ingredients, upon a lining of heavy felt paper laid next the pipe. During thirty minutes in which this test was made the thermometer rose from 97° to 103°. The Asbestos Felting Company's covering, two inches in thickness, was next tried, and in ten minutes the thermometer rose from 97° to 102°, and in half an hour from 97° to 105°. The patented "Air-space" covering of the Chalmers-Spence Company was next tested. This, as the name indicates, is a method of covering by which a dead air chamber is formed between the covering and the surface covered. This air space is formed in the following ingenious manner: Heavy wire cloth is used, to which is fastened every four or six inches a stud one inch or more in length. The wire cloth is then placed over the surface to be covered, the studs keeping it at the proper distance. Plastic covering is then applied to the thickness of half an inch, and this partly penetrates the meshes of the wire cloth and keys itself, thus giving a strong durable hold. The second coat of plastic is then applied and finished smoothly. At this test the thermometer did not rise above 94°, the time allowed being thirty minutes. A test was also made of the "plain" covering made by the same firm. This consisted of one and a half inches of the composition used in the first method, without the air space. During thirty minutes when it was tested the thermometer rose from 97° to 102°. On the application to the Salamander covering, consisting of one and a half inches of cement, the thermometer rose from 97° to 102°. All the the above tests were made under a pressure of ten pounds of steam. A synopsis of these trials, as communicated to us, is as follows:

Covering.	Test commenced when thermometer reached	Rose in 30 minutes to
H. W. Johns' Manufacturing Co.....	97°	103°
Asbestos Felting Co.	97°	105°
U. S. and Foreign Salamander Felting Co...	97°	102°
Chalmers-Spence Co.'s "plain".....	97°	102°
Chalmers-Spence Co.'s "air space".....	90°	94°

During the test the method employed was to watch the thermometer inside the box until it indicated a temperature of 97°, when, after leaving it in for thirty minutes, the temperature was again noted. But in testing the "air space" covering the temperature was so much less than the others, that after waiting until the thermometer indicated 90° it was found that it would not reach over 94°, although left in over one hour.

It was thus demonstrated that the "air space" covering showed the best results, and the contract was accordingly awarded to the Chalmers-Spence Company.

On the Manufacture of Plaster Casts.

BY J. J. MERTINS.

There are two little points which require special care in casting plaster of Paris: one is greasing the article to be moulded, and the other is stirring up the gypsum with water. For the first purpose it does not require a penetrating fat, but one that remains on the surface and covers it. In making the paste, water must not be poured upon the plaster of Paris, but the latter must be strewn in as loose condition as possible upon the water until the plaster reaches the surface of the water, and then quickly stirred together. The substance employed to oil the moulds is prepared by adding some fatty oil, generally lamp oil, to a solution of soap in water; this is called "smear."

If, for example, a rosette 12 inches in diameter is to be cast on a 4 inch high rim, the following method is employed. The pattern made by the artist in gypsum must be repeatedly coated with shellac solution, to prevent, as much as possible, the oil from penetrating and make it easier to separate the casting from the model.

The wedge-shape pieces that are to form the vertical part of the rosette are cast first and are three in number, a strip of clay being used to form three sides of the first one, two sides of the second (for a side of No. 1 forms one side of No. 2), and one side of the third, for this is bounded on two two sides by Nos. 1 and 2.

Each part of the mould must be varnished and greased or oiled before a second part is cast in contact with it, to insure separation when dry. The surface of the model is again carefully oiled and a cast made of the whole model without taking away the side pieces, but making a fresh wall of clay close about the model. To preserve the necessary sharpness and avoid bubbles, and bare places, the first layer of plaster poured upon the model should be as thin as possible, and a soft pencil be employed to remove bubbles and bring it into contact with the edges and cavities. Thick plaster is next poured upon this and finally the thick sediment can be scraped out upon the cast and smoothed off. In a short time it can be removed from the model, the side pieces taken apart, and all carefully dried. Before making a cast from this mould the separate parts are placed together, after oiling, backed up and adjusted with clay walls, etc.

The Coquito Palm.

In Chili a sweet syrup, called *miel de palm*, or palm honey, is prepared by boiling the sap of the *jubœa spectabilis* to the consistence of treacle, and it forms a considerable article of trade, being much esteemed for domestic use as sugar. The sap is obtained by the very wasteful method of felling the trees, and cutting off the crown of leaves, when it immediately begins to flow, and continues to do so for several months, until the tree is exhausted, providing a thin slice is shaved off the top every morning, each tree yielding about 90 gallons. The small nuts, which resemble miniature cocoanuts, are used by the Chilian confectioners in the preparation of sweetmeats, and by the boys as marbles.—*Journal of Applied Science.*

TO REMOVE rust from steel, cover the metal with sweet oil well rubbed in; 48 hours after rub with finely pulverized unslaked lime.

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Notes & Queries

(1) J. L. L. asks for rules for constructing the body of a microscope, to be 10 or 11 inches in length, to be like that furnished (as far as proportions and make is concerned) with so-called student's microscopes, and to be used with any objectives? A. There are no standard rules for the diameter of the body of the microscope, but the makers generally adopt a tube about 1 inch to 1⅛ inches in diameter. The tubes are either made of heavy sheet metal over a steel mandrel, or cast and finished in the lathe. The best plan is first to procure the eyepiece, and then make the body to allow the eyepiece to fit the upper end of it. At the lower end of the body have a collar with a screw for the object glass. The mountings of all first class English and American object glasses are now made with the screw of a standard size, which originated with the London Microscopical Society, and is known as the society screw.

(2) B. K. D. says: If I take a tank and fill it partly with water, then force air up and through the water, drawing it off at the top, will this air have the same proportion of oxygen as the air naturally held in water? Or will it still have the same, 1 part oxygen to 4 of nitrogen, as before entering the water? A. No. Oxygen is more soluble in water than nitrogen, and, consequently air forced through recently boiled (but cold) water will be found less rich in oxygen than before. If the water is aerated under pressure (by which the solubility of gases is augmented), when the pressure is relieved, the air escaping from the water will be rich in oxygen. By repeated solution in this way nearly all of the nitrogen may be removed.

(3) D. H. S. says: Will you please give me a recipe for something (besides lime, protosulphate of iron and sawdust) for purifying coal gas? I have also trouble to free the gas from tarry matters, which pass through the scrubber to the purifier. A. From what you say we judge that the trouble is not so much with your purifiers as with the washer and scrubbers. Water, good slaked lime, and hydrated ferric oxide are about the only purifiers in use. A larger main, better washing and greater surface, and the scrubbers will no doubt remedy the evil.

(4) J. F. E. asks how he can keep the water in an aquarium free from dirt? A. The only remedy will be to use purer water, or to renew frequently.

(5) C. P. advises C. H. C., who asks how to remove lime from cistern water, to try the addition of hard spring water. The lime is generally derived from poor cement used in the lining.

(6) In reply to E. H.—The paint will answer very well for some purposes, but does not compare with good quality Venetian red in color. It cannot be improved much by heat.

(7) J. E. F. says: I have been using artificial teeth for about 3 years. The plates are made of the material commonly used, a gutta percha composition made nearly the color of the natural gums. About a year ago the plates commenced to grow dark. What is the cause of the discoloring, and please give me a recipe for cleaning them? A. The plates are usually made of vulcanized rubber colored with vermilion. The change of color may have been due to sulphur compounds brought frequently in contact with it, in medicines or otherwise. Try fine emery powder, applied with a splinter of soft wood. If this fails, make a strong solution of iodide of potassium in water, add to it a few drops of hydrochloric acid, and apply, with care not to soil the teeth; then rinse with a little alcohol and wash in plenty of water.

(8) F. W. W. asks for a recipe for washing powder? A. Take sal soda, 12 parts; good quicklime, 5 parts; powder, mix, and keep in covered stoneware jars, or in bottles for use.

(9) C. B. asks (1) for a good cement for lining the inside of a galvanic battery trough, made of wood. The fluid used will be diluted sulphuric acid, 1 part acid to 10 parts water, also bichromate of potash, sulphuric acid, and water in the carbon compartment? A. Melt together equal parts of gutta percha and pitch; apply this hot. Or use a solution of caoutchouc in carbon disulphide mixed with 6 per cent of absolute alcohol; give several coats. 2. What would be the resistance of 150 feet of copper wire No. 14 (Brown and Sharpe gauge) be? A. If of good copper, about ·40 ohms under ordinary circumstances—less in cold and more in warm water. 3. In electrical measurement, what is the difference between 1 volt and 1 ohm? A. The ohm is the unit of electrical resistance, and is equal to the resistance of a prism of pure mercury, one square millimeter (=0·001549 square inch) section and 1·0486 meters (=41·281891 inches) long, at 32° Fah. The volt is the unit of electromotive force, which varies little from the electromotive force of a standard Daniell's cell.

(10) Electric subscriber asks: What solution and quantities thereof is best for generating electricity with carbon or zinc in the same jar or cell without using the porous cup, and if sufficient strength to run a dwelling annunciator of 4 or 6 magnets with 5 cells of 1 gallon each? A. Amalgamate the zinc, and use water mixed with about 5 per cent of sulphuric acid. Six cells should be amply sufficient. The Leclanché cell is now generally preferred for annunciators.

(11) H. H. finds cracks in his stove and asks if there is any cement which can be used to fill them? A. Yes, make and apply a paste of finely pulverized iron (obtained at the druggist's) and water glass. The hotter the fire, the more the cement melts and combines, and the more completely the crack becomes closed.

(12) A. G. says that small metal fancy articles, which are in show cases, become rusted easily and lose their polish. Is there any way of protecting them? A. See that the cases are moderately tight, and keep in each a small lump of quicklime in a saucer.

(13) J. S. asks how to drill a hole in a china plate? A. Use a copper drill and emery moistened with spirits of turpentine.

(14) G. A. asks how to cut battery carbons? A. Use a hand saw moistened in water.

(15) W. B. asks whether paraffin candles can be dyed with aniline colors? A. Yes.

Is there any difference in strength of timber from different sides of the same tree? A. It is said that the strongest side of the tree is that which in its natural position faces the north.

How can I keep my fish net from rotting? A. Steep in melted paraffin, or boil in decoction of oak bark.

(16) F. H. B. asks what plaster moulders use to cover the insides of moulds? A. Lard and oil mixed. Glycerin is also said to be good.

(17) A. P. C. inquires how to find the speed of a belt in feet per minute? A. Multiply the diameter of either pulley in feet by 3·1416 times the number of revolutions that it makes per minute.

(18) E. T. asks: What mordants are commonly employed in dyeing with sumac? A. Either tin, acetate of iron or sulphate of zinc. The first gives yellow, the second gray or black, according to the strength, and the third greenish yellow.

(19) J. N. B. asks (1) if sumac leaves are substituted for bark in tanning leather? A. Yes; for some kinds. 2. How are the leaves prepared? A. The leaves are thoroughly dried, and ground to a fine powder 3. Where can a market be found? A. The chief market is New York city.

(20) W. B. P. asks: What can I do for my lips to make them tough so they will not chap? A. Apply twice a day a lotion of borax, 2 scruples: glycerin, ½ oz.; water, 7½ ozs.

What will restore the ivory mouthpiece of my flute to its former whiteness? A. Brush over with pumicestone and water and expose to the sun under glass until bleached.

(21) J. E. W. asks for a recipe for cleaning marble that has become rusty or mossy by exposure to the weather, and which will not injure the stone? A. Mix up a quantity of the strongest soap lees with quicklime to the consistence of milk, and lay it on the stone for 24 hours; clean it afterwards, and it will appear as new.

(22) S. W. L. asks: 1. What size wire would be required to convey an electric shock sufficient to kill a horse, or other large animal, and would a number of small wires, aggregating the same size, be preferable to a single large wire? A. No. 16 Brown and Sharpe's gauge. Yes, if it is likely to be bent or twisted. 2. What size battery would be required to produce the shock, and would it matter if the jars were covered so as to prevent spilling if upturned? A. It would require about 800 square feet of Leyden jar surface, or a very powerful induction coil, and battery. No.

1. What effect have air and water on rubber when it is exposed to their combined action? A. It destroys its elasticity. 2. In what thicknesses is good elastic rubber impervious to air? A. $\frac{1}{32}$ of an inch. 3 How can I estimate the horse power required to work an air pump which is to be used to keep a vacuum? A. Multiply the number of square inches of piston surface by 15, and by the number of feet it travels in a minute; divide this product by 3,300; the result will be the horse power required; to which one fifth should be added for friction.

(23) G. A. F. asks: What is chymogene, used for ice making, and how is it used? A. Chymogene is simply high gravity gasoline at about 110°. It passes with rigoline as the first product of petroleum distillation. See article on ice machine in this issue.

(24) J. T. W. asks: If the back motion eccentric rod of a locomotive is a little too short or a little too long (say ⅛ inch) what effect will it have on the valve in forward motion? A. None.

(25) A. F. W. asks how to zinc coat or galvanize malleable castings? A. Clean in sulphuric acid and water, wash, scour with cocoanut husk. Dip in melted zinc covered with sal ammoniac. Drain. Wash in cold water.

(26) S. R. H. asks: What can I clean brass shells with, such as are used in breechloading guns? A. 1 oz. oxalic acid, 6 ozs. rottenstone, ½ oz. gum arabic in powder, 1 oz. sweet oil, and enough water to make paste. Apply and rub dry with flannel.

(27) D. T. S. says: I have some silk covered copper wire which is bare in places; how shall I insulate it? A. Apply gutta percha dissolved in benzole or bisulphide.

(28) A. P. asks for a recipe for red printing ink, vermilion red? A. It consists usually simply of vermilion ground up with prepared linseed oil. To 6 quarts of boiled oil add 6 lbs. of rosin, and when this is dissolved add 13¼ lbs. of dry brown soap of best quality cut in slices. Then mix in and grind the pigment.

(29) F. S. asks how bronze is dyed on leather with anilines? A. Dissolve aniline violet in water and brush over the leather.

(30) E. B. R. asks how to clean plate glass? A. Try a strong solution of carbonate of potash.

(31) T. P. J. says: Will you please inform me concerning the *modus operandi* of the Mt. Washington railway? Is the track an ordinary one with the addition of a central rail, upon which a cog wheel on the engine works? A. The construction of the railroad is as you suppose. Very efficient means of stopping are provided, consisting of a pawl and ratchet, in addition to air brakes, and when descending, air is admitted into the cylinder of the locomotive, and the exhaust is controlled by the engineer, so that the train is regulated in this manner also. You will find a detailed account of the railroad in the *Proceedings of the American Society of Civil Engineers*, vol. 3, p. 12.

(32) K. L. D. asks for a cement which will withstand the effects of hot water; the cement to be used for uniting pieces of a porcelain vessel. A. Quick lime mixed to a cream with white of egg.

(33) A. D. B. E. asks how a room 40 by 14 without the agency of steam heating, in the most economical way can be made into apartments for Turkish baths, so as to answer the purpose? A. A water heater, such as is used on many railroad cars, will answer the purpose.

(34) T. L. C. asks how to make a soap that will remove grease, etc., from silk or woolen goods without removing the color? A. Aqua ammonia 2 ozs., soft water 1 quart, saltpeter 1 teaspoonful, shaving soap in shavings 1 oz. Mix.

(35) C. M. S. says: Will you inform me how many lbs. of No. 22 cotton-covered copper wire it would take to construct a machine capable of giving an electric light; the machine to be run by an engine and to be similar to Gramme's? A. About 25 lbs. of No. 32 wire, but this size, being so fine, would require an especial winding to adjust the necessary relative resistance of the armature and magnet. It would be better and less expensive to use 17 lbs. of No. 20 for the magnet, and 8 lbs. of 32 for armature.

(36) H. W. B. says: In a discussion relating to the safety of lightning rods, it was claimed that no rod, that is considered a good conductor, could detract the thunderbolt from its course, even if it did fall within the space equal to that of a circle described with the height of the rod as radius, and that the rod might possibly save the house if the bolt happened to strike the rod; it was claimed that if the bolt was "headed" toward a certain point it would go there, regardless of all rods, conductor, etc., even if the said point was within ¼ inch from a rod. I claimed that the rod protected a space equal to the circle, with the hight of the rod as radius, and that if a bolt was coming towards any point within this circle it would be changed from its course and conducted down the rod. A. It is generally estimated that a properly constructed lightning rod protects an area whose radius is double the height of the rod extending above the structure. This rule is not now, however, considered very reliable, by reason of the extensive use of gas and water pipes in dwellings. When electricity finds several paths it will prefer the best, it is true; but some portion will also pass along the poorer conductors. It is a good plan to connect all pipes and metal work of any extent in the building with the rod. The rod offers most efficient protection to buildings by discharging silently the accumulated electricity at the earth's surface, thus, in great measure, preventing the possibility of a disruptive discharge from the clouds.

(37) G. M. asks for a good method of dyeing silk seal brown? A. For 10 yards—Boil fustic 1 lb., logwood 3¼ ozs., cudbear 2½ ozs. Cool to 200° Fah.; enter and winch for 30 minutes, air out, repeat: sadden to pattern with 4 ozs. copperas; wash and dry.

(38) A. S. says: Please tell me the difference in the pressure of water in an upright tube 33 feet high and 1 inch in diameter, and a tube 2 feet high and 6 inches in diameter? A. If you mean the pressure per square inch on the base, it will be in direct proportion to the height of column, and you can estimate that each inch of height corresponds to a pressure of about 0·036 lbs. per square inch.

(39) I. N. D. says: 1. What kind of water wheel should I use for a water power of 3 feet head and 4,000 cubic feet per minute, having reference more to economy in building than extreme economy in the use of water? A. A breast wheel will answer. 2. How can I convey such power to a distance of 80 feet at an angle of 30° up, having in view economy of construction as much as saving of power? A. You can use two universal joints. 3. If I should use a breast wheel, what would be the proper diameter, and length and size of buckets, and what percentage of the power due to such head and quantity of water; under such conditions, could I expect to realize? A. Professor Rankine gives the following data in his "Treatise on the Steam Engine, and other Prime Movers," which you may consult for further particulars. Efficiency of breast wheels, 70 to 80 per cent. Ordinary velocity for outer surface of wheels = 6 feet per second. Q = cubic feet of water discharged per second. w = surface velocity of wheels in feet per second. r = radius of wheel in feet. b = depth of bucket, from 1 to 3¼ feet; length of buckets in feet $= \frac{3Q}{2wb\left(1-\frac{b}{2r}\right)}$

COMMUNICATIONS RECEIVED.

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

On the History of Coal. By R. P. S.
On Curious Blood Disks. By J. M.
On Our Thrushes. By E. I.
On the Torpedo Balloon. By F. P.

HINTS TO CORRESPONDENTS.

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

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

WANTS AND BUSINESS INQUIRIES.

Almost any desired information, and that of a business nature especially, can be expeditiously obtained by advertising in the column of "Business and Personal," which is set apart for that purpose subject to the charge mentioned at its head.

We have received this week the following inquiries, particulars, etc., regarding which can probably be elicited from the writers by the insertion of a small adver-

tisement in the column specified, by parties able to supply the wants:

Where can I obtain English steel stamps with two shears?

Who manufactures dynamite?

Who makes engines for propelling steam plows?

Where can felt cloth be obtained, suitable for rubbing crayon marks from blackboards?

OFFICIAL.

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October 23, 1877,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

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

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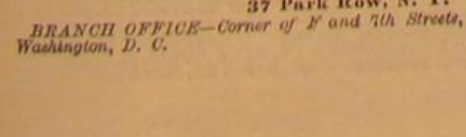

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REPORT

OF THE

Superintendent of the Insurance Department

OF THE STATE OF NEW YORK,

ON THE

EXAMINATION

OF THE

New York Life Insurance Company,

OF NEW YORK CITY.

INSURANCE DEPARTMENT, Albany, October 24th, 1877.

The Superintendent having personally, and through the services of the Deputy Superintendent, aided by the force of the Department, commenced and completed a searching examination into the affairs of the NEW YORK LIFE INSURANCE COMPANY of the City of New York, it affords him unqualified pleasure at being able to announce and make public the gratifying fact that the result of this examination is most satisfactory, and that, from the data in possession of the Department, the solvency of this, or other companies undergoing a similar test, can be readily ascertained, at little expense, for many years to come.

This Company was organized in 1845, and no investigation having been made, either by the Department or other properly constituted public authority, prior to the date when the department was formed, much time has necessarily been expended to bring the matter to a conclusion.

The services of forty-one gentlemen of character, standing, and experience, have been procured, who have valued and appraised the property situated in forty counties in this State and in the State of New Jersey, covered by 2,629 mortgages amounting to $17,354,847.84, and forty-nine pieces of property owned by the Company amounting in value to the sum of $2,541,576.46; which services have been intelligently and efficiently performed. The abstracts of title to each and every piece of these large amounts of property have been closely examined and reported on to the satisfaction of the Superintendent. All other investments, amounting to $10,311,045.67, have been carefully looked into, and evidence of payment by the Company, either by check or otherwise, for such investments, demanded and given, although many of these payments were made twenty years ago. The cash securities of the Company, the cost of which on the books amounts to $9,730,529,91, are of the most unexceptionable character, and are worth $580,515.76 more than cost.

The Superintendent personally examined these securities, taking the letter, number, and denomination of each security, and preserving the record of the same in the Department. In every instance where securities had depreciated in value, such depreciation had been promptly charged to profit and loss account, and all items of doubtful character had been stricken off by the Company from its assets, and omitted from its reports. Complete seriatim lis s of policies, premium loans, and uncollected and deferred premiums have been made, and are on file in the Department.

LIABILITIES.

Every item of liability, real and actual, or contingent, as sworn to by the officers in the last Annual Report made to the Department, a copy of which is herein embraced, has been closely scrutinized, and the statements in said report found to be true to the letter, and no other liabilities were found to exist.

MISCELLANEOUS.

The different Departments—Medical. Actuarial and Agency—have been reviewed, with the most satisfactory results—gentlemen entirely competent and assiduous having been found in charge of each branch, to whose conduct and performance of their duties much is due.

Agents collecting funds of the Company at different points are held to a rigid accountability, remittances being required at the larger points tri-weekly, while at the smallest points settlements are not allowed to be delayed longer than a week. Bonds are required where the sums handled are sufficient to justify the same.

The system of book-keeping adopted by the Company, after many years of experience, seems to be perfect—the checks of one division on another being so complete, that no wrong can be done to policy-holders by false entries of any kind short of wide-spread collusion among many employés, all of whom were found to be exceedingly courteous, and, acting under instructions from the principal officers of the Company, were prompt in furnishing full information as to every detail.

Judged by the hardest test that could be applied under the law, and with every doubtful item eliminated from their sources, the net surplus, as shown by the detailed statement of this Company, which follows, amounts to $5,962,878.79.

This exhibit clearly establishes the fact that where a Life Insurance Company is honestly, ably, and prudently managed, there is no occasion to force a showing of solvency by including in its assets prospective value of real estate, and excesses of premium payments to be received.

For the reasons above given, the Superintendent has no hesitation in stating that this great Corporation is entitled to public confidence and its officers to his warmest commendation.

ASSETS.

	Cost Value.	Market Value.	
Real Estate			$2,473,087.50
Bonds and Mortgages			17,205,232.84
Stocks, Bonds, etc., owned by the Company:			
Merchants Bank, N. Y., stock	$15,758.75	$16,100.00	
Bank of America, N. Y., stock	8,484.00	10,164.00	
Bank of the Republic, N. Y., stock	1,470.00	1,470.00	
American Exchange Bank, N. Y., stock	10,125.00	10,500.00	
Metropolitan Bank, N. Y., stock	5,381.25	6,400.00	
United States Bonds	3,792,113.97	3,892,763.34	
Central Park Loan	25,233.75	26,750.00	
Delaware and Hudson Canal Co., stock	44,800.00	44,800.00	
Delaware and Hudson Canal Co., bonds	400,000.00	400,000.00	
New York Street-Opening bonds	549,967.10	576,110.00	
New York County Bounty Bonds	41,104.00	42,000.00	
New York City consolidated bonds	645,596.25	745,875.00	
New York County consolidated bonds	113,928.75	131,625.00	
New York City (Morrisania and West Farms) bonds	60,000.00	60,000.00	
New York Central and Hudson River Railroad, bonds	1,019,382.50	1,170,000.00	
New York and Harlem Railroad bonds	1,074,075.00	1,178,333.33	
Brooklyn City bonds	983,144.80	1,024,700.00	
Jersey City bonds	442,425.00	450,590.00	
Yonkers Town bonds	178,479.16	183,700.00	
Newark City bonds	129,875.00	131,210.00	
Flushing Water bonds	77,600.00	80,000.00	
Rensselaer and Saratoga Railroad bonds	9,519.92	10,155.00	
Eastchester bonds	5,000.00	5,000.00	
Richmond City bonds	46,250.00	56,500.00	
Tennessee bonds	8,000.00	8,000.00	
Georgia bonds	2,730.00	3,500.00	
Alabama bonds	15,840.00	15,840.00	
South Carolina bonds	8,960.00	8,960.00	
Mississippi warrants	15,285.71	20,000 00	
Totals	$9,730,529.91	$10,311,045.67	10,311,045.67
Premium Notes and Loans			$781,585.39
Cash in Banks and Trust Companies			1,427,933.18
Interest due and accrued on Bonds and Mortgages			224,052.75
Interest due and accrued on Stocks and Bonds			42,320.39
Interest due and accrued on Premium Notes and Loans			25,709.37
Rents due and accrued			8,476.17
Premiums due and unreported		$125,027.15	
Premiums deferred		432,695.40	
Total		$557,722.55	
Deduct 20 per cent. estimated cost of collecting above		111,544.51	
Net amount			$446,178.04
Total admitted assets			$32,945,621.30
ITEMS NOT ADMITTED:			
Agents' Balances		$36,154.19	
Cost value of Real Estate over present appraised values		68,488.96	
Loans on Mortgage in excess of present value		149,605.00	
Total			$254,248.15
Total Gross Assets			$33,199,869.45

LIABILITIES.

Death Losses and Matured Endowments not due	$418,393.19
Death Losses and Claims resisted	97,200.00
Premiums paid in advance	17,098.32
Estimated liability on Lapsed Policies	10,000.00
Net Re-Insurance Reserve	26,440,111.00
Total Liabilities	$26,982,742.51
Surplus as regards policy-holders, on the basis of admitted assets as determined by this report	5,962,878.79
Surplus as regards policy-holders on the basis of total assets, as reported by the Company	6,217,126.94
Estimated surplus of Tontine policy-holders included in the above	517,504.84

JOHN F. SMYTH, Superintendent.

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