SCIENTIFIC AMERICAN

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

Vol. XXXII.—No. 13. [NEW SERIES.] NEW YORK, MARCH 27, 1875. $3.20 per Annum, Postage prepaid.

PORCELAIN MANUFACTURE IN NEW YORK.

Resuming our description where we quitted it last week, we have to direct the reader's attention to the next process, which is

CONVERTING THE WARE INTO BISCUIT,

as it is termed after the first baking. The kilns in which this operation is performed are huge cylindrical structures (see Fig. 7), fifteen and a half feet in diameter, and having two stories, the lower one eleven and a half, and the upper one nine, feet in hight. The walls, which are of brick, faced inside with fire brick, are nearly four feet in thickness. Directly beneath the lower story is a grate, covering the entire area and accessible by several doors. When fired, a kiln uses about ten tuns of coal to a baking, and combustion is continued for twenty-eight hours. It takes three days for the interior to cool. The raw ware for the first baking is placed in the upper story, which is subjected to a less degree of temperature than the compartment below, the exhaust heat being used. The seggars now come into use, each one being filled with as many articles as can be placed in it without touching each other, small pieces of fire clay serving as supports. The filled seggars are then ranged in piles from floor to ceiling of the kiln, the bottom of one seggar serving as the cover to the other, and the surfaces being separated by rings of soft clay, which form a tight joint. As many as 30,000 pieces of ware may be included in one baking. The fires are now urged for the proper time; and after the kiln has cooled, the ware is removed, a hard, brittle, porous body. This is the biscuit, so called from its resemblance to ship bread.



Fig 1.—THE EARTHENWARE KILNS.

The next operation is

GLAZING.

The glazing compound is made of precisely the same ingredients as the ware, only they are differently combined. There is more felspar added, so that the result is a complete



Fig. 8.—DIPPING IN GLAZING LIQUID

vitrification. To witness the process we were conducted into another great room; in which were a number of tubs, the contents of which a girl continually stirred, as shown in Fig. 8. The liquid was the glazing powder mixed into a thin cream with water. Into this the article to be prepared is quickly dipped. Being dry and porous, it speedily absorbs the moisture in the material deposited upon it, leaving the powder in an almost dry state, adhering to the surface. Thick pieces, such as knobs, have to be dipped in water first,



Fig. 9.—INTERIOR OF THE KILN.

so as to prevent their absorbing too much of the moisture, while smaller articles, on the other hand, are sometimes heated in order to force them to take up moisture enough.

We next found the articles being packed in seggars a second time, in order to undergo the intense heat of the gloss oven or

SECOND BAKING.

For this purpose the lower story of the kiln is employed, and the heat generated is far more than sufficient to melt iron. The seggars and their contents glow with an intense white radiance, and this continues until vitrification ensues. It is at this point that great skill is required in managing the fires, for, as our guide explained, "the art is to get up vitrification and yet have the ware stand up in the kiln." In other words, the fires must be checked at a point a little beyond that at which the glaze vitrifies, and just before the articles themselves run and melt.

Our artist has chosen the operation of removing the finished ware from the gloss oven as the subject of the large illustration, and in a smaller engraving (Fig. 9) he shows the interior of the kiln, with the seggars arranged in piles. The open shoots (on each side of the kiln in the large engraving), with the heavy covers, are furnace doors; and just beside the entrance to the kiln will be seen the glass-stoppered holes through which the process of baking is watched.

The porcelain is now finished, and nothing remains but to sort it over for imperfect pieces, which are consigned to the grinding mill to be pulverized and made over. In case the ware is to be ornamented with colors and gilding, still another manipulation is necessary. The

DECORATION

is done by hand. The colors used are formed by the combination of certain metallic oxides and salts, with certain fluxes, which enables them to fuse into colored glasses. The oxides are usually those of chromium, iron, uranium, manganese, zinc, cobalt, antimony, etc. The salts and other bodies are ground up with fatty turpentine, and painted on in the ordinary manner. It is not until the heat of the furnace has driven off the oil and chemically combined the ingredients of the colors that the effect can be judged of, for the hues at first are dingy and unpleasant, and

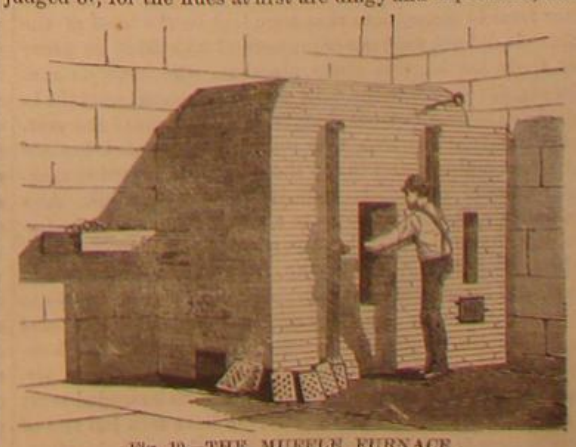


Fig. 10.—THE MUFFLE FURNACE.

give no idea, to the inexperienced eye, of the intended effect. Gold is applied by dissolving the metal in aqua regia; the acid is driven off by heat, when the gold remains in a state

of minute division. After the ware is ornamented, it is inclosed in a muffle furnace, shown in Fig. 10. This consists of an inner box of fire brick, which is so arranged as to be completely surrounded by the products of combustion. After the colors are developed the articles are removed, and hand-burnishing of the metallic portions completes the manufacture.

Scientific American.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS.

One copy, one year, postage included.....$3 20
One copy, six months, postage included..... 1 60

Club Rates:

Ten copies, one year, each $2 70, postage included.....$27 00
Over ten copies, same rate each, postage included..... 2 70

☞ By the new law, postage is payable in advance by the publishers, and the subscriber then receives the paper free of charge.

NOTE.—Persons subscribing will please to give their full names, and Post Office and State address, plainly written, and also state at which time they wish their subscriptions to commence, otherwise they will be entered from January 1st, 187.. In case of changing residence state former address, as well as give the new one. No changes can be made unless the former address is given.

VOLUME XXXII., No 13. [NEW SERIES.] *Thirtieth Year.*

NEW YORK, SATURDAY, MARCH 27, 1875.

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FROZEN PIPES AND HYDRANTS.

This year the winter has been really one of the kind that are only equaled in the memory of the oldest inhabitants. In some places not far from New York, we hear of the water in mains being frozen, where it was supposed that the pipes were deeper in the ground than the frost ever penetrates. As for house connections and hydrants, they gave out soon after the commencement of the cold snap. As we explained recently, the house connections were in many cases unduly exposed by the carelessness of the plumbers who did the work. But there were numerous instances in which the water froze in connections that were laid on the level of the main. It did not need an occurrence of this kind to prove that there are a great many plumbers who have no consciences, for we see in the daily papers numerous remarks in regard to their outrageous charges, at all seasons of the year. But the manner in which they ordinarily proceeded to thaw out a frozen pipe seems to cap the climax, in regard to making repairs in the most expensive manner possible. As a general rule, when the water in a house connection was frozen, the plumber would lay a portion of the pipe bare, and light a fire around it, consuming from one to three cords of wood, and keeping several men employed for from twelve to thirty-six hours, or even longer. In this manner he would manage to run up nice little bills of thirty, fifty, one hundred dollars, and more, if we can credit the statement of victims, published in the daily papers. In some extended tours of observation throughout the city, we have seen but two or three boilers in use, furnishing steam to thaw out the pipes. It is such a simple means of clearing a pipe, and the boiler required can be constructed so cheaply, that we were surprised not to find them generally employed. As a result of a good deal of inquiry, however, we infer that the plumber reasons somewhat in this manner: "It will cost me thirty or forty dollars, or perhaps a little more, to make a steamer; and if I use it, I can clear a pipe in two or three hours. But if I keep on in the good old way, and build a wood fire around the pipe, I will incur no expense at starting, and will be a day or two about the job." We shall be greatly mistaken if some enterprising individuals do not draw a useful moral from these facts, or if, by another winter, the charges for this class of plumber's work at least will be properly regulated. While the house connections were becoming frozen, the street hydrants were following suit; and we see by the papers that in some cases they were frozen so hard that fires made great headway before they could be brought into service. We have been edified, in New York, by disputes between two departments, as to whose duty it was to thaw out the hydrants; but we have not seen much stress laid upon the fact that it is somebody's duty to prevent the hydrants from freezing up. In fact, we find a good many people who seem to think it is the correct thing for ice to form in a hydrant in cold weather, so that it cannot be used until the ice is melted. On the contrary, however, if a hydrant is properly constructed and cared for, no ice will ever form in it until the main with which it is connected becomes frozen. We could give a number of reasons in support of this assertion, but a practical proof will no doubt be more satisfactory to our readers. On the occasion of a recent visit to Poughkeepsie, in this State, we were very courteously shown around the water works by Mr. Davis, the superintendent. This gentleman informed us that, though it had been cold enough to form ice in one or two instances in the mains, all the hydrants had been serviceable, with a single exception. This single hydrant, which was frozen up, well illustrates the value of system. The hydrants are all inspected every day to see whether or not they are frozen; and immediately after a fire, the hydrants that have been opened are examined by an employee of the water department, to make sure that they are properly drained and closed. After one fire, the chief engineer of the fire department reported that three hydrants had been opened, while, in fact, four had been used. As a consequence, the fourth hydrant was not examined, and ice formed in it during the night; but it was discovered early the next day and thawed out. Now it seems to us that this demonstrates that hydrants can be kept ready for use even in very cold weather, although, as generally managed, they are very apt to freeze. It may be added that there are some forms of hydrants that should never be employed in a region where pipes are liable to become frozen up.

INCREASE OF POSTAL CHARGES.

The same Congress which rendered itself infamous by the passage of the well known salary grab again looked after its own interests, at the expense of those of the public, during the last hours of the late session, by enacting a law altering the postal rates in order that its own speeches might be enabled to cumber the mails. By a recent amendment to the postal law, the speeches of members and other stuff are to be sent free, while the postage charged to the public is doubled in price. Instead of half a cent an ounce, the scale is now altered to one cent an ounce on every one of the following articles: Books, pamphlets, maps, prints, engravings, transient magazines, periodicals and newspapers, circulars, handbills, posters, occasional publications, prospectuses, book manuscripts, proof sheets, blanks, patterns, samples, and, in fact, all articles sent by mail except letters, and newspapers and periodicals sent by publishers. The new rate imposes an enormous additional expense on those who use the post office as a means of transmission for articles more bulky than simple letters.

That this additional tax upon the people is due, in large measure, to the lobbying influence of the express companies there is very little room for doubt. Cheap postal rates are obviously in opposition to their interests, and it is well known that a strong and constant pressure has been brought to bear on Congress in their behalf during the past session. The express charge for the smallest package sent from New York to San Francisco is 75 cents; the post office carries one weighing a pound for sixteen cents, and before the recent amendment did the same service for eight cents. In some cases, for packages of certain weight forwarded short distances, under the old law the mail rates were much below the express charges; under the new, the former are considerably higher

There is a large number of persons whom the measure will directly affect in a business point of view. Publishers of books, of pamphlets, in fact of all works other than periodicals, many of which are of great value to the community as disseminators of useful information, will find it necessary to reduce the weight of their packages one half, in order to mail them at the same price as formerly. From this follows a diminution of labor and a decreased consumption of paper and material, and thus other classes of the public are in turn affected. Mercantile houses selling by samples sent by mail, shippers of seeds and of manufactured productions readily inclosed in small packages, and like forwarders will, in many instances, find the doubled postal charge by no means an inconsiderable inroad into their profits, and it will necessitate on their part a reduction in the weight of the articles sent. The consequence of the above, so far as the postal revenue is concerned, is that it will remain stationary, and will not experience that gradual increase which has always been attendant upon the cheapest tariffs.

The measure generally affects the reading public. Three cents postage must now be paid on the SCIENTIFIC AMERICAN and other large papers, and eight cents on each magazine that formerly went for four, and so on. Besides, a rather anomalous state of affairs is caused when a person is charged three cents to send this paper across the river from New York to Brooklyn, and but two cents to forward it over the ocean to London.

The country has very little cause for gratitude to Senator Hamlin, of Maine, for pushing through this ill-advised law. Its prompt and early repeal is a measure which the next Congress will doubtless find is demanded by the people.

MODELS BY MAIL.

We recently advised our readers that, by the provisions of the new postal law, they were at liberty to send models and other matters through the mail, in packets weighing not more than four pounds, at the rate of eight cents a pound; and we dilated a little upon the excellence and great public convenience of this arrangement. But scarcely were our types printed before the salary-grabbing Congress made a change in the law, doubling the above rates for the public, while ordering their own speeches to be sent *free*. Looked at in one aspect, this is an outrage on the public; but it cannot be helped until the meeting of the new Congress in December. Meantime the public must endure the payment of the doubled rates, and all who propose to send models should bear it in mind. Sixteen cents a pound must now be paid.

A TRADE MARK REJECTION.

The Commissioner of Patents, on an appeal taken to him in person, has had occasion to set aside a decision of the Trade Mark Examiner, who refused registration to the applicant, because the latter stated in his papers that he had not used, *but intended to use*, the mark. The Examiner rejected the application, requiring that, before he would grant it, the applicant must strike out the word "intended" and insert "commenced," thus making the applicant say in his papers that he *had already commenced to use the mark*. As this was not true, the applicant declined so to state, so the case was rejected and the appeal taken.

The Commissioner of Patents reversed this decision, and at the same time administered to the Examiner a rebuke which, if has any sensibility, he will be likely to remember.

"The language of the statute is made so plain that it would seem impossible for any one to err therein. Yet this plain language the Examiner assumes to criticise as loose, and interprets it exactly contrary to the obvious meaning by an altogether unnecessary inference."

The decision of this Examiner is only one of the many examples of Patent Office errors which are not likely to be eliminated while the present practice is maintained. About one hundred examiners are now employed, chiefly in hunting up objections to the grant of petitions for patents. If they did not make large numbers of incorrect rejections, their occupation would, to a great extent, be gone.

PARTNERSHIPS OF ANTS AND PLANTS.

The curious observations of the "Naturalist in Nicaragua," in connection with the ant-supporting plants and plant-protecting ants of tropical America, have been described in these columns. In certain *acacias* and *cecropias*, it will be remembered, Mr. Belt found the ants serving as volunteer armies for the defence of the trees against invasion by insect or other enemies, resenting with bites and stings the slightest interference with their charge, while the plant in return provided habitations for the ants, and either special secretions and fruits for their sustenance, or juices for the support of their domestic cattle: the relation between the two being so close that neither could thrive without the other.

It appears from the investigations of Mr. Britten, of the Botanical Department of the British Museum, that this remarkable sort of partnership is not so rare as has been supposed. His attention being called to the matter by Mr. Belt's observations, Mr. Britten has gone over the books and material at his command, and collected the scattered notices of ant-tenanted plants, a *resumé* of which he gives in a long article in the *Popular Science Review*, mentioning the following orders and genera as affording known examples, and specifying the parts of the plants which the ants inhabit

Leguminosæ: Acacia, various species: thorns.

Melastomaceæ: Tococa, calophysa, mycrophysa, myrmidone, and *maieta*, various species: petioles and leaf bases.

Rubiaceæ: Myrmecodia and *hydrophytum:* tubers. *Remijia*, petioles.

Gentianaceæ: *Tachia Guianensis:* stems.

Boraginaceæ: Cordia nodosa: base of petioles.

Verbenaceæ: Clerodendron: internodes.

Polygonaceæ: Triplaris, various species: trunks and branches

Artocarpaceæ: Cecropia peltata: trunks and branches.

Orchidaceæ: Schomburgkia tibicinis: pseudo bulbs.

One of the most striking instances of this sort is afforded by *myrmecodia tuberosa*, to the very existence of which it is essential that the tuber should be tenanted by ants. It was discovered by Rumpf, in Amboy, something over a hundred years ago; but he was uncertain whether the whole was a vegetable or whether the tuber was an ant's nest from which the plant sprung. It presents the form of a large, irregular tuber, from which spring a few thick, fleshy leaves crowded together at the summit. Dr. Beccari, who has lately collected the plant in Borneo, has watched the development of the tube throughout all its stages. The seed is surrounded by a viscid pulp, resembling that of the mistletoe, and readily attaches itself to the branches of trees on which it falls. It is probable that birds aid also in its distribution. The seed soon germinates under favorable conditions and unfolds its cotyledons; the stem develops slightly, then stops until a particular species of ant burrows a small lateral cavity at its base. The wound determines a great development of cellular tissue, as the sting of the cynips causes galls on the

oak; and as the stem enlarges into a sort of tuber, the ants excavate galleries in all directions and establish therein their colony. The marvelous part of the matter is that, if the stem is not invaded by the ant, it fails to develop and the plant dies. The apparently abnormal tuber appears to be essential to the growth and maturity of the plant; and the ants—a small, red, and very fierce variety—aid in protecting the plant by making it unpleasant for anything which happens to disturb their dwelling.

The genus *myrmecodia* was formerly regarded as exclusively Malayan; but it is now known to be represented in Java and also in Australia. Five specimens of an Australian species are now growing at Kew Garden.

They have a slaty-gray color and greatly resemble wasps' nests. The galleries with which the tubers are intersected are lined by the ants with a thin papery material. Whether colonies of ants were imported with the plants, Mr. Britten does not say. The allied genus *hydrophytum* has a similar structure, and the best known species, *h. formicarium*, is tenanted by ants. There are three or four other species known, natives of Tropical Australia, the Fiji Islands, and the Indian Archipelago.

The next occurrence of the sort was observed by Aublet, and described in 1775, in his account of the plants of French Guiana. Aublet mentions two species of *triplaris* as inhabited by ants which acutely tormented him when he interfered with the trees in which they had taken up their residence. More recently Weddell, describing these trees, the trunk branches and even the smallest twigs of which are hollow and tenanted, says that, if one happens to touch the trunk of a *triplaris* accidentally, especially if it be shaken, the ants rush out by hundreds from the interior through the small canals by which the medullary canal communicates with the exterior; and if escape is not made quickly, the intruder is covered with dangerous guests, the bite of which is exceedingly painful. The Indians of Guiana call the *triplaris* the "ant tree," the tree being occupied by ants in every stage of its development. Weddell has found the tree, and suffered from the attacks of the ants, a clear brown variety, in many parts of Brazil, in Bolivia, and in Peru.

In the work already mentioned, Aublet describes also a shrub of the genus *tachia*, the stems of which, like those of the *cecropia* described by Belt, furnish bed and board for species of ants. The Galpis call it *tachia*, which in their language signifies "ant's nest."

The bases and petioles of the upper leaves of certain South American species of the genus *cordia* are similarly tenanted, so likewise are the leaves of a number of closely allied genera of *melastomacea*, all natives of South America. In these it is usually the petiole which has developed a form adapting it as a residence for ants. The following description, which Aublet gives of the mode of growth in the *tococa Guianiensis* will apply with slight modifications to all the other genera: The leaves are attached to the stems by a small hairy petiole, hollowed out into a groove on its upper surface and convex below. The two sides of the petiole swell out so as to form a double heart shaped bladder, corresponding with which are two holes on the under side of the base of the leaf, between the two intermediate nerves. Through these holes the ants have access to the divisions of the heart-shaped bladder. The stems, which are hollow, are entered by different openings. Mr. Belt describes a similar arrangement which he observed in an allied plant in Northern Brazil. A Mr. Trail, who is at present investigating this subject in Central America, writes to Dr. Hooker from Santarem, that at least three species of ants inhabit a melastomaceous plant of that region: he believes it to be *myrmodona formicaria*.

The manner in which the *acacia* known as the bull's horn thorn is tenanted and defended by ants in Nicaragua, as observed by Mr. Belt, was described in the SCIENTIFIC AMERICAN last summer.

In Honduras an orchid affords an equally satisfactory residence for ants. The hollow pseudo bulbs have a small hole at their base through which the ants enter; and so thoroughly do they take possession that Mr. Skinner, who discovered the plant, was almost prevented from collecting specimens by the stings of the swarms which rushed out upon him when he touched the plant. The orchidaceous plant referred to by Mr. Bates, "The Naturalist on the Amazons," in describing the formicarium of the Brazilian *crematogaster limatus*, was probably a relative of the one described by Mr. Skinner.

Now that attention has been called to the matter, it is quite likely that other partnerships of the sort will be discovered. Indeed Mr. Britten mentions several plants, specimens of which give evidence of such occupation. They are all South American species: a rubesaceous plant no referred to *Remijia*; and two species of *hyptis—h. Salzmanni* and *h. calophylla*—which almost invariably present hollow swellings suitable for formicaria

MOLECULAR CHANGES IN METALS.

BY PROFESSOR R. H. THURSTON.

In a series of articles contributed to the SCIENTIFIC AMERICAN during the past year, the writer gave an outline of the various phenomena affecting the strength of metals used in construction, and described some that were peculiar in character and but recently discovered, illustrating these facts by graphic representions of the changes of resistance with change of form, such as were obtained by the automatic action of the autographic testing machine of the Mechanical Laboratory of the Stevens Institute of Technology. There are some phenomena which cannot be conveniently exhibited by strain diagrams; such are the molecular changes which occupy long periods of time. These phenomena, which consist in alterations of chemical constitution and molecular changes of structure, are not less important to the mechanic and the engineer than those already described. Requiring, usually, a considerable period of time for their production, they rarely attract attention, and it is only when the metal is finally inspected, after accidental or intentionally produced fracture, that these effects become observable.

The first change to be referred to is that gradual and imperceptible one which, occupying months and years, and under the ordinary influence of the weather, going on slowly but surely, results finally in important modification of the proportions of the chemical elements present, and in a consequent equally considerable change of the mechanical properties of the metal. The process of oxidation, or corrosion, is such a process, and is the most familiar one. Cast and wrought iron are both subject to it, the latter to, by far, the most serious extent. Cast iron is comparatively little affected by oxidation, even where exposed in wet situations or to alternate moisture and dryness. Wrought iron, under ordinary conditions of exposure, is said to become rusted to the depth of a sixteenth of an inch in a quarter of a century. In exceptionally trying situations, it corrodes far more rapidly. Steam boilers are sometimes rusted through, about the water legs, at the rate of a sixteenth of an inch a year, and instances have been known of even more rapid work that this. Exposure, however, while producing oxidation, has another important effect: It sometimes produces an actual improvement in the character of the metal.

Every mechanic knows that old tools, which have been laid aside or lost for a long time, seem to have acquired exceptional excellence of quality. Razors which have lost their keenness and their temper recover, like mankind, when given time and opportunity to recuperate. A spring regains its tension when allowed to rest. Farmers leave their scythes exposed to the weather, sometimes, from one season to another, and find their quality improved by it. Boiler makers frequently search old boilers carefully, when reopened for repairs after a long period of service, to find any tools that may have been left in them when last repaired; and if any are found, they are almost invariably of unusually fine quality. The writer, when a boy in the shop, frequently, if denied the use of their tools by the workmen, looked about the scrap heaps and under the windows for tools purposely or carelessly dropped by the men; and whenever one was found badly rusted by long exposure, it proved to be the best of steel. One of the most striking illustrations of this improvements of the quality of wrought iron with time has recently come to the knowledge of the writer. The first wrought iron T rails ever made were designed by Robert L. Stevens about the year 1830, and were soon afterward laid down on the Camden and Amboy Railroad. These were Welsh rails, and, when put down, were considered, and actually were, brittle and poor iron. Many years later, these were replaced by new rails, but until quite recently some still remained on sidings. When a lot of unusually good iron was wanted, some of these rails were taken up and re-rolled into bar iron. The long period of exposure had so greatly changed the character of the metal that the effect was unmistakable. These facts are stated by gentlemen upon whom perfect reliance may be placed.

"But," it will be asked at once, "how can such changes occur without apparent cause, however long the time?" There are probably two methods of improvement, each due to an independent molecular action. In the case of the razor and the spring, which regain their tempers when permitted to rest, it seems probable that a molecular rearrangement of particles, disturbed by change of temperature in one case and by alternate flexing and relaxing in the other, goes on, much as the elevation of the elastic limit and the increase of resisting power, discovered by the writer and shown on the strain diagram, takes place under strain and set. The other cases may probably be due to a combination of this physical change with another purely chemical action, which is illustrated best in the manufacture of steel by the cementation process. In this process, iron, imbedded in charcoal and kept at red heat, gradually absorbes carbon and becomes steel. Here the element carbon enters the solid masses of iron, and diffuses itself with greater or less uniformity throughout their volume. There seems to exist a tendency to uniform distribution which is also seen in a thousand other chemical changes. Many chemical processes are accelerated, checked, and even reversed by simple changes of relative proportions of elements, which compel acceleration or reversal as the only means of securing this uniformity of distribution.

When, therefore, wrought iron, containing injurious elements capable of oxidation, is exposed to the weather, the surface may be relieved by the combination of these elements with oxygen, and the surcharged interior, by this tendency to uniform diffusion, is relieved by the flow of a portion to the surface, there to be oxidized and removed. This process of flow goes on until the metal, after lapse of years perhaps, becomes comparatively pure. Meantime the occurrence of jarring and tremor, such as rails are subjected to, may accelerate both this and the previously described change.

The effect of strains frequently applied, during long intervals of time, is quite different, however, where they are so great as to exceed the elastic range of the material. The effect of stresses which strain the metal beyond the elastic limit has already been referred to in the SCIENTIFIC AMERICAN. The case of the porter bar (of which a sketch was given, showing how, after a long period of severe usage, it finally broke suddenly, exhibiting the peculiar fracture characteristic of such a method of rupture) will probably be remembered by many readers. A still more marked case has recently come to the notice of the writer

The great testing machine at the Washington Navy Yard has a capacity of about 300 tuns, and has been in use 35 years. Quite recently, Commander Beardslee, whose valuable work has been alluded to in this paper, subjected it to a stress of 288,000 lbs., but it subsequently broke down under about 100 tuns. The connecting bar which gave away had a diameter of five inches, and should have originally had a strength of about 1,000,000 lbs. Examining it after rupture, the fractured section was found to exhibit strata of varying thickness, each having a characteristic form of break. Some were quite granular in appearance, but the larger proportion were distinctly crystalline. Some of these crystals are large and well defined. The laminæ, or strata, preserve their characteristic peculiarities, whether of granulation or of crystallization, lying parallel to their axis and extending from the point of original fracture to a section about a foot distant, where the bar was broken a second time (and purposely) under a steam hammer. It thus differs from the granular structure which distiguishes the surfaces of a fracture suddenly produced by a single shock, and which is so generally confounded with real crystallization. This remarkable specimen has been contributed by the Navy Department to the cabinets of the Stevens Institute of Technology.

The somewhat similar instance of the dropping-off of the end of an immense shaft at the Morgan Iron Works, sometime since, while the opposite end was under the steam hammer, has been described in the SCIENTIFIC AMERICAN.

Were more conclusive evidence required of the occurrence of crystallization of iron, it has recently been given by an interesting incident at the Stevens Institute of Technology. A pupil, while annealing a number of steel hammer heads,

Fig. 1.

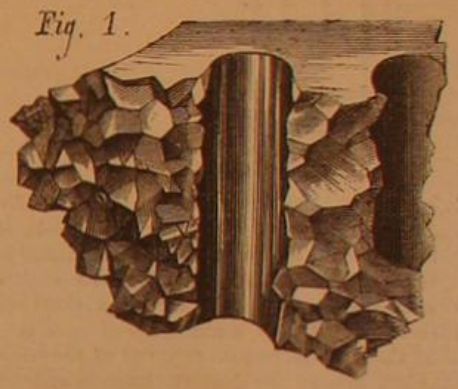


Fig. 2.



left them exposed all night to the high temperature of the air furnace in the brass foundery; when finishing one of them, a careless blow broke it, and the fractured surface was found to possess a distinctly crystalline character. In this example, however, the faces were all pentagonal, and were usually very perfectly formed. These illustrations are conclusive of the question whether iron may crystallize under the action of long continued and severe shocks, or of high temperature. When imperfect crystals are developed, it is easy to mistake them, but the formation of pentagonal dodecahedra, in large numbers and in perfectly accurate forms, may be considered unmistakable evidence of the fact that iron may crystallize in the cubic, or a modified, system. This may apparently take place either by very long-continued jarring of the particles beyond their elastic limits, or under the action of high temperature, by either mechanical or physical tremor. But no evidence is given here that a single suddenly applied force, producing fracture, may cause such a systematic and complete rearrangement of molecules. The granular fracture produced by sudden breaking, and the crystalline structure produced as above during long periods of time, are, apparently, as distinct in nature as they are in their causes. The broken hammer head is so beautiful and perfect an illustration, and such instances are so rare, that it has been drawn and engraved by the accomplished gentlemen attached to the SCIENTIFIC AMERICAN, and appears in this article as the first illustration of the kind which has appeared in the literature of engineering.

STEVENS INSTITUTE OF TECHNOLOGY, HOBOKEN, N. J.

Bacteria and Putrefaction.

Dr. Arnold Hiller, of Berlin, has made a series of elaborate experiments with the view of determining the relations of bacteria to putrefactive changes, and has come to the conclusion that the whole subject needs to be re-examined from the beginning. He has demonstrated that active putrefaction may take place in the absence of bacteria, and that bacteria may be present in abundance without giving rise to putrefaction. In short it seems quite possible that effect may have been mistaken for cause.

THE managers of the International Centennial Exhibition will promote the interests of the enterprise by establishing an agency in New York, and announcing the fact through the newspapers. A number of persons call at the office of this paper every day for information which we are unable to give.

A ONE track prismoidal railway is to be in operation by July 5, 1875, from Sonoma, Cal., to deep water in Sonoma creek, thus making communication by rail and water with San Francisco.

IMPROVED TREE PROTECTOR.

We publish an engraving of a tree protector which is intended by its inventor to furnish an efficient guard to the trunks of trees, and which is also easily placed, removed, and packed for storage and transportation. It is constructed of U-shaped wires, A, and straps of light sheet metal, B; the number of each depends on the required hight of the protector. In the straps, B, at a suitable distance apart, are cut pairs of short parallel slits. The metal between the slits is bent outward to form a half round transverse groove, and inward to form a half round transverse groove. In this way are formed sockets to receive the wires, A. The arms of the loops or bends of the wires, A, overlap or interweave with each other. Upon the end of each strap, B, is formed a small tongue, b^1, which fits into a short transverse slot, b^2,

Fig. 1

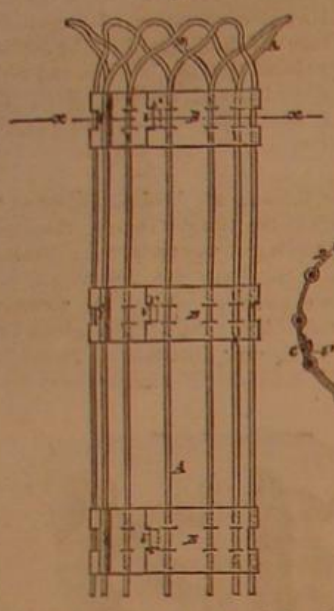


Fig. 2

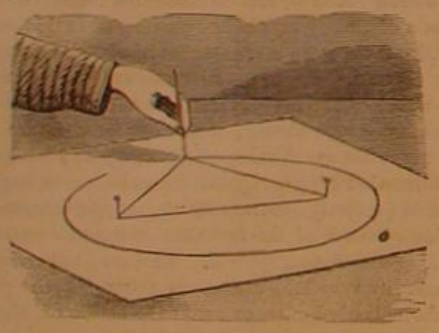


ormed in said straps, B, near their other ends, as shown in Figs. 1 and 2. In the straps, B, at their square ends, and at a little distance from their tongued ends, are formed holes, b^3, Fig. 2, in such positions as to coincide with each other when the ends are overlapped, to receive a short bolt, C, which is secured in place by a nut screwed upon it. The outer arm of the last wire loop at each end of the straps, B, overlaps the last arm of the loop at the other ends of the straps.

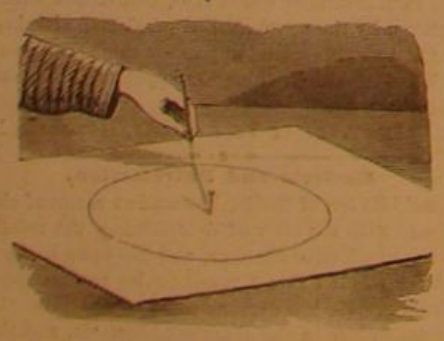
Patented April 7, 1874, through the Scientific American Patent Agency. For further particulars address Mr. Dwight Hitchcock, 34 Greene street, New York city.

TO MAKE OVALS AND CIRCLES OF ANY SIZE.

The following methods will be found convenient, in the absence of dividers or other instruments:



To make an oval, tie together the ends of a thread or string. Two pins arranged within the loop, as shown, govern the size of the oval, which is marked upon the paper by means of a pencil, carried against one side of the loop as indicated. The dimensions of the oval may be made larger or smaller, as desired, by enlarging or diminishing the size of the loop. Elliptical garden paths, flower beds, etc., may be accurately laid out in this way.



To describe a circle, attach one end of the cord to the center pin, and place the pencil in a loop at the other end. Then sweep the pencil around.

These methods are useful for cutting out picture ovals, patterns, and other purposes.

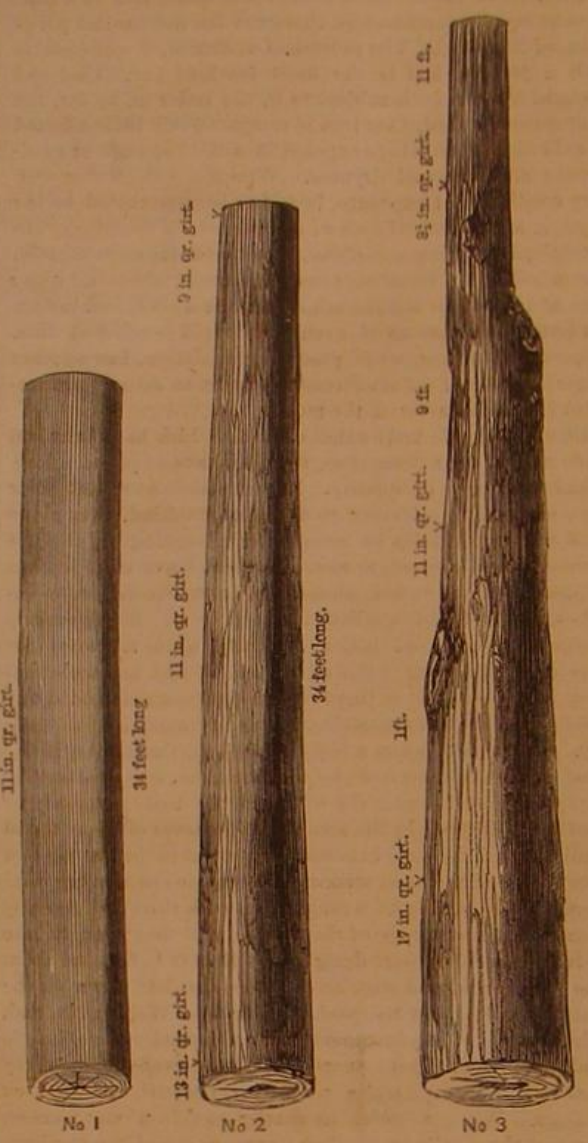
ENGLAND and the United States, according to the latest statistics, are the largest sugar-consuming countries in the world. In 1874 England consumed 830,000 tuns, or about 57·2 lbs. per head of population. The United States in the same period used 770,000 tons, or 44 lbs. per individual.

To prevent hard soap, prepared with soda, from crumbling he bars may be dipped in a mixture of resin soap, beef tallow, and wax

MEASURING BUILDING MATERIALS.

Mr. Richard Horton publishes, in a recent work entitled "The Complete Measurer," the following practical application of his method of ascertaining the solid contents of a tree or similar body:

"Measure its length in feet by a rod, tape, or carpenter's rule, and then take its circumference in the middle with a piece of common whipcord, doubling the cord into four equal parts, and so apply it to the carpenter's rule, to learn the quarter girt in inches, with any fractional quarter or



quarters of an inch that there may be. Or the circumference of the tree may be taken with a narrow, non-elastic painted tape, having spaces of four inches marked upon it, each space being numbered in successive rotation as girting inches, and every such space subdivided into four equal parts by a partial mark on the tape, to answer as quarters of inches. A purchaser will prefer using the whipcord, unless at the commencement of the tape three quarters of an inch is given in the measurement as an equivalent to him for the accustomed advantage obtained by the doubling of the whipcord to apply to the carpenter's rule to find the quarter girt of the tree. The tape, when passed round the tree, shows its quarter girt forthwith. These directions for taking the dimensions of a tree or pillar are under the consideration of its size being the same throughout, as instanced by the diagram No. 1; or of the tree or column tapering regularly from one end to the other, after the manner of the diagram No. 2. But when the size of a tree is not reguiar its whole length, in consequence of sudden variations in its circumference, each part or length of it so varying in girt must be measured separately, in conformity with the subjoined diagram, No. 3, and then the contents of the different parts added together. Having obtained the length and the quarter girt as directed, we refer to the top of the table for such quarter girt; and beneath it, opposite to the length of the tree found in the outward columns of the page, is shown the solid contents of the tree, or portion of the tree, as it may be.

Length. Feet.	Quarter girt. Inches.	Solidity. Feet.
14	17	35½
9	11	9½
11	8½	7
		52

Any part of a timber tree not girting 24 inches (that is 6 inches in quarter girt) is not usually considered timber, and is excluded from the measurement, unless by agreement to the contrary.

The annexed diagram of the transverse section of a tree, with its demonstration, is intended to exemplify the principle upon which the round timber table is compiled, and to represent how to acquire the true quantity of any round body, be its size what it may, as also to clearly show the construction of the square-sided timber table which Hoppus erroneously adopts for round timber."

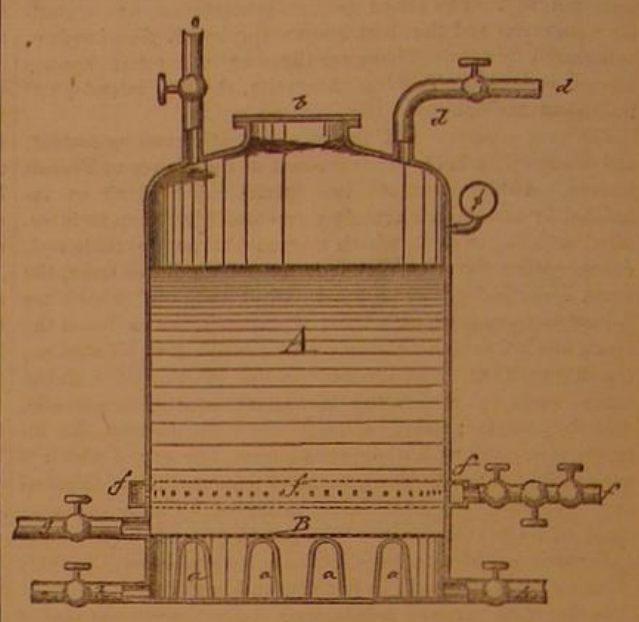


EVERY stone for grinding tools should be provided with a rest, and apprentices should be taught how to use it.

IMPROVED SUGAR-REFINING TANK.

We illustrate herewith a new process for refining sugar, in which the raw product is, when suitably moistened, subjected to the action of air at a high pressure, so that the air is forced into and percolates through the granules, effecting the bleaching and purifying the sugar before it is dissolved. A subsequent part of the process consists in admitting steam and water into the vessel or tank, to complete the purification.

In the engraving, A is the tank, constructed (together with its false bottom or horizontal partition) of such strength and material that a pressure of about 65 lbs. to the square inch may be exerted thereon. The false bottom, B, is perforated and provided with sieves, being placed at suitable hight above the bottom of the tank, A, and stiffened by additional braces, *a*. The top part or side of tank, A, or both, may be provided with a manhole, *b*, for admitting the raw sugar,



the top of the tank being connected with the air-forcing pump by a pipe, *d*, at one side. A water pipe, *e*, of the top furnishes the water required in the treatment of the sugar. The tank is provided with a steam pipe, *f*, which surrounds the tank and admits the steam. An exit pipe and stopcock, *g*, below the steam pipe, *f*, admit the drawing-off of the solution of sugar, while pipes, *h*, serve as outlet pipes for the molasses or sirup. The degree of pressure is indicated on a manometer placed at a suitable point of the tank.

The raw sugar is filled into the tank and moistened, and a better quality of raw sugar, suitably moistened, placed on the top. The manhole and pipes are then closed, with the exception of one at the bottom below the sieves, and that connected with the force pump. The air-forcing pump is now set in operation, and the sugar exposed gradually to pressure.

The same tank is then made use of for the purpose of dissolving the sugar by admitting water and steam at the same time through the water pipe, *e*, and steam pipe, *f*.

When the purging of the sugar is complete, the air-forcing pump is continued in operation and dry cold or heated air forced through between the granules of the sugar, drying the same rapidly and carrying the evaporated moisture in similar manner as the sirup, through the lowermost outlet pipes.

Patented June 23, 1874, through the Scientific American Patent Agency. For further particulars, address the inventor, A. H. W. Schrader, Hoboken, N. J.

Agricultural Work for March.

The proper preparation of the ground, care of hotbeds, and sowing of hardy seeds will now occupy the gardener. Seeds of asparagus may be sown as soon as the ground can be worked, in drills a foot apart, and plants from seed sown last year may be set out. Put in rich soil in rows three to four feet wide, and a foot apart in the rows. Old beds ought to have a good dressing of rich manure. Sow beets, carrots, parsnips, and salsify early, in drills of fifteen or sixteen inches, and thin out as soon as they can be handled. Cabbage and cauliflowers from hotbeds, or wintered over, may be set out as soon as the ground is fit. Give them a good location, and keep them thoroughly worked. Sow celery as early as possible, and keep clean of weeds. Lettuce may be set out and seed sown for succession. As soon as the ground is tillable, onion sets may be planted and seeds sown thickly for sets for next spring's planting. They need a rich soil. Sow parsley seed in drills a foot apart, and keep clean. If the seed are soaked in warm water they germinate sooner. As soon as the ground can be worked, peas should be sown: make the drills pretty deep, cover with earth, and on top of this put fine manure. Put brush to them early. Potatoes for early use should be put in as soon as possible. Spinach may be sown now, and that sown last fall ought to be cultivated. Turnips may be sown as soon as the frost is out.

Hotbeds should be in order for sowing egg plants, tomatoes, and peppers to be set out in May. Melons, squashes, and cucumbers may also be started in them, a good way being to reverse pieces of sod and plant the seeds on them, as they are then easily moved, and, adds the *American Farmer*, have your seeds and tools all ready for the work now at hand.

A LITTLE camphene dropped between the neck and stopper of a glass bottle will render the latter easily removed if jammed fast.

GATHERING AND STORING ICE.

Our engravings illustrate the most recent improvements in the methods and tools employed for gathering and storing ice. They are selected from the *Science Record* for 1875.

Fig. 1 is a general view from a winter scene on the Hudson river, one hundred miles above the city of New York. At various convenient points along the banks of the river are located immense storehouses, within which the ice is deposited, and kept for summer use. Fifty thousand or a hundred thousand tuns are frequently deposited in a single storehouse.

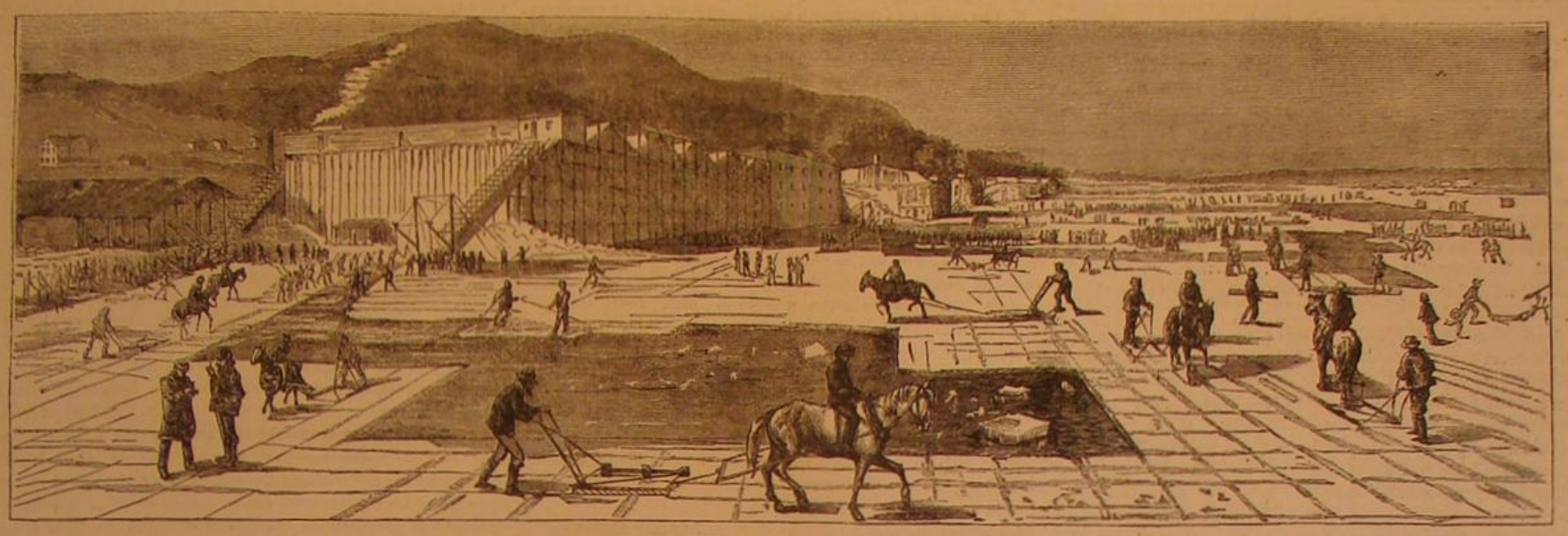


Fig. 1.—ICE GATHERING ON THE HUDSON RIVER, NEAR NEW YORK.

The storehouse buildings are composed of wood, with double walls, and are very rough-looking. In summer the ice is loaded into barges, towed down stream to New York, delivered therefrom directly into ice carts at the dock, and thence distributed to customers at the doors of their dwellings. Ice is thus ordinarily supplied in New York at a cost to the user of about one quarter of one cent up to one cent per pound, depending on the quantity taken and the relative abundance of the supply. An open winter yields a poor crop of ice, and the price during the ensuing summer is fixed at a higher figure.

In gathering ice, the work commences as soon as the ice reaches a thickness of nine inches. The plots of good ice (for the thickness and quality of the ice vary greatly at different points on the river) within convenient distance of the ice houses are staked out and marked with hemlock brush. Then, with ice plows, the men mark out the ice in suitable squares (36 by 22 inches), cutting the groove about an inch in depth (see Fig. 1). Following the markers, plowmen with plows of deeper blade sink the groove to a depth of three inches, and continue this operation until a sufficient depth is attained. Just enough ice is left to hold the blocks firmly together. The next operation is to separate a raft of the blocks (generally 112 in number) by taps of the heavy ice chisel. These rafts are towed by horses into a canal cut from the pond to the ice house, where the raft is secured by pikemen, and thrust toward the slope of the ice house. Before this is reached, men with tridents have broken the raft into single cakes, which, as they reach the slope, are guided to the cleats attached to endless chains, which, moved by steam power, carry a steady stream of ice to any desired gallery of the storehouse (see Fig. 2). From this point, the blocks glide swiftly down an incline until they reach the doorways, where bar men dexterously switch cake after cake into the slide which leads into the house. The work of stowing is quickly done, and the blocks are so arranged that a space of two or three inches between the cakes gives circulation of air and means of escape for the water from the melting ice. When the house is filled, loose hay is thrown over the top, and the house is closed.



Fig. 2.—THE STEAM ICE ELEVATOR.

The form of the ice plows is shown in Figs. 1 and 2. One of the runners, which is smooth, rests on the ice and serves as a bearer; the other runner is provided with a series of teeth or shares, which cut a groove in the ice.

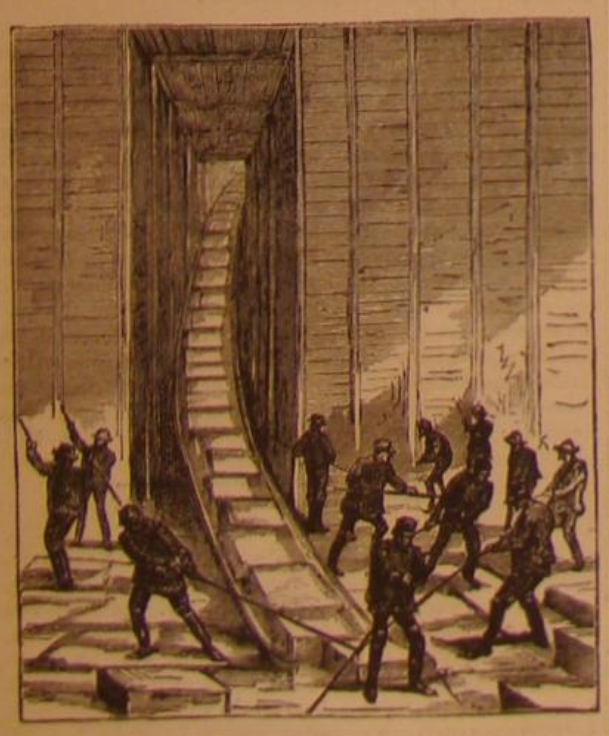


Fig. 3.—SMALL ICE ELEVATOR.

The New York Canals.

The State Engineer and Surveyor, in his annual report on the canals of New York, says that the navigable canals and feeders aggregate a length of about 907 miles, and, with the lakes and rivers artificially connected with them, make 1,393 miles of navigation. The total cost of these canals, including their equipment and extraordinary repairs, is given at $100,717,995.

It appears from the report that the improvement of the chief of these works—the Erie Canal—is not yet completed, either in width or depth, in accordance with the original plan. It is estimated that, for the expenditure of $379,000, a uniform depth of seven feet can be secured. The State Engineer expresses great confidence that the progress made in the use of steam, for towing purposes on the Erie Canal, will soon cause steam to supersede all other kinds of motive power.

Speed of Trains and Weight of Rolling Stock.

The current report of the Railroad Commissioners of Maine contains suggestions in regard to reducing the speed of trains and the weight of rolling stock on railways, to the end of diminishing the wear and tear of the latter and of the track. In a communication from Superintendent Sawyer, of the St. Croix and Penobscot Railroad, that officer writes: "With two engines in equally good repair, we ran one at a speed of 26 miles an hour, 42 miles daily, with a mail train, and at a speed of 14 miles an hour daily with a freight train: total, 84 miles daily until it had run 14,000 miles, when it became necessary to take it off for general repairs. The other ran 84 miles daily at a speed of 14 miles an hour, with a freight train, until it had run 21,000 miles before requiring general repairs, and was even then found in better condition than the one running at the higher rate of speed. Wood and oil were consumed nearly in the same proportion. It is fair to suppose, also, that the rails, sleepers, bridges, etc., suffered the same additional wear. It is my opinion that an increase of speed of 12 miles an hour, beyond 14 or 15 miles, will increase the cost of repairs at least 75 per cent.

"In relation to wheels, I think that, at a lower rate of speed, a 350 lbs. twenty-eight inch wheel is more than equal to a 500 lbs. 32 inch wheel at a high speed. A heavy axle will jar off at high speed before a light one will become unsafe with the same number of miles run at low speed. A 25 tun engine is of sufficient weight for general use. If additional power is required with a snow plow on heavy freights, rather increase the number of engines than the weight of them; there is less risk in moving snow with power and force than with momentum. As



Fig. 4.—TRANSFERRING ICE FROM THE GALLERY TO THE STOREHOUSE.

to passenger cars, a fifty seat passenger car can, in my opinion, be run more economically than the ordinary car. The first cost is $1,000 less, the weight and wear on the rails are less, the cost of repairs is less, and it requires less power to move six fifty seat cars, there being a difference of 18 tuns in favor of the six light cars."

Correspondence.

A Fever Case.

To the Editor of the Scientific American:

In the coal regions of Pennsylvania is a town of five or six thousand inhabitants, situated in a valley so narrow that, for a considerable distance, only one street is possible. Down the valley runs a stream or creek which has a fall of about 200 feet to the mile. Sometimes the stream has a depth of 3 or 4 feet, at others only as many inches; it runs under the front and back yards and houses, and is used as a very convenient sewer to carry off filth of every description, to bless the inhabitants along the river where the current is not so rapid. This creek is generally covered with heavy hemlock plank, while in every yard is a door through which garbage may be emptied.

During last October, a citizen sent his teamster to dig some earth from the cellars of two of his stores; the earth was thrown into the street and then hauled some half or three quarters of a mile up town, and spread over a vacant lot adjoining some dwelling houses. The earth taken from the cellars had a pungent odor, and a peculiar watery, iridescent appearance. On the night following its removal from the cellar, the proprietor of the place, who had superintended and assisted at the digging, was taken with violent cramps, which lasted several hours, and then gave place to a dull, languid feeling, with pains like rheumatism and a discoloration of the skin, the hands and arms swelling and becoming quite purple. The next day the teamster was taken ill, and the doctor pronounced the symptoms to be those of typhoid fever. The day following a young man, working in one of the stores from the cellar of which the dirt was taken, was also taken violently ill, and the doctor pronounced the case to be similar to that of the teamster. Upon the same day a girl about 14 years old, living in the dwelling adjoining the lot where the dirt was thrown, was taken with the same symptoms, which developed into violent typhoid fever and culminated in death a few days later. There were soon more than a dozen cases of the fever, as it began to be called, and in two weeks the number reached upwards of 60. The symptoms generally were violent headache, pain in the back of the neck, and high fever, with loss of appetite and general languor. When the fever subsided, the tongue became coated with a thick coat of dark green matter, which remained until the patient was convalescent. The fever averaged, probably, in each case from 12 to 15 days, but was followed by extreme weakness, loss of memory, dimness of sight, etc., lasting from 3 to 6 weeks additional.

The majority of cases did not result in a radically typhoid condition, as I understand it, the bowels being seldom attacked. In every case where a patient took a relapse from exposing himself too soon, the result was fatal, and in very few other cases did it prove so. The evidence hardly seems indisputable that the fever was contagious, as sometimes only one person, and sometimes several, in a large family took it. In one case a person who came more than a hundred miles from home, to nurse a patient, left him upon his convalescence, and was home only a few hours when she was taken with the same complaint, and went through a regular six weeks' course, although hers was the only case in the city of 25,000 inhabitants where she resided.

The question has arisen whether the half dozen wagon loads of putrescent mud, the atmospheric conditions, or the possibly foul emanations arising from the natural sewer, in which the water had been rather low for some time, caused the fever. If any of your readers can throw light upon this subject, we would be happy to hear from them, as six weeks' experience with this fever has sadly broken into twenty-eight years of otherwise uninterrupted health. H.

East Mauch Chunk, Pa.

Cotton Manufacturing in the South.

To the Editor of the Scientific American:

It is a well known fact that cotton factories at the South have been making money while many of those at the North have been compelled to suspend operations in whole or in part. Some of the reasons for this state of things are as follows:

1. Labor is cheaper at the South than at the North.

2. In consequence of a milder climate, the necessary expense of living is less there than in New England, as is also that of heating factory buildings, etc.

3. Coal is abundant in the South, and cheap water privileges can be obtained in every direction.

4. The purchase of the raw material direct from the producer saves the profits of numerous middlemen, the cost of several buildings, and long transportation.

To these advantages I am satisfied that still another of great importance can be added. The Southern factory should buy the cotton in the seed, gin, and then spin it, without packing into bales; and it is to urge some of your inventive readers to arrange machinery for this purpose that I write this communication. Some of the advantages of such a system would be as follows:

1. The yarn would be stronger. Baled cotton cannot be prepared for carding without beating, and thus weakening the fiber to a greater or less extent.

2. There would be less waste. Frequently much cotton is discolored and otherwise injured by foreign substances that have been packed with it. I understand that at the North and in Europe it takes from 108 to 115 lbs. of cotton to make 100 lbs. of yarn; and although the waste is not so great at the South, it is nevertheless considerable.

3. The cotton seed would be pressed at the same establishment, and the oil and oilcake sold for many millions each year.

4. The interest on gins and gin houses, which are now idle the greater part of the year, would be saved to planters.

5. The raising of cottons on small farms would be encouraged. The plantation system is not adapted to free labor, and is steadily breaking up; but until cotton can be readily sold in the seed, few small farms will be opened in the cotton section, for the reason that a man cannot afford to buy and operate a gin if he only plants a few acres of cotton. Better cottons and more per acre will be obtained on small farms than on large ones. The reason of this is that a hand can plant and cultivate two or three times as much cotton as he can pick. During the picking season, the entire field should be gone over at least once a day. Even under the slave system, planters who put in an acre of corn for each acre of cotton, and sent the smallest pickanniny into the field to pick cotton, were often unable to pick fast enough; and now that they have so little control over their workmen, the result is sometimes disastrous. But the small farmer if he is unable to get extra hands when he needs them, can generally rely on wife and children to help.

I am confident that, under the system proposed, the South can manufacture cotton cheaper than New England, or Old England either; and that if the proper effort is made, it need not be long before her income from cotton will be double what is now.

Manhatton, Kansas. ALBERT GRIFFIN.

Telegraph Alphabets.

To the Editor of the Scientific American:

In your issue for March 13, you published a communication from John Millis, of Addison, Mich., in regard to telegraph alphabets, which is calculated to mislead your many readers, inasmuch as it gives an utterly erroneous and empirical view of the subject. Mr. Millis states that the Morse "alphabet is defective, as the sound of a dash is very much like the sound of a dot with a succeeding space." Judging from this, I should say that Mr. Millis is as yet but a beginner in the art, for when most persons begin to learn to telegraph they fancy they perceive the same thing. The fact is, to any one at all practised in reading by sound, the defect is by no means as stated in the communication under review. No operator could possibly mistake a dash sounded for a dot with a succeeding space; and I do not know an instance, even among very ordinary sound operators, in which a mistake has occurred for the reason given by Mr. Millis.

The defect is in the spaced dot letters, C, O, R, Y, and Z. This was long ago recognized. Bain avoided it; but his alphabet was longer than the Morse. In the European code, also, the defect is avoided; and were it not for the difficulties involved in achange, the Western Union Telegraph Company would have adopted it some time ago. It was seriously proposed at one time, as I clearly remember. This being the acknowledged and long felt-defect in the Morse alphabet, to which innumerable errors can be traced and by reason of which they are occurring every day, how does Mr. Millis' proposition meet the case? In the Morse system, there are five such letters. Mr. Millis proposes to increase them to seventeen. In other words, his alphabet, besides being cumbrous and inadequate to speed, increases the chances of errors more than three times.

It may not be inappropriate to suggest that the composition of telegraph alphabets be left in the hands of the great body of experienced telegraphers, not only in this country but in Europe, who may well be presumed to know the difficulties and wants of existing systems.

Washington, D. C. WM. E. SAWYER.

The Sun's Orbit and Rate of Motion.

To the Editor of the Scientific American:

As you have been kind enough to publish several of my articles, relative to the retrograde motion of the sun in space, you will still confer a favor by publishing the following, relative to the size of the orbit of the sun and the rate of his motion.

The sun annually retrogrades sufficiently to keep the earth rotating 20 minutes and 23 seconds before she comes to her sidereal place in the heavens. Those 20 minutes and 23 seconds are the 70¾ portion of a day, and, strange as it may appear, I am going to measure the sun's orbit by them.

As astronomers have not given, so far as I am aware, the computed distance of the earth from the sun since observing the transit of Venus, I will assume a distance; and when the distance is announced, the correction, if any, can be made.

Assuming that the distance of the earth from the sun is 92,000,000 of miles, the circumference of the terrestrial orbit will be 552,000,000 of miles. Now, in a sense, the earth sweeps around the whole in twenty-four hours. How many miles, then, are in the arc which the earth rotates past in twenty minutes and twenty-three seconds? Answer: 7,811,320 miles. That is the number of miles the sun travels in a year. Multiply the 7,811,320 miles by the number of years in precession, to wit, 25,800, and you have for the circumference of the solar orbit, 201,532,056,000 miles, and for its diameter, 67,177,352,000 miles: which shows that the diameter of the sun's orbit is nearly twelve times as great as is that of the orbit of Neptune; and when the two orbits are compared, the latter is like the eye or hole in the center of a large circular saw, compared to the saw itself.

Gloucester, N. J. JOHN HEPBURN.

Aerial Flight.

To the Editor of the Scientific American:

Will your various correspondents on this subject pardon my saying, after a careful study, that they are all on the wrong track? The first thing to be done is to comprehend the rationale of bird flight. This, I apprehend, is grossly misunderstood. It is supposed to be due solely to the mechanical movements of the wings, guided by instinct. Now, how could this be? Mere muscular effort will not reasonably account for the ascent in the air, still less for the propulsion forward. I would ask naturalists to consider, more particularly than they yet have done, the weight of the larger birds, the loads they sometimes carry with them, the great altitude to which they ascend, and the length of time they continue on the wing. Think of birds of passage flying for consecutive days without a single break on the journey, and that often against a strong head wind, the wings moving, in many cases, over 500 times in a minute. What a labor to be accounted for! It is manifestly above bird strength. If, again, they do rest upon the wing, all the greater is the mystery, for they would now have to be both kept from falling and glided onward by a power we know not of, otherwise one of these two catastrophes would ensue: Either they would fall to the ground, or they would fail in their journey; they would go in any direction but the right one. Upon the muscular effort theory, they would have before them a labor quite exceptional, so herculean that nothing in Nature is to be compared with it. Before they had gone many miles, they would fall to the earth exhausted, and die. Despite appearances, it must surely be that birds in their flight are not entirely dependent upon muscular energy; there must be no labor in the question at all. A beneficent Creator has given them the power of flight as their natural mode of transit; hence to fly, to them, is as instinctive, as natural, as it is for the heart to beat or the lungs to be incessantly inhaling and expelling large volumes of air. The animal flame internally performs unremitting labor, but without effort expended; toil there is none, but on the contrary, relief. To the winged tribes, it is a labor to walk, hence they are doomed to fly, and that is manifestly one of the crowning pleasures of bird existence.

The winged insect tribes afford more striking proof, I think, that flight is not entirely the effect of mechanical effort. The common bluebottle flies but little; he darts from place to place as if his wings seemed to do no more than balance him.

I do not think it possible to explain the phenomena in question without calling in the aid of some force hitherto unsuspected, which, for want of a better term, might be looked for under the name of "will power." If something could be laid hold of by investigation in this new channel, and applied to the balloon, aeronauts might, with greater cheer, prosecute their labors, and save some money and some necks, by making the discovery known. Huxley may be approaching the line of thought. MOUNT NEBO.

Dunedin, New Zealand.

Early Steam Navigation.

To the Editor of the Scientific American:

In reply to the question: "What was the name of the first steamship that crossed the Atlantic?" you answer: "The Savannah," built by Crocker and Fickitt in New York, in 1819.

My father, Dr. C. P. Van Houten, of Amite City, La., who will be 82 on April 15, 1875, writes me as follows: In 1816 he engaged with Allaire and Stoutinger, steam engine makers in Fulton's old works in Jersey City, he having previously served his time at the business. He afterward engaged with Daniel Dodd, engine maker, of Elizabethtown (now Elizabeth), N. J. Dodd soon placed him in charge of his works; and during his time, in 1818, the steamship Savannah received her engines and boilers from Dodd's shop, was fitted out and made a voyage to Russia, calling at Liverpool. She was the first steamship that crossed the Atlantic.

Matteawan, N. Y. P. L. VAN HOUTEN.

Frozen Water Mains.

To the Editor of the Scientific American:

The present severe winter, with its continued low temperature and severe frosts, has been a cause of much loss and damage to the systems of water supply. Steam fire engines have been rendered helpless, and burning towns left to the mercies of the elements. A remedy might be found in laying an additional pipe under all mains and service pipes, through which steam could be injected and the mains thus kept from freezing. The steam pipe should be immediately under the water pipe, and it could be arranged with a branch terminating at each fire plug. The steam pipe should also be supplied with means of relieving the pipe from the water of condensation.

The steam fire engines could be arranged to force steam into the pipe to thaw out the mains and fire plugs, and the action of frost might be very much resisted by forcing steam through the pipes occasionally in seasons of extremely cold weather. C. F. H.

Hazleton, Pa.

Small Steam Engines.

To the Editor of the Scientific American:

I have been much interested in reading the various statements as to the results accomplished by small steam engines, but why does not some one manufacture them for sale? The demand for small motors, for driving lathes, coffee mills, washing machines, and many other uses, is very great and rapidly increasing. Only yesterday, I was inquired of by a man who said he had examined all the advertisements in the SCIENTIFIC AMERICAN and other papers he could find, but nowhere could he find a steam engine of from one half to

one horse power, nor could he find any one who could inform him where such an engine could be had.

If some person would make such an engine and boiler, that could be sold at a reasonable price, I am confident large numbers could be sold. As they would be used by amateurs in or about residences, they should be as simple as possible. No money should be expended on them merely for show, such as planing or polishing parts which can be painted; but they should be strongly built, and special care should be taken to furnish ample boiler capacity, with strength sufficient to prevent accidents.

Thinking persons are now convinced that much of our domestic labor can and should be done by power. It is a disgrace to our civilization that a woman should be compelled to break her back over a wash tub and board. Very few men would be willing to do the same work all day; and there is no reason, why this operation, which is a combined chemical and mechanical process, should not be done by machinery, and so of many other domestic labors.

Some fifteen years ago I had great difficulty to find a small foot lathe, as no manufacturer appeared to make one for sale; and after writing far and wide, I only succeeded in getting one from a man who built it for his own use. Today they are regular articles of trade, made by several concerns, all of whom find ready sale for them. The same would undoubtedly prove true of small engines. Who will do it?

Washington, D. C. W. C. DODGE.

An Appeal to Inventors.---A New Invention Greatly Needed.

To the Editor of the Scientific American:

This part of the country is infested with fleas and sand flies, and so far I have been unable to find anything that will either drive them away or kill them. We have tried rock camphor, carbolic soap, and kerosene oil, and have so far failed. The fleas infest our houses and barns, and almost every animal that walks. Some people say that the sand breeds them, some attribute them to the hogs, but there have been no hogs running round here since the war. Some people say that the fleas are not as bad as they were just after the war, but both pests are terrible. We keep our bedrooms dark, and undress outside; and keeping camphor in the beds, we have better nights, but in the morning they go for us, as hungry as ever and by the score.

The sand flies go for both man and beast, especially on still, moist mornings and evenings, and all day when it is still. Some people smoke to drive them away from the face, and the negroes substitute a stick in the mouth with a bunch of burning rags on the end; but the little persistent pests will bite the ears, hands, and neck, in spite of everything. Kerosene oil will keep them off for 5 or 10 minutes; but it evapo rates, and they bite as badly as ever. If there is anything known to the scientific world, that will either kill or drive them off, you will confer a great boon on a large suffering community by letting us know of it.

Borel Plantation, St. Mary's, Ga. WILLIAM STEELE.

PRACTICAL MECHANISM.

NUMBER XX.

BY JOSHUA ROSE.

PUMPS.

Pumps are commonly divided into three classes, the suction pumps, the force pumps, and the suction and force pumps.

SUCTION PUMPS.

A suction pump causes water to raise itself, by relieving its surface of the pressure of the column of air resting upon it. The principle upon which it acts may be explained as follows:

The surface of all water exposed to the air has the pressure of the air or atmosphere resting upon it; if, therefore, one end of a pipe or tube be lowered into water, and the other end be closed by means of a valve or other device, and the air contained in the pipe be drawn out, it is evident that the surface of the water within the pipe will be relieved of the pressure of the atmosphere; and there will be no resistance offered to the water to prevent its ascending the pipe. The water outside of the pipe, still having the pressure of the atmosphere upon its surface, therefore forces water up into the pipe, supplying the place of the excluded air. The water inside the pipe will rise above the level of that outside of the same in exact proportion to the amount to which it is relieved of the pressure of the air, so that, if the first stroke of a pump reduce the pressure of the air contained in the pipe from 15 lbs. on the square inch (which is its normal pressure) to 14 lbs. per inch, the water will be forced up the pipe to the distance of about 2¼ feet, because a column of water an inch square and 2¼ feet high is equal to about 1 lb. in weight.

It is evident that, upon the reduction of the pressure of the air contained in the pipe from 15 to 14 lbs. per square inch, there would be (unless the water ascended the pipe) an unequal pressure upon its surface inside as compared to that outside of the pipe; but in consequence of the water rising 2¼ feet in the pipe, the pressure on the surface of the water, both inside and outside, is evenly balanced (taking the level of the outside water to be the natural level of the water inside), for the pressure upon the water exposed to the full atmosphere will be 15 lbs. upon each square inch of its surface; while that upon the same plane, but within the pipe, will sustain a column of water 2¼ feet high (weighing 1 lb.) and 14 lbs. pressure of air, making a total of 15 lbs., which is, therefore, an equilibrium of pressure over the whole surface of the water at its natural level.

If, in consequence of a second stroke of the pump, the air pressure in the pipe is reduced to 13 lbs. per inch, the water will rise up it another 2¼ feet, and so on until such time as the rise of the column of water within the pipe is sufficient to be equal in weight to the pressure of the air upon the surface of the water without; hence we have only to determine the hight of a column of water necessary to weigh 15 lbs. per square inch of area at the base of the column to ascertain how far a suction pump will cause water to rise, and this is found by calculation or measurement to be a column nearly 34 feet high. It becomes apparent then that, however high the pipe may reach above the water level, the water cannot rise more than 34 feet up the pipe, even though all the air be excluded within the pipe, because the propelling force, that is, the atmospheric pressure, can only raise a column of water equal in weight to itself. It is found, however, in practice, to be an excellent suction pump which will raise water thirty feet.

From this it will be perceived that the terms "drawing water" and "suction pump" do not accurately represent the principles upon which this pump performs its duty; and it would be much more proper to call it a "displacement pump," since its action is simply to enable the water to rise by displacing the air from its surface.

The duty of this pump is, therefore, in the first place, to extract the air from the suction pipe, and, in the second place, to discharge the water from its barrel through the medium of valves in such a manner that the column of water in the suction pipe is at all times entirely excluded from the pressure of the atmosphere.

FORCE PUMPS.

A force pump is one by means of which the water is expelled from the pump barrel and through the delivery pipe by means of the mechanical force applied to the pump piston or plunger; the amount of power required to drive such a pump will, therefore, depend at all times upon the hight to which the water is required to be forced. When a pump is arranged to draw the water, and force it after it has left the pump barrel, it is termed a suction and force pump; but if the water merely flows into it in consequence of the level of the water supply being equal to or above that of the top of the pump barrel, it is termed simply a force pump. Hence a suction pump performs its duty in causing the water to rise to the pump, a force pump is one which performs its duty in expelling water from its barrel, and a suction and force pump is one which performs both duties alternately.

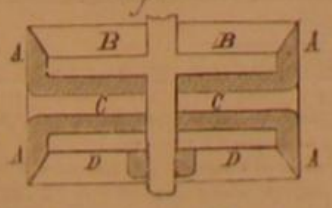
All pumps require a suction and a discharge valve, the suction valve being so arranged as to open to admit the water into the pump barrel while the pump piston or plunger is receding from that valve, and to close as soon as the plunger stops or reverses its motion. The delivery valve is so arranged that it closes as the pump plunger or piston recedes from it, and opens when the same approaches it. When, therefore, the pump piston recedes from the suction valve, the latter opens and admits the water; and when the piston reverses its motion, the suction valve closes, and the descent of the pump piston forces the water through the delivery valve, that being its only possible mode of egress from the barrel of the pump.

The arrangement of the valves may be the same for a force as for a suction pump (although it is advisable, in some cases, to place an additional valve to a force pump to prevent the pump piston from receiving the force of the water in the delivery pipe), the only difference being that the water is permitted to flow freely away from a suction pump, whereas it is confined to the delivery chamber or pipe in a force pump, so as to force it to the required hight or pressure, as the case may be.

PISTON PUMPS

A piston pump is one in which the water is drawn or forced by means of the piston fitting the barrel of the pump airtight, which is most commonly done by providing the piston with two cupped leathers, formed by being pressed in a die made for the purpose. The leather is soaked in water before being placed in the die, and is allowed to remain in the die until it is dry, when it will be sufficiently hard to admit of being turned in the lathe. Fig. 57 represents such a piston in section, A A being the leather, B the piston, C C

Fig. 57.



a piece of metal, placed between the leathers to fit their rounded corners, so that the sides of the leathers shall not move when the piston reverses its motion, and D the follower, which clamps the whole together by means of the nut behind it.

The capacity of a piston pump is its area multiplied by the length of its stroke; but it must be remembered that all pumps throw less water than their capacity, the deficiency ranging from 20 to 40 per cent according to the quality of the pump. This loss arises from the lift and fall of the valves, from inaccuracy of fit or leakage, and in many cases from there being too much space between the valves and piston or plunger.

A plunger pump is one in which a plunger is used in place of a piston, the gland through which the plunger moves serving as its guide and also keeping it air and water tight. The plunger is made smaller in diameter than the bore of the pump barrel, so that the capacity of such a pump is the area of the end face of its plunger multiplied by the length of its stroke, because the pump acts by reason of the displacement caused by the plunger entering the barrel. Pump plungers should always be draw-filed lengthways to prevent them from wearing away the packing so rapidly. It is always advisable in this kind of pump to allow as small an amount of space between the plunger and barrel as possible, for the following reason: When the plunger becomes worn, it is necessary to turn it up again in the lathe, thus reducing its diameter. The result is that there is so much air in the pump, between its barrel and the plunger, that it expands as the plunger leaves the barrel and is merely compressed by the plunger returning, so that the pump becomes very ineffective, and finally ceases to pump at all. If the pump, in such a case, be primed with water each time it is started, it may draw water, but not to its full capacity, as the air will remain in the pump barrel until such time as it may become absorbed by the water.

Suction valves for all pumps should be made as large in area as it is possible to get in, so that they will not require to lift much to admit the water to the pump: since it is evident that, when the piston or plunger commences to descend and the suction valve to close, the water passes back through the suction valve until it is closed, thus diminishing the effectiveness of the pump, and, further, causing the valve to close with a blow which proves very destructive to the valves, especially of fast running pumps.

The area of the opening of a suction valve must be at least equal to the area of the suction pipe, whose area is determined by the following principles: Water will not flow through a suction pipe in a solid stream at a greater speed than that of 300 feet per minute. It follows, then, that, the quantity of water the pump is required to throw being determined, the suction pipe must be of such a size that 300 feet of it will hold such quantity.

If the suction pipe be any smaller than that size, the pump will not be fully supplied with water; and the piston or plunger traveling faster than the supply of water follows it, there is, when it arrives at the end of its suction stroke, a partial vacuum in the pump barrel, which keeps the suction valve open. When the piston or plunger has descended until it strikes the water again (the suction valve not having yet closed), the water, descending with the piston, strikes the suction valve with a blow, which, as before stated, gives a backward impetus to the water in the suction pipe, and closes the valve with a blow very destructive to it; especially is this the case in a force pump or a fast running steam pump, in which latter case the steam piston accelerates in speed (when the pump piston has the partial vacuum, referred to, in it because not only is the steam piston relieved from performing any duty, but it is assisted by the vacuum; so that it accelerates its speed greatly until the piston strikes the water in the pump barrel, which it will do with such force as to very probably break some weak part of the engine or pump, or cause the crossheads or piston to become loose. If the working parts of any pump are accurately fitted, it will deliver more nearly its full capacity of water when running slowly.

An air chamber placed in the suction side of any pump causes a better supply of water to the pump by holding a body of water near to it, and by making the supply of water, up the suction pipe, more uniform and continuous. Air chambers should be made as long in the neck as possible or convenient, so that the water, in passing from the pump barrel to the delivery pipe, shall not be forced up into the chamber at each stroke of the pump; for the air in the chamber becomes gradually absorbed by the water. If fresh water is continually passing into and out of the chamber, the air in it will soon become absorbed, and water will supply its place; but if the air chamber has a long neck, the water at its highest level in the chamber will remain there unchanged by the action of the pump, and will become impregnated with air, thus diminishing its propensity to absorb any more; and although the air will finally become all absorbed out of the air chamber, the process is a very much slower one, the air chamber being so much the more effective, and its elasticity, imparting a steady flow of water from the delivery pipe, being unimpaired.

Pumps whose pistons revolve are subject to the same defects from inequality of wear as are rotative engines, but the results are not so keenly experienced, because water will not leak through so rapidly nor to so serious an extent as steam, and, further, because the leakiness of the pump may be compensated for by an increase of the rotative speed of the piston.

Water will not, however, as before stated, flow through the suction pipe at a greater velocity than 300 feet per minute; so that, if the pump performs more revolutions that are requisite (according to its capacity) to carry off more than the quantity of water contained in 300 feet of its suction pipe, the power used in running those extra revolutions is lost, inasmuch as they are superfluous except for the purpose of compensating for the defects in the construction or leakiness of the pump, in which case the excess of speed becomes a necessary evil.

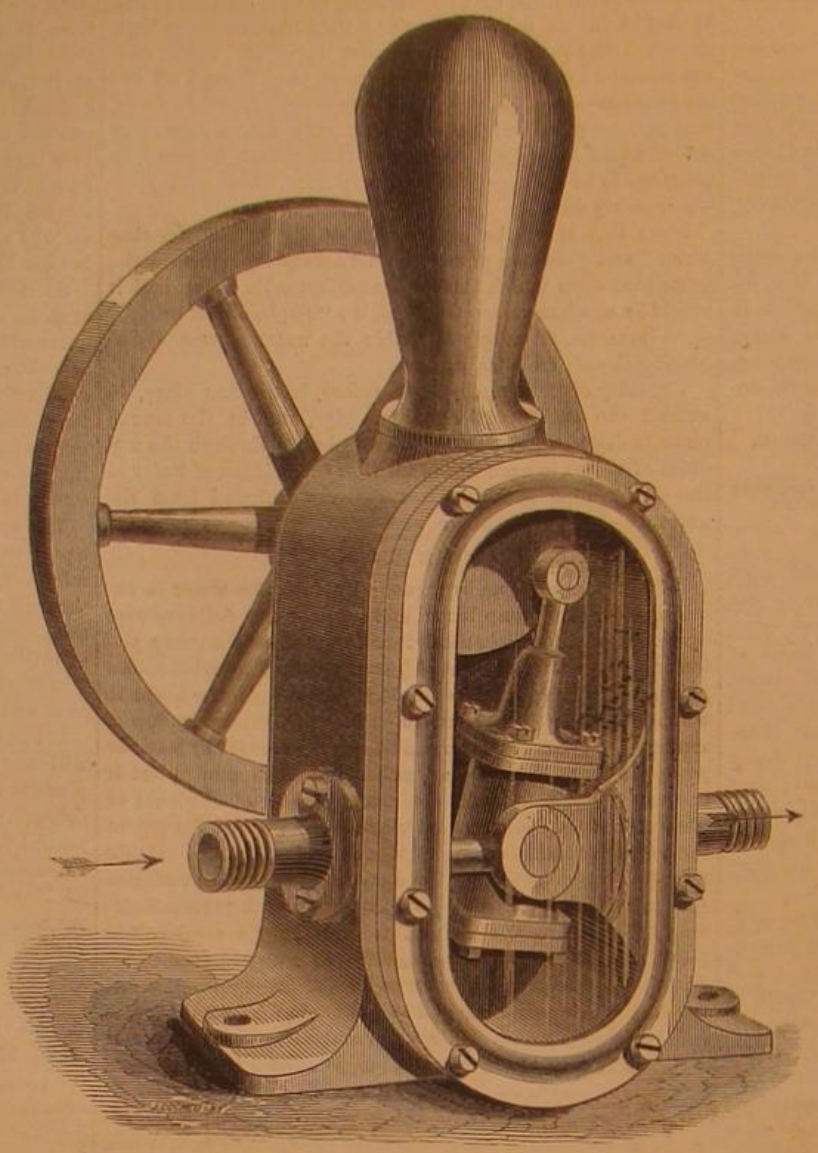
HAIR can be turned blonde, or, in other words, killed, by washing in a very weak solution of soda twice a day. We happen to know that two of the leading belles of New York society owe their much-admired golden tresses to this simple recipe. A piece of soda about as big as a small hickory nut to a quart or so of water is the right proportion. Less soda gives the hair a reddish tone. We do not advocate, however, any such interference with Nature.

IMPROVED HYDRAULIC MOTOR.

The hydraulic motor represented in our illustration is intended to run one or more sewing machines, or other light machinery, and may be used in any house provided with a regular water supply. The apparatus consists of an oscillating engine placed within a perfectly watertight outer casing, into which the water enters at one side and leaves at the other, as indicated by arrows. The oscillating engine cylinder, driven by the water, swings in bearings, as shown, suitable entrance and exit ports of the bearing permitting alternately the entrance and discharge of water from the cylinder. The piston rod of the cylinder is pivoted to a crank disk of the driving shaft. The power is transmitted to the machinery by a friction cone and belting, and can be arranged to run the same at different speeds. A brake device could be applied to produce the instant stoppage of the motor.

The regulating air chamber, shown at the top of the inclosing casing, secures uniformity of motion under varying pressures. A glass front shows the working of the interior parts of the apparatus. The casing is to be attached by fastening screws to any suitable point at or near the sewing machine, and the water can be conveyed thereto by rubber pipes. No oiling is necessary, as the apparatus works entirely in water, which forms a sufficient lubricant. The motor is capable of making from 120 to 500 revolutions per minute, with an average water consumption of forty gallons.

The inventor of this ingenious little apparatus is Mr. A. Schmid, of Zurich, Switzerland.



SCHMID'S HYDRAULIC MOTOR.

Application of Armatures to Magnets.

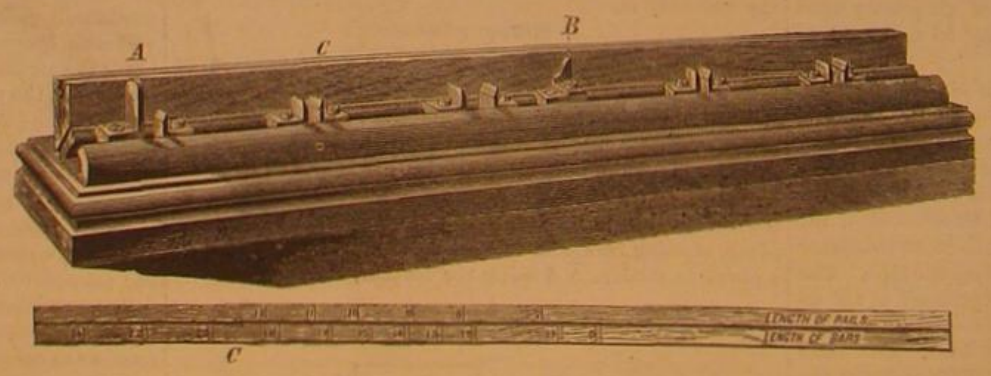
M. J. Jamin states that, if a single armature is placed at the northern end of a magnet, it in no wise modifies the magnetic condition of the southern end, which remains bare. If the effect produced on the south side by the application of an armature is considered, it will be found that it takes magnetism which the steel loses, but that this new distribution is no wise modified by putting an armature on the opposite side, or by removing one. Hence, as regards armatures, there is an absolute independence between the two halves of the magnet. This independence proves a capital fact: that the application of an armature to one of the ends of the magnet occasions a new distribution there, but neither decreases nor augments the sum total of the magnetism there present; the steel loses what the armature gains. This points out a method of determining the magnetism of steel as compared with that of soft iron.

IMPROVED DEVICE FOR LAYING OUT SASHES.

The invention illustrated herewith is a device for laying out sashes of all sizes, from two-lighted windows having casements four feet square to windows of sixteen lights. It is claimed to mark in such a way as to enable better work to be produced than when the like operation is effected by gages fixed in the mortising machine, and to be a decided improvement over the ordinary method of laying out by hand or from separate standards for each size. Stiles, rails, and bars may, in using the apparatus, be molded before marking, thus saving the time used in marking them with a pencil in pairs.

The device consists of iron guides in which the markers are easily adjustable. Upon the upper knife edges of the markers the stiles are laid, the stop, A, receiving the end mortised out for the meeting rail. A light tap of the hammer causes the cutting blades to enter the wood, thus marking any number of pieces exactly alike. For rails and bars the stop, B, is used, which allows the tenon to extend and receive the shoulders.

The bar, C, serves as an index to the implement, and gives the exact length between the shoulders of rails and up and down bars for twelve-lighted sash from 7x9 to 12x24 inches. It is so arranged that the stiles and bars will always be in proper relative proportion. The length of the apparatus is four and a half feet, and its weight 40 lbs. Its construction is strong and durable, and, judging from the numerous references forwarded us by the inventor, its use has given excellent satisfaction. A sash square, to regulate the depth of molding, and full directions for operation are supplied with each device. For further particulars address the inventor, Mr. Andrew Cook, Box 66, Medina, Orleans county, N. Y.



COOK'S IMPROVED DEVICE FOR LAYING OUT SASHES.

Protection from Fire.

At a recent sitting of the Society of Arts, in London, Mr. Coleman, an American civil engineer, read a paper descriptive of an apparatus for the protection of buildings and ships from fire, and for the ventilation of ships, starting with the statement that the annual loss to England and America from fire cost the two countries $250,000,000. Mr. Coleman proceeded to express his undoubted opinion that neither country was possessed, as yet, of the proper apparatus for quenching a fire, either in a building or on shipboard. The cases of Chicago and Boston had shown that no building was absolutely fireproof; and also that, from the moment a great fire obtained a certain head, no amount of water could quench it. What was wanted was an apparatus calculated to send the water into a fire in the proper place, at the proper time, and in the proper quantity. His plan was prevention, and consisted of iron standpipes, one going to the roof, and others to the separate stories of a building, the cocks of the whole to be secured in a box in the side wall. These pipes he would work with a steam engine, placed within the building or close to it. For ships he would have a somewhat similar apparatus. A ship of 1,200 tuns could be fitted with his apparatus for $1,500, and by it all danger of fire at sea would be avoided. The ventilation of ships he would effect by the use of compressed air and perforated pipes, which would diffuse the introduced air all over the interior space to be ventilated. The principle had already been carried out successfully in the Mont Cenis Tunnel. The use of steam as a means of extinguishing fires he had ascertained, by experience, to be an expedient of doubtful efficacy. In the brief discussion that followed, the lecturer was complimented on the ingenuity of his plans, but some doubts were expressed as to their being so applicable to European as they were to American buildings, also as to whether their expense would not be an obstacle to their introduction.

To the above we may add that not only are better means needed to apply water to fires, but inventions are wanted to prevent the freezing of the hydrants in winter. In this city great trouble was experienced during the recent cold weather. Hundreds of hydrants were rendered useless by freezing, and the city was exposed to fearful risks of great conflagrations.

NEGOTIATIONS are in progress for the construction of a narrow gage railroad on the island of Nantucket, to extend from the village of Nantucket, through Town Pasture, the Plains, and head of the plains to the South Shore, a distance of five miles.

Natural History in our Public Schools.

Professor Tenney, of Williams College, publishes an interesting article, in the New England *Journal of Education*, on the importance of teaching natural history in public schools. From it we extract the following:

Every physical necessity and want of man is supplied, and every physical comfort and every physical enjoyment of man comes, directly or indirectly, from the material world; and therefore no subject, of mere human study and learning, can be of greater practical importance than that which embraces the consideration of those things upon which his very existence depends. Nay, the food which we eat, the hat on our head, the shoes on our feet, the coat on our back, every substance which enters into the structure of our dwellings, all come from the objects which natural history considers, and with which this science makes her votaries acquainted. And there are scores and hundreds of objects—minerals, plants, and animals—in the material world today, in addition to those we now use, which are waiting to serve us and bless us, when they have been fully studied and all their properties pointed out.

No, language can hardly exaggerate the importance of natural history studies, and the importance of teaching the elements of these studies early, even to children in the primary schools, as well as to those in the schools of higher grades.

And I have not alluded, by name, to the fact that all the great problems relative to supplying the world with glass and all grades of earthenware—with coal and iron—with lead and tin and copper—with gold and silver and precious stones—with grain for bread—with food fish from the streams and the lakes, and even from the ocean itself—with the flesh of fowl and of cattle—are connected today, most intimately, with natural history studies, and will be more so with every increasing year, with every added million to the population of the earth, and with every real or imaginary physical want.

Nor have I alluded to the fact that in every country, our own as well as others, millions upon millions of dollars worth of grain are destroyed by insects every year, both in the fields and in the granary, and that, if this annual destruction ever ceases, as it probably will cease, or at least be much abated, it will be mainly through remedies or preventives which will come from a more extensive knowledge of the insect tribes; and the boy who is catching and studying butterflies and other insects today may become the man who through his knowledge of natural history shall save to the farmers of this great nation, millions of bushels of grain in a single year—and perhaps a nation from want, and even from famine itself.

What one man can do who has been trained in the elements of natural history, and thus led to the careful study of Nature, is well illustrated by what has been done by such a man as Linnæus, or such a man as Pasteur, or such as many others who might be named, and whose history has already been written, and with whose valuable labors we re already familiar.

Many will perhaps remember that it is recorded that when the King of Sweden saw the ship timber in the royal dockyard going to decay and destruction, he consulted Linnæus, hoping through him to learn the cause of the destruction, and also a remedy or preventive; and he was not disappointed as to what he would know. Linnæus traced the destruction of the timbers to insects, learned their instincts and habits; and by directing the King to have the timbers sunk beneath the water at a certain season of the year, when these insects are abroad in the winged state and when they lay their eggs, he enabled him to prevent further waste. And who can tell the millions of dollars that have been saved to maritime nations by this simple direction which Linnæus gave to the King of Sweden! And it was Linnæus, who had studied the nature and habits of plants, who first taught the nations how to resist the encroachments of the sea by merely sowing a certain species of beach grass (*arundo arenaria*) which served to cover the sands and bind them in their places; and to this day Holland and other nations of the earth have profited by his teaching.

A few years ago, when the silk culture of France was crippled and apparently in danger of being wholly annihilated, by the disease of the silk worm known as *pébrine*, when France had lost by this malady more than two hundred millions of dollars, the French government invoked the aid of Pasteur, a student of Nature, hoping thereby to learn both the true nature of the disease and a remedy or a preventive; and the aid was not invoked in vain. He saved, directly and indirectly, millions of dollars which we can hardly estimate. And all this done, and all this saved, I say, by one man, a careful student of Nature, and just such a one as should be growing up in every school room in our country.

AN EAST INDIAN ORNAMENTAL SHRUB.

Our engraving represents a specimen of a beautiful genus of the sub-order *vacciniacea*, or whortleberry family. The familiar huckleberries (three kinds) are of this tribe, and the cranberry, blueberry, and bilberry are nearly allied to it. Many species are exceedingly ornamental as greenhouse shrubs, our present subject (*epigynium leucobotrys*) being, according to the English *Garden*, the best adapted for this purpose. The foliage is very handsome, the leaves being of a bright glossy green; and the berries, which the plant produces in great profusion, are of an opalescent white color, dotted with black spots. The root of the shrub is very peculiar, being very similar in appearance to a tuber, such as a yam or a Chinese potato.

The *epigynium leucobotrys* has flourished well in the open air in the south of Ireland, standing the winter, which is very mild in that region, exceedingly well. The blossoms, regarded individually, are not especially attractive, but they are produced in abundance; and springing from the centers of the clusters of leaves at the ends of the last year's growth of wood, the intervening stems being quite bare, they give the shrub a singular and effective appearance. The blooms are short-lived, and set their fruit immediately, the berries coming to their full development early in September, and usually remaining on the shrub during that month.



THE EPIGYNIUM LEUCOBOTRYS.

Great Exhibition of Machinery in Manchester, England.

The preparations for the exhibition of machinery, fixed and in motion, at the Royal Pomona Palace, Manchester, in May next, are progressing in the most satisfactory manner; and no doubt, after the great success which attended the show of machinery in connection with the cattle show at the same place a few months ago, most of the principal manufacturers and exhibitors in the country will send entries. The amount of prizes offered exceeds $5,000; and as it is intended to keep the exhibition open for a lengthened period, ample opportunity will be afforded for exhibitors to exhibit their productions and to attract buyers from all parts of the country. The immense demand which is daily made for improved machinery of all kinds in the manufactories of Lancashire makes Manchester essentially a headquarter where an exhibition of this nature cannot fail to attract attention, especially as the Lancashire manufacturers themselves are so keenly alive to competition from without. Already many entries have been sent in, principally from Lancashire, London, and Newcastle on Tyne, including machines for converting fiberous materials, such as cotton, wool, silk, hair, etc., into yarns, threads, or fabrics, andfor printing and otherwise imparting designs to them, also machine tools and apparatus used in molding, casting, pressing, forging, engraving, and cutting metals or timber. The general machinery will embrace steam, hydraulic, and other engines, boilers, and apparatus for generating and transmitting motive power, tramway, engines, and carriages; letter press printing apparatus; machinery for melting, puddling, working, and rolling iron and steel; machinery for bleaching, finishing, dyeing, etc. The promoters of the exhibition, further, with the view to give the exhibition a thoroughly universal and practical character, have applied to the Board of Trade to grant provisional protection to any unpatented and novel invention, and their request has been acceded to. Unpatented and novel inventions may thus be provisionally protected, and persons of limited means may have the opportunity of being assisted in making their designs practicable through their being submitted to the test of thoroughly competent judges. The exhibition will be held in a brick building with a glass roof, covering an area of 40,000 square feet, and Mr. Reilly, the proprietor and one of the promoters of the exhibition, has undertaken to provide, at his own cost, steam boilers, main steam piping, and covering for the floor. The classification of machinery will, as far as practicable, be the same as was adopted at the Great Exhibitions of 1851 and 1862.—*Iron*.

Finding the Meridian.

Mr. George W. Blunt, of this city, who knows as much about nautical matters as any gentleman we know, gives the following simple mode for running a meridian line:

Take a piece of board, or any similar material, and describe on it a number of concentric circles. Place this in the sun; over the center hang a plummet. Observe the shortest shadow from the plummet; the sun will then be on the meridian; draw a line to the center of the circle, and that will be the true meridian line. This will do to mark the apparent time or to correct the compass for variation.

The Tock-Tay, or Large House Lizard.

A correspondent from Eastern Bengal, India, describes (in *Nature*) the lizard of that country.

"This noisy but harmless animal generally finds a lodgement in the bamboo and mat houses of the district that are anywhere near the jungle. It is also fond of living in hollow trees, which give great resonance to its loud and staccatoed cry of tock-tay. It is of a green tint, mottled over with red spots; and suckered feet, like its smaller congener, the tick-tickee, enable it to run under beams and bamboos. Its cry is, however, very different from the gentle tick-tick of the small lizard, being sufficient at night to awaken the soundest sleeper. He begins with a loud rattle as if to call attention; this is followed by another and more imperative rattle; and when every body may be supposed to be listening, he strikes in deliberately with tock-tay—a moan—tock-tay—another moan—tock-tay—a last and final moan, with which he winds up, not to be heard again for aninterval.

In the way of edibles he is fond of a good crust, and the common dung beetle frequently furnishes him with a *pièce de résistance* That insensate insect becomes an easy prey, owing to his heedless rattledum-clash ways; he is the great extinguisher of lights at night in native houses, and Europeans are also familiar with his strong sustained drone, varied by intervals of silence when he has dashed against some rafter or projection, or given himself a heavy fall; but he is not to be discouraged, and is soon droning about as dismally as ever.

The drone, however, is sometimes suddenly quenched without the consequent thump on the floor, and when this is followed by a cruching sound overhead one may safely infer that it is tock-tay who has been lying in wait for him and has snapped up his prey.

These lizards may easily be caught during the day by slipping a noose over their necks while they are asleep in an exposed position; and when so caught they snarl, growl, and snap at their captor in a very ferocious way. I have not heard, however, that they are venomous."

THE CUT-LEAVED BEGONIA.

This pretty little species, *begonia Richardsiana*, is ana -



tive of Natal, and was introduced to England in 1871. In general habit and mode of flowering it bears considerable resemblance to the well known *b. Dregei*, from which, however, it differs, in having laciniated foliage. It forms an elegant decorative plant and grows freely in a moderately cool greenhouse, forming bushy little specimens covered with multitudes of snow-white crystalline flowers. Like all the tuberous-rooted species of the genus, it is readily propagated by division; and if grown near the light, these divisions soon form flowering plants. A compost of turfy loam, leaf mold, and coarse sand suits it admirably, and, like most other members of the genus, it requires an abundant supply of root moisture when growing. Plants of this desirable little species have already found their way into European markets, and it well deserves cultivation as one of the prettiest plants in the whole group.

New Process for Preserving Wood from Fire and Decay.

The following process is by S. W. Moore and Weatherby, of England:

The wood to be prepared is first kiln-dried, which process deprives it of all moisture and much of its volatile turpentine and other inflammable matter; it is then put into suitable cylinders, in which lime and water, with sulphurous acid gas, are forced into the pores of the wood under considerable pressure, the sulphurous acid being a by-product from the wasting of pyrites.

The wood is removed and dried, and is then ready for use.

When sulphurous acid is passed into lime under pressure, a sulphate of lime is formed which is soluble in water, capable of crystallizing as a bisulphite, which is readily oxidizable and convertible into sulphate of lime or gypsum.

As this is an exceedingly insoluble salt, it is not easily removed, therefore, from the pores of the wood, and not only protects the wood by its presence as a non-conductor of heat, but deoxidizes all matters which are likely to prove objectionable as ferments.

The advantages presented by this wood are that its weight is less after treatment than of the same wood before kiln-drying; a series of pieces gave a mean specific gravity of 0·3501. The process for working is very much cheaper than that of any other yet devised; it is an admirable means for preventing dry rot and decay from the action of water, as the pores are coated with an insoluble salt; it thus wears longer and vibrates less than ordinary pine; it resists the attacks of insects, and, from the removal of the volatile inflammable matter, as well as from the introduction of a non-conducting material, it is well able to withstand fire, the interior parts not giving up gaseous matter, which always so readily inflames.

The wood, although answering these ends, contains but little matter foreign to itself. Wood fiber, 87·2; moisture at 239° Fah., 8·5; ash, 4·3. Total 100.

The idea here presented is much the same as that noticed accidentally in the late Franco-Prussian war; many houses there were found to have been protected from fire when they were largely built with plaster; lath and plaster walls were absolutely uninjured by the fire when surrounding parts were destroyed.

Portland Cement.

Portland cement, says Mr. H. Faija, of London, consists of carbonate of lime mixed with silica, iron, and alumina, and is made by mixing chalk with mud obtained from the banks of the Thames and Medway, in the proportion of about four of chalk to one of mud; in some cases gault clay is used instead of mud. The materials are mixed in wash mills, and the result, called slurry, is run into large reservoirs or backs, and allowed to settle; it is then dried and calcined at a high temperature, and afterwards ground between millstones to the requisite fineness. The wash mill is a large, shallow, circular pan built of brick, into which the barrow loads of chalk and mud or clay are tipped; and a supply of water being added, the whole is stirred and thoroughly mixed by a a set of revolving arms carried upon a central vertical shaft.

The liquid material flowing from the wash mill is raised by an elevator or pump, and delivered into a reservoir, in which it is allowed to settle; the water is then drawn off by a sluice, and the reservoir refilled from the wash mill. This process is repeated until the reservoir is full of the deposit or slurry, which is then dug out and laid on a drying floor of fireclay tiles or iron plates, heated by flues underneath, and covered with a light roof. The dried slurry is taken to the kilns to be burned, being charged into them with alternate layers of coke; when sufficiently burned, the clinker is allowed to cool, and is then drawn out at the bottom of the kiln, and taken to the crushing rollers, by which it is broken up into small pieces preparatory to being ground by the millstones. Having passed through the millstones, the cement is laid out on the warehouse floor and allowed to cool, being occasionally turned over; this mixes the different days' work, and gives uniformity to the cement produced, and also allows any particles of lime still unslaked to slake by exposure to the air. In color, Portland cement should be of a dull bluish gray, and should have a clear, sharp, almost floury feel in the hand; it should weigh from 112 to 118 lbs. per struck bushel, and, when molded into a briquette or small testing block, and soaked in water for seven days, should be capable of resisting a tensile strain of from 300 to 400 lbs. per square inch. The cement should, during the process of setting, show neither expansion nor contraction.

Diamond Glass Cutting.

In a recent patent trial concerning the revolving wheel glass cutter, Judge Shipman described the form and action of the diamond in cutting glass as follows:

While almost any diamond will scratch or tear the surface of glass, it is a fact that the value and efficiency of a diamond to be used for the cutting or severing of glass depends not merely on the hardness, but upon the form, of the cutting surface. Other gems than the diamond will successfully cut glass, provided they can be shaped into forms similar to those of the diamonds used for this purpose. Dr. Wollaston, in the "Philosophical Transactions" for 1816, thus explains the peculiarities required for the glazier's diamond: "In the natural diamond there is this peculiarity, in those modifications of the crystals that are chosen for this purpose, that the surfaces are, in general, all curved, and, consequently, the meeting of any two of them presents a curvilinear edge. If the diamond is so placed that the line of the intended cut is a tangent to this edge, near to its extremity, and if the two surfaces of the diamond laterally adjacent be equally inclined to the surface of the glass, then the conditions necessary for effecting a cut are complied with. The curvature is not considerable, and, consequently, the limits of inclination are very confined. If the handle be too much or too little elevated, the one extremity of the curve will be made to bear irregularly upon the glass, and will plow a ragged groove, by pressure of point. But, on the contrary, when the contact is duly formed, a simple fissure is effected, as if by lateral pressure of the adjacent surfaces of the diamond, diverted equally to each side. The effects of inequality in the lateral inclination of the faces of the diamond to the surface of the glass are different according to the degree of inequality.. If the difference be very small, the cut may still be clean, but, as the fissure is then not at right angles to the surface, the subsequent fracture is found inclined accordingly. When an attempt is made to cut with an inclination that deviates still more from the perpendicular, the glass is found superficially flawed out on that side to which the greater pressure was diverted, and the cut completely fails."

The Electrical Condition of Air in the Arctic Regions.

M. Vikjander, during one of the recent Swedish expeditions to the arctic regions, made extended investigations into the electrical condition of the air there existing. All of his observations agree in showing that the atmosphere conducts electricity at temperatures relatively high, a circumstance to which may be attributed the absence of thunder and the presence of the aurora borealis. It has been suggested that this is due to the great humidity of the air in such regions; but it is evident that the phenomenon must be ascribed to other causes, since the same temperature and the same degree of humidity do not produce a like effect in lower latitudes. At less temperatures, —4° and —13° Fah., and below, the air isolates better.

Generally the arctic atmosphere appears to be positively electrified, and the earth negatively. In several instances, the air was effectively electric of itself, and this not due to terrestrial induction. During certain periods of the spring, at a time when the air isolated relatively well, both ground and air were charged with negative electricity. This change of electrical state of the atmosphere was not a constant consequence of greater cold; but when the temperature had been lowered for some time, the air had an evident tendency toward a negative condition.

There seems to be a natural connection between these facts and the aurora. During the months of January and February, the latter phenomenon appeared daily, and was especially noticeable on the 19th and 26th days of the latter month. It then disappeared, to reappear, however, on the 2d of March.

At the same time, changes in the electricity of the air were observed, suggesting the theory that the negative electricity, deprived of the possibility of discharging itself into the aurora, was obliged to accumulate in the lower atmospheric strata, which isolated relatively well. From the 2d to the 11th of March, the aurora returned; and during this period the air was in a good conducting condition, or else, when effecting isolation, was positively charged. Subsequent to the latter date, the auroras ceased entirely, and an interval supervened, of low temperature with negatively electrified air, which lasted until the increasing light of the season of the year precluded further auroral observations.

The Royal Albert Bridge.

The Provincial Parliament some time since passed an act for the construction of a bridge over the St. Lawrence river at Montreal. Up to the present time the surveys have been completed, and the future plan is in process of elaboration. The length of the bridge proper over the river will be 7,300 feet, and of the viaducts in the city 5,000 feet, making the total length of the structure 12,300 feet. The main span, of 600 feet in length and 160 feet above water, will extend over the navigable channel. On each side of this principal span there will be one of about 350 feet, and the remaining spans will average some 300 feet, or such other dimensions as may be established when the cost of stone piers with iron superstructure is fully considered. The piers will be very heavy, and those in the water will be built after the manner of the similar portions of the Victoria Bridge.

The style of iron superstructure will be open lattice work. The rail level will be on the lower chords. Twenty feet above, a floor will support the ordinary carriage traffic; a second floor, twelve feet above the first, will give facilities for city car traffic, several lines of rails being placed and the train drawn by dummy engines; the top of the bridge (to be floored over, and with strong ornamental iron railings for safety) will furnish all the required facilities for pedestrians. For the convenience of the latter, hydraulic or steam elevators are to be arranged at different streets where the bridge extends over the city, so as to enable passengers readily to reach the footway.

Generally speaking, it is thought the bridge will cost very considerably less than the Victoria, and be built in one half the time, the surveys having revealed much more favorable engineering conditions of line than had been anticipated.

Wood Ashes as a Fertilizer.

How can I best utilize that big heap of ashes out by the wood pile? This is a question which we have no doubt that hundreds of the some odd thousands of farmers who read this paper have suggested to themselves, now that the milder weather renders drafts on the wood pile less frequent. In nine cases out of ten, we wager that the speaker's excellent spouse immediately remarks that she is about to sell them to the soap maker; and the money? well, that is her perquisite, and it would be very ungallant on our part to venture a suspicion as to its outlay. Still, we dislike to see these ashes go to the soap boiler, and perhaps a word as to their value to our farmer friend may cause him to think as we do; so with a word of apology to both madame and the soap man for our unwarrantable interference with their little traffic, we venture to suggest that those ashes are very much more valuable as fertilizer than for lye.

We suppose that every agriculturist now-a-days has some general idea of the principle of restitution; that is to say, the elements necessary to the growth of vegetables must be replaced; and if they are not, the crop either fails utterly, or at best is deficient in health and growth. The amount of these elements, phosphorus, lime, potash, and several others, to be replaced varies according to the vegetables cultivated. Thus a potato crop from seven and a half acres of land takes away the seed constituents of four wheat crops, besides about 600 pounds of potash. The average turnip produce of the same area removes the seed constituents of four wheat crops and about 1,000 pounds of potash. Similarly also grapes, clover, peas, beans, lucerne, and nearly all leguminous vegetables remove potash in immense quantities. It is evident that in such cases potash is the material which the land most requires to produce a new crop. To buy potash and add it to the soil would be expensive; true, it may be procured in combination with other substances in various fertilizers, but there is a much simpler source for it, and that source is the ash heap, which otherwise the soap man purchases.

Professor Storer, whose recent paper on the fertilizing properties of wood ashes we find in the *Bulletin* of the Bussey Institution, gives the latest information on the value of this most useful material. He says that the analysis of thirteen samples of house ashes shows a range of from 6 to 10·8 per cent of potash, and from 0·4 to 4·6 per cent of phosphoric acid. The lowest percentages of potash, 6 to 6·5, were from ashes of a mixture of maple, oak, and white pine wood, collected by a soap boiler in a country village. The highest percentages, 10 to 10·8, were in ashes of mixed beech, birch, and maple in one case, and in those of pitch pine in the other. Eight of the samples ranged, as to potash, from 7·4 to 9·5, the average of them, as well as that of all the thirteen samples, being about 8½ per cent. This, it must be borne in mind, is the proportion of the chemist's potash or oxide of potassium, and corresponds to about 10½ per cent of the potash of commerce, which is an impure carbonate and hydrate of potassium. The average of phosphoric acid in dry commercial wood ashes, whether unleached or leached, is about two per cent, a much less quantity than would be inferred from the composition of the "pure ash" of many woods.

This phosphoric acid is also a valuable fertilizing material in the majority of soils. The balance of the elements contained in the ash, namely, silica, alumina, iron and manganese oxide, lime, soda, etc., are of no or little account, so that, on what the potash, first, and the phosphoric acid, second, contained, mainly depends the value of wood ashes as a fertilizer. The material is besides a useful dressing for the ground about orchard trees, as it not only improves the soil, but prevents in considerable degree the inroads of insects in the roots and bark.

It only remains for us to show that there is not merely a loss to the land effected, but that a direct expenditure of money is the result of using ashes in a manner otherwise than we have pointed out. In order to thrive, the farmer must keep his land in producing condition, and, as we have already remarked, to soils which require potash, potash must be returned. Potash is worth about six cents a pound, and phosphoric acid is sold in the New York markets for about 12½ cents for the same quantity. A barrel of wood ashes is bought by the soap maker for say twenty-two cents, and it weighs 125 pounds. These ashes contain on an average, as we have already shown, 8 per cent, or 10 pounds, of potash, and besides include two per cent, or two and a half pounds, of phosphoric acid. According to the above prices, the total value of these substances is 91 cents, and therefore a barrel of ashes is intrinsically worth as a fertilizer nearly five times the amount for which it can be sold to the soap manufacturer.

"Ashes," says the *Rural New Yorker*, "contain essential components of all crops. They should not be mixed with compost (there is no gain in so mixing them) but applied broadcast directly to the soil, whether it is grass or arable land. We never knew a farmer who could get more ashes than it was profitable to apply to his land. One hundred bushels per acre is not too much to apply to old cultivated lands. Especially are ashes excellent for orchards. They should not be heaped right about the bodies of the trees, but spread over the roots, which extend as far from the bodies of the trees as the branches do. *Ashes* are especially valuable as top dressing on old grass lands, or on lands cropped with grain. For root crops they are equally important; indeed, as we say above, there is no crop grown and no land cultivated that is not benefited in a greater or less degree by the application of leached or unleached ashes, the latter being the more valuable."

Most farmers still sell wood in the cities and villages; and rather than go home empty, they should carry back ashes and other fertilizers to replace the potash, lime, and phosphoric acid that have been carried off in the crops and animals sold. Ashes show immediate effect from their application, and at the same time last long in the soil.

DECISIONS OF THE COURTS.

United States Circuit Court.--District of Massachusetts.

PATENT BRUSH—THOMAS E. MURPHY *et al. vs.* LAURENT KIESLING *et al.*

[*In Equity.—Before* SHEPLEY, *J.—October*, 1874.]

This was a suit under letters patent for an improved brush, granted to Francis McLaughlin, January 11, 1870, being the same patent that was involved in the suit of *Murphy et al. vs. Eastham et al.* The object of the McLaughlin invention was to obviate the danger of breaking glass and injuring the surface of wood or other substances to be washed or dusted by contact with the brush head. To this end the patentee proposed to form a groove in the brush head or stock near the bristles, and in this groove to insert a rubber band, one edge or angle of which should project outward and prevent injurious contact between the brush head and the surface to be cleaned. The novelty of the invention and the scope of the patent were fully discussed in the case above referred to.*

Decree for injunction and account as prayed for in the bill.

J. L. Newton, for complainants.

J. T. Wilson, for defendants.

NEW BOOKS AND PUBLICATIONS.

WOODEN AND BRICK BUILDINGS, WITH DETAILS, containing One Hundred and Sixty Plates of Plans, Elevations, etc., with Descriptive Letter Press. Two Volumes, Large Quarto. Price $18. New York city: A. J. Bicknell & Co.

We know of no recent publication which will prove of so much utility to architects and builders as that the title of which is above written. The first volume, just issued and now before us, contains fifty-four designs, carefully drawn and evidently reproduced in *facsimile* from the handiwork of some of the foremost architects in the country. These are accompanied with forms of specifications, descriptions of details, and other explanatory matter calculated to be of direct practical use to the profession. To architects residing in country and suburban towns, we can especially commend the work, as it abounds in designs for rural dwellings, all of which are handsome, and some artistically elegant. Mr. A. J. Bicknell, publisher of the *American Builder*, under whose supervision the book has been compiled, deserves great praise for the admirable and painstaking care exhibited in its pages. Both to him and to the publishing house of which he is the head, the public has long been indebted for the production of architectural works, the effect of which must be gradually to substitute, for the normally uncouth edifices of American towns, structures which combine the principles of scientific building with exteriors denoting taste and artistic skill.

THE PRIVATE LIFE OF A KING. Compiled by John Banvard, Artist. 670 pages. Price $2.25. New York city: The Literary and Art Publishing Company, 806 Broadway.

This book is alleged to contain a truthful memoir of the Prince of Wales afterwards George IV., of England.

NEW YORK STATE RAILROAD REPORT.

We are indebted to Hiram Calkins, Esq., Clerk of Assembly, for a copy of the State Engineer's Report for 1873. We also acknowledge the receipt, from same source, of a copy of the "Clerk's Manual" for 1875.

Recent American and Foreign Patents.

Improved Trellis.

Timothy L. Buell, Marietta, Ohio.—This is a trellis made of wire bands or rings and stakes and posts, the rings being attached to the stakes and posts, so that the trellis may be folded up when not in use.

Improved Water Closet Valve.

Edwin O. Brinckerhoff, New York city.—The weight of the person using this water closet forces down rods and valves, compressing springs and bringing the openings of the valves opposite the open ends of the pipe, so that the water may flow freely, and may continue to flow as long as the weight of the person rests upon the seat. As the weight of the person is removed, the elasticity of the springs raises the rod and the valve, stopping the flow of the water.

Improved Saw-Burring Tool.

Franklin J. Martin, Williamsport, Pa.—Two angle plates, about the length of four or five saw teeth, are bolted together adjustably, so that a channel is obtained between the plates for the reception of the edge of the saw between them. The channel being widened or narrowed, according to the gage of the saw to be burred, by shifting one of the plates on the other, this tool is placed on the edge of the saw, with the bottom wall of the channel against the points of the teeth, after the saw has been filed. The operator then gently taps it with a hammer, and thereby burrs the points of the teeth a little, flattening them slightly on the points, and making them of uniform width and length. By this burring of the teeth the saw is prevented from dodging out of its course, and it makes the lumber much smoother than the teeth are capable of as ordinarily dressed.

Improved Safe.

George Damen, Brooklyn, N. Y.—This invention consists of safe having a series of pigeon holes or recesses arranged equidistant from a center spindle, which carries a revolving face plate with apertures fitting the pigeon holes, so as to open one of them at the time while closing the others, and locking them all by means of suitable spring bolts entering rear holes of the face disk in moving the disk forward.

Improved Car Axle Box.

Benjamin K. Verbryck and Thomas Newberry, Chicago, Ill.—The object of this invention is to improve the axle boxes of railway cars in such a manner that the covers or lids are locked or fastened in an absolutely secure manner without the use of set screws, springs, or other devices. The lid is hinged to one side of the axle box, and provided at the other side with a groove and cam, into which a pivoted latch piece with eccentric cam is swung, thus locking rigidly the cover.

Improved Attachment for Injector.

David Lees, of Birmingham, assignor to himself and S. C. Stewart, of Tyrone Forges, Pa.—Between the valve and nozzle of the injector is a lateral tube, in which is placed a valve, held inwardly and away from its seat by a spring, until the pressure of steam is sufficient to close it. Until this occurs, the water of condensation is afforded an outlet, and thereby the starting of the injector greatly facilitated.

Improved Washing Machine.

Simon W. Shanks, Benton Harbor, Mich.—An endless chain of slats passes around two wheels attached to a shaft, the journals of which work in bearing in standards. By this construction, a longer rubbing surface is formed for the clothes, and the spaces between said slats allow the water squeezed from the clothes to flow off freely. Four coiled springs hold an upper rubber down upon the clothes, and at the same time allow said rubber to yield to adapt itself to the varying thickness of the clothes being operated upon. In using the machine, the clothes are inserted between the lower and upper rubbers, and are carried back and forth between said rubbers by turning the crank, first in one and then in the other direction.

Improved Paper Bag Machine.

Charles H. Kellogg, East Leverett, Mass.—The paper passes over guide rolls and between feed rolls, which draw it from the paper roll and present it to the folding table over longitudinal body folders, the margin being at the same time drawn under a pasting roll. The paper rests on a carrier, which reciprocates between the feed rolls and the head, and conveys the paper forward to the cutters, its complete reciprocations corresponding in number with the strokes of the cutters. The carrier turns the feed rolls by the belts, and a coiled spring is applied to pull the carrier back after carrying the paper forward. The belts go back without turning the feed rolls back, and engage the rolls by ratchets and pawls, to turn them forward when the belts are pulled forward by the carrier. A cross head carries a forming plate, over which the tubular portion of the bag is to be folded, which is moved down upon the sheet of paper at the same time that the cutter goes down, and it is held while the folders are performing their work. After this forming plate comes down on the paper, the longitudinal folders are thrown over, folding the paper and sticking the edges together by the pasted margin. After these folders are turned over, they are held while the bottom is folded and till the bag is ready to be discharged. They are then thrown back by springs. Before the folders go back, the bottom of the bag is folded and pasted, the first operation being by the horizontal spreaders, which fold in the side parts against the ends of the folders and the table. As soon as the sides of the ends of the tubes are folded in by the action of the spreaders, the paster rises and pastes the upper and lower corners of the folded bottom, above and below the spreader. The object of this pasting operation is to unite one of the said corners to the middle of the bottom or end portion of the bag, and the other corner to the first corner, which will result when the corners have been folded. The lower vertical folder has a pressure roll connected with it, to press the ends together after they are folded, and stick the paste. There is also a little projecting stud on the upper corner of each folder, to throw it off a little when it comes in contact with the paper, so as not to tear or cut it. A little coiled spring regulates the pressure of the folder on the paper. The discharger, being under the lower part of the bag and pushing against the folded bottom below the center to draw it off from the folder, thrusts the lower edge of the bottom forward and presents it to rolls, so that, in drawing it between them, they fold the bottom down on the upper side, ready for folding up for packing in bales or boxes.

Improved Tea Kettle.

Harriet Gray, Marquette, Mich.—The subject of this patent is an improved tea kettle, by which the spilling and boiling over of the water is prevented, and also the heat issuing at the top part is utilized for the purpose of keeping articles warm or cooking therewith. The kettle is provided with a funnel-shaped top rim and outer cover, and also with an interior perforated cover, having an adjustable slide plate, for opening or closing the steam-issuing perforations.

Improved Dash Board.

Christian C. Schwaner, Winterset, Iowa.—The frame for this dash for buggies and other vehicles is so formed that it may be contracted or expanded should the leather cover be made too tight or too loose, and also so that all the stitching may be done before the said cover is applied to the said frame.

Improved Window Shade Fixture.

Charles De Quillfeldt, New York city.—The main objection to the shade fixtures with spring rollers has been the sudden escape of the shade from the hands of the person trying to adjust the same by the action of the spring, so that the shade is wound up with great rapidity around the roller, and exposed to injury. This invention is designed to produce the absolute and positive stopping of the shade at any desired point, by means of a notched hub of the spring roller, having sliding disks, in connection with a covering roller cap, provided with a break piece for stopping the roller and disks when turned in one direction by the spring, but admitting the passage of the disks in opposite direction for the unwinding of the shade.

Improved Saw Gummer.

George Washington Griswold, Pottersville, N. Y.—The clamps for holding the saw are on the ends of screws, one of which passes through the end of the handle, and the other through the end of a bow. The other end of the bow is confined on the outside of the handle. The bow rises up from the screws to give room for the saw. A cutting cylinder is made with a shank, which passes through the sleeve, and has one or more slots through its surface. Cutters, passed through the slots, are inserted from the end, and are beveled at the inner ends, so that they correspond with the surface of the cylinder. The cutters cross each other, and their edges project sufficiently to take a thin chip from the saw as the cylinder revolves.

Improved Ticket Printing Machine.

James Anderson, New York city.—The paper is drawn between a pair of printing rolls from a spool, printed and caused to issue from the case and passing between cutters which cut off a ticket at each half revolution of the printing rolls, one cutter being forced down by a spring, which is restrained by a cam while the paper is moving, and released by it at the proper time for the cutter to strike. As it may not in some cases be desirable to use a cam independent of the printing rolls, and geared to them in this manner, the cutter may be lifted by a push pin and lever, to be worked by hand before turning the rolls, one of which may have cams to hold the cutter up as soon as the roll is turned far enough, so that the push pin may be released by the thumb to leave the cutter free to be thrown back by the spring. There is a little frame to prevent the printing roll from turning backward or forward while the cutter is down. It is tripped to release the roll when the cutter rises by arms. This instrument is designed essentially for making tickets to be given by the conductors to passengers when they pay their fares, so that they can be detected in case they do not give them; but it is equally adapted for other purposes.

Improved Binder for Roll Couplings.

James Gillespie, Cleveland, Ohio, assignor to himself and William Garrett, of same place.—The object of this invention is to provide, in place of the leather belts used for binding together the spindle and stretchers in rolling mills, an improved spring binder, that may be quickly applied and taken off, so as to secure the stretchers tightly during the motion of the rolls, and to prevent completely the slipping off of spindle and roll-connecting boxes. It consists of a wire binder, with spiral spring part and hook and eye at the ends, for being tightly fastened around the roll-connecting spindle and stretchers.

Improved Cooking Stove.

Edwin O. Brinckerhoff, New York city.—This cooking stove is provided with an arrangement of flues and spaces, so that when the stove is used for baking purposes it may be heated quickly, thoroughly, and uniformly, and with a comparatively small amount of fuel, and that when used for boiling purposes the entire stove need not be heated.

Improved Horse Power Attachment.

John George Merchen, Lowden, Iowa.—In the upright bars of a drum are formed holes to receive the ends of cords which pass through guide eyes formed in pulleys pivoted to the upper ends of short studs attached to sweeps near the edge of the platform. From the studs the cords pass around guide pulleys pivoted to the upper ends of other studs, which are made higher than the studs first mentioned, and the lower ends of which are attached to the outer ends of the sweeps. To the outer ends of the cords are attached loops to which the horse reins are designed to be attached. The studs support the cords and the reins at such a hight as to be out of the way of the doubletrees and whiffletrees, and so as to prevent the horses from getting their feet over said cord or reins. The driver, by turning the central drum, draws all the reins taut at the same time, and is thus able to readily control all the horses.

Improved Hitch Hook for Street Cars.

David Demarest, New York city.—This consist in a bill or head formed upon the point of the hitch hook of street cars, and of such a size that the coupling link of the pole shoe can be readily raised over it when the horses are in line with the car, but which, when the horses are in any other position, will force the side of the link of the pole shoe beneath the shoulder of the said bill, and thus prevent the detachment of the horses. This invention will prevent the running away of frightened horses that have become accidentally detached from their car.

Improved Sole and Heel Shave for Boots and Shoes.

Fanny M. Foster, Leicester, Mass., executrix of George P. Foster, deceased.—The body of the knife is slightly curved, and its side edges are dovetailed into the stock. A screw passes through the stock, with its end bearing on the long end of the lever, and exerts a lever purchase to force the short end against the beveled or dovetailed side of the knife. By means of this lever the knife is forced down into the dovetail, kept firm, and prevented from chattering when in use. The lever also prevents the knife from getting loose or starting out. By lowering the screw, the knife may be slipped from the dovetails and taken out for sharpening and other purposes.

Improved Sand-Papering Machine.

Valentine Hepp, Chicago, Ill.—The frame which carries the heads around has a hollow shaft, with a shaft running down through it, and carrying a large spur wheel, which gears with the pad carrier, so as to divide the motion between the carrying frame and the driving shaft, in such a manner as to obtain the requisite rapid motion of the pad carriers without having to run either the frame or the driving shaft at a high speed.

Improved Child's Carriage.

J. Manvill Lewis, North Springfield, Vt.—The two axles are connected by a reach of two malleable iron rods, with a spring near about the middle for supporting the front portion of the body. Ordinary C springs on the rear axle support the rear end of the box, by which it is designed to simplify and cheapen the construction considerably, while at the same time the carriage is equally as strong and more elastic than those in which the body sills curve down and connect with the front axle to form the reach.

Improved Washing Machine.

Francis M. Myers, Windsor, Mo.—This invention is a roller to which clothes are attached, and a semi-cylindrical oscillating rubber, provided with a slot through which the clothes pass, and resting upon a roller bed, or equivalent surface. When one side of the part of the clothes being operated upon has been sufficiently rubbed, the rubber is turned once around in such a direction as to reverse the position of the clothes between the rubber and the roller, and the rubber is again oscillated. When this part of the clothes has been sufficiently rubbed, the roller is turned to roll the washed part of the clothes upon it, and another part is operated upon. When the article has been wholly washed, it is detached and another is applied.

Improved Magazine Fire Arm.

Edwin A. Prescott, Hatfield, Mass., assignor to Prescott Pistol Company, of same place.—The invention consists of certain peculiar devices and arrangements thereof for throwing out the case of the exploded cartridge, feeding the cartridge to be fired into the barrel, and retaining the cartridges in the supplementary barrel or magazine while the discharging barrel is being loaded. Two springs in the magazine are used for holding the cartridges from falling out when the barrel is turned down, instead of one spring and a notch in the barrel, as heretofore. A spring catch is combined with the stock and the groove into which the head of the cartridge is received from the magazine, to catch the flange and hold it against being thrown or knocked out before the flange rises up. The slide is connected with the arm by a connecting rod, for working it by said arm, instead of a toothed segment on the arm and a toothed bar on the slide, which is a simpler and cheaper arrangement, and works more accurately. A little cam on the end of the rod connected to the slide is thrown up above the top of the slide to raise the cartridge above the top of the slide while being moved up to its position behind the barrel. This avoids the loose joint, which is objectionable for its rattling noise and uncertain action. The spring catch for fastening the barrel and the breech together swings vertically on a horizontal pivot, and is provided with a thumb bit directly in advance over the top of the barrel, so that the thumb of the hand in which the arm is held may be used for unlocking the barrel to swing it down for loading, by merely pushing down on the thumb bit, and also so that the pressure exerted for unlocking them also tends to force the barrel down.

Improved Feathering Paddle Wheel.

Bernhard Vater, New York city.—This is an improved construction of paddle wheels for steamboats, by which the paddles pass vertically into and through the water, so as to utilize the full amount of power with less agitation of the water and vibration of the vessel. The invention consists of a paddle wheel with vertically arranged paddles, that retain their position during their passage through the water by the rotation of the supporting frame in connection with the action of intermediate gearing, and a central stationary cog wheel on the gear wheels of the paddles.

Improved Spring Equalizer.

Thomas L. Guest, Pottstown, Pa.—The forward and backward throw of the body of a carriage, as the wheels descend and rise from a level in passing through a hollow and over an obstruction, are limited to the amount of play given to a stay rod, and the movement of the said body within said limits is made easy by the play of pivoted cross bars in their bearings.

Improved Holder for Ornaments, etc.

Walter J. Garvey, St. Louis, Mo.—The object of this invention is to provide means for holding up the ornaments which are placed upon ceilings until they can be fastened thereto; and it consists in a spring holder made adjustable as to length, capped with rubber or other soft material, and with a spring at the other end, to hold it in place.

Improved Drag.

Wilson Gardner, Wheelersburg, O., assignor to himself and L. Salladay, of same place.—The pulverizers and furrowers are connected with the same carriers, so that ground may be laid off in rows for planting as fast as it is brought into fine tilth, and by the same operation.

Improved Blind Stop.

Charles E. Steller, Milwaukee, Wis.—A series of slats pivoted in a frame is connected with an opening and closing bar. A slight pressure of a cam against the side of the bar serves to hold it and the blinds in any desired position, while a tighter pressure makes the blind slats stand so firm that no wind or storm can cause them to rattle.

Improved Chair.

William T. Doremus, New York city.—In this device, when the cover is put under pressure a roller will be turned in such a direction as to tend to coil up springs, so as to give elasticity to the back of the chair.

Improved Printing Press.

William E. Gump, New York city, assignor to Mrs. Maria L. Gump, Garden City, N. Y.—By operating a lever, the platens will be brought up against the form. Upon the rear of the upper parts of the end frames are formed cams, which take up all the play of the joints of the rods, arms, and levers, and bring the platens against the form fully and squarely, and thus insure a full, clear, and clean impression.

Improved Washing Machine.

Thomas Stumm, Ada, O.—This invention has for its object to improve the construction of the washing machine for which letters patent were granted to same inventor May 5, 1874. By moving the free end of a lever in one or the other direction, the uprights and a rod or shaft and its attachments may be raised and lowered to raise the clothes out of or lower them into the water. To the uprights are attached the ends of a dasher board, against which the clothes are pressed, and which has numerous holes formed through it to allow the suds to readily escape.

Improved Velocipede.

Edwin Crother and Michel Bergeron, Hackensack, N. J.—In this velocipede the rider can use either his hands or his feet, or both together, to control the direction and uncouple one of the wheels for turning curves in the road. When the strain upon the spring ceases, the reaction throws the coupling into gear with the wheel, and both wheels become propelling wheels.

Improved Car Coupling.

Benjamin J. Sirmans, Blackshear, Ga.—When two cars are run together, the link of one car will enter the hole of the bumper head on the other, strike against a plate, and push the inner end of a lever to the rearward, which movement of the said lever withdraws a catch arm from another lever, and allows the pin to drop through the bumper head and link, coupling the cars.

Improved Bob Sled.

John Wampach, Shakopee, Minn.—Pivots and holes in the tongue roller are contrived to allow the pins to play up and down freely as the roller is raised or lowered at one end above or below the other by the rising or falling of one of the runners independently. The hounds extend forward of the hind beam each side of the reach, and cross bars connect them at the front, above and below the reach, to hold the hind beam so as not to rock with the runners.

Improved Corn Planter.

Abram Staley, Martin, Mich., assignor to himself and Joseph L Staley, of same place.—The slides are so arranged relatively to each other that the opening through one registers with the passage through the pocket when the other does not, thus enabling one to close and the other to open by one and the same movement of the two slides. The construction of these jaws and slides is such that the jaws open and make a good opening in the ground before the seed drops, which allows the seed to scatter as when planted by hand, and they open so that the seed can be seen after dropping, and before the jaws are lifted out of the ground, so as to be certain of the perfect action in every case. The machine also opens the ground, so as to insure the covering of the soil perfectly.

Improved Organ Reed Board.

John R. Lomas, New Haven, Conn., assignor to Bernard Shoninger, of same place.—A partial set of reeds is inserted below the sounding board, which come within the length of the bass reed valve. By this means there are added to the treble as many reeds as can be supplied with air by this valve, thereby making no difference in the required touch of the keys.

Improved Composition for Filling Teeth.

Erwin Erlenmeyer, Houston, Tex.—This is a composition for filling hollow and decayed teeth, which is pulverized when used, and which is compounded of phosphoric acid, lime, magnesia, fluoride of calcium, potash, silica, and oxide of zinc.

Improved Harvester.

Charles K. Myers, Pekin, Ill.—The driver, while standing upon the platform attached to the rear part of the tongue, by operating a lever can easily guide the machine in any desired direction, and by means of another lever can raise and lower the cutter bar to cut the grain farther from or closer to the ground.

Improved Machine for Making Metal Shoe Shanks.

John Hyslop, Jr., Abington, Mass., assignor to Hiram H. Jenkins and George O. Jenkins, of same place.—The shanks are cut off from a sheet fed on a stationary block, and fall down the stationary incline in front of the stationary former, where they are held by suitable means until the movable former comes forward and presses them to produce the requisite shape. A couple of pushers move forward after each one falls, and push it, together with the previously fallen ones, forward along the table side by side, so that they may be taken off in batches in such order.

Improved Carriage Curtain Fastener.

Carl Kurz, New York city.—This invention consists of a metal button with a T head, which is fastened to the inside of the apron or curtain, and a little slotted plate fastened on the bow, with its slot at right angles to the head of the T, so contrived that the slotted plate, which only swells out a little around the slot, does not project like the studs now in use, nor does it show on the outside, as the studs do. The button-hole plate to be used for the top of the curtain has the upper portion of the slot widened, so that the buttons can drop into it when the button plate is held up horizontally; and a portion of the button-hole plate above the slot is so contrived that, after the button has been dropped down with the curtain as it hangs, it locks the button, so that it cannot be detached while so hanging.

Combined Land Roller and Seeding Machine.

James H. Holland, Aurora, Mo.—The roller is made in two parts, and to its outer ends are detachably bolted two wheels, one or both of which are rigidly connected with the shaft, so as to carry said shaft with them in their revolution.

Improved Lamp Extinguisher.

Augustus Umholtz, Tremont, Pa.—The invention consists in attaching an extinguisher to the stem or rod by which the wick is raised and lowered, so that both may be operated together, and in constructing the extinguisher plate with slots in the flanged top portion, contiguous to the top of the wick tube, for admitting the passage of air upward to the flame of light downward.

Chief Engineer's Office, U. S. Navy Yard,
WASHINGTON, November 18, 1874.

Commodore Thos. H. Patterson, U.S.N., Commandant:

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Zero-Refrigerator with Water Cooler. Best in the World. Send for Catalogue. A. M. Lesley, 224 W. 23d street, New York.

The Lester Oil Co., 183 Water St., N.Y., Exclusive Manufacturers of the renowned Synovial Lubricating Oil. The most perfect and economical lubricant in existence. Send for Circular.

For small size Screw Cutting Engine Lathes and Drill Lathes, address Star Tool Co., Providence, R. I.

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Notes & Queries

J. S. & Co. will find directions for utilizing mica scraps on p. 42, vol. 25.—J. D. F. will find directions for manufacturing ice on p. 54, vol. 31.—L. F. L. will find instructions for preventing the percolation of water through a brick wall on p. 75, vol. 32.—R. H. D. will find a recipe for Worcestershire sauce on. p. 281, vol. 26.—A. C. A. will find some particulars as to the manufacture of aluminum on p. 91, vol. 31.—J. H. will find directions for preparing buffalo hides on p. 266, vol. 25.—J. M. C will find a formula for ascertaining the contents of a cylinder on p. 281, vol. 25, and for the proportions of a safety valve on p. 107, vol. 31.—E. S. T. will find a recipe for indelible ink on p. 112, vol. 27.—H. R. W. will find a recipe for wood filling on p. 347, vol. 31.—L. F. S. will find directions for making rubber hand stamps on p. 156, vol. 31.—B. A. S. will find directions for making and using a pantagraph on pp. 99, 179, vol. 28.—F. G. T. should consult, as to his diet, a physician who is acquainted with his case.—C. S. R. will find a recipe for a dip for brass goods on p. 282, vol. 29.—W. F. R. and others can solve the problem of the length of the hypothenuse by the method illustrated on p. 187, vol. 32.—W. B. will find directions for calculating the proportions of gear wheels on p. 187, vol. 29.—F. B. will find directions for removing clinkers from stoves on p. 187, vol. 32.—A. B. will find the dimensions of the Great Eastern on p. 346, vol. 31.—J. R., Liège, Belgium, and others will find a description of a wood-splitting machine on p. 79, vol. 28.

(1) H. M. asks: Please explain the antiseptic action of common salt, and also of sugar. A. In the case of salt, the albumenoid and other putrifiable matter goes into solution in the brine; sugar or sirup acts by preventing the access of atmospheric oxygen to the substances immersed in it.

(2) H. D. D. and others.—One process for utilizing tin scrap consists in first cutting it in a suitable machine into comparatively fine chips, and then placing it in a revolving cylinder so arranged as to constantly shower the chips with mercury, with which the tin unites; and the two may afterward be separated by distillation, or by the oxidation of the tin.

(3) W. C. asks: Can heat enough be obtained in a small furnace to melt brass without the aid of a pair of bellows? A. Yes.

What will dissolve chemical paint out of a brush? A. This depends wholly upon the composition of the paint. Most of the common pigments find solvents in either water, turpentine, alcohol, ether, or oil.

(4) J. H. asks: In pressing quicksilver through buckskin to extract the impurities or gold, is it injurious to have the hands in contact with it? A. We do not know of any trouble originating in this way: but as mercury is slightly volatile at common temperatures, extreme care should be taken not to inhale the vapors, as it is liable, otherwise, to produce salivation.

(5) J. McM. asks: Why is an inverted image seen when one looks upon the concave side of a burnished spoon, and an erect image when the convex side is turned towards the face? A. In the case of a concave mirror, the reflected rays of light approach and cross each other before reaching the eye, thus producing an inverted image. In the case of convex mirrors, the convex surface simply causes the rays to diverge.

(6) D. H. S. Jr. asks: 1. Has ozone ever been used as a bleaching agent? Yes. 2. Can it be produced by the discharges (into atmospheric air or pure oxygen) of the electricity generated by the glass plate or cylinder electrical machine? A. It can, but in exceedingly minute quantities in comparison with the bulk of the gas operated upon. 3. Is there any work extant which treats minutely upon the production, properties, and uses of ozone? A. Read the work by Cornelius B. Fox, entitled "Ozone and Antozone," published by J. A. Churchill, London, England.

(7) L. N. P. says: 1. I am thinking of putting electric bells into a house. Is there any likelihood of the batteries or any connections ever setting fire to easily inflammable things? A. No. 2. Is there any chance of batteries in a closet forming gas liable to catch fire? A. No.

(8) F. G. N. ask: 1. Suppose that I take a permanent magnet, and surround its armature with a helix, would not a feeble current be generated every time the magnet and armature were united and separated? A. Yes. 2. If the ends of the helix are connected with a Rhumkorff coil, would not the feeble current of electricity generated induce a stronger one in the other wire of the coil, so that, by connecting several wires successively, we might finally obtain a current indefinitely stronger than the one we started with? And if we connected the last coil with a helix surrounding a soft iron horseshoe, would not the current of induced electricity transfer it into a much stronger temporary magnet than the permanent one we began with? A. If properly constructed, it would. 3. Would the induced current differ from the generating current otherwise than in being stronger? A. That would depend upon the construction of the machine. 4. If this is true, does it not overthrow the idea that one force cannot produce a greater one without a corresponding loss in time or distance? A. Not at all. If the results you suggest were to follow your premises, they would not tend to overthrow the idea mentioned. In this case it would be simply a transfer of mechanical force (the moving of the armature) into electrical energy, and the amount of the energy would be proportioned, other things being the same, to the rapidity of the movement of the armature.

(9) D. H. L. H. says: In your answer to W. E. D., you give directions for making a Callaud battery; can I nickel plate steel with such a battery? A. Yes.

(10) P. R. H. asks: Is there any battery that will produce electricity continuously, without being touched or renewed after once being completed and put to work? A. No.

(11) I. H. asks: How can I plate with nickel without a battery? A. Use a magneto-electric machine.

(12) M. P. asks: What is the best method of removing gold that has been deposited on brass by galvanic battery, so as not to destroy the brass in the operation? A. Place the articles in strong nitric acid, and add some common salt in crystals. After coming out of the acid, the articles must be polished.

(13) E. M. asks: Will you please suggest the simplest way that I can produce rotary motion by electricity? I have a small battery and electro-magnetic telegraph. But I want to show to my pupils how a wheel may be turned. Being poor, I cannot buy an electric engine. Any cheap and simple way by which I can make rotary motion by the battery, at home, that is what I want. A. Suppose you attach four soft iron keepers to the circumference of a wooden wheel, so that in turn they approach the poles of an electro-magnet. Let the circuit of the electro-magnet be closed as each keeper approaches the poles and opened as soon as it comes opposite. The method of making a circuit closer will occur to any ingenious mind.

(14) W. D. H. asks: 1. How can I electroplate in bronze? In what solution shall I immerse the articles to be bronzed? A. Make a solution composed of 50 parts carbonate of potash, 2 parts chloride of copper, 4 parts sulphate of zinc, 25 parts nitrate of ammonia, and use a bronze plate as the positive electrode. 2. Which is the best battery for the purpose, Smee's or Leclanché's? A. The Smee.

(15) L. K. asks: 1. How many feet of air does one grown person require to keep him in good health for six hours? A. The average amount of air inspired and exhaled at each respiration is 30 cubic inches, and the average number of respirations 20 per minute, so that 500 cubic feet of air pass through the lungs in 24 hours. The amount of carbonic acid exhaled is variable, and is interesting as an index of the rate of internal change. The more energetic the circulation, the larger the quantity of carbonic acid; it is less during sleep than while awake, and less during fasting than after a full meal. 2. Is it best to have a constant change of air from the outside into a room in which we are sleeping? A. A sleeping apartment should always have adequate ventilation while in use.

(16) O. D. asks: I have heretofore worked the burglar alarm apparatus in my house by the Leclanché battery, of which I use 6 cells. But this winter they stopped working. I then put in 6 new cells of the same; still they did not work. I then substituted the ordinary sulphate of copper battery, and have had no trouble since. Now can you tell me what probably was the matter with the Leclanché? Did the cold weather produce any mischief? A. No. The Leclanché battery will stand as much cold as the sulphate of copper. Did you test your Leclanché cells separately on short circuit to see if the connections were good?

(17) H. M. asks: What chemicals are used to render paper sensitive so that you can photograph directly on it? A. Chloride of ammonium 40 grains, gelatin 20 grains, water 20 ozs. Dissolve by the aid of heat and filter when cold. Take 10 or 12 sheets of thin clear paper, and, having marked the right side, immerse them bodily in the liquid one by one, *taking* care to remove air bubbles; then turn the batch over, and remove them singly, beginning with the sheet immersed first. Render the paper sensitive by a solution of ammonio-nitrate of silver, 60 grains to the oz. of distilled water.

Is there any chemical that I can insert in the bark or sapwood of trees, that will kill them? A. Try a strong solution of chloride of zinc.

(18) J. W. L. asks: Can I light gas by electricity? A. Put on a pair of dry slippers, and walk briskly over a carpet. You will thus charge yourself with electricity, and may light the gas with your finger in dry cold weather.

(19) P. J. N. asks: 1. To what pressure per square inch can air be subjected by means of the air pump? A. A maximum of condensation has not been reached. It depends altogether upon the strength of the pump, its valves, and the power and velocity with which it is driven. 2. What work is the best on pneumatics? A. Ganot's "Physics."

(20) E. L. F. asks: Why does a distant light scintillate like a star? A. Because of the interposed changing layers of air of different densities. The diverging rays are caused partly by the irregular figure of the crystalline lens of the eye, and are partly owing to the pull of the six muscles which move it.

(21) W. B. H. asks: 1. How many Grove cells are required to operate a line half a mile in length, using No. 14 common iron wire, with a relay at one end of 100 ohms, and at the other a relay of 120 ohms? A. Two cells. 2. How can I charge a main line Grove battery of 10 cells? A. Cover the zincs with quicksilver. Put 16 parts water to 1 part sulphuric acid for the outer solution, and use pure nitric acid of commerce for the porous cup. 3. How often should it be replenished? A. Replenish the nitric acid every day and the solution once a week. Brush the zincs every day.

(22) C. W. asks: Which is the heavier, a cubic foot of water or of ice, and what is the difference? A. The water is the heavier. If one cubic foot of distilled water at 39° Fah. weigh about 62¾ lbs., one cubic foot of pure ice will weigh about 58⅛ lbs.

(23) A. C. asks: What acid is used to mix with urine to detect Bright's disease of the kidneys? A. Nitric acid. Urine when mixed with nitric acid and boiled should coagulate if the person is suffering from Bright's disease.

(24) J. D. W. asks: 1. Is the Leclanché battery inodorous and constant? A. Yes. 2. Do the contents of the porous cups ever have to be removed and renewed? A. Yes. 3. What are the proportions of sal ammoniac and water to a quart cell? A. Two thirds full. 4. What is the reaction? A. Ammonia is set free at the negative pole, while the nascent hydrogen from the ammonium reduces the peroxide of manganese to sesquioxide. The zinc unites with chlorine, forming chloride of zinc.

(25) W. H. B. asks: Is there a solution which, mixed with pure white quicklime, will harden it into stone in 24 hours? A. Soluble glass, or silicate of potash or soda, is used for this. You will find it advertised in our columns.

(26) R. M. C. asks: What is the latest and and best work on electro-metallurgy? A. "Manual of Electro-Metallurgy," by James Napier.

(27) D. X. asks: What are the powers and focal lengths of the two largest equatorial refractors? A. That at Washington is 26 inches clear aperture, weighs 180 lbs., and was nine months correcting. The new McCormick telescope is a trifle over 26 inches aperture, was eight months correcting, and weighs 170 lbs. Both are of about 33 feet focus, and their highest power is 2,000 diameters. The objectives alone are worth $25,000 each. The government equatorial cost $46,000 currency, the McCormick $38,000 gold.

(28) H. H. asks: 1. What battery, and how many cells, would be the best for electroplating and making an electric light? A. For electroplating, 2 cells of Smee's battery. For electric light, 50 cells of Bunsen's. 2. What solutions should I use for gold, silver, nickel, and copper plating? A. Gold solution, 1 grain of gold and 10 grains of cyanide of potassium in 200 grains of water. For silver, 2 grains of cyanide of silver and 2 parts of cyanide of potassium in 300 grains of water. For copper, a saturated solution of sulphate of copper. For nickel, See p. 346, vol. 31.

(29) C. J. W. says: 1. I have made a Morse sounder, key, and battery for telegraphing. I made my horseshoe magnet by winding the covered wire round in the usual way, only I wound both poles to the right and then joined the wires. I made another by screwing two cores into a flat base, and wound one pole to the right and the other to the left. This has a neater appearance. Which is the best in your opinion? A. They must be so wound that the current shall flow in the same direction in both. 2. Does it make any difference to a magnet if the wires from the battery are first applied in one way, and then (by mistake) reversed? A. No. 3. How is the electric bell made? A. The armature lever closes an electric circuit when the spring draws it back, and opens it when the magnetism draws it forward. 4. What is meant by positive and negative poles of a bat

tery? A. The copper pole is positive and the zinc negative. 5. What are the right proportions of sulphuric acid and water for the Bunsen battery? A. One acid to 10 water. 6. What are the proportions of bichromate of potash and sulphuric acid for the porous cup? A. Two ounces of bichromate of potash to 20 water and 10 sulphuric acid. 7. Is the Bunsen a good battery for telegraphic purposes? A. Yes. 8. How many cells should I have for 100 feet of very thin copper wire? A. One cell.

(30) C. B. L. asks: What cement will do for cementing emery together to form wheels? A. Try oxychloride of zinc.

(31) S. & S. as'k: Does distilled water contain any vegetable, mucilaginous, or albuminous substances? A. It should not when distilled in proper vessels, and dust excluded.

What substance is best to use to test oils for mucilaginous or albuminous matters? A. Strong oil of vitriol should produce a stain by carbonizing mucilaginous matter, etc.

(32) B. & S. ask: Is there any preparation for coating the seams of large wrought iron tanks so as to prevent the leakage of alcohol? The tanks are for storing it; they are perfectly watertight, but the spirit, being of a much less specific gravity than water, oozes out. A. Try cotton cloth soaked in glue, and cold rivet with this between the plates. Let us know if this succeeds, and also the results of other expedients tried by you; and we may be better able to inform you of a mode of procedure.

(33) P. W. asks: How could I make my cider foam like ale, and at the same time be clear and bright as wine? A. Try adding a little sugar to the bottled cider.

(34) G. F. C. asks: What is the reason that coal oil freezes at 3° below zero? It is almost white after being frozen. A. Coal oil is composed of numerous compounds, whose volatility and melting points vary greatly. Your oil is probably rich in some of these denser bodies, such as paraffin, which congeal before attaining a very low degree of temperature.

Can rosin from the bow be removed without injury to a varnished violin? It may be removed by a little ether; expeditiously applied.

(35) C. G. says: I am a distiller of virgin turpentine in a copper still of about 800 gallons. By what process can I so clarify the turpentine as to make window glass rosin? I think that the dregs or particles of bark, wood, etc., prevent the rosin from being transparent after distillation. A. Common rosin or colophony essentially consists of pinic acid mixed with a little sylvic acid. Its dark color is traced to pinic acid. White rosin is obtained from Bordeaux turpentine by digesting the powdered rosin, six parts of cold alcohol, and one part of ether, and the residue is treated with boiling alcohol. This solution is next evaporated down, and the residue melted and allowed to cool, yielding a colorless glass as clear as crystal.

(36) C. R. W. asks: How can four messages pass over one wire at the same time? A. There are various methods of doing it, but the method employed by the Western Union Telegraph Company is probably the best. This is simply a modification of Stearns' duplex, by the addition of a current reversing key and a polarized relay to his bridge plan. The polarized relays are worked by a change of polarity in the battery, and the Morse relays by an increase of potential. Some knowledge of the more advanced methods of telegraphy is required to understand the details of the arrangement, but the above outline will convey a correct and intelligible idea of the general principle upon which the apparatus depends for its successful operation.

(37) M. A. B. asks: If we have two cisterns each 20 feet deep, one filled with hot water at 200° Fah., and the other with cold water, will there be any difference in pumping the water with pumps of equal size? A. The power required will be that which is necessary to lift the water. The weight of a cubic foot of water at 60° Fah. is 62½ lbs., while at 200° it is 60$\frac{3}{10}$ lbs.; the cold water, therefore, will be the hardest to pump. If the piston of the hot water pump is above the surface of the water, it will not pump water but steam; for as soon as the pressure of the atmosphere is removed from the water in the pump, steam will form and fill the vacuum, and so balance the atmospheric pressure upon the surface outside the pump. At 15 lbs. to the square inch pressure, water will boil when it contains 212° of heat, at 11$\frac{7}{10}$ lbs. pressure it will boil at 200°, and at $\frac{7}{10}$ of a pound pressure it will boil when heated to only 100°. Thus it is seen that steam is easily formed in the pump, in proportion as the pressure is reduced; and steam will be pumped instead of water in the case of the hot tank.

(38) A. E. S. asks: 1. Can there be a mixture of lard and kerosene made, that would be safe to burn at 212° Fah.? A. No. The inflammability of the mixture will depend upon the burning point of the kerosene, which will not be rendered higher by mixture with the lard oil. 2. Please give me a recipe for making signal oil. A. Use a lard oil.

(39) J. McK. asks: I contend that no steel can be made without carbon. My friend claims that chrome steel, by the introduction of chrome ore into the crucible with ordinary iron, secures the different grades in proportion to the amount of chrome used. I claim further that the result of such a process is not steel, but an alloy or chromate of iron. Which is right? A. It may be steel, because the iron itself contains carbon, the presence of which is, as you say, essential to the formation of steel. The chromium enters, like manganese and other metals, as an alloy, and modifies the properties of the steel.

(40) J. B. G. asks: What is the difference between a high pressure and a low pressure engine? A. In one the steam is condensed, in the other it is exhausted into the atmosphere.

What is the average temperature at Peru and at Rio de Janeiro? A. About 75° Fah. in each case.

How many miles of railroad are there in Brazil? A. Between 400 and 500.

(41) A. P. A. asks: Can compressed air give the same amount of power as steam, used in a common engine, the compressed air and steam having similar pressure? A. Yes, if worked under the same conditions.

(42) D. K. J. Jr. asks: How can I ascertain the heaviest blow which a steam hammer of given dimensions is capable of giving? A. It could only be ascertained by experiment.

(43) F. E. H. says: I have made a large wooden trough to hold a silver solution for electroplating. With what shall I cover the inside, so that the solution would have no effect on it? A. Marine glue.

Would an engine of 2 inches bore x 4 inches stroke furnish power enough to run a polishing lathe? A. Yes.

(44) A. J. B. asks: What is meant by 6 to 1, or 3 to 1, or 1½ to 1, which we see on architects' details? A. It means that, of the two things compared, one has 6, 3, or 1½ times the measurement of the other. Thus, if the lengths are as 6 to 1, the length of the first is 6 times that of the second. The expression is used similarly of area, volume, hardness, strength, velocity, etc.

(45) C. L. G. asks: At what place in the United States was the first steam railway built? A. The Baltimore and Ohio Railroad; it was commenced in 1828. Fifteen miles were opened in 1830, horses being used until 1831, when a locomotive was brought into use.

(46) F. H. D. asks: 1. If a small quantity of nitro-glycerin were exploded in a vessel strong enough to withstand the shock, how long would the gas thus formed retain its pressure? A. Probably the pressure would commence to diminish at once, as the gases cooled down. 2. How much pressure would 1 oz., if exploded as above, exert if confined within a cylinder 12x24 inches? A. This is a matter that could only be settled by experiment. It is supposed that one volume of nitro-glycerin produces about 10,000 volumes of gas after explosion; but if it were rigidly confined, complete explosion might not take place. 3. Would there be any shock or noise following the burning of nitro-glycerin in such a vessel? A. We presume not, if the vessel were perfectly rigid. We advise you to turn from idle speculation of this character to something of practical importance.

(47) E. A. P. asks: 1. What pressure per square inch will a column of water 90 feet high exert? A. This column will require a pressure of 40 lbs. by steam gage to sustain it. 2. Will a steam boiler pressure (by the gage) sustain the column? A. This will depend on the size of pipes, bends, etc. Under average conditions, you could expect to get a hight of 50 or 60 feet.

(48) G. W. H. asks: 1. What would be the loss, by friction and other causes, in the conveyance of compressed air at 60 lbs. per square inch to a distance of 1,600 feet? The pipe is to be about 1½ inch gas pipe. A. Two or three lbs. pressure per inch. 2. What would be the loss in pressure of steam under similar circumstances, the pipes being well protected? A. Double the above.

(49) A. M. says: My friend says that a stove with thin plates requires more fuel than a stove with thick plates. I say the contrary. Which is right? A. You are.

(50) N. P. B. says: 1. My small cast iron castings are too hard. How can I make them soft enough to drill and file nicely? A. It would be well to use a better quality of iron. 2. What can be used for the purpose of bedding one rough piece of casting to another, besides putty or plaster of Paris? The extent of the surface is 6x12 inches, and the openings range from ¼ inch to the least thickness. A. See a forthcoming article on "Glues and Cements."

What is the best way by which large grindstones are trued up when worn out of truth? A. The common method is to use an iron tool with a hooked point.

(51) J. J. W. says: I am a blacksmith by trade, and am bothered with my swage iron becoming bare and exposed to the fire. I have been using common yellow clay to bed it with. Is there anything which will stand the fire and not crumble away as the clay does? A. Try firebrick, set in fire clay.

(52) J. S. B. asks: How is music made on glass goblets, and how are they tuned? A. By moving the moistened finger around the rim, which puts the material of the goblet into vibration, after the manner of a bell. They can be tuned by having different quantities of liquid in them, or by grinding them until they produce the right note.

How are the magnets of a telegraphic sounder constructed? A. See p. 379, vol. 30.

(53) W. C. K. asks: Can a piece of steel be refined and made to stand as good a temper, by pressing it into shape by machinery, as a similar piece forged by hand, using the same style of die? A. In general the hammered steel will be the best.

(54) J. F. B. asks: What would be gained by applying a condenser to an engine of the following dimensions: Diameter of cylinder 22 inches, length of stroke 4 feet, with automatic cut-off balanced poppet valves, gridiron slide valves, and exhaust open full length of stroke, running 60 turns per minute under from 60 to 80 lbs. of steam? The engine is scarcely ever called on for more than half her power, about 60 or 70 horse. A. As a general rule, if an engine is in good order, a condenser makes a saving of at least 25 per cent. As you will see, however, by the article on the subject, p. 256, vol. 31, you do not send enough data.

(55) W. D. G. asks: Which of the following metals will best stand exposure to heat without warping, sheet steel, sheet iron, cast iron from $\frac{1}{16}$ to $\frac{1}{16}$ of an inch in thickness? A. All metals will be liable to warp, if exposed to high temperature in the form of large and thin sheets. Probably cast iron will answer as well as any other.

What are the largest sized sheets of mica that can be had for use in blowers for fire grates? A. About 8 by 10 inches.

(56) A. D. B. says: 1. In building a large brick cistern lined with cement, would it be of service to brush over the cement with water glass? A. The use of water glass solution is of doubtful policy. 2. Is Portland cement enough better than Rosendale for lining cisterns to pay for the difference in cost? A. Yes, if you get the best kind of Portland cement. It is not always uniform in quality.

(57) H. Y. N. says: I have an engine of 36 inches stroke, with plain slide valve, having 2¾ inches travel. It cuts off steam at $\frac{3}{11}$ of the stroke and exhausts at $\frac{1}{11}$. The exhaust port is open ¼ inch before it takes steam at the other end. Is not ¼ inch more clearance than is necessary? If I arrange to cut off at 20 inches, should I make the clearance less? A. It would not be well to decrease it.

(58) A. E. P. asks: 1. How many horse power can I get from an engine, the cylinder of which is 4¾ inches in diameter by 9 inches stroke, with 80 lbs. steam? A. From 4 to 5 horse power, under favorable conditions. 2. Is said engine powerful enough to run a circular saw, 18 inches in diameter, for sawing shingles? A. Yes.

(59) R. M. asks: Why is it that a greater number of drivers are used on locomotives designed for heavy draft, since the adhesive friction is not dependent upon the extent of surface contact? A. To avoid bringing excessive weight on any one driver.

(60) J. P. N. says: On a very cold day I had to keep the cold water faucet in the kitchen dripping constantly in order to prevent freezing. About sunset I noticed that our girl had shut the water off, and the sink (a cast iron one) had become dry. I opened the faucet full and suddenly, when, the instant the water touched the iron, an explosion occurred at that point, sounding very like a gun cap, only louder. Can you explain this? A. We have often noticed the expulsion of air under such circumstances, accompanied by a kind of explosion. We have never, however, witnessed precisely what you describe, and without further information must confess that we cannot explain it.

(61) A. C. asks: 1. Is it practicable to line a water reservoir (to hold 1,000,000 gallons) with plate iron from $\frac{1}{8}$ to $\frac{3}{16}$ of an inch thick? A. Yes, perfectly. 2. Is there any material good for coating the iron with to prevent rust? A. Pitch would make a good material for coating the iron, or the plates might be galvanized.

(62) X. Y. Z. says: A. claims that the air is lighter when smoke does not rise. I say that it is heavier. Which is right? A. Sometimes the smoke does not rise because the barometer is low, that is, the pressure of the air is diminished. At other times, as in damp weather, the smoke is cooled down, and will not rise, even though the pressure of the atmosphere is the same as before. 2. A. also claims that the wind lowers the mercury in a thermometer. I say that the wind has nothing to do with it. Which is right? A. You are.

What is a good cement for joining the angles of an aquarium, built of glass and wood? A. Make a mixture of boiled linseed oil, litharge, and white and red lead.

Has a law permitting any person to make and sell any patented article, on payment of 10 per cent to the owner, been passed? A. Such a law was proposed, but has not been passed.

(63) J. A. B. asks: What size of engine would be the most economical for driving a two run flouring mill and attachments? A. The question is rather indefinite, but we imagine that an engine with cylinder 7x9 will answer your purpose very well. If you use shavings for fuel, a plain slide valve engine will give good satisfaction.

Which has the fastest motion, the top of a wagon wheel or the bottom? A. Considering the rate of motion with respect to a fixed point without the wagon, the top of the wheel runs the fastest.

(64) L. A. C. asks: What is the cause of ice forming on the bottom of the bay at Rockaway? It is sometimes from two to three inches in thickness. A. It is doubtless formed at low tide, and afterwards covered with water.

(65) M. asks: What is the philosophy of warm weather driving the frost into the ground still deeper? It seems to be a fact that water pipes laid four feet deep are more apt to freeze when warm days come than during the coldest weather. In other words, when it commences to thaw, the frost in the ground extends to a greater depth than before. A. We never observed that this was a fact, but it is easy to understand that the freezing process may go on underground when it is thawing above, since it takes time, as well as cold, to produce frost and ice.

(66) C. O. H. asks: Is it practicable to use a wire rope (instead of chain or hemp rope) over pulleys 3 inches in diameter, where there would be an unsteady strain of from 100 lbs. to 400 lbs.? A. It would not be easy to use a wire rope with such small pulleys, or, indeed, a hemp rope or chain, unless some special construction were adopted.

(67) H. M. F. asks: Can you give me a method for determining the pitch line of a cog-wheel, having the number of cogs and the pitch? A. We could not do the subject justice in our limited space. You will find it well treated in Rankine's "Machinery and Millwork," or in the "Machinist's Assistant."

Can you give a recipe for making a preparation for sticking drawing paper to a board? A. Good paste answers very well.

(68) F. McG. asks: If equal quantities of salt water and fresh water were put in a vessel, which would come to the top? A. They would mix, but not very readily; and the lighter of the two, the fresh water, would tend to go to the top.

(69) G. V. asks: What is the momentum of a body of a given weight moving at a given velocity? Take for an example the piston, rod, walking beam, and connecting rod of a steamer. How much power is required to arrest the motion of these parts, and to move them in a directly opposite course? A. To change the motion suddenly from one direction to the opposite direction, with the same velocity as before, the energy of the moving mass must be overcome, and an equal amount of energy impressed. The force required to overcome the energy of a moving mass is found by multiplying the weight of the body in pounds by the square of the velocity in feet per second, and dividing by 64·4.

(70) W. E. H. asks: We have been putting in two new turbine water wheels under 21 feet head, using 52½ cubic feet of water per second. We bring the water to the wheels in a round wooden trunk of 208 feet length and 6 feet inside diameter. The trunk is made of white pine, 3 inches thick and hooped with iron hoops, ½ inch thick by 2 inches wide. The hoops are placed 2 feet apart, from center to center. The lags are 44 in number to the circle of the trunk, each lag being driven 2 feet, there being no more than 7 joints under any hoop. At the upper end of trunk we put an air pipe 8 inches in diameter. When the wheels are running, the volume of water passes through the trunk at a speed of from 2 to 3 feet per second. What is the shortest time in which it will be safe to shut the gates without danger of bursting the trunk? We have a regulator connected with the wheels which will shut the gate in 40 seconds. A. We think it will be perfectly safe to close the gate in the time mentioned. It might be well to connect a pressure gage to the trunk, and see exactly what change of pressure occurs from shutting the gate quickly.

(71) W. F. S. asks: 1. Do you think it a good plan to force hot water through the tubes of a horizontal boiler 15 feet long, 3 feet in diameter, with 24 three inch tubes? The boiler is new, made of ⅜ inch iron doubly riveted. A. We understand you to refer to cleaning the tubes by forcing hot water through them. We do not recommend this. It is better to use a brush or scraper. In special cases, steam can be employed with advantage. 2. My engine is a horizontal; cylinder is of 9 inches diameter and 18 inches stroke. It drives about 8 horse power. I carry steam at 60 lbs. and exhaust into about 1,000 feet of three inch heating pipes, the lever to back pressure valve having considerable weight on it. I burn between 5 and 6 cwt. of Pittston nut coal per day, and very little smoke comes from the chimney. I would like to put an indicator on my engine, but I cannot get one here. Am I using too much coal? We cannot tell certainly whether you are running economically, but it seems to us that you are managing very well.

(72) J. N. T. says: I grouted the floor of my cellar some two years ago with a mixture of sand, gravel, lime, and cement. Since it became dry, it has continually ground off from the top into a fine lime dust, making it impossible to sweep without raising a great dust, besides wearing down into the larger gravel in some places where it is used most. Can you suggest through your columns a cheap wash or paint that will harden the surface and obviate the dust? A. Wet the surface and float it over with a thin, pasty coat of Portland cement of best quality. This may give you the surface you want.

(73) S. says: I have an icehouse whose dimensions are 89 feet 6 inches long, 22 feet 6 inches wide, and 14 feet 9 inches high. How many tuns of ice will it contain? A. Multiply the length by the breadth, and this product by the hight, all in feet, and the result will give you the number of cubic feet of contents in your icehouse. Then, as there are about 40 cubic feet in a tun of ice, divide the said number of cubic feet by 40, and the quotient will indicate the number of tuns of ice the house will contain if filled full in all parts solid (about 742 tuns in this case). But allowance must be made for vacant spaces in every case. Weight of a cubic foot of ice, 57½ lbs.

(74) D. W. S. asks: 1. Is a single Bunsen quart cell sufficient to magnetize a horseshoe bar within a helix? A. Yes. 2. Must a helix be made of copper wire, or will soft iron wire answer the same purpose? A. Copper is better.

(75) H. L. C. says: I have a battery of four Hill cells, and a key and sounder. I used No. 32 cotton insulated wire for my sounder. When I arrange my battery for quantity (all zincs on one wire and all coppers on the other), the sounder is so faint that it cannot be heard. What is the difficulty? A. The wire is too fine in your sounder.

(76) G. G. B. says, in reply to J. C. W., who asks how to tin small lead castings: Clean your castings well, rub them with powdered rosin, and dip them in a tin bath. Be sure to use plenty of rosin.

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

J. M. H.—It is iron pyrites.—R. L.—It is tin.—W. S. N.—It would be difficult to form an estimate from the pieces of ore sent, which are of ferruginous quartz rock. If you desire to have an assay, it would be necessary to send sufficient of what you regard as average rock, to yield about an ounce of the ore. The expense of the assay for silver would be $10, for silver and gold $20. If the surface indications are as you state, it would be well to locate the vein.—W. H. G.—It is tin.—R. L.—No. 1 is sulphide and carbonate of copper. No. 2 is the same as No. 1, with quartz. No. 3 is carbonate of copper with oxide of iron. No. 4 is oxide of manganese with quartz. No. 5 is yellow oxide

of iron. No. 6 is oxide of manganese, containing carbonate of lime.—J. E. G.—It is actinolite, a silicate of magnesia and lime with a small percentage of the oxides of iron and manganese. It is not valuable as an ore.—J. C. B.—It is a compact slate, containing a considerable amount of iron pyrites; this has been converted by exposure to the weather to a white incrustation of sulphate of iron, which is soluble and gives the disagreeable taste. No. 2 is a fine sand rock containing some alumina.—B. S.—The specimen of granite sent has a fine color, is tough, and would come into use for the purposes to which red granite are applied.—H. L. A. C.—The red mineral is red ocher, or sesquioxide of iron; the crystals in the cavities are quartz, which have occupied the place of crystals of another species; the other mineral, glassy but softer than quartz, is sulphate of barytes or heavy spar.—J. C. B. T.—It is sulphide of lead, or galena.

E. J. B. asks: What will cure blindness in chickens? The disease, which is contagious, consists in a sort of yellow scum growing over the sight of the eye, and comes, I have been told, from overfeeding with corn.—D. G. asks: How can I prepare small blocks of wood so that they will not expand when exposed to the action of steam, nor contract when exposed to the atmosphere of 100° Fah.?—H. B. asks: Does the hair grow after death? If so, why?—W. says: A cast iron ball 18 inches outside diameter, cored out to 12 inches, leaving a shell 3 inches thick, with one hole 1½ inches in diameter through the shell, lay in such a position that it filled with water. The water froze, and with a loud report the ball was torn in three pieces. How many tuns pressure did it take to tear asunder the ball, and why did it give a report in bursting?—W. J. B. asks: What is the best method of grinding leger blades for shearing woolen cloth?

COMMUNICATIONS RECEIVED.

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

On Propelling Yachts. By H. W. H.
On the Birth Rate. By F. Y. A.
On the Fish Jointed Rail. By F. A. B.
On an Ore-Roasting Furnace. By E. H.
On Talking Ants. By J. S.
On Rifle Projectiles. By J. M.
On Spiritualism. By F. H. R.
On an Invisible Gas Lighter. By E.
On Telegraph Alphabets. By J. W. C.
On the Sagacity of the Partridge. By J. K.
On Mathematical Problems. By A. E. O.
On Perpetual Motion. By J. W.
On Small Steam Engines. By E. W.
On Engine Valves. By L. F.
On Pneumatic Transmission. By S. P. D.
On Balloons. By W. A. W.
On the Drive Wheel of a Locomotive. By J. A. K.

Also enquiries and answers from the following:

F. A. R.—H.—G. G. C.—J. W. C.—J. N. N.—A. M. C.—J. C.—J. E. B.—W. J. D.—G. A. B.—J. V. M.—R. D. C.—M. F. R.—P. P. J.—T. F. & Co.—F. A. G. B. W. G.—C. T. E.

HINTS TO CORRESPONDENTS.

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

Enquiries 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 enquiries analogous to the following are sent: "Who sells dollar steam engines? Who makes pens for ruling machines? Who sells sextants and quadrants? Who makes endless chain? Who makes a machine for cutting dough into pieces of similar weight? Who sells hemispherical anemometers? Who makes blowers suitable for furnaces for melting iron? Who sells nitroglycerin? Who sells stereotyping appliances? Who sells materials for decalcomanie, vitrimanie, and diaphanie?" 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

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EXTENSIONS GRANTED.

31,252.—IRON BALE TIE.—J. J. McComb.
31,315.—GRINDING CARD TEETH.—C. Hardy.
31,324.—LOOM.—Jno. Davis.
31,330.—CARRIAGE WORK COLLAR.—M. Seward.

DESIGNS PATENTED.

8,070, 8,071.—PAPER.—H. D. Cone, Stockbridge, Mass.
8,072.—CARPET.—J. H. Smith, Enfield, Conn.
8,073 to 8,106.—CARPETS.—O. Heinigke, New Utrecht, N. Y.
8,107 to 8,125.—CARPETS.—H. Horan, East Orange, N. J.
8,126 to 8,131.—CARPETS.—L. G. Malkin, New York city.
8,132 to 8,151.—CARPETS.—E. J. Ney, Dracut, Mass.
8,152 to 8,159.—CARPETS.—H. Nordmann, New York city.
8,160.—CARPETS.—G. W. Piggott, New York city.
8,161.—WORK STAND.—M. S. Dunn, Rochester, N. Y.
8,162.—CARPET.—H. F. Goetze, Boston, Mass.
8,163.—ROCKING CHAIR.—G. M. Harwood, Troy, N. Y., et al.
8,164, 8,165.—GLASS DISHES.—G. W. Lowry, East Cambridge, Mass.
8,166.—SPOON HANDLE.—C. Osborne, N. Attleboro', Mass.
8,167 to 8,171.—CARPET.—J. H. Smith, Enfield, Conn.
8,172.—CARPET.—F. W. Green, Orange, N. J.
8,173 to 8,176.—CARPET.—J. H. Smith, Enfield, Conn.
8,177 to 8,179.—CARPET.—W. H. Smith, Enfield, Conn.

TRADE MARKS REGISTERED.

2,247.—SILVER POLISH.—W. E. Dunham, Fall River, Mass.
2,248.—SHAFTS, ETC.—J. A. Leippe, Lancaster, Pa.
2,249.—CIGARS.—S. Lowenthal & Co., Cincinnati, Ohio.
2,250.—WASHING BLUE.—S. S. Myers, Philadelphia, Pa.
2,251.—BAKE POWDER.—Plumb & Co., Grand Rapids, Mich
2,252.—HOSIERY.—W. F. Salmon, Lowell, Mass.
2,253.—TEAS.—Williams & Co., San Francisco, Cal.
2,254.—COSMETIC.—A. Deland, New York city.
2,255.—CIGARS.—A. W. Foote, Brooklyn, N. Y.
2,256.—TOOTH PASTE.—Forster et al., Philadelphia, Pa.
2,257.—CIGARS.—Goldsmith et al., Cincinnati, Ohio.
2,258.—POCKET STOVE.—G. P. Houston, Washington, D. C.
2,259.—STEAM ENGINE, ETC.—V. Mauger, New York city.
2,260.—COTTON PRESS.—Mrs T. C. Nisbet, Macon, Ga.
2,261.—PAINT OR CEMENT.—E. W. Tibbels, Chester, Pa.

SCHEDULE OF PATENT FEES.

On each Caveat	$10
On each Trade mark	$25
On filing each application for a Patent (17 years)	$15
On issuing each original Patent	$20
On appeal to Examiners-in-Chief	$10
On appeal to Commissioner of Patents	$20
On application for Reissue	$30
On filing a Disclaimer	$10
On an application for Design (3½ years)	$10
On application for Design (7 years)	$15
On application for Design (14 years)	$30

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA, FEBRUARY 26 to 27, 1875

4,430.—E. H. Aydon, Wandsworth, England, et al. Improvements in smelting, etc. Feb. 26, 1875.
4,431.—Wm. Johnson et al., Montreal, P. Q. Plane iron adjustments. Feb. 26, 1875.
4,432.—H. M. Converse et al., Waterloo, P. Q. Blind and scene apparatus. Feb. 26, 1875.
4,433.—J. B. Tison, Montreal, P. Q. Window fastener. Feb. 26, 1875.
4,434.—P. Beaudry et al., Ottawa, Ont. Motor. Feb. 27, 1875.
4,435.—J. Dewe, Ottawa, Ont. Mail or despatch bag. Feb. 27, 1875.
4,436.—H. J. Young, Lansdowne, Ont. Hay loader Feb. 27, 1875.
4,437.—J. B. Brown, Stanstead, P. Q. Milk cooling apparatus. Feb. 27, 1875.
4,438.—S. T. Lamb, New Albany, Ind., U. S. Nut lock and washer. Feb. 27, 1875.
4,439.—S. L. Crocker, Taunton, Mass., U. S. Smelting and refining copper ores, etc. Feb. 27, 1875.
4,440.—L. Miers et al., Lynden, Ont. Horseshoe machine. Feb. 27, 1875.
4,441.—R. Eaton, Montreal, P. Q. Freight car. Feb 27, 1875.
4,442.—L. A. Frigon, Montreal, P. Q. Spring bed. Feb 27, 1875.
4,443.—D. R. Winnett, London, Ont. Oil still. Feb. 27 1875.

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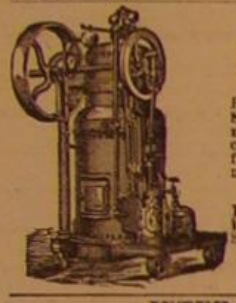
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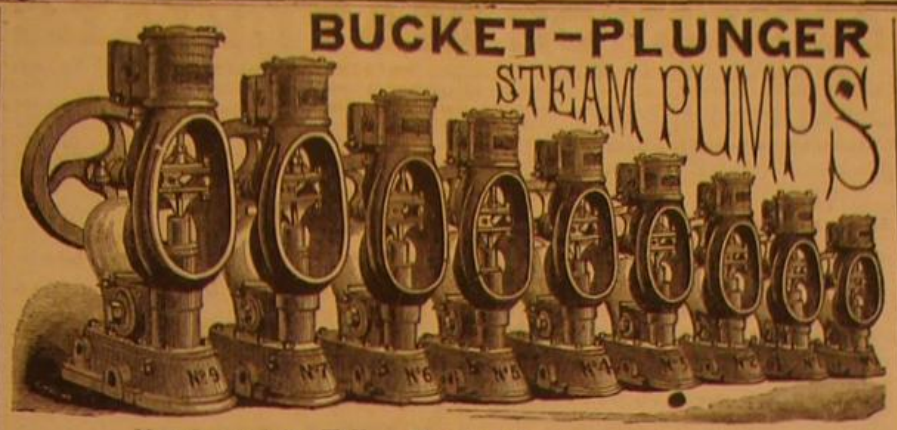
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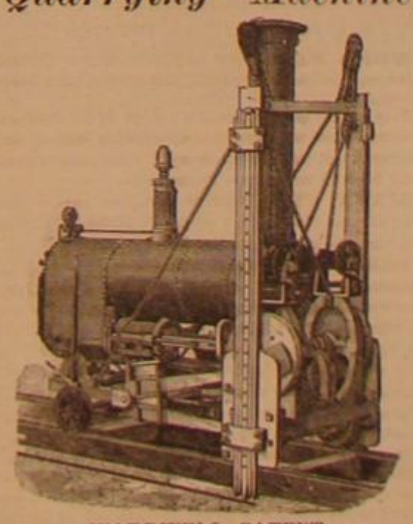
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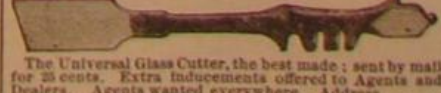
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SCIENTIFIC AMERICAN

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

Vol. XXXII.—No. 14. (NEW SERIES.) NEW YORK, APRIL 3, 1875. $3.20 per Annum, Postage prepaid.

THE SAXBY AND FARMER SAFETY SWITCHES AND SIGNALS.

We have heretofore had occasion to notice, in the SCIENTIFIC AMERICAN, the merits of the Saxby and Farmer interlocking system, as applied to railway points and signals, which, for nearly ten years past, has been in operation upon the principal English railroads. It has proved successful to such a degree that, by act of Parliament, its use has been rendered obligatory on all new lines in England.

The remarkable capabilities of the invention, in controlling the most intricate sets of switches, is practically exemplified at the Waterloo junction station, London. We have before us a photograph of the operating works at this station, at which no less than 108 switch and signal levers, all connected with the many tracks at this junction, are contiguously employed.

It is gratifying to know that this valuable improvement, which is certainly one of the most important of all safeguards against switch accidents, is now being extensively introduced in this country. The Pennsylvania Railway Company, animated by the highly creditable desire to provide their road with the best safety appliances, have lately put up, at the East Newark junction, on the suggestion of Mr. G. O. Howell, principal assistant engineer of the New Jersey Division, a splendid example of the Saxby and Farmer system. The engravings herewith presented are taken from these works. We understand that plans for the employment of the system at the grand depot of the same company at Jersey City, are now in progress. We hear that the invention will also be employed at the railway junctions on the Centennial Exhibition grounds, Philadelphia, Pa., next year.

Unless an engine driver deliberately shuts his eyes to prominent danger signals and intentionally dashes his train to destruction, it would seem that with the Saxby and Farmer mechanism an accident is hardly possible. The switch tender is utterly precluded from making a blunder either in signals or in locking or setting his points. The very worst he can do is to neglect his duty altogether, and the only result arising therefrom would be a temporary stoppage of the trains. He cannot shift points during the passage of a train and so send the rear cars off the track, nor can he easily signal a line clear until such is the case. The characteristic feature of the Saxby and Farmer system is its absolute positiveness.

Our artist contributes in Fig. 2 a sketch of the locality at East Newark, N. J., showing the converging tracks leading from different portions of New ark to the junction, and on the left the Saxby and Farmer signal cabin, within which all the levers which control the signals and switches are located. Beside the tracks are the home and distant signal posts, the arms of which are always extended, indicating danger, except when lowered by the operator for a few seconds, to signify that the passage is clear. The distant signals are cautionary, and placed 2,100 feet from the switches, and the engine driver, if the signal arm denotes danger, slows down at once and runs to the home post near the switches, and there stops and awaits the giving of another signal before proceeding.

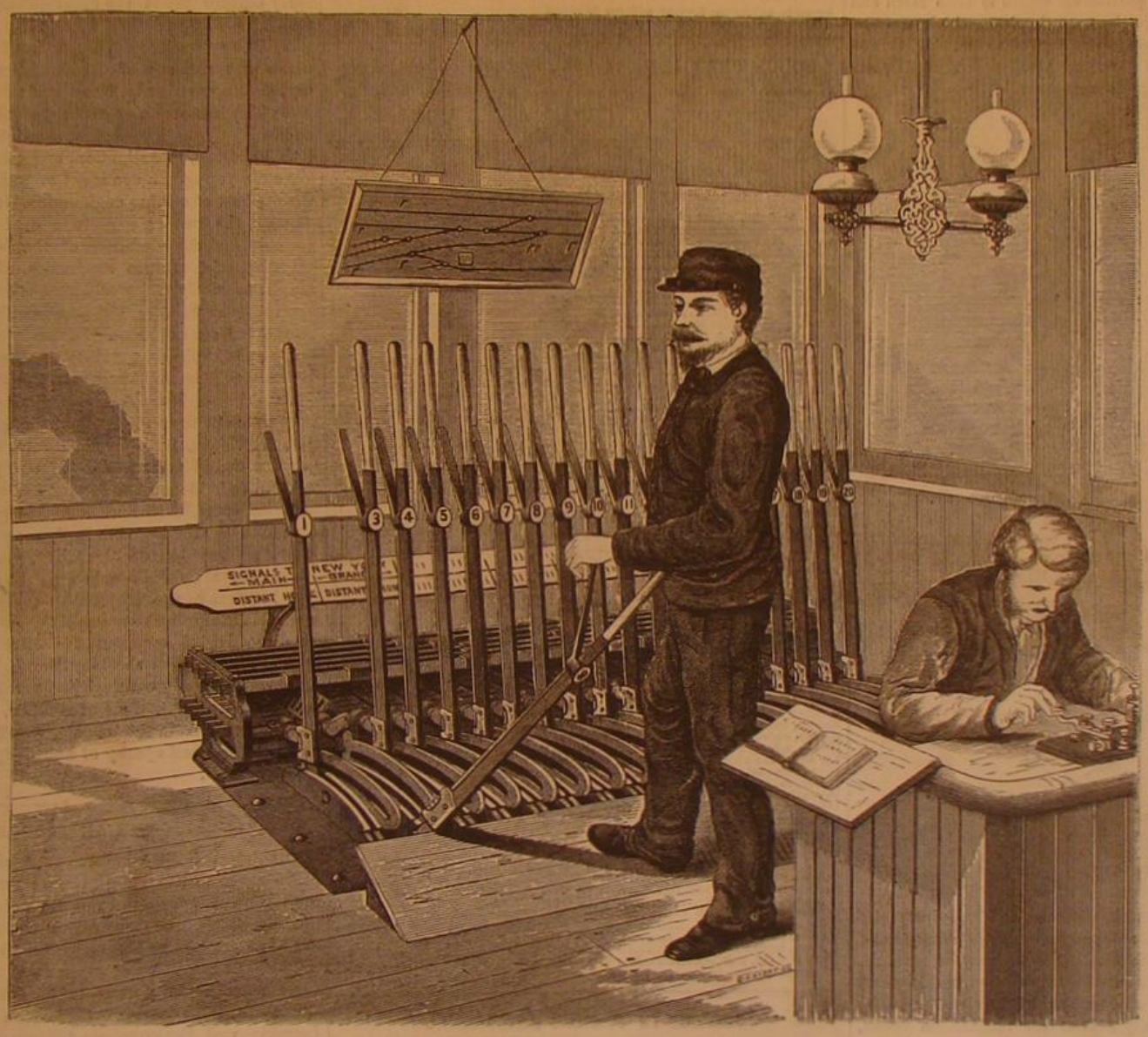


Fig. 1.—SAXBY AND FARMER'S SYSTEM OF RAILWAY SWITCHES AND SIGNALS.

The large illustration, Fig. 1, represents the interior of the signal cabin, the upper story of which is surrounded by windows, affording a clear view in all directions. Here is located the row of levers and the governing mechanism, while beneath the flooring are the counterweights, together with the heavy rods and wire cords which lead to the various points which are to be controlled. The rods and cords extend from the cabin underground, in tubes, to the signals that are to be operated, the most distant of which is nearly half a mile away from the cabin. A sectional view of the lever mechanism is shown in Fig. 3. Just in the rear of the bank of levers is a frame containing two sets of rods, which fit in slots in the extremities of the frame, and have a free longitudinal motion. Connected with each lever arm is a locking bar, which, beside serving as a latch to hold the lever either upright or inclined, also tilts a link which in turn oscillates a slotted piece of metal attached to the lever, and arranged at right angles to the sliding bars, and between them. As the slotted piece is turned, certain cogs or projections on the sliding bars engage in the slots, so that by this means certain levers other than the one or ones moved are rendered entirely immovable, through the bars being thus firmly held. It will be seen at once that, if these hooked projections on the bars be made adjustable, they may be so set and fastened that several of the levers may be locked by the motion of one, and, conversely, that it may be necessary to change the position of several levers before one can be operated. Now in this latter case, if it be supposed that the levers which must be operated first serve to lock facing points, or to cut off connection to a line to be kept clear, then it will be seen that, until this is done, the last lever which sets the signal right cannot be moved. And this is the governing principle of the entire system.

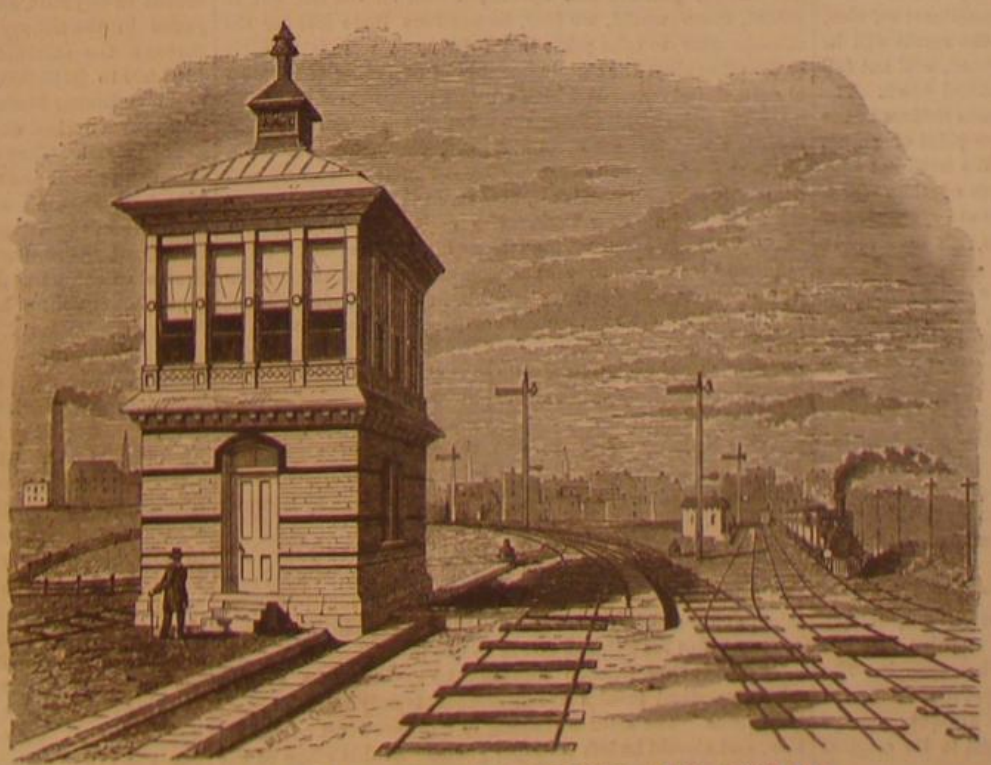
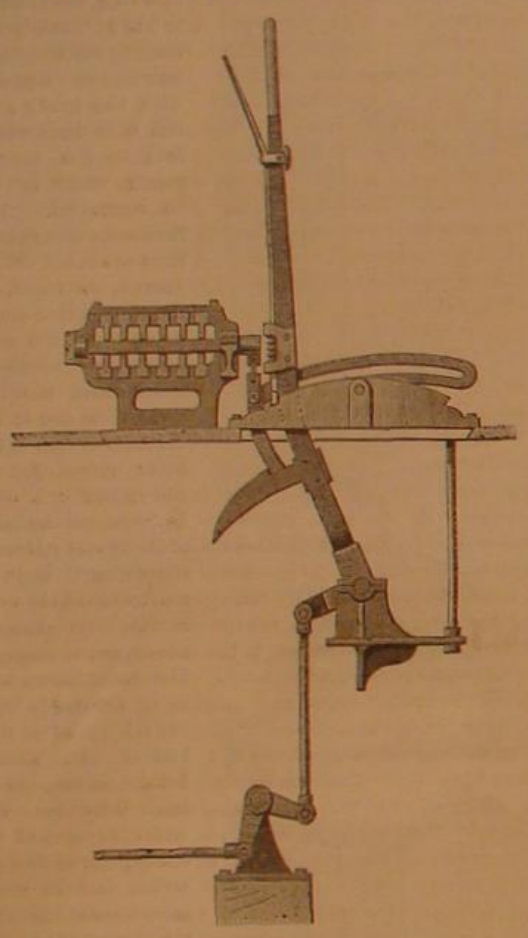


Fig 2.—SIGNAL HOUSE, SWITCHES, AND SIGNALS.

The levers, in order to be readily distinguished, are numbered, and painted in different colors. A black lever moves the switch points, and this it does by the positive connection of bell cranks and rods, leading to a bar between the points. A blue lever governs the locking mechanism which holds the latter in place. The same mode of communication leads to a long pivoted plate lying beside one rail, which, when the lever is changed,

rises up like one side of a parallel ruler, a little above and to one side of the rail, and swings over to a new position. The plate connects with a three-way crank, and the latter with bolts which shoot into the cross piece between the points. It is obviously impossible for the plate to swing over during the passage of a train, for the wheels prevent. Red and green levers manage the home and distant signals, and by suitable wire cords either turn the lights or lower the arms, arms being exhibited by day and lights at night. In rear also of the levers is a plate, showing their uses; and numbers on each serve to individualize them in accordance with a plan of the switches, etc. On each signal lever, besides its number, are marked the numbers of the other levers which must be moved before it can be, so that the operator is provided with every means for showing him instantly what he has to do. It is impossible for him to move No. 2 signal, for example, until he has moved point lever 7 and locked it by lever 8; and then after he has pulled No. 2, that very operation prevents his stirring Nos. 11 and 15, which govern points crossing to the line shown clear by the signal; nor can he move No. 14, which might enable him to give a safety signal to lines which the open road crosses. A point lever cannot be stirred when a signal which should be at danger stands at safety. In brief, the device resembles a kind of permutation lock, each portion of which is both latch and key; sometimes the projections on the bars which serve as the tumblers cause said bars to be shoved to one side, throwing other bars into or out of engagement—and thus all parts are inter-related in an ingenious manner.



The levers are all worked by one man, and he is instructed by the telegraph, the operator and instruments being located in the same apartment with him. The instant the wires deliver the message the levers are quickly moved, and in a few seconds the smoke of the approaching locomotive is seen far down the line. Should any part of the mechanism break, even at the last minute, there is no peril incurred. If any portion of the locking or switch gear give way or get out of adjustment, the signal lever cannot be stirred, and the semaphore arm remains at danger—its normal condition; so, also, if the signal mechanism itself rupture, the result will be negative, for the arm, being counterweighted, will not fall of itself, and, from the break, cannot be pulled down. The levers are moved in an instant; twenty seconds suffices at the Cannon street station in London to move ten pairs of points and all the signals belonging to them. We need not suggest the number of hands and the length of time which would be required to do the same under the old systems, nor the economy in expense and freedom from risk involved in the substitution of the new method.

Mr. Joseph Dixon, Secretary of the Broadway Underground Railway Company, is the agent for Messrs. Saxby & Farmer in this country, and from him, at the office of the above named corporation, 263 Broadway in this city, further and more minute particulars may be obtained. The mechanism in the locality above described was manufactured in the factory of the inventors, an immense establishment in London, N. W., employing some 1,800 men, and imported hither. Certainly, the invention is one of surpassing importance and value; and with that conviction we can confidently direct to it the attention of the railway companies, as well as that of the public in general.

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VOLUME XXXII., No 14. [NEW SERIES.] *Thirtieth Year.*

NEW YORK, SATURDAY, APRIL 3, 1875.

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SCIENCE IN COMMON SCHOOLING.

If it were possible to dispossess an average school boy of all the mental development and discipline, with all the knowledge, general and special, which he did not get in school, there would, we fear, be precious little left for the schoolmaster to take pride in. Still more, were it possible to set off, against the certain benefits of schooling of the usual sort, the advantages which a better ordered system of primary culture would afford, the popular appreciation of the schools would, we are certain, be seriously disturbed.

There are few places that can boast a more liberal scheme of public schooling—liberal, that is, in time and material—than this city of New York. Her children may begin with the alphabet and end with a college diploma without other aid than that which the free schools afford. Yet the records of the schools show that, of the hundreds of thousands of children who have begun their schooling in them, more than half have gone out unable to read intelligently an easy page of print. Of those that are able to stay longer—that is, more than three or four years—it is but the fortunate few who are able, when their school days come to an end, to read with understanding the foreign telegrams in the morning paper; probably to not one in a hundred is the daily report of prices current any more intelligible than a page of integral calculus.

The fault lies less with the brevity of their school life than with the misuse of it which the school system entails—a system which makes a fetich of alphabet and multiplication table, and wastes on these tools of culture the children's best opportunities for gaining power to use them.

To insist that Science teaching be grafted on a system whose practical results are so meager is only to make matters worse. The sciences belong to a higher level of education, and should be left for riper years. At this stage of the child's development, the Sciences, as systematized groupings of related facts and principles, have no existence, only objects and sensations, palpable facts and tangible relations, have being in the child world; and the child is merely the observing traveler and explorer. The scientific geographer, geologist, and the rest come later. Could we control the work of the common school, therefore, we should rigorously exclude all Science teaching, real or pretended, and all teaching not scientific.

Schoolmasters who imagine that teaching scientifically means cramming children with facts, principles, and theories in geography, grammar, physiology, physics, and what not may accuse us of making a distinction where there is no difference; but the difference is as wide as between right and wrong. The most unscientific teaching which the common schools—and not a few of our higher schools, also—are guilty of appears in their teaching of the sciences. We would have none of it. Nevertheless, we say, as we have said before, that to educate truly, the work of the primary school, in matter and spirit and method, should be, from first to last, purely scientific. In other words, the work of the primary schools should be shaped to accomplish these three ends:

(1) The systematic development and training in quickness, keenness, and accuracy of all the child's faculties of sense, through the pleasurable exercise of the senses; for in primary culture joy is the great quickener and inspirer of effort.

(2) The systematic development of the child's mental faculties by varied acts of discrimination, judgment, and memory, dealing primarily, if not exclusively, with sensations.

(3) The formation of right habits in knowledge-getting, and in applying knowledge, through the personal observation, handling, investigation, and using of common things.

As the young surgeon is set to study the human body; as the student of mining engineering is made sensibly acquainted with the ores he expects to deal with, their mineral associates, and the conditions of their existence; as the practical machinist studies mechanics, so the child should be taught to study the world he has come to live in; not as a specialist in Science, but as a practical man, determined to master his environment. In this way only can his powers of sense and intellect be rightly developed and trained, and he be fitted to play well his part in the great game of life.

To this end letters are useful as auxiliaries, and for the cultivation of the wide fields of thought that lie without the pale of Science; but they should not be made the beginning nor the end of instruction. If one part in ten of a child's school life be devoted to letters, and the rest employed as we have indicated, he will not make less progress in reading than if the whole time be given to them; and he will be immensely better fitted to turn the art to advantage in after years. Besides, if the child's schooling be untimely cut short, as now happens in the majority of cases, his scientific training would fit him to make something, nay, to make the most, of his out-of-school opportunities. Far better absolute ignorance of letters, with the inquiring habits of mind and educated senses to be got by scientific training for a year or two, than the half-acquired art of reading, which the majority of children carry from the schools, weighted with the unawakened faculties and apathy of knowledge which they too commonly exhibit.

SYRIAN SPONGES.

The latest project before the Acclimatization Society of Paris is the cultivation of the celebrated Syrian sponge in the waters of Southern France, a valuable and most useful product, which, like many another gift of the sea, is in danger of extermination through excessive fishing.

The sponge-producing grounds of Syria occur along the coast, from Mount Carmel in the south to Alexandretta in the north, the centers of production being Tripoli, Ruad, Lattakia, and Bartroun, on the coast of Mount Lebanon. The best qualities are found in the neighborhood of Tripoli and Bartroun. According to a late report of the British vice consul at Beyrout, as many as three hundred boats are engaged in the fishery; the annual yield, though falling off through the exhaustion of the grounds, still amounts to $100,000 to $125,000. The majority of the boats used are ordinary fishing boats, from eighteen to thirty feet in length, three parts decked over, and carrying one mast with an ordinary lug sail. They are manned by a crew of four or five men, one to haul and the rest to serve as divers.

In former years the coast was much frequented by Greek divers from the islands of the Archipelago; the number is now restricted to five or six boats a year, the skill of the Syrian combined with his better knowledge of the fishing grounds, enabling him to compete successfully with his foreign rival.

Diving is practised from a very early age up to forty years after which few are able to continue the pursuit profitably The depth to which the diver descends varies from five to thirty "brasses," or from twenty-five to one hundred and seventy-five feet. The time he is able to spend under water depends on natural capacity, age, and training; sixty seconds time is reckoned good work—in rare instances eighty seconds are spent under water. The Syrian diver uses a heavy stone to carry him quickly to the bottom, and is drawn up by a comrade. On the bottom, he holds the guide rope with one hand and tears off the sponges with the other, placing them in a net which he carries. No knife, spear, or instrument of any kind is used in detaching the sponges; nor does he, like his Greek competitor, ever use the diving dress, having an antipathy to it on the score of its reputed tendency to produce paralysis of the limbs. Two or three fatal accidents occur annually, mainly among the skillful and daring, who sometimes drop the rope to secure a tempting prize, and

missing it on their return, attempt to rise to the surface unaided, and are drowned. At other times the diver will be wounded by jagged rocks, or his rope will become entagled, exposing him to great risks where the depth is great.

Though varying much in quality and size, the sponges are roughly divided into three classes: (1) The fine white bell-shaped sponge, known as toilet sponge; (2) the large reddish variety called bath sponge; (3) the coarse red sponge used for household purposes, carriage cleaning, etc. Two thirds of the produce of the Syrian coast are purchased by native merchants for exportation, while the remaining third is purchased on the spot by French agents. France takes the bulk of the finest qualities. One tenth the price received by the finders goes to the government for revenue.

It is possible that this high-priced and durable variety of sponge might be cultivated in our southern waters, as a substitute for the beautiful but tender sponge they now yield. The experiment would be worth trying.

INSPECTION OF BOILERS.

We have recently received the report of the Hartford Steam Boiler Inspection and Insurance Company for 1874. These annual reports always contain a great deal of information valuable to steam users, and we give a summary of the present one.

The company report the total number of boiler explosions of which they have knowledge, occurring during the year in the United States and Canada, to be 105, killing 183 persons and injuring 199. They were only able to ascertain the causes of a few of these explosions, but venture the opinion that they might have been prevented in great part by a system of careful inspection. As we have already explained to our readers, the ground in England is so well occupied by boiler insurance companies that the cause of every explosion is carefully investigated; and the results of these investigations confirm the opinion of the Hartford company, that boiler explosions can be prevented.

During the year, the company inspected 29,200 boilers. Of this number, 9,451 inspections were internal and complete, and the hydraulic test was applied to 2,078 boilers. The number of defects discovered by these inspections was 14,256, of which 3,486 were regarded as dangerous, or, in other words, the company declined to take any risks until the defects were remedied. The report is mainly taken up with explanations of the nature of these defects and the proper remedies. It is not uncommon to find a furnace out of shape, or with a fractured sheet, as the result of overheating and sudden cooling. Blisters in plates are caused by imperfections in the iron. They should be trimmed off and a patch applied, if the thickness of the sheet is much reduced. External corrosion is caused by exposure to the weather, leaky fittings, and the like. Boilers should be set so that they can readily be examined externally. Internal corrosion is ordinarily caused by acids in the feed water, and the remedy is, of course, to purify or change the feed. In cases of internal corrosion, some plates of a boiler will be clean and bright, while others are corroded and pitted. This seems to be due to differences in the iron composing the sheets. Internal grooving is caused by change of shape, due to varying temperature and the action of acids in the feed water.

One of the most common difficulties is caused by the deposit of scale in boilers. The principal impurities in water are lime, sodium, and magnesia, with salts of iron and organic matter. The carbonate of lime is deposited in the form of a soft slush; but combined with other impurities, it forms a hard scale. If a boiler is blown out while the water is hot, this slush remains, and is baked into a hard mass; but by allowing the water to cool, and then letting it run out, the slush can readily be removed by a stream of water from a hose. The sulphate of lime, unlike the carbonate, forms a hard scale at once, and is, therefore, much more troublesome than the carbonate. It becomes necessary in such a case to use some kind of scale preventive. The company hesitate to recommend any of the patent compounds in the market, since it is impossible to say that a preparation which is good for one boiler will be good for all. Frequent blowing will be found very beneficial, lowering the water level two or three inches at a time. Potatoes act mechanically, enveloping the deposits and preventing their adherence to the boiler. Petroleum has been found useful in some cases, but its general application is not recommended. Astringents, containing tannic acid, decompose the carbonates, forming insoluble tannates; but the tannic acid in some cases attacks the iron of the boiler. Common soda appears to be one of the best solvents, being introduced with the feed, in ordinary cases in quantities of from 1 to 2 pounds a day. Whenever solvents of any kind are used, the boiler should be cleaned frequently. The use of feed water heaters, to collect the impurities, has been recommended in former reports. These views are entitled to great respect, from the extensive experience of the company with deposits in boilers and the means of preventing and removing them. We can fully indorse the recommendations given above.

While we have necessarily been brief in our review of this admirable report, we have endeavored to notice all the most important points.

MICHIGAN'S SALT INTERESTS.

The first establishment for the production of salt in Michigan went into operation in the spring of 1860. Four thousand barrels were made the first year. In 1864, the yield was upwards of half a million barrels. The next five years showed little progress; since then the gain has been steady until 1874, when the total product was 1,026,979 barrels. Thus in fifteen years the Saginaw Salt Springs have become as productive as the Kanawha (Va.) Springs, where the manufacture of salt has been carried on since 1804; and two thirds as productive as our New York springs, where the manufacture was begun as early as 1797. The manufacturing capacity of the salt works of Michigan is now about 1,800,000 barrels a year: the total product since 1860 being nearly eight million barrels. Owing to the constant efforts of the State Inspector, and the intelligent care of the manufacturers, during the past two or three years the quality of the salt produced in Michigan has been much improved, so that it begins to compare favorably in the markets with the products of Onondaga.

The first satisfactory evidence of saline waters in the State, of a strength to make the manufacture of salt profitable, was published by the State Geologist, Dr. Haughton, in 1840. The untimely death of that gentleman deprived the State of its main reliance for giving intelligent direction to the development of the industry which promised so much advantage, and the interest languished for twenty years. Since 1860, as we have already seen, the correctness of Dr. Houghton's opinions have been amply demonstrated.

The primary source of the brines of Michigan is not yet fully determined, though indications point strongly to a deposit of rock salt underlying a large portion of the northern part of the Lower Peninsula. No borings have yet demonstrated this theory; still such would seem to be the most probable source of the present supply of brine. The immediate sources of the saline waters appear to be areas of depression in the strata known as the Michigan salt group and the contiguous sandstones above and below. Along the Saginaw Valley, the depression seems to be greatest, and here the brines have the highest specific gravity. The rocks which furnish the brine lie a thousand feet or so below the level of the lakes, and all wells carried to a sufficient depth in this region are sure to yield rich and productive brines. The quantity of brine seems to be unlimited. The strength of the brine increases with the depth; in the first well sunk it marked 1 degree at the depth of 90 feet; 40° at 516 feet; 60° at 559 feet, and 90° at 636 feet.

Borings have also been made in the Michigan representatives of the Onondaga salt group, which furnish the brines of New York, but thus far they have failed to afford more than a reasonable hope that these rocks may yield brines sufficiently strong to be worked with profit.

The salt-producing territory of the State is divided into twelve inspection districts, comprising sixty-eight salt companies, working forty kettle blocks, as many steam blocks, twenty-two pan blocks, and forty-four hundred solar salt covers.

The first variety of salt block consists of fifty or sixty kettles and the stone or brickwork in which they are set, a protecting building from 75 to 100 feet long and about 20 feet high in the center, and sheds on each side containing drainage bins. The brine is pumped to vats, near each block, whence it is carried in pump logs along the brickwork between the double rows of kettles, with a spout for each kettle.

The process of manufacture is very simple. The kettles are filled with brine and heated, and the scum which rises is skimmed off. Then the brine is boiled, whereupon crystals of salt form on the top and fall to the bottom. When the brine is about half evaporated, the salt is dipped out and thrown into baskets to allow the mother liquor to drain away.

In the steam process, the brine, after settling in vats as in the kettle process, is drawn into the steam settlers, strong wooden cisterns, from 100 to 120 feet long, 8 feet wide, and 6 feet high. Here the brine is heated by steam pipes until brought to complete saturation; then after standing awhile to settle, the clear brine passes to the grainers, which are wooden vats differing from the settlers only in being shallow, and heated in the same way. The saturated brine begins to deposit salt at once, and in the course of twenty-four hours is exhausted. During this time the hot brine is constantly stirred, making the crystals fine. The salt is then thrown out upon draining boards; thence it is taken to the packing house, where it remains a fortnight for complete drainage, before it is packed in barrels.

A pan block is a building large enough to cover the settler, the pans, and the packing room. From the settlers the saturated brine is drawn to the pans, set in flues so that the heat is applied at bottom. In this process—which is considered most economical—the evaporation is very rapid, and the salt makes continually, with great economy of heat.

The solar process is the simplest of all, the evaporation being effected by sun heat alone. Shallow wooden vats, 18 feet square, are employed, each provided with a movable roof or cover, so as to protect or expose the brine as the weather may require. The evaporation begins in April, or as early as the weather becomes sunny, and continues until November. The first crop of salt is gathered about the middle of July, the second in September, and a third in October. The middle crop is the most valuable, owing to its greater coarseness. About a tenth of a crop is gathered in November, which ends the season. The annual product of a "cover" is about fifty bushels.

Four grades of salt are recognized by the State Inspector, to whose annual report, for 1874, we are indebted for the foregoing information:

Fine salt: Suitable for general use for family purposes. Made with artificial heat; of this grade the yield last year was 960,757 barrels.

Packers' salt: Suitable for packing and bulking meat and fish. Yield, 20,090 barrels.

Solar salt: Coarse and fine. Claimed to be equal to the best Onondaga solar. Yield, 29,391 barrels.

Second quality salt: Includes all salt intended for No. 1 of the foregoing grades, but not up to the standard. Good for salting stock, hay, hides, etc. Yield, 16,741 barrels.

THE MISSION OF THE FLY.

The generally received opinion about flies is that, despite limitless ingenuity expended on patent traps and poisoned paper, they form one of those ills of life which, it not being possible entirely to cure, must perforce be endured with as good a grace as may be. Consequently when they ruin our picture frames and ceilings, insinuate themselves into our milk and molasses pitchers, or lull us to sleep with their drowsy buzzing, only to bite us during our slumbers and render the same uneasy, we thank fate that the cold weather will rid us of the pest. To be sure they are scavengers in their way; but after we have spent several minutes in picking a score or more out of the butter dish, we arrive at the conclusion that it is an open question whether they do not spoil more good material than they carry off bad.

Festina lente, good reader, hasten slowly and do not anchor faith to such opinions until you are certain that the above sum up all of the fly's mission in this world. *Musca domestica* (Science uses six syllables in Latin to express that which good round Saxon epitomizes in two) is a maligned insect. He fulfils a purpose of sufficient moment to cause you to bear his inroads into your morning nap with equanimity, o even complacently to view him congregated by the score within your hidden sweets.

Did you ever watch a fly who has just alighted after soaring about the room for some little time? He goes through a series of operations which remind you of a cat licking herself after a meal, or of a bird pluming its feathers. First, the hind feet are rubbed together, then each hind leg is passed over a wing, then the fore legs undergo a like treatment; and lastly, if you look sharp, you will see the insect carry his proboscis over his legs and about his body as far as he can reach. The minute trunk is perfectly retractile, and it terminates in two large lobes, which you can see spread out when the insect begins a meal on a lump of sugar. Now the rubbing together of legs and wings may be a smoothing operation; but for what purpose is this carefully going over the body with the trunk, especially when that organ is not fitted for licking, but simply for grasping and sucking up food.

This query, which perhaps may have suggested itself to thousands, has recently for the first time been answered by a Mr. Emerson, an English chemist; and certainly in the light of the revelations of that gentleman's investigations, the fly assumes the position of an important friend instead of a pest to mankind. Mr. Emerson states that he began his self-appointed task of finding out whether the house fly really serves any appreciable purpose in the scheme of creation, excepting as an indifferent scavenger, by capturing a fine specimen and gluing his wings down to a microscope slide. On placing the slide under the instrument, to the investigator's disgust the fly appeared covered with lice, causing the offending insect to be promptly released and another substituted in his place. Fly No. 2 was no better off than fly No. 1, and as the same might be predicated of flies 3, 4, 5 (or of *n* flies, as the algebras have it), Mr. Emerson concluded that here was something which at once required looking into. Why were the flies lousy? Meanwhile fly No. 2, on the slide, seemed to take his position very coolly, and, extending his proboscis, began to sweep it over his body as if he had just alighted. A glance through the microscope, however, showed that the operation was not one of self-beautification; for wherever the lice were, there the trunk went. The lice were disappearing into the trunk; the fly was eating them. Up to this time, the investigator had treated his specimen as of the masculine gender; but now he changes his mind and concludes it to be a female, busily devouring not lice but her own progeny. The flies then carry their young about them; and when the family get too numerous or the mother too hungry, the offspring are eaten.

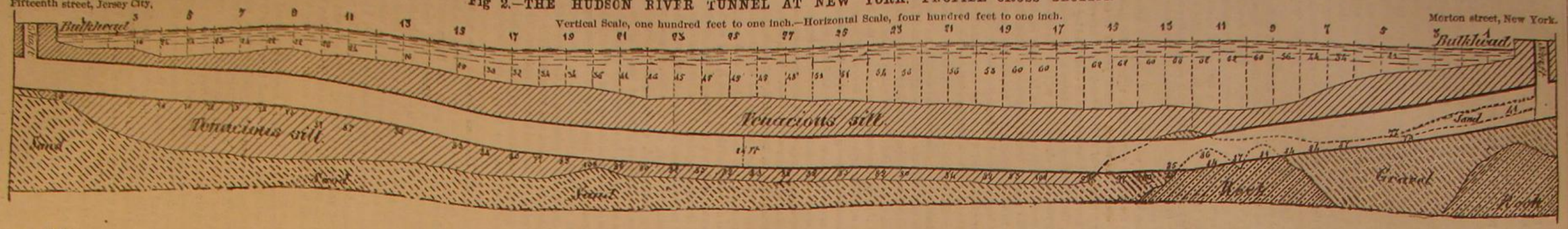
Awhile reasoning thus, Mr. Emerson picked up a scrap of white writing paper, from which two flies appeared to be busily eating something, and put it under the instrument. There were the progeny again on the paper, and easily rubbed off with a cloth. "This," he says, "set me thinking. I took the paper into the kitchen again and waved it around, taking care that no flies touched it, went back to the microscope and there found animalcules, the same as on flies. I had now arrived at something definite; they were not the progeny of the fly, but animalcules floating in the air; and the quick motions of the flies gathered them on their bodies, and the flies then went into some quiet corner to have their dainty meal."

The investigator goes on to describe how he continued the experiment in a variety of localities, and how, in dirty and bad smelling quarters, he found the myriads of flies which existed there literally covered with animalcules, while other flies, captured in bed rooms or well ventilated, clean apartments, were miserably lean and entirely free from their prey. Wherever filth existed, evolving germs which might generate disease, there were the flies, covering themselves with the minute organisms and greedily devouring the same.

Mr. Emerson, while thus proving the utility of the fly, has added another and lower link to that curious and necessary chain of destruction which exists in animated nature. These infinitesimal animalcules form food for the flies, the flies for the spiders, the spiders for the birds, the birds for the quadrupeds, and so on up to the last of the series, serving the same purpose to man. He certainly deserves credit for an interesting and novel investigation, and for an intelligent discernment which might even attack the more difficult task of teaching us the uses—for Nature makes nothing without some beneficial end—of the animalcules themselves.

Fig 2.—THE HUDSON RIVER TUNNEL AT NEW YORK.—PROFILE CROSS SECTION

Vertical Scale, one hundred feet to one inch.—Horizontal Scale, four hundred feet to one inch.



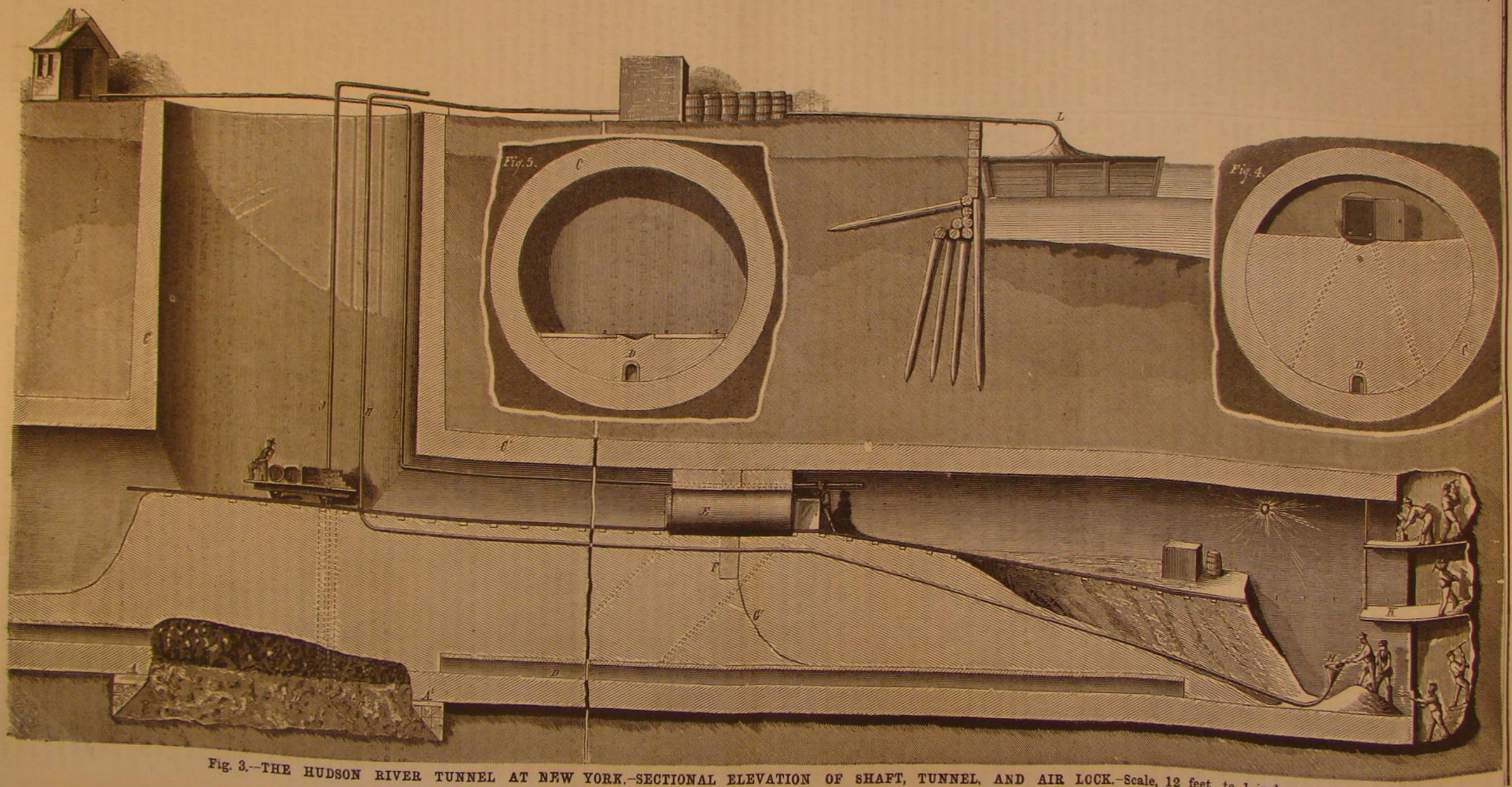


Fig. 3.—THE HUDSON RIVER TUNNEL AT NEW YORK.—SECTIONAL ELEVATION OF SHAFT, TUNNEL, AND AIR LOCK.—Scale, 12 feet to 1 inch.

THE HUDSON RIVER TUNNEL AT NEW YORK.

We have heretofore made reference to the commencement of the great work of tunneling the Hudson river, for the purpose of establishing direct railway connection between the city of New York and the many great railways that now have their termini at Jersey City, upon the opposite bank of the stream. The gigantic traffic of all these railways at present depends upon ferry boats, the maintenance of which is expensive, while they are subject to frequent interruption. In winter, especially, when fogs and ice obstruct navigation, the ferry passage often involves the public in disastrous risks and inconveniences.

The project of tunneling the Hudson river at this point has been often proposed. Its importance as a promoter of the prosperity of New York city can hardly be overestimated. Every additional link in the chain of communications by which access to this metropolis is improved, rendered quicker, cheaper, or better, is a positive and permanent gain for the city. Every added facility for ingress and egress helps to swell its business, helps to increase both its resident and floating population, helps to build it up as the chief mart of commerce and finance of the New World. So obvious are the public benefits that must result from the building of great works like this that it seems hardly credible that it could have any real opponents. It is a serious fact, however, that there are individuals and corporations who are laboring against it. But we are confident they will not prevail. The work has been actually commenced, the means, it is alleged, are provided, and we believe the day is close at hand when railway cars will run under our Hudson with the same frequency and regularity as they now run under the Thames, at London.

This work of tunneling the Hudson is being carried on under the auspicies of the Hudson Tunnel Company. Capital, $10,000,000. Incorporated under the General Laws of the States of New York and New Jersey. The President of the corporation is DeWitt C. Haskin; Vice-President, George G. French; secretary, L. C. Fowler,; Consulting Engineer, William H. Paine.

Fig. 1 is a plan sketch of New York and vicinity, showing the general position of the new Tunnel. The other engravings are taken from the Company's drawings and works.

Fig. 2 is a cross section of the Hudson river, showing the Tunnel works in profile, the depths of soundings, borings, grades, and distances. The upper figures show the latter in hundreds of feet from the bulkhead lines. The intermediate figures indicate the depth of the water in feet. The lower figures give the depth of borings in feet. The extreme grade of the Tunnel is two in a hundred feet, descending from Jersey City, then, ascending on the New York side, three in a hundred for 1,500 feet, then two in a hundred to the New York end.

The greatest depth of water is a little over sixty feet. The borings show that the soil through which the Tunnel will pass is for the most part a tenacious silt, underlaid by hard sand. Near New York shore, a small extent of rock is encountered, and some gravel. The tenacious character of the soil is considered favorable for tunnel construction, and no serious difficulty of any kind is anticipated by the Company.

Fig. 3 shows a cross sectional elevation of the vertical shaft on the Jersey city side, lately begun, together with a portion of the intended horizontal Tunnel as it will appear when extended under the river.

Fig. 4 is a cross section of the Tunnel at the air lock.

Fig. 5, cross section of complete Tunnel and railway tracks.

The Tunnel walls, C', will be constructed of the best hard brick and cement, three feet in thickness; circular in form, twenty-six feet in width and twenty-four feet in height, painted white in the inside, and lighted with gas; with a double track railway, with heavy steel rails, upon stone ballast five feet from the bottom. D, bottom drain.

The entrance to the tunnel on the Jersey side of the river is to be from Jersey avenue, on Fifteenth street; the work is to extend thence to Hudson street and the river, about 3,400 feet; thence under the river, curving five degrees northward, to the New York bulkhead line, at or near the foot of Morton street, about 5,400 feet; thence curving slightly southward in New York, about 3,000 feet, to a point to be selected by commissioners.

The entire length of the tunnel and approaches will be about 12,000 feet (with the depot tracks to be added thereto), being about one mile under the river, and nearly three fourths of a mile upon each side.

The track will be of steel, ballasted with broken stone to five feet from the bottom of the tunnel, where can be located gas pipes, pneumatic tubes, and water pipes, if needed. Telegraph wires can be placed upon either side.

For the purpose of expedition, it is proposed to work, from each side of the river at the same time, as many men as can be successfully employed in excavating and laying brick, changing them each eight hours. Thus by constant work, doing three days' labor every twenty-four hours—by which it is believed the work can be advanced five feet from each end every day—the whole work can very easily be completed within two years. The Hudson Tunnel Railroad Company will then be able to convey passengers, without change of cars, from the South and West, as well as from Newark, Elizabeth, Paterson, and all local points, arriving at Jersey City, and within six minutes thereafter to Broadway, New York, where the Company hopes to make connection with the Broadway Underground Railway, which is to run north and south.

The company say that more than four hundred trains of cars could be passed through the tunnel each twenty-four hours. Freight trains would have transit at night. Market trains in the early morning. All drawn by powerful engines, made especially for this purpose, to be run by signals—without bells or whistles—consuming their own steam and smoke, or run with compressed air.

All connecting railroads are to have an equal right to have their passengers and freight transported through the Tunnel upon the same equitable terms.

The construction of the Hudson Tunnel to a point near Broadway will soon involve the construction of another Tunnel under the East River to Brooklyn, from near the same point; then a perfect system of rapid transit railroads, running East, West, North, and South, would be in operation. This, the Company believes, is in the near future, and their report adds:

"Rap d transit should not be considered as useful in only one direction, but is equally useful to run East, West, South, and North—will be as well for New York, if extended to Brooklyn and Jersey, as to run into Westchester County. All will be benefited by the general prosperity of the main city itself. All are feeders to it. Thus all will derive their proportion of the benefits that their position entitles them to. This Tunnel the company justly regards as but the precursor to rapid transit in all directions, soon to follow



Fig. 1.—THE HUDSON RIVER TUNNEL AT NEW YORK.—PLAN OF THE CITY AND VICINITY, SHOWING THE LOCATION OF THE TUNNEL.

'The Tunnel was commenced in November last, after extensive borings, for a year previous, in the bottom of the Hudson river, down to the depth to be occupied by the tunnel. A circular working shaft, C, thirty feet in diameter and to be sixty-five feet in depth, was then commenced one hundred feet inland from the water, on Fifteenth street in Jersey City. After it had been sunk twenty feet, with perfected brick walls four feet in thickness, the further prosecution of the work was enjoined at the suit of the Delaware, Lackawanna, and Western Railroad Company. The litigation occasioned thereby, it is hoped, will be terminated soon, and the necessary legislation secured, when the work proposed will be resumed and forwarded as rapidly as possible."

The company further say "that the great expense of an undertaking of this magnitude has hitherto prevented its construction. The Hudson Tunnel Railroad Company, however, by the aid of compressed air, as applied in the patent therefor, obtained by its president, Mr. Haskin, in connection with other important appliances, will be able to complete this work at much less expense than any similar work has ever been constructed. It is believed that its present capital of ten million dollars will be abundant for that purpose. In its plan of construction no expensive coffer dam, caissons, or Brunel shields will be needed."

"The use of compressed air introduced into the face of the Tunnel, with sufficient pressure to hold in place, or keep back and prevent the interruption of silt, clay or water, will," it is believed by the company, "overcome the difficulties usually experienced in constructing tunnels, and also enable it by this agency, to remove the water and waste earth to the surface, through pipes, without the aid of hoisting apparatus."

The intended method of operating will be understood by reference to Fig. 3.

A is the foundation ring on which the masonry of the vertical shaft is built and allowed to settle as fast as the earth below the ring is excavated. At E, is an air lock, composed of an iron cylinder, with hinged doors at each end for access of men and materials. The cylinder is of small dimensions and rests upon a bed of earth and a wall, F, which, with a canvas curtain, G, and other packing, makes a sealed partition and forms a tight air chamber heading in front of the lock. A small railway track will convey bricks and materials to the heading. Air pipe, I, conducts compressed air from the surface to the heading. This air pressure is expected to assist in keeping out water and upholding the roof of earth during excavation in front of the masonry, also to supply air for the workmen, who will work in considerable numbers on platforms, K, as shown in our engraving.

The air pressure will also carry back up to the surface, through pipe, H, and discharge at L, into scows at the dock, all sand, mud, or water that may accumulate in the heading during the course of the excavation (H, Fig. 3).

We shall watch the progress of the work with great interest, giving our readers from time to time such incidents in connection therewith as may be desirable. We heartily wish success to the enterprise, and trust that it may be brought to the speedy completion that the company anticipates.

Backing for Photo Transparencies.

The *British Journal of Photography* says: To plain and rather thick collodion add some finely sifted carbonate of lead (white lead), in the proportion of a teaspoonful to four ounces of the collodion. Incorporate well together by trituration or shaking, then add a few drops of castor oil and as much Canadian balsam as would fill the half of a walnut shell. Filter through muslin, if necessary. This emulsion when poured upon glass will give a very fine and even opal surface; and glass thus prepared will, for the purpose under consideration, answer just as well as the finest and most expensive opal glass, whether flashed or pot metal.

Another opal mixture consists simply of a mixture of collodion and negative varnish. Although very pure and transparent when in the bottle, no sooner has a film been formed upon a cold plate of glass and allowed to become dry than the transparence gives way to a pure translucent white, presenting a very beautiful appearance. The mixture by means of which we made our finest specimens was composed in the proportion of an ounce of ordinary collodion to two drams of a retouching varnish, which we had made of sandarac dissolved in alcohol.

Let those of our readers who desire to examine and exhibit their transparencies under the most favorable circumstances at once remove the ground glass from them, supplying its place with a plain piece of glass rendered opaline by one or other of the methods described, and they will have every reason to be satisfied.

The Oxy-Sulphur Light.

We had a small sheet iron retort of the usual conical form. The delivery tube of this we loosely plugged to act as a safety valve, if necessary, and in the lid we drilled a hole and screwed four inches of quarter inch brass tube. Through a hole in the side of this was inserted a piece of much smaller tube, closed by hammering the end, and having the closing pierced by a fine hole. By this arrangement we had the larger tube in communication with the interior of the retort and in the center of that tube, and rising a little higher than the level of its mouth, a smaller tube coming out at the side and long enough to enable a rubber tube to be attached—an arrangement, in fact, very much like the ordinary form of blow-through oxyhydrogen burner. A quantity of sulphur was placed in the retort, and sufficient heat applied to raise the temperature to about 725° Fah. the point at which it vaporises. The end of the smaller tube was attached to the oxygen bag—one containing four cubic feet—and a fourteen pound weight applied, which was found amply sufficient. When the vapor of sulphur made its appearance, the oxygen was turned on, and the result was a steady flame of about two inches in length, and of such intensity that, although we had not an opportunity then of trying it, we are sure a small statuette could have been photographed by it in a few seconds.

The product of combustion—sulphurous acid—may easily be got rid of if there be in the room a suitable chimney; but even without that, there is no difficulty in rendering it so harmless that the operation may be carried on in a drawing room.

Beet Cider.

M. Plouard, a lawyer of Andelys, France, has invented a new cider, said to be very cheap and of excellent flavor—the peculiarity of which is that a large proportion of sugar beets is mixed with the apples before pressing; 80 lbs. of beets are mixed with 700 quarts of apples, or about 11 lbs. to 100 quarts. The beets and apples are pressed together, then saturated with water, left quiet in a cellar for twenty-four hours, and pressed anew. This is repeated seven times. The inventor says he makes 100 quarts of cider for 80 cents, which seems rather questionable.

The Latest Novelty in Paper.

Inasmuch as paper has been made available for the manufacture of almost every variety of furniture and articles of dress, it is passing strange that paper coffins should have been left till this late day unthought of. The undertaker is certainly not an enterprising party. Trunk makers have long been credited with using all the unsalable printed books; but at the present rate of production, were every traveler supplied with a van load of these troublesome *impedimenta* to traveling, such a stock would remain that all the bookshelves in the world would not contain a tithe of them. To further reduce the stock, a manufacturer out West proposes to supply every journeyer, to that bourne whence no traveler returns, with a last trunk made of *papier maché*, waterproofed with asphaltum.

M. SCHRETZ states that borax enfeebles the spontaneous movements of all living vegetable tissues and kills microscopic animalculæ. In this country, the use of borax as a preservative of wood has been patented.

Correspondence.

A Fossil Skeleton.

To the Editor of the Scientific American:

About three weeks ago, there was a report circulated in this vicinity that some men, while digging for water, had come across the skeleton of a most gigantic beast, the like of which had never before been found.

On hearing that the skeleton was on exhibition in this town, I went to see it. There were not many of the bones to be seen, but there were enough to give an idea of what the beast must have been.

The horn, which was the most conspicuous, I found to be eight feet nine inches in length and two feet one inch in circumference. It is slightly spiral and considerably curved in form tapering almost to a point; it is hollow for about four feet from the large end, which bears traces of having partly wasted away. There are three pieces of the jaw, one of which is two feet long and contains the two back molar teeth, and is one foot five inches from the joint to the first molar tooth. A similar piece of an ox jaw is about one half the whole length; so this, in the same proportion, would be about four feet long. This piece, which is of the lower jaw, is about six inches thick and eight deep. The largest of the teeth are seven inches long, and three and one half broad measured on the face. A joint of the back bone measured thirteen inches in breadth and twenty-one in hight; but it is broken on the upper end. The joint at the back of the head measured eighteen inches across. A bone, said to be the third short rib, is four feet five inches in length, and the bone from the knee to the ankle is seven inches across the top.

The horn in its present state weighs one hundred and five pounds, and one of the teeth weighs five and one half pounds. The bones are in a very good state of preservation, and also the horn; but the teeth (which are tubercular) are perfect, the enamel being as hard and intact as ever.

These remains were found in marshy land on the north shore of Lake Erie, eighteen inches underground; and over them there stood an oak tree three feet in diameter. There is more of the skeleton still under the surface, which will be taken out as soon as the frost is out of the ground.

Is this skeleton similar to that of a mastodon?

St. Catharine's, Ontario. A. R.

Kaolin in the United States.

To the Editor of the Scientific American:

Thirty-five miles from Omaha, Neb., there is a deposit of kaolin, about 30 feet thick and underlying about 100 acres. It crops along a bluff for over one half mile, with but a few inches of earth covering it. Beginning at the top, it is coarse and of a granulated nature; but as we descend, it grows finer, and is very fine and white near the bottom. It quarries in lumps, like chalk, and very readily dissolves in water.

Pure and free from foreign substances, it readily becomes pliable, and can be turned or molded into almost any form; and its shrinkage in drying is remarkably small. The difference of grades in fineness adapts it to the manufacture of a very large class of goods, such as are in demand throughout the West; and as it lies near the Burlington and Missouri Railroad, shipping facilities are convenient.

It makes a beautiful white brick, suitable for fronts and trimmings; and it seems well adopted for terra cotta, chimney tops, drain pipes, and all classes of jugs, crocks, etc., and is very superior for fire bricks.

This immense deposit, located as it is with timber, water, and all conveniences for manufacturing, offers, I think, a good opening for some capitalist to build up an immense business. I hope to see such a one take hold of and develop this material.

Omaha, Neb. J. M. GOODWIN

Setting Locomotive Valves.

To the Editor of the Scientific American:

In your issue of February 20, W. S. W. asks whether locomotive valves can be set without opening the valve chests? If the face of the valves and their seats are in good order, their adjustment may be determined with sufficient accuracy for all practical purposes by the issuing of steam from the water cocks in the bottom of the cylinders. This may be best done when there is but little pressure in the boiler, not quite enough to move the engine. Set the reverse lever to its extreme forward position, then open the water cocks and the throttle; then bar the engine forward, and, as the cranks approach their dead points, note carefully when the steam begins to issue from the water cocks. If the valves are correctly set, steam will begin to issue just before the cranks arrive at their dead points, owing to the lead of the valves. The amount of lead may be determined by placing a straight edge against the gland of the stuffing boxes of the valve stems, and marking (with a fine scratch awl) on the valve stem, just at the point where steam begins to issue, and then again just as the crank reaches its dead point; the distance between the scratches will of course indicate the amount of lead, and should not exceed one eighth of an inch for passenger engines, and less than one sixteenth of an inch for freight engines.

One revolution of the drivers is sufficient to examine each of the four dead points and adjust the lead and range of the valves, the range being adjusted by varying the length of the rods, of course, and the lead by moving the eccentric on the shaft, forward or back, as the case may be.

In setting valves as above explained, it is well to repeat the observation at each of the four dead points by moving the engine back sufficiently to take up the slack of the valve gear, and then bar it forward again and apply the straight edge as before.

To set the valves for the backward movement of an engine, the reverse lever must of course be placed at its extreme back position, and the engine must be moved backward instead of forward, otherwise the adjustment is of course precisely the same as for going ahead, except that all adjustment in the range of the valves must now be done by varying the length of the eccentric rods, because the least variation in the length of the valve stems would now upset the previous adjustment for going ahead.

Worcester, Mass. F. G. WOODWARD.

Method for Squaring Numbers.

To the Editor of the Scientific American:

In your issue of February 27, a correspondent gives a short method for squaring numbers ending with 5. There is an excellent rule for squaring any number; and by its aid the operation can be performed mentally on any number of not more than two figures. It is as follows:

Take the nearest number ending with a cipher to the number to be squared; if such number be greater than the one to be squared, subtract the difference between the two from the number to be squared, and if it be less add the difference; then multiply the number thus obtained by the one ending with 0, and to this product add the square of the aforesaid difference. The result will be the square of the numbers.

For example: Take the number 64. The nearest number ending with 0 is 60. The difference between the two is 4, which add to 64, making 68. Then 68×60, which can easily be performed mentally, is 4,080, to which add the square of the difference, which is 4×4 or 16. The result is 4,096, the square of 64.

If the number to be squared were 68, the operation would then be $(70 \times 66) + 2^2 = 4,624$.

This rule is always correct, easily remembered, and will often save time and figures. E. T.

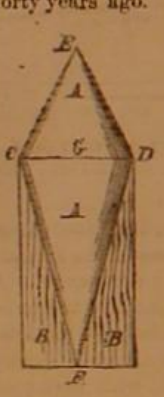
Newark, Ohio.

A New Rifle Projectile.

To the Editor of the Scientific American:

I enclose a sectional sketch of a projectile which I have invented. It is principally adapted to rifles. I believe I may safely say that I have made the longest shooting with it that was ever accomplished, *ceteris paribus*. Out of ten shots which I fired at a barn, at a distance of 2,773 yards, five passed through two boards, each over an inch and a half in thickness, and the sixth passed through the first board, and afterward became imbedded in a post.

I used a common rifle, an old one, without any of the modern improvements; judging from the circumstance that it originally had a flint lock, it must have been made at least forty years ago.



A is the projectile. B is a wooden cover in which the shot is placed. It serves two purposes: 1. That of filling up a space. 2. That of preventing windage, which it effectually does. C D is the waist. It comes, or was intended to come, in contact with the rifling of the cylinder. Proportions: C D = diameter, E G = 1 diameter, F G = 2 diameters. Were the projectile designed for a field piece the waist would be broader, and would be fluted for the purpose of receiving a band of softer metal, upon which studs would be placed.

Colonel Strange, R. A., Dominion (Canada) Inspector of Artillery, whose opinions on such matters are worthy of consideration, and who was one of the officers selected by the British Government to report on the artillery and arms of Prussia and France during the recent war, writes as follows:

J. Macdonald, Esq., London, Ont.:

Dear Sir:—I have to acknowledge the receipt of yours of January 8, 1875, inclosing description of a projectile proposed by you, and asking my opinion. 1. I am not surprised at its having an extremely long range. The form is exceedingly favorable not only to overcome resistance from air in front, but the projectile would be less retarded than those of the ordinary form (that is, with a flat base) by the vacuum formed behind the projectile when it moves with a velocity greater than the air can rush in behind it, which is a source of retardation at high velocities.

2. The center of gravity of your projectile is in about the right place, if the rifle had a quick twist; otherwise it would have a tendency to drop in front at extreme ranges.

The causes which led to the good shooting are probably:

a. The wood, having a lower specific gravity than the lead, was forced forward by the discharge and filled up the grooves of the rifle, imparting a twist and preventing windage. If you examine the bullets, you will find probably that not even the waist was cut by the grooves.

b. In the service artillery projectile, no part of the hard metal comes in contact with the gun.

c. The drawback to your system would be the difficulty of fixing a ring or studs of soft metal at the waist, which is and must be narrow to preserve your form.

d. The effect of field artillery depends on the shell power. Solid rifled artillery projectiles are obsolete. The space for powder in a common shell, on which its destructive power depends, is much diminished in your form of projectile.

e. Also the space for bullets in the Shrapnel shell.

I would not wish to discourage your researches, especially as you have hit on correct principles. Excuse haste and a candid reply.

T. B. STRANGE, Colonel,
Dominion Inspector of Artillery.

You are at liberty to make what use you like of this communication. J. MACDONALD.

London, Ontario

Experiments with Honey.

To the Editor of the Scientific American:

On page 132 of your current volume, I noticed that one of your correspondents has great difficulty in preserving strained honey. Perhaps it would be of interest to him, as well as other readers of your valuable paper, to know that candied or crystalized honey can be permanently restored to transparency by the following method, which I have found successful: Take a flat bottomed pan, as deep as the bottles containing the honey, and fill it with cold water; place the bottles in it so as not to touch each other, put it on a slow fire, and heat it up to 212° Fah., and keep it at that heat until the honey is clear. Remove the pan from the fire, and you will have no further trouble with the honey.

Pittsburgh, Pa. A. L. F.

Tests of Vulcanized Rubber for Belts.

Chemical analysis, in the majority of cases, is powerless to determine the quality of vulcanized rubber, and the consumer is usually left to mechanical tests of the article furnished him, in comparison with other and similar products of known excellence, in order to find out whether the former is adapted to his purpose or attains a fixed standard of efficiency. These trials consist in examining the comparative degrees of elasticity and tenacity. The manner in which they are conducted in the French navy appears to us practical and easily followed. The first test consists in cutting from the sheets samples, which are left in a steam boiler under a pressure of 5 atmospheres for 48 hours. At the end of this time, the pieces should not have lost their elasticity. The specimens may then be placed on the grating of a valve box, under a pressure from above of 85·5 lbs. per square inch, and should withstand 9,100 strokes at the rate of 100 per minute. Specimens not boiled should withstand 17,100 strokes. Thongs of rubber boiled, and having a section 0·6 inch square and a length of 8 inches, fixed between supports and elongated 3·9 inches, should resist without breaking a further elongation of 8 inches, repeated 22 times a minute for 24 hours. Thongs not boiled, under the same conditions, should resist for 100 hours. These extra elongations may be easily made by a wheel, to the periphery of which one end of the thong is fastened, while the other extremity may be attached to a support. By turning the wheel, any determined elongation may be given at the rate of from 20 to 25 times per minute. Under the above conditions bands of first quality rubber, perfectly pure and well vulcanized, break after 180 or 200 elongations of 8 times the initial length. Bands cut from pure rubber, but of secondary quality, break after 50 or 60 elongations. Inferior caoutchouc, containing mineral matters or residue of old vulcanized rubber, gives no results at all.

M. Ogier (from whose valuable paper, recently read before the Paris Society of Civil Engineers, we extract the main facts of this article) has investigated the properties of rubber belts made of repeated layers of cloth covered with prepared rubber. Through the adhesive nature of the caoutchouc, the superposed tissues form, after vulcanization, a homogeneous substance, comparable, in M. Ogier's opinion, to the best curried leather. His experiments, in order to obtain the coefficient of friction of these belts on cast iron pulleys, give us results varying from 0·42 to 0·84, as against the coefficient for leather, 0·28. The minimum value corresponds to canvas and rubber belts without an exterior rubber coating. On pulleys of various forms, the maximum value of the coefficient of friction was found on those slightly convex and presenting a roughly turned surface, this result being inverse to that obtained with leather belts. Similarly the presence of fatty bodies has an opposite action on the cloth and rubber belts to that which it has on leather. On covering the former with a light varnish of half olive oil and half tallow, the adhesion was found to be considerably augmented. This fact M. Ogier, who does not counsel the use of the varnish but for rubber-coated belts, attributes to a resinification resulting from an action on the mixture of the excess of sulphur, which the caoutchouc always rejects after a certain period.

Experiments were also instituted on leather and rubber belts, in order to determine their resistance to rupture, and the law of elastic and permanent elongations obtained under increasing stress. These trials were made on belts 117 inches long, suspended from a crane by jaws, and carrying at their lower extremities other jaws which sustained the weight. Both pairs of jaws grasped the leather for a sufficient distance to preclude any possibility of slipping. The belts were allowed to remain under stress for an hour and a half before the elongations were measured. The results obtained may be summarized as follows: 1. The resistance to traction of rubber and canvas belts per square millimeter (0·0009 square inch) of section is at least equal to that of leather belts. 2. This resistance per square millimeter is independent of dimensions—length, breadth, or thickness. Such is not the case with leather belts, and therefore preference should be given to rubber belting whenever the conditions of the power to be transmitted necessitate the employment of very long, very wide, and very thick belts. 3. From two trials it appears that the external covering of caoutchouc adds nothing to the resistance, and hence it is advantageous to use covered belts which, at equal weights and prices, give a superior resistance. 4. Under the same weight the elastic elongation of leather belts is double that of rubber ones. The permanent elongation, under a change of 0·55 pound per square millimeter, reached 2 per cent in the former and nothing in the latter.

This last fact is worthy of special note, since the lack of success of rubber belting, in many cases, may be traced

thereby to the fact that a workman, used to leather belting, treats rubber naturally in the same way. He tightens the latter when it slips, a proceeding which results in breakage or rapid destruction through use at too high a tension. M. Ogier concludes that, in the present state of the leather and rubber industries, the price of installation, useful effect being considered, of leather and rubber belts is about the same, but the cost of maintenance of the latter is small when compared to that necessitated by the use of leather belts of large dimensions.

Electric Lathe Chuck.

In order to obviate the inconvenience and loss of time involved in the ordinary mode of fixing upon a lathe chuck certain special kinds of work, such as thin steel disks or small circular saws, the chuck is converted into a temporary magnet, so that the thin steel articles, when simply placed on the face of the chuck, are held there by the attraction of the magnet; and, when finished, can be readily detached by merely breaking the electric contact and demagnetizing the chuck. The face plate of the magnetic chuck is composed of a central core of soft iron, surrounded by an iron tube, the two being kept apart by an intermediate brass ring; and the tube and core are each surrounded by a coil of insulated copper wire, the ends of which are connected to two brass contact rings that encircle the case containing the entire electro-magnet thus formed. These rings are grooved, and receive the ends of a pair of metal springs connected with the terminal wires of an electric battery, whereby the chuck is converted into an electro-magnet capable of holding firmly on its face the article to be turned or ground. For holding articles of larger diameter, it is found more convenient to use an ordinary face plate, simply divided into halves by a thin brass strip across the center; a horseshoe magnet, consisting of a bent bar of soft iron, with a coil of copper wire round each leg, is fixed behind the face plate, each half of which is thus converted into one of the poles of the magnet. The whole is enclosed in a cylindrical brass casing, and two brass contact rings fixed round this casing are insulated by a ring of ebonite, and are connected with the two terminal wires of the magnet coils. A similar arrangement is also adapted for holding work upon the bed of a planing or drilling machine, in which case the brass contact rings are dispensed with, and any desired number of pairs of the electro-magnetic face plates are combined so as to form an extended surface large enough to carry large pieces of work. For exciting the electro-magnet, any ordinary battery that will produce a continuous current of electricity can be used; but in machine shops, where power can be obtained, it is more convenient to employ a magneto-electric machine—such as Gramme's, for instance—rather than a battery.

The Pyrophone.

At a recent meeting of the Society of Arts, London, a paper, descriptive of M. Kastner's new musical instrument, the pyrophone, was referred to. One of the instruments was in the room, and was experimented upon in the course of the evening. It was composed of a frame enclosing glass tubes, arranged in the form of the pipes of a small organ. In each of the tubes were two jets of gas, which were made to unite and separate by the action of keys, and thereby produced musical sounds. The paper, after describing the sound of the pyrophone, proceeded to explain the principles on which the sounds were produced. A very simple mechanism caused each key to communicate with the supply pipes of the flames in the glass tubes. On pressing the keys the flames separated, and the sound was produced; as soon as the fingers were removed from the keys, the flames joined, and the sound ceased immediately. If two flames of suitable size were introduced into a glass tube, and they were so disposed that they reached one third of the tube's hight, measured from the base, the flames would vibrate in unison. This phenomenon continued as long as the flames remained apart, but the sounds ceased as soon as the flames were united. The chairman, Lieut.-Col. Strange, said that this instrument was the invention of a young man who did not claim merit for it as a musical instrument, but as a scientific experiment, which, he hoped, would be of great value in the musical world.

The engraving of the pyrophone appeared in Vol. XXX, SCIENTIFIC AMERICAN, page 279.

The Morse Telegraph Alphabet.

At a recent meeting of the Scottish Society of Arts, Edinburgh, Dr. Russell, Demonstrator of Anatomy to the University, read a paper on "The Telegraphic Alphabet as a branch of Technical Education in Primary Schools."

In the course of his remarks, the lecturer explained the structure and uses of the Morse or telegraph alphabet, by means of a diagram, advocated its introduction into primary schools, and more especially into those situated along the coast. He then proceeded to mention some of the advantages possessed by the alphabet as a means of communication. Among these were its extreme simplicity and the ease with which it could be learned by very young children; that it helped to prepare for post office employment and a seafaring life; that it was already known all over the world by experts; and that it could be used with or without any apparatus—an advantage which the lecturer believed was not possessed by any other method of signaling; that it involved no expense; that it formed a good alphabet for the blind; that it developed the sense of time or rhythm; and was important in relation to lighthouses. Dr. Russell further stated that the Morse alphabet had been introduced with marked success into Kilmodan Free Church School and South Hall Public School.

Glues and Cements.

The following article translated from *Des Ingenieurs Taschenbuch*, seems to contain, in a small space, a great deal of valuable information which will probably be acceptable to many of our readers.

GLUES.

1. COMMON GLUE.—The absolute strength of a well glued joint is:

	Pounds per square inch.	
	Across the grain, end to end.	With the grain.
Beech	2 133	1,095
Elm	1,436	1,124
Oak	1,735	568
White wood	1,493	341
Maple	1,422	896

It is customary to use from one sixth to one tenth of the above values, to calculate the resistance which surfaces joined with glue can permanently sustain with safety.

2. WATERPROOF GLUE.—Boil eight parts of common glue with about thirty parts of water, until a strong solution is obtained; add four and a half parts of boiled linseed oil, and let the mixture boil two or three minutes, stirring it constantly. (In these directions, and in those that follow, parts by weight are to be taken).

CEMENTS.

1. WATERPROOF CEMENT FOR CAST IRON PIPES, ETC.—Take equal weights, in dry powder, of burnt lime, Roman cement, pipe clay, and loam, and knead the whole with about one sixth the weight of linseed oil. The addition of more Roman cement improves the quality.

2. CEMENT WHICH RESISTS MOISTURE AND HEAT BUT NOT THE DIRECT APPLICATION OF FIRE, FOR GAS AND STEAM PIPES AND SIMILAR PURPOSES.—Two parts of red lead, five parts of white lead, four parts of pipe clay; fine and dry, and work the whole into a stiff mass with boiled linseed oil.

3. RUST CEMENT FOR WATER AND STEAM PIPES, STEAM BOILERS, ETC.—Make a stiff paste with two parts sal ammoniac, thirty-five parts iron borings, one part sulphur, and water, and drive it into the joint with a chisel; or, to two parts of sal ammoniac and one part flowers of sulphur, add sixty parts of iron chips, and mix the whole with water to which one sixth part vinegar or a little sulphuric acid is added. Another cement is made by mixing one hundred parts of bright iron filings or fine chips or borings with one part powdered sal ammoniac, and moistening with urine; when thus prepared, force it into the joint. It will prove serviceable under the action of fire.

4. STOVE CEMENT, FOR THE JOINTS OF IRON STOVES.—Mica, together with finely sifted wood ashes, an equal quantity of finely powdered clay, and a little salt. When required for use, add enough water to make a stiff paste.

5. IRON CEMENT, WHICH IS UNAFFECTED BY RED HEAT.—Four parts iron filings, two parts clay, one part fragment of a Hessian crucible; reduce to the size of rape seed and mix together, working the whole into a stiff paste with a saturated solution of salt. A piece of fire brick can be used instead of the Hessian crucible.

6. CEMENT FOR FASTENING WOOD TO STONE.—Melt together four parts pitch and one part wax, and add four parts brick dust or chalk. It is to be warmed, for use, and applied thinly to the surfaces to be joined.

The Vicissitudes of the Sea.

The steamship Abbotsford recently arrived at New York, 108 days from Antwerp, during which the following mishaps occurred: On reaching one of the southern points of England, the ship stopped for a few minutes to land her pilot, and while so engaged was run into by another steamer, and so badly injured that the vessel had to go to London for repairs. Delay one month. The Abbotsford then continued her voyage to New York, but in mid-ocean, during a heavy gale, her propeller suddenly broke off. This converted her into a sailing vessel. The captain then put back to Queenstown, Ireland. On approaching land, a heavy gale blowing, he signalled for help from another steamer, which, in the effort to connect a hawser, dashed into the Abbotsford, knocking a hole forty feet long, happily above the water line. Through this aperture the water poured in whenever the vessel rolled, until the fore compartment was filled. But at last they reached Queenstown harbor; temporary repairs were made, and tugs employed which took the vessel to Liverpool. Here another month was consumed in repairs, and then another start for New York was made. Heavy gales were encountered, and the passage was long but successful.

Petroleum in Algiers.

A petroleum well, capable of giving a large and paying yield, has recently been discovered in Algiers, near the plain of Cheliff. The substance looks like tar, is soft and very tenaceous, melts in boiling water, and dissolves in turpentine. It burns with a very bright flame, and yields a large variety of products and considerable carbonaceous residue on distillation. It is neither tar, naphtha, bitumen, nor asphalt, but seems to possess the properties of all, in a measure. It has most characteristics in common with naphtha, but, unlike that substance, is almost completely insoluble in alcohol.

Honors to a Young American Lawyer.

The British Social Science Association has lately awarded its first prize of $1,000, for the best essay on international arbitration, to Mr. A. P. Sprague, of Troy, N. Y. Mr. Sprague is a young man of great promise and ability. The essay in question occupied 150 pages.

SCIENTIFIC AND PRACTICAL INFORMATION.

CURE FOR WARTS.

Lisfranc immerses the parts on which the warts are developed in a strong solution of black soap. This causes a slight cauterization of the surface of the wart. The loosened tissue is to be removed and the application repeated every day till the cure is complete. Oil of vitriol should never be used for this purpose; it is very irritating, and inflames the warts instead of curing them.

NEOGENE.

The above name is given by M. Sauvage to a new white alloy composed of copper 57 parts, zinc 27 parts, nickel 12 parts, tin 2 parts, aluminum 0·5 part, and bismuth 0·5 part. It has a silvery appearance, is sonorous, tenacious, malleable, and ductile, and is recommended for jewelry, as a substitute for silver in plate, and for low coinage. The new elements in the combination are those of the bismuth and aluminum. The alloy is very homogeneous, and is susceptible of a high polish.

A NEW SYSTEM OF DREDGING.

M. Bazin, of Angiers, France, proposes to attach, to a steamer with an engine of 60 horse power, two pipes on each side at some 12 feet below the water line. These pipes are to be 10 inches in diameter, about 50 feet in length, and are to be connected to the ship, so as to swing up or down, and also so as readily to yield to the movements of rolling, etc. The extremities of the couple on each side are united by tubes of like diameter, open at the forward end. In clearing out a quicksand, the vessel is got underway at the speed of 8 knots per hour; and on reaching the obstruction, the tubes are lowered with the soft mass. The water pressure above the sand or mud, which of itself would force the material into and up the tubes, is aided by the onward motion of the vessel, and the result is that the mud is driven through the tubes and into the hold. When the vessel is full, the apparatus is raised, and her contents hoisted out or otherwise discharged in some suitable locality. M. Bazin says that, with tubes of the size and with the speed above mentioned, 43,200 cubic feet of mud per hour could be raised. He points out that, in case of their becoming obstructed, the tubes can easily be cleared by simply elevating them out of the mass and allowing the water to rush through them.

Useful Recipes for the Shop, the Household, and the Farm.

The main objection most people have to sending communications on postal cards is that the writing is, of course, open to general perusal. A good way of avoiding this difficulty is to use sympathetic ink. A solution of 10 grains hyposulphite of soda in 16 teaspoonfuls water is the simplest fluid for the purpose. Use a perfectly clean pen, and after writing go over the letters with a smooth paper cutter to remove all traces of the salt. Exposure to the heat of a bright coal fire turns the writing black.

Soluble glass can be made of pure sand 15 parts, charcoal 1 part, and purified potash 10 parts. Mix and heat in a fireproof melting pot for five hours, or until the whole fuses uniformly. Take out the melted mass, and, when cold, powder it and dissolve it in boiling water.

To make pocket mucilage, boil one pound of the best white glue and strain very clear; boil also four ounces of isinglass, and mix the two together; place them in a water bath (glue kettle) with half a pound of white sugar, and evaporate till the liquid is quite thick, when it is to be poured into molds, dried and cut into pieces of convenient size. This immediately dissolves in water and fastens paper very firmly.

A solution of chloride of lime, in water to which a little acetic acid has been added, is among the many receipts recommended to remove ink stains from linen.

Marble can be stained different colors by the following substances: Blue, solution of litmus; green, wax colored with verdigris; yellow, tincture of gamboge or turmeric; red, tincture of alkanet or dragon's blood; crimson, alkanet in turpentine; flesh, wax tinged with turpentine; brown, tincture of logwood; gold, equal parts of verdigris, sal ammoniac, and sulphate of zinc in fine powder.

Mounting fluid for microscopic objects is made of gelatin 1 oz., honey 5 ozs., distilled water 5 ozs., rectified spirit ½ oz., and creosote 6 drops. Filter through fine flannel. Heat the honey before adding to the gelatin, which last must be dissolved in the boiling water. When cool, add the creosote.

Copies of signatures, which may be printed from on a copperplate press, can be made by writing the words and then sprinkling the wet ink with very finely pulverized gum arabic. Make a rim of dough, putty, or similar material, about the writing, and pour in melted fusible alloy of 5 parts bismuth, 3 lead, and 2 tin. This alloy melts at 199° Fah.

To bleach sponge, wash first in weak muriatic acid, then in cold water; soak in weak sulphuric acid, wash in water again, and finally rinse in rose water.

A very good imitation of meerschaum, which may be carved like the genuine article, can be made by peeling common potatoes and macerating them, in water acidulated with eight per cent sulphuric acid, for thirty-six hours. Dry on blotting paper, and for several days on plates of plaster of Paris in hot sand. The potatoes should be strongly compressed while drying.

NEW subscribers to the SCIENTIFIC AMERICAN will hereafter receive the papers from the time of our receiving the order, unless they specify some other date for commencing. All the back numbers from the commencement of the volume (January 1) may be had if requested at the time of sending the order, or on request, after receipt of first number.

IMPROVED WATER INJECTORS.

The value of the water injector is now widely known, especially for locomotive use, as it enables the engineer to fill the boiler while the engine is in the shed, and the water evaporated in the steam passed through the blower can be replaced before the engine is ready to start on its trip. The invention now under consideration is constructed in several forms, two of which we illustrate. Both of them are locomotive injectors, Fig. 1 showing a lifting injector, which is intended to pump the water as well as to force it into the boiler against a steam pressure, and Fig. 2 showing a form of apparatus to be used when the water flows from the tank at a higher level than the feed pipe of the boiler. Fig. 3 shows a non-lifting injector as applied to a stationary boiler. Fig. 4 shows Fig. 2 in section.

The new features in Mr. Friedmann's invention are the intermediate nozzle, shown in Fig. 4, which admits steam to the flow of water in two annular jets instead of one. This is claimed to prevent the recoil of the steam from contact with the water, as momentum in the water is continuous, owing to the jets being two in number. Another advantage in this arrangement is that the overflow from the first orifice flows down to the second, adjusting the water supply to the pressure of the steam. It is also claimed that this injector starts as promptly and works as well with steam of a high pressure as with that of a low pressure, and delivers more water with the same consumption of steam than injectors with movable nozzles, or other contrivances liable to get out of order, besides being more simple and easily manipulated. The intermediate nozzle of this injector being fixed and stationary, it is not liable to wear or need repairs.

The lifting injector, Fig. 1, will raise water 6 or 8 feet with ease, and can be applied where want of space prevents the use of the non-lifting form, which must be placed below the water line. The latter, Fig. 2, can be used as a heating cock for the tender or water tank, by closing the overflow valve. The ordinary heating cocks are thus done away with, and the expense spared. The water in the tank can be heated by this means up to 120°, without any trouble in working or starting the injector. The overflow valve, with which each of these injectors is supplied, prevents air or dirt from entering the boiler. By simply transferring this valve from one side to the other, the injector may be used for either the right or left hand side of the engine.

The value of the injection system is very forcibly shown by its use on stationary boilers, which can be kept full when the engine is stopped for repairs. In a great many manufactories, hot water and steam are constantly needed for various processes, and the stoppage of an engine on which a boiler is dependent for its feed hinders the whole business. This, however, is obviated by the attachment of the non-lifting injector, as shown in Fig. 3. The injector is placed a little lower than the bottom of the heater or water reservoir, so that the water will flow to it by the action of gravity. The steam pipe should be attached to the top of the boiler, as shown, so as to secure dryness in the steam. The lifting form of injector is also adapted to stationary boilers.

On many locomotives, force pumps are altogether dispensed with, and two of these injectors are substituted on each engine. These are amply sufficient to keep the boiler supplied with water; and if one gives way the engine is not stopped. Another important point of economy is the wear and tear, as the force pump must keep moving while the engine is running, whether it is throwing water or not. Friction soon renders a new plunger necessary, and frequent stuffing and constant attention occupy much valuable time. These are saved by the use of the injector.

Other forms of the appliance, adapted to portable and marine boilers, are also made by the proprietors of the invention, who report that their sales of these useful and economical devices, in this country and in Europe, have reached 15,000 in number.

Patented April 6, 1869, by Alex. Friedmann. For further particulars address Messrs. Nathan & Dreyfus, 108 Liberty street, New York city.

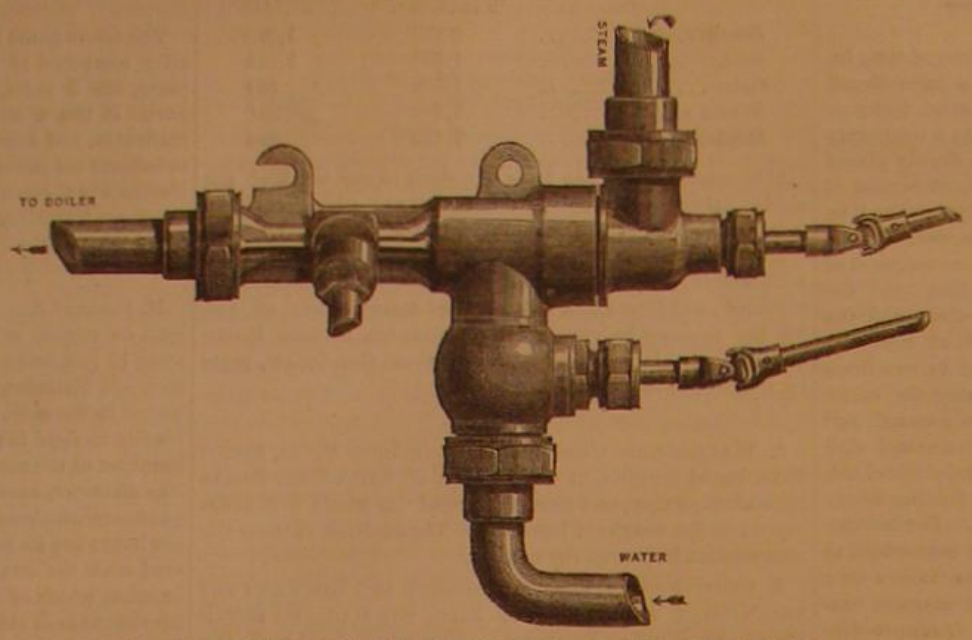


Fig. 1.—FRIEDMANN'S LIFTING WATER INJECTOR.

Fig. 2.

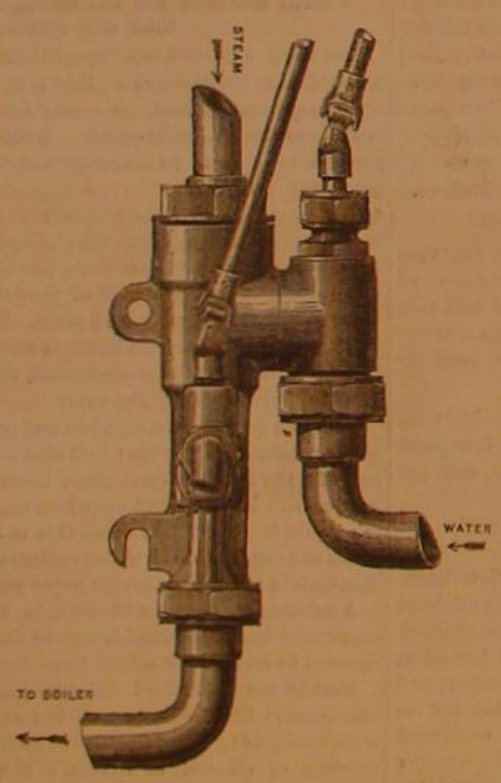
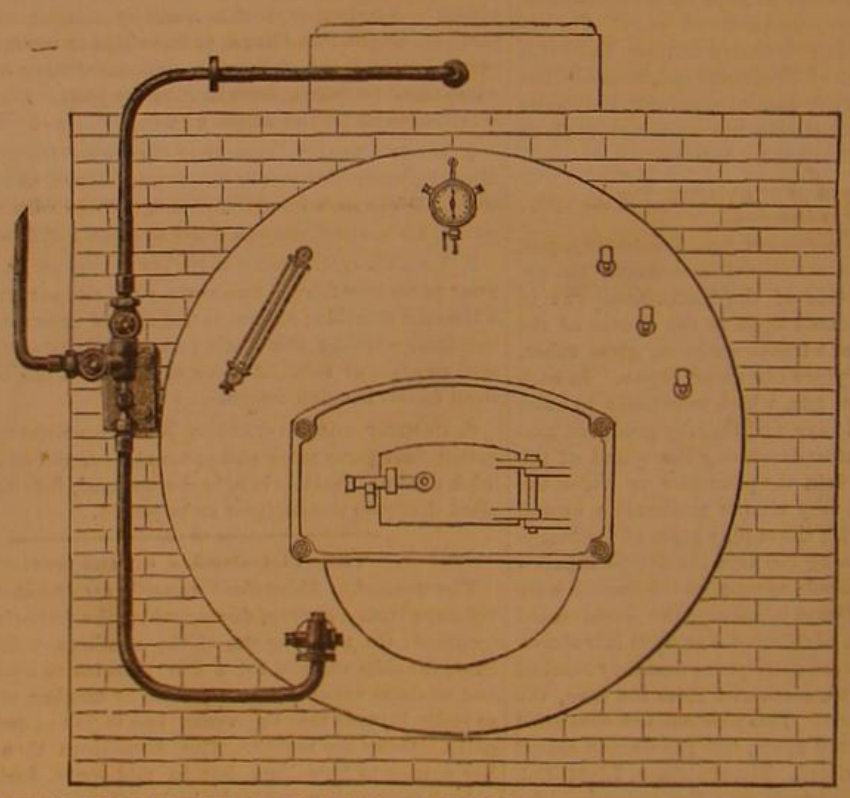
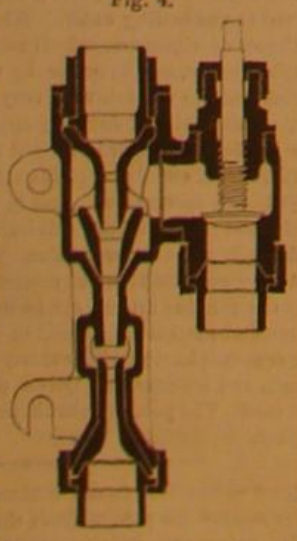


Fig. 3.



FRIEDMANN'S NON-LIFTING WATER INJECTOR.

Fig. 4.



A Tough Old House.

The Nashua (N. H.) *Telegraph* says: "There is an unoccupied house in Barnstead, Belknap county, having a chimney in the center. The house is 22 by 30 feet. The chimney is built so as to support the sills and beams. The frost has got in o the cellar and frozen under the chimney and raised it up several inches, lifting the house free from the ground, except some nine feet where it touches the underpinning. In places it is two or three inches from the underpinning, and can be rocked by pushing against it with the hand. It has attracted a good deal of notice from the citizens of Barnstead."

We recommend the pattern of this house to dwellers in San Francisco and vicinity. A house that can be lifted by the chimney and rocked to and fro without danger would seem to be just the thing for all earthquake countries.

Paper as a Plant Protector.

A gentleman residing in Guernsey, Channel Islands, writes to say that he has saved his crop of early potatoes under glass by spreading newspapers over them, while his neighbors lost theirs by the severe frost. He suggests that a convenient number of newspapers be pasted together, and the edges folded over strings, thus making a screen which, suspended over the newspapers spread loosely over the plants, would give the young shoots an excellent protection in the severest cold weather, and from the sun's rays in summer.

AMONG recent curious inventions is the application of the camera obscura to a railroad car, imparting to the traveling and wondering beholder a moving diminutive picture of the country through which he is passing.

Keeping Ice without an Ice House.

Ice houses are not difficult structures to build, and we presume that few farms are without them. There are cases, however, when it is desirable to stow away a larger quantity of ice than the receptacle will contain, and when the farmer is unwilling to go to the expense of a house which he might utilize only for a single season. In such instances, as well as those where the ice house is absent altogether, the following plan for storing ice without an ice house will prove useful. The present time, we may here remark, should be taken advantage of at once to procure the ice, as the spring thaws now beginning will speedily cause the opening of the streams and ponds.

The first thing to be done in following the directions, which we find in the English *Gardener's Magazine*, is to select a shady spot, on the north side, if possible, of a clump of trees. Throw up a circular mound, some twelve inches in hight and at least fifteen feet in diameter, flattening the summit carefully, and leaving a trench around the eminence, two feet in width and eighteen inches in depth. In gathering the ice, there is no necessity of cutting into uniform shape or of seeking large pieces. Fill up the carts with any kind of fragments, transport them to the mound, and dump them on a platform made of a few planks. Ram the surface of the mound hard and firm, cover with sawdust, and then place the first layer of ice, which should previously be cracked into small pieces, for which purpose the men should be provided with wooden mallets. As each layer is put on the stack, the ice should be thoroughly pounded both above and at the sides so as to form a huge block of ice, the shape of which will be slightly conical.

When the stack is completed, it will require two coverings of straw, one lying upon the ice and the other supported on a wooden framework about eighteen inches outside the first covering.

The layer of straw next the ice must be well beaten and flattened down upon it, and when this is done be twelve inches in thickness. The framework, upon which a similar thickness of straw is placed, may be formed by inserting stout larch or other poles of a suitable length round the base in a slanting direction, so that they can be readily brought together at the top, and securely fastened with stout cord From six to eight of these will, when joined together by means of strips of wood fixed about twelve inches apart, afford ample support for the second covering of the straw. This must be put on nicely, so as to prevent the possibility of the rain's penetrating to the inner covering. By this arrangement there will be a body of air, which is one of the most effectual non-conductors known, between the two coverings of straw. To effect a change of the enclosed air, when rendered needful by its becoming charged with the moisture arising from the melted ice, a piece of iron or earthenware piping a few inches in diameter should be fixed near the apex, one end being just above the straw, and the other end reaching into the enclosed space. The pipe can be readily opened or stopped up, as may appear necessary, but as a rule it will suffice to open the pipe once a week, and allow it to remain open for about two hours. This should be done early in the morning, as the air is then much cooler than during the day or in the evening.

In removing ice from the stack, the early morning should be taken advantage of, because of the waste which must naturally ensue from a rush of warm air at midday. That removed can be placed in a cellar, or even an outhouse, and be enveloped in sawdust until required. The ice must be taken from the top; and when the first supply is obtained, a good quantity of dry sawdust should be placed over the crown. The principal points to avoid waste are to ventilate in the manner indicated, to avoid opening the stack more frequently than is really necessary, and to take the supply early in the day, before the air has been warmed by the sun.

ACCORDING to recent investigations by M. Cailletet, the results of burning sulphide of carbon, alcohol, and carburet of hydrogen, under pressures reaching thirty-five atmospheres, are that the flame augments considerably in brilliancy, while the combustibility of the substance burned is notably diminished.

Honing a Razor.

"The first requisite," says our correspondent G. W. D., "is to have a well shaped, well tempered and well (water) ground razor; unless very truly ground, it will be impossible to hone it properly. Take an Italian hone, of not too fine grit, face it perfectly with fine emery paper glued on a board; dust it off, and drop 6 or 8 drops of sperm oil on its face. Hold the razor perfectly flat on the stone, draw firmly but lightly from heel to point (from the further right hand corner to the lower left hand corner), against the edge; if a wire edge be produced, run the edge lightly across the thumb nail, and a few strokes on the hone will remove all trouble on that score. If you will examine the edge of the razor now, by aid of a magnifier, you will find that the fine grooves or teeth incline towards the heel.

I would here say that the hone must be kept perfectly clean, as, after using a few times and then neglecting it, the pores will get filled with steel, and in that case it will not be possible to get a keen edge on the razor. I have had a hone in use for forty years, for my own and friends' razors. I have kept it perfectly true, and yet there has been no perceptible wear.

I make my own straps as follows: I select a piece of satin, maple, or rose wood, 12 inches long, 1¾ inches wide, and ⅛ inch thick; I allow 3½ inches for length of handle. Half an inch from where the handle begins, I notch out the thickness of the leather so as to make it flush towards the end. I taper also the thickness of the leather; this precaution prevents the case from tearing up the leather in putting the strap in. I then round the wood very slightly, just enough (say $\frac{1}{12}$ of an inch) to keep from cutting by the razor in strapping and turning over the same. I now select a proper sized piece of fine French bookbinder's calfskin, cover with good wheat or rye paste, then lay the edge in the notch, and secure it in place with a small vise, proceed to rub it down firmly and as solid as possible with a tooth brush handle (always at hand or should be), and, after the whole is thoroughly dry, trim it neatly and make the case.

Use cold water for lather, as it softens beard and hardens the cuticle; hot water softens both and makes the face tender. Always dip the razor in hot water before using, and also after use, as it will dry it and prevent rusting."

RED DEER.

The deer family, species of which are indigenous to all countries in the world except Australia, are everywhere renowned for their graceful and elegant form and their timidity, their remarkable fleetness of foot enabling them, in open country, to keep away from the haunts of man. The race includes genera of all sizes from the little muntjac to the moose, and the chief peculiarities of the species, the horns, the hairy skin, the habit of rumination, and the feet, each with two principal and two rudimentary toes, are to be found in all of them. The American deer (*cervus Virginianus*) has a long head with a sharp muzzle, with large eyes; and the legs are long and slender. It is easily domesticated but requires a spacious range to keep it in health. The hind produces two or three young at a birth, but no *accouchement* takes place till she is two years old; she conceals her young carefully, visiting them only three times a day.

The subjects of our illustration are the red deer, formerly found in all parts of Great Britain, but now seen only in the mountains of Scotland and on one or two extensive moors. The red deer are so exclusive in their habits that they will not feed with inferior animals; they have an especial abhorrence for sheep, leaving the place at once if there are foot prints of sheep on the herbage.

The kind usually kept in parks in England is the fallow deer, a native of Africa originally; but it has been domesticated in England for some centuries. It is humbler in its tastes, and accommodates itself well to a small park or paddock. Like all its tribe, it sheds its horns annually, retiring as if in shame till the new growth appears.

Chemistry of Milk.

C. A. Cameron, M. D., states that the opacity and whiteness of milk are due, not to the liquid being an emulsion of fats, but to the reflection and refraction of light by solid caseous matter suspended in it.

COW'S MILK.—Forty analyses of pure milk from Dublin dairy cows gave the following average results: Water, 87·00, fats, 4·00, albumenoids, 4·10, sugar, 4·28, mineral matter, 0·62.

MARE'S MILK.—The average of the fourteen specimens gave: Water, 90·310, fats, 1·055, albumenoids 1·953, sugar, 6·285, mineral matter, 0·397. Mare's milk is bluish white: specific gravity about 1·031; reaction neutral, or faintly alkaline.

SOW'S MILK.—The sow parts with its milk (except to its young) with great reluctance. Its specific gravity is 1·041; its reaction faintly alkaline, and color yellowish white: 100 parts contain (mean of two analyses): Water 81·760, fats, 5·830, albumenoids, 6·180, sugar, 5·335, mineral matter, 0·895. These results show this species of milk to be very rich. It is remarkable that in the lactometer it shows up no cream. Drying on the water bath, it exhales the odor of roast pork, and on putrefying that of putrid bacon.

Salting, Packing, and Selling Butter.

Blanchard's *Butter Manual* recommends one ounce of salt to a pound of butter as sufficient for keeping it; but the better paying class of customers, who are a little more fastidious about the quality, prefer about one half as much; and this is found sufficient, if the casein has been properly removed. Butter makers in the vicinity of large towns should seek out regular customers for their produce, in which cases it may be put up in balls or any other form adapted to the demand. "Philadelphia prints," which have acquired a worldwide reputation, are pound balls, with a small figure upon the top. They are usually enclosed in a white linen napkin, and packed in a cedar, zinc-lined chest, with apartments at each end for ice, to keep it hard while being transported to market. For the great mass of butter makers, the wooden tub, holding from fifteen to one hundred pounds, must ever be the most economical form of package. In the vicinity of New York city, heavy return pails, of the best white oak, with thick covers, having the owner's name branded on them, are used and re-used year after year. In some parts of the West, miserably poor oaken tubs are employed, which affect the butter very injuriously. In other localities, ashen tubs are favorites, while in Northern Vermont the most approved tubs are spruce. Spruce is unquestionably the least liable of all timber to affect the flavor of butter injuriously; while it is generally believed that, for long keeping and much exposure, good white oak is preferable. Stone jars and crocks are sometimes used, but we do not recommend them. Much depends upon the purity of the salt—it must be perfectly white, and completely soluble in water. The office of salt is, first, to remove the buttermilk from the pores of the butter, and, secondly, to render harmless what cannot be removed.

A New Utilization of Refuse Materials.

A very important discovery has recently been made by MM. Croissant and Bretonniere, of Mulhouse, France, which consists in producing dyes of a large variety of brown hues from substances not merely refuse but in themselves colorless. The pigments are obtained by the reaction of alkaline sulphides upon ordinary wood sawdust, humus, horn, feathers, linen, silk, cotton, and paper waste, gluten, blood, and a number of other materials. In certain cases, when treated with the sulphides or polysulphides, the sulphur directly combines with the organic body; in others sulphuretted hydrogen becomes substituted for the hydrogen atoms eliminated.

The same body gives different shades, according to the degree of temperature, the duration of the operation, and the proportion of sulphide employed. The longer the heating and the higher the degree, the nearer the dye approaches to black. Humus gives a fine bistre shade, which does not fade and is unalterable by organic or mineral acids, caustic lyes, soap, oxalate of potassa, etc. With bran, a color is produced which subsequently, with bichromate, yields a fine brownish yellow or rosin color, which can be changed to gray by the addition of carbonate of soda. Sawdust, preferably of oak, chesnut, and other non-resinous woods, gives a soluble dye of a brownish black, which appears upon the fabric of a greenish hue. It is possessed of high coloring properties and is very permanent.



A FAMILY OF RED DEER.

Phosphorus Steel Making.

M. F. Gautier, engineer of mines, France, gives the following useful sketch of the various methods for producing phosphorus steel, or, to use a more correct definition, phosphorus cast metal. This metal, says M. Gautier, cannot be employed in industry except on condition that it is nearly deprived of carbon, consequently every process which will yield extra soft steel will, with inferior materials, produce phosphorus cast metal.

I. THE BESSEMER PROCESS.—1. *The ferro-manganese process practised at Terre Noire.*—The silicious pig iron used contains but little manganese; the first stage, that which precedes the appearance of the yellow ray in the spectroscope, lasts about a quarter of an hour, according to the richness of the pig iron in silicon. There is no explosion, the flame is pure, without smoke; the completion of the operation is positively marked by the disappearance of all the rays of the spectroscope with the single exception of the yellow sodium ray. For the production of extra soft metal, the refining is prolonged for about twenty seconds, the blast is stopped, and the converter is laid on its side. Manganese iron, previously heated to redness, is then thrown in by means of shovels, taking care that the pieces pass through the scoria and enter the metal. The manganese iron used is an alloy containing a little carbon; the manganese in it reduces the oxide of iron in the converter, and the greater part of the carbon is converted into oxide of carbon in the form of brilliant flames. When the agitation ceases, the charge is drawn. The metal is even and quiet, without bubbles or other irregularities; and, which is of essential importance, the product is always equal and regular in practice. This is the method also which is adopted at the Seraing works, with the same manganese iron.

2. *Swedish method, with highly manganiferous pig iron.*—The pig iron used is without silicon, but rich in manganese, the proportion running from 4 to 5 per cent. The character of the operation is such that there is not what is called a first period; the yellow ray appears at once. There are abundant explosive projections, which would render the process ruinous if care were not taken to have enormous converters relative to the quantity of metal treated. The flame is veiled by smoke and gases, the principal of which is oxide of manganese. It is difficult to control the operation; for if the temperature be reduced by additions of small quantities of steel and iron, the object is not attained, for the heat must be retained in order to keep the metal in such extreme fluidity as will permit the oxide of iron to separate itself and arrive at the surface, for no addition is made of spiegel. The work is carried on blindfolded, for the intermittent flashes of flame are blinding; the heat caused by the explosions is annoying, and the spectroscope is misleading. From time to time samples of the scoria have to be drawn to find how matters are proceeding; after a certain amount of experience, the state of the metal is ascertained by the behavior of metallic globules under the hammer, and from the color of the scoria. But the results are uncertain, and have to be classified. The ingots, moreover, are liable to shrink and to become flawed. This mode is adopted at Fagersta, in Sweden; at Zwickau, in Saxony; and Maxhütte, in Bavaria; but it requires all the value that attaches to the production of extra soft steel to induce any one to continue a method so uncertain.

3. *English method, that of spiegeleisen by explosion.*—In this process, silicious pig, such as that of Cumberland, for example, is employed, and the operation is carried considerably beyond complete decarburation. In order to succeed, a certain quantity of oxide of iron, neither more nor less, must be produced in the bath, and which carries off by explosion the carbon of the spiegeleisen which is added. This instantaneous production of oxide of carbon is dangerous, a part of the metal, and sometimes the whole charge, being projected out of the converter, and endangering the operator and his men. Generally the product is soft, but it is liable to flaws, which are not much felt in sheet iron, but which unfit it for rails. Steel makers will choose whichever of these three methods appears to them the most advantageous for the production of phosphorus steel with pig iron of second quality. M. Gautier adds: The Bessemer process is destined to lose much of its importance in presence of the certain and unlimited extension of the Martin-Siemens process, which, he considers, will take the lead in future, and regulate prices. It is capable of using up old iron, and employing almost all kinds of ore, for puddling is still the only known method of practically getting rid of the greater part of the sulphur and phosphorus; while the Bessemer process, requiring silicious pig iron containing little sulphur, must always be of a limited application. The true mode of making phosphorus steel is then in the sole furnace.

II. THE MARTIN-SIEMENS PROCESS.—In this method the matter is more simple. In order to produce extra soft metal there is but one way, that is to say, to act chemically upon the oxide of iron in the bath. Manganese iron must be resorted to, as spiegel always gives hard products; the proportion is the same as in the Bessemer process, namely, 1 per cent of the whole, or about 2 per cent of manganese iron to 40 or 50 per cent of useful metal. When a sample is procured which bends perfectly when cold, the manganese alloy heated to redness is added, the bath is stirred slightly, and the charge run off.

An account, by M. Grüner, of the process followed at Zwickau and Maxhütte, supplies a striking confirmation of the fundamental properties of phosphorus steel; you may introduce phosphorus into cast steel on condition of eliminating the carbon, and the less the amount of the latter the greater may be that of the former. Practically, by the German method, which is really but that of Fagersta applied to ess pure materials, metal is produced which may almost be said to be without carbon, and, as no spiegel is introduced, there is no element of recarburation. It is not, then, astonishing that the metal thus obtained should be perfectly malleable and yet contain a notable proportion of phosphorus, that is to say, half the quantity which may be tolerated in a truly soft steel, when produced in a Martins-Siemens furnace with manganese iron

Having a Hobby.

The question "is there money in it?" is said by some men to be the test by which everything is to be received or rejected. And those who offer this very mercenary gage claim to be the only "practical" men, and the true prophets for these times, and indeed for all times. The science of getting, the art of keeping, and the process of increasing are deemed by them to include all that is useful in the circle of sciences, the field of art, and the aims of thought. Most people concede in the abstract these pretensions of the mercenary philosophers, though the great majority in practice are better than their theory.

The maxim, roughly expressed, that "everybody should have a hobby," is a good one, provided that the "hobby" one rides should be a mental rather than a sensual one. It should carry the rider over the route of mental improvement to the development of his reasoning and analytical powers, and thus promote the growth of the attributes which distinguish him from the brutal and ally him to the divine. To go back to the question alluded to above, in regard to education, the first question asked may very well be: "Is there money in it?" But if this be the last question as well as the first, and the sole object of learning be mercenary, the seeker will find relief in bodily excesses, from his mental discipline. Or, classing drudgery of the mind with drudgery of the body, he will look for enjoyment where the intellect may be laid aside, like the tool of the artisan or the ledger of the merchant.

It was well said in a recent address to young men, in the evening classes of the City of London College, that "they must extend their mental horizon by raising the level of their sight; that they had to adorn their lives as well as to sustain them; and that they had not only to be tradesmen but men." The speaker told them that they must not only pursue their technical studies, but, as a relief and recreation, follow themes calculated to raise the tone of their minds and carry them beyond the routine of their daily lives. He said that they had not only to live but to enjoy their lives. He recommended them to take up one subject, "to which they could devote themselves with such enthusiasm that it would become a pleasure and a relaxation." To a man immersed in any business pursuit, it is highly desirable that he should change the current of his thoughts and prevent his whole existence from being confined to one routine, which, without such relief, must inevitably dwarf his intellect and weary his body.—*Philadelphia Ledger.*

Steam Hill Climber.

A new locomotive for use on Ithaca Hill, N. Y., has made its appearance. The incline has five tracks, of which the two outer are of the usual width, used in the ordinary manner. When the engine starts up the hill, it rests upon a pair of rails just within the usual track and upon a set of double flanged small driving wheels which are upon the same axles with the big drivers—they being only about thirty inches in diameter; this inside track is raised about fifteen to eighteen inches above the outer one, and high enough so that the big drivers do not touch the track at all; the engine rests now upon the small drivers, and is independent of the outer ones; then in the center of the track is placed a wide cogged rail, which exactly meshes into the cog wheel which is between these small drivers, directly under the center of the locomotive. Thus it will be seen that, by applying power to the big drivers, in the ordinary way, the power is applied to the cogged wheel, which does the climbing. The cogs are about three inches from tip to tip, and the wheel is eight inches wide.

Bright Deep Blue on Wool.

The following is said to yield a tolerably fast color, of desirable luster, similar to that of dark vat blue: The wool or cloth is prepared by boiling for an hour in a hot kettle, with 2½ lbs. alum, ¾ lb. chromate of potash, 1¼ lbs. sulphuric acid, and 2 ozs. tin salt in solution, for 40 lbs. of material. It is then opened out and well cooled, and allowed to lie for 12 hours. The day after, 8 lbs. of logwood are boiled in a fresh bath, and then 3 ozs. of aniline violet (the bluish, soluble in water) are added, and, as soon as it is dissolved, another ¼ lb. of sulphuric acid. The prepared articles, after being washed or rinsed, are placed in the bath at 122°, and, after half an hour, are worked at a boil for an hour. More aniline violet affords a stronger blue, more logwood a deeper blue. The color can easily be cleaned in cold water.

PRODUCTION OF OZONE.—Ozone may be easily and abundantly generated in any apartment by means of an aqueous solution of permanganate of potash and oxalic acid. A very small quantity of these salts, placed in an open porcelain dish, is all that is necessary, the water being renewed occasionally as it evaporates. Metallic vessels should not be used.

AT the Edinburgh Literary Institute, Professor Geikie stated it to be his opinion that his colleague, McCroall, had pitched upon the precise epoch in which the glacial era had taken place, and attributed it to a period of great eccentricity of the earth's orbit, which took place about 240,000 years ago and lasted about 160,000 years.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]
From February 2 to February 25, 1875, inclusive.

AXLE.—S. L. Harrison, San Francisco, Cal.
BALANCED SLIDE VALVE.—E. T. Smythe, New York city.
BEVEL, SQUARE, RULE, ETC.—W. Ascough, Buffalo, N. Y.
BOILER FURNACE.—H. A. Studwell, Brooklyn, N. Y.
BUSTLE, ETC.—A. W. Thomas, Philadelphia, Pa.
CAR SPRING.—G. Godley, New York city.
FERTILIZER.—B. Ackerman, New York city.
FILLING BOTTLES, ETC.—J. B. Bradford, Boston, Mass., *et al.*
FILTER.—J. Outerson *et al.*, Windsor Locks, Conn.
FREEZING, CHURNING, ETC.—W. Redheffer, St. Louis, Mo.
FURNACE GRATE.—J. B. Larkin, Pittsburgh, Pa.
HARVESTER.—D. M. Osborne, Auburn, N. Y.
HORSE SHOE NAIL.—J. R. Heard, Boston, Mass.
IMITATION LEATHER, ETC.—C. H. Knelles, New York city.
LOOM HEALD.—H. O. Whipple, New York city.
MOTIVE POWER ENGINE.—G. Westinghouse, Jr., Pittsburgh, Pa.
MULTIPLEX TELEGRAPH, ETC.—T. A. Edison, Newark, N. J.
NEEDLE.—W. Trabue, Louisville, Ky.
ORDNANCE.—G. H. Felt, New York city.
OVERALLS.—H. F. Woodward, New York city.
PATCHING BULLETS.—H. Borchardt, New Haven, Conn.
PORTABLE LATHE.—F. Scott, Bennington, Vt.
PRISM.—J. W. Queen & Co., New York city.
ROCK DRILL.—E. S. Winchester, Boston, Mass., *et al.*
RUBBER BOOT AND LAST.—I. F. Williams, Bristol, R. I.
SCREW PROPELLER.—A. C. Fletcher, New York city.
SHEARING SHEEP, ETC.—E. Chaquette, San Francisco, Cal.
STEAM ENGINE.—A. S. Cameron (of New York city), London, England.
STEP SURFACE.—G. A. Keene, Lynn, Mass., *et al.*
TREADLE APPARATUS.—G. D. Dows, Boston, Mass.

Recent American and Foreign Patents.

Improved Washing Machine.

Silas W. Holbrook, Catskill, N. Y.—The invention relates to an arrangement of yielding plates forming the continuous inner wall of the suds box, and being free to move at each end between parallel guide blocks. The clothes are put into the space between the ribbed spring plates and a ribbed cylinder, and are carried around through said space by the revolution of the said cylinder, and are washed clean by being rubbed against said plates, and by being carried around through the water.

Improved Seat for Extension Carriages.

James V. Randall, Newtown, Pa.—The rear seat is made adjustable toward or from the front of the carriage, and the elastic front seat is pivoted and supported, so that the weight of the person or persons sitting upon it will spring its center down slightly, which tends to throw the lower ends of the standards outward, and thus holds the gudgeons securely in their sockets.

Improved Lamp Burner.

Walter McKinley, Tremont, Ohio.—The object of this invention is to provide a lamp burner of improved construction, which shall be simple and detachable in all its parts, and, in consequence of the same, more convenient to clean and easy to keep in repair. It consists in a burner cap provided with a groove, in combination with a detachable wick tube, a detachable set of spur wheels for adjusting the wick, and a detachable shaft for operating said wheels. It also consists in the peculiar construction of the spur wheels, and in the manner of fastening the devices together.

Improved Ditching Machine.

Senator Theodore F. Randolph, Morristown, N. J.—Ex-Governor Randolph has for some time past been engaged in developing the novel form of ditching machine which forms the subject of this patent. The device now completed presents many excellent points of merit, and, in the opinion of the inventor and many of his friends, is the most practical and efficient of the many machines for ditching purposes now before the public. Its construction is such that it will work equally well in clayey or sticky soils and in sandy or loose soils. It may be readily adjusted and controlled, so as to sink a vertical ditch upon inclined or uneven ground, and the ditching wheel may be readily fed down as the ditch increases in depth. There is a novel combination of parts for adjusting the angle and hight of the shoe with relation to the ditching wheel. By suitable construction, the wheel and frame can be raised and lowered without affecting the axle, and the axle can take any inclination the surface of the ground may require without affecting the ditching wheel and its frame. The rear axle may be inclined in either direction to accommodate it to the surface of the ground. The edges of the flanges of the ditching wheel are made sharp, so that they may be sunk into the soil at the bottom of the ditch by the weight of the wheel and frame, so as to separate the sides of the slice of soil to be raised from the sides of the ditch. As the soil passes over the top of the wheel it is delivered into a chute, by which it is discharged upon the side of the ditch, and which is provided with a tongue, which enters the channel of the wheel and serves as a scraper to disengage the soil from said channel. The frame and ditching wheel may be held in a vertical position, while the axle is inclined in either direction by its wheels in passing over uneven or inclined ground. By this construction, all the necessary adjustments can be made without stopping the machine. Knives shave off the sides of the last previous cut to widen the ditch, and enable the ditching wheel to work freely and without binding.

Improved Sheep Holder for Shearing.

Joseph R. Virgo, Texas, Mich.—This consists in an adjustable shearing table, having an adjustable stand and plates for holding the legs of the sheep. When a sheep is fastened on the table, it is in an easy position and convenient for the shearer, and can be turned by turning the table to the right or left, as may be required.

Improved Fifth Wheel for Vehicles.

George F. Putman, Fonda, N. Y.—The head block or axle is provided with guard plates at both sides and opposite points of the fifth wheel, for protecting king bolt and wheel.

Improved Parlor Fountain.

Herman Wenzel, New York city.—Air is forced by the upward pressure of water in the base through a pipe, over the water in a chamber below, and, by its compressive force, ejects the liquid through the nozzle. A pump operated by a treadle is arranged within the base, and connected with the lower chamber of the basin by a pipe, so as to enable the water in the base to be forced into the lower chamber of the basin, and kept there in full supply.

Improved Combined Fluting and Sad Iron.

Charles Raymond Rand, San Francisco, Cal.—This invention relates to an improved fluting and sad iron which is heated internally with gasoline or other volatile distillate of petroleum. It may be readily used on different sides, either as a sad iron or for fluting. A detailed illustrated description will be found on p. 150 of our current volume.

Improved Bridle Bit.

Peter Casey, Newport, R. I.—Side pieces pass through mortises in the ends of a movable bar. The side pieces, in order to render them adjustable, are provided with holes, which receive the ends of set screws, so that the bar is securely held in place. The driving lines are attached to the loops of the bar.

Improved Wagon Jack.

Samuel Chard, Mianus, Conn.—This invention consists in a cramping band and pillar, with a hoisting lever having a fulcrum pin and holding hook. The long end of the lever being depressed, the weight will be thrown upon the fulcrum pin, which will cramp the band on the stand and prevent it from slipping.

Improved Range.

Edwin O. Brinckerhoff, New York city.—The arrangement of the flues in this range is such that it may be thoroughly and uniformly heated for baking purposes, that it may be used for boiling purposes without being wholly heated, may have a strong draft, and may be easily manipulated to control the heat.

Improved Saw Mill.

Charles Lindner, Hockley, Tex.—The intermediate wheel for running the carriage back is mounted on the lever, which is pivoted to a fixed pivot, so as to have a little end motion. It is connected at the other end by a link to lever, in which the shaft is journaled, and which is so pivoted that, whenever said lever is shifted to gear the feed, it throws out the running back gear; and when it is shifted so as to gear the running back train, it throws out the feed.

Improved Shoe Blacking Case.

William H. Morse, East New York, N. Y.—A foot-rest bar rests in notches in the inner sides of the box, and is kept from rising by a plate or tenon, which enters a groove. In a block which fits in the box is a round hole to receive the box of blacking, which is secured in place by a curved spring. The cover is supported, when turned down, by a wide cleat, which, with another cleat, serve as handles for lifting and carrying the case.

Improved Hay Gatherer.

Chesley Thomas Noell, Clarksville, Mo., assignor to himself and Uriel Griffith, of same place.—This invention consists in a toothed rake provided with pulleys to which the traces or draft appliances are connected. When the load of hay has been drawn to the place of stacking, the rake may then be drawn from beneath the hay and another load gathered.

Improved Fanning Mill.

Asa Y. Felton, Plain View, Minn.—The sieve is of sheet metal, the perforations being of the same size and farther apart in the upper portion, where the grain is received on it, than in the lower portion. This causes a larger portion to slide along the sieve before falling through, and spreads the falling grain more evenly throughout the area of the sieve, so that the air will act to better advantage. The sieve supports are shifted up and down in the side boards of the shaker, and fastened at any point to hold the sieves in the proper descent by slide bolts.

Improved Die for Making Chain Swivels.

Philander H. Standish, Jefferson City, Mo., assignor to himself and J. H. Bodine, of same place.—When the link blank and eye piece are put in their places in the dies, and pressed together, the overlapping ends of the link blank will be folded around the neck of the eye and welded together, and at the same time be shaped and finished in regard to form by one or two blows of the dies. The prongs of the eye piece are then heated and bent up, shaped, and welded in any approved way.

Improved Wheel Cultivator.

George S. Brower, George W. Brower, and Edwin A. Brower, Crawfordsville, Ind.—Devices are provided to swing the inside plows laterally to the row, for regulating them to the curvatures, and to correct the effect of irregular driving; and to so shift the plows, hangers are connected to cranked foot levers, which are to be worked by the driver's feet as he rides in the seat.

Improved Velocipede.

Walter Knight, San Andreas, Cal.—The feet rest on supports during the revolving of the front crank axle by the hands, and turn a lever and therewith turn the wheel to either side for guiding and steering the perambulator. The steady hold which is exercised by the simultaneous action of the feet on the fulcrum lever keeps the steering wheel in any desired position, so that the carriage may be easily guided in the required direction.

Improved Churn.

August Meyer, Port Washington, Wis.—In the cover is formed an air hole, in which is inserted a tube, to the upper end of which is attached a knob. The base of the knob is made of a larger diameter than the tube, so as to prevent the said tube from dropping through the cover. The lower end of the tube is flanged with stops, to prevent it from being drawn out of said cover. The lower end of the tube is open, and in the sides of its upper part are formed holes, so that, when the said tube is drawn up, the air may pass out and in freely, and when the said tube is pushed down the passage of air may be prevented. The milk is prevented from spattering into the tube by a guard plate.

Improved Draft Equalizer.

Edwin A. Beers, De Kalb, Ill.—By this invention, the draft of three horses, when used abreast, is equalized. A rod is attached to the front of the wagon, and the tongue is attached to the rod by braces. These braces have eyes which slide on the rod, and the tongue may be adjusted in any desired position by means of collars, in which are set screws. The evener is attached to the tongue at a point about one third of the length of the evener. A single whiffletree is provided for the right-hand horse. A lever is fastened by a joint through its end to the end of the evener, and a chain is attached to the lever at a point about one fourth the length of the lever from the loose end. This chain is attached to the rod by an adjustable slide. A whiffletree is attached to the loose end of the lever for the middle horse. A band is attached to the under side of the evener, and surrounds the lever and limits its action back and forth. Lastly, a whiffletree is attached to the evener for the outside horse.

Improved Window Ventilator.

Samuel W. Couch, Cold Spring, N. Y.—Two sets of plates are placed directly over the top bar of the upper sash, and the top bar of said sash is grooved upon its upper side to such a depth as to receive the plates when they are closed up. With this construction, when the upper sash is lowered, the plates descend with it or open out, and when the said sash is raised they are closed up and inclosed in the groove of the upper sash bar, so as to be entirely out of sight. The air passes in and out through the spaces between the plates.

Improved Spring Bed Bottom.

Joseph Fowler, New York city, and John R. Dewar, Bergen, N. J.—This improvement relates to connecting the slats of the bed bottom in pairs or sections, and also preventing endwise movement of the same, by means of notched blocks, which engage or lock with the springs that support the bed.

Improved Music Leaf Turner.

William H. King, Petersburgh, Ind., assignor to himself and Jerome Borer, of same place.—This is an attachment consisting of a cord fastened by a hook and elastic strap to the left side of the music rack, to be wound around the knob of the music leaf turner. It passes then over suitable pulleys to a lever pivoted to the under side of the piano, the front part of which is acted upon by a hinged plate with segmental ratchet, and operated by the leg or foot, turning the leaves, on raising the ratchet plate, by means of the elastic strap in one direction, and by means of the lever in opposite direction.

Improved Pawl and Ratchet.

Ralph Tomlinson and Joseph Smith, Boston, Mass.—The pulley is loose on the shaft, the ratchet is keyed to it, and the pawl is fixed on a pivot at or about the middle, and has a projection with relation to which and the pivot of the pawl the spring is so arranged that it will hold the pawl either in or out of connection with the ratchet, according to which way it is shifted.

Improved Revolving Spice Box.

Thomas W. F. Smitten, New York city.—This consists of two or more upright cases, with perforated tops for pepper and other condiments, pivoted on the vertical spindle of a stand, to swing horizontally around it. There are as many imperforated covers as there are cases, less one, so contrived that, the one case to be used being shifted to the place where it is uncovered, the others will, by the same operation, be brought under cover, so that the holes will be closed in all except the one to be used.

Improved Whip Tip Ferrule.

Edward B. Light, Denver, Col.—A short solid cylinder is fitted into the center of the ferrule, and secured there by a pin. A rod passes longitudinally through the center of the cylinder, and is rigidly secured. Upon each end of the rod is cut a screw thread. In using the device, the butt end of the tip is screwed into the ferrule until it strikes the end of the cylinder. The small end of the whip stock is afterward screwed into the other end of the ferrule until it strikes against the end of the cylinder. By different sizes of ferrules, a whip, when broken, can be cut into at the break and conveniently repaired, without the use of any tool.

Improved Level.

Christian C. Schwaner, Winterset, Iowa.—The case is made hollow, with a slot in the middle part and with semicircular projections upon its upper edge. Upon the front projection is formed a scale. The rod of a pendulum passes up through the slot, and has a knife-edge crosshead attached to its upper end. A pointer is pivoted to the pendulum and receives a pin, which serves as a fulcrum. The pin is bent at right angles, and is passed through a hole in another pin, which may be turned with a screw driver to adjust the pin first mentioned, which is secured adjustably in the hole by a set screw. The upper end of the pointer passes up to the scale, so as to indicate the angle of inclination of the object to which the instrument may be applied.

Improved Garden Rake.

Frederick B. Hedge, Greenport, N. Y.—This invention consists of a garden rake having a series of concave teeth or tines with sharpened ends at one side, and concave and larger teeth at the other side, for being used, as required, for breaking the earth or for drawing furrows.

Improved Motor for Light Machinery.

David Baldwin, Midland Park, N. Y.—This machine is a stool or seat, on which the operator sits and gives a rack the reciprocating motion instead of using his feet, the reciprocating motion being converted to a rotary motion. The motor is adapted to sewing machines and similar light mechanism.

Improved Street Sprinkler.

William Westerfield, New York city.—In the main tank is a valve tank, to contain the valves, and to which the sprinkling tubes are connected, the said tank being connected to the principal tank by a pipe. This valve tank will have a portion of the cover contrived to be readily removed to afford access to the valves, for adjusting them and for other purposes.

Improved Clothes Line.

Thomas S. Cary, Brooklyn, N. Y.—This invention consists in having a double pulley block attached at a window sill; and opposite it, near the other end of the same window sill, is a single pulley block set on a building opposite, through which the traveler rope runs. Thus, when fully extended, there will be two clothes lines full instead of one, as heretofore, thus saving time, labor, and space, both in extending the line and also in taking in the clothes.

Improved Feed Water Heater.

Horatio N. Waters, West Meriden, Conn.—The corrugated pipe through which passes the exhaust steam is attached to the head of the heater, and thus suspended within it; and a branch pipe extends therefrom, down through the bottom of the heater, to carry off the water of condensation. Said branch pipe is fitted in a stuffing box so as to have free vertical movement corresponding to the vertical expansion and contraction of the corrugated steam pipe under the variations of temperature. By this construction and arrangement of parts, the leakage incidental to the ordinary feed water heaters is effectually avoided, since the joints or other parts of the heater are subjected to no strain in consequence of variation in the degree of temperature.

Improved Sawing Machine.

John Gehr, Clear Spring, Md.—The invention consists in the main shaft of a sawing machine provided with ratchets, pawls, bars, and yokes, whereby light work may be done rapidly, and heavy work slowly, by hand, while horse or other power may readily be applied when desired.

Improved Car Coupling.

William Green, Hyde, England.—The invention consists in employing as a car coupler a pivoted hook closed by a rear spring and opened by a lever, thus entirely avoiding the use of pins that are so often lost or stolen, and dispensing with all complication of parts that render it liable to frequently get out of order.

Improved Bee Hive.

Julius S. Coe, Mont Clair, N. J.—This invention consists of a bee house and bee hives combined, and is so constructed and arranged that the room containing the hives is protected on all sides by a series of dead air spaces, and provided with thorough ventilation. The air inside may thus be kept at any desired temperature, quite independent of the exterior atmosphere. It is claimed that this device insures a certain crop of honey, fully protects and preserves the bees in winter, prevents the operator's being stung, and that, when thus constructed, a house and fifty hives will cost a third less than the same number of good outdoor hives, and yield a much larger and more certain profit.

Improved Hydraulic Packing.

John F. Taylor, Charleston, S. C.—This invention relates to an improved hydraulic packing, and it consists in a ring of rubber or other elastic material contained within a cup ring of leather, and attached to the same at one side and free at the other, and the whole disposed within a groove in the cylinder. The water enters the loose side of the cup ring and presses it tightly against the ram, the rubber serving to accommodate the unequal thickness of the leather, and keep the latter always in proper place.

Improved Wooden Barrel.

H. W. Fitzhugh, Bay City, Mich.—The invention consists in using straight staves having parallel edges, with constricted bands whose overlapping ends are fastened by a screw extending into the wood. This enables the barrel to be made entirely by machinery, and renders coopering unnecessary.

Improved Shirt Bosom Supporter.

James S. Edmunds, Princeton, Ky.—The object of this invention is to cause the shirt bosom to stand out prominently and evenly from the breast of the wearer. The device consists of elastic longitudinal metallic strips connected by ribs and plates.

Improved Fish Plate and Rail Fastening.

Joseph M. Kenny, Blairsville, Pa.—This invention relates to certain improvements designed to give greater security to fish plates and fastenings for railroad rails; and it consists in a bolt having a locking bit which, when turned, occupies the position transverse to the slot in the rail and plate. The rail is slotted to allow for expansion and contraction, and the bit rests in a space between the rail and the fish plate which receives the nut. The said plate is indented upon its exterior surface with depressions which prevent the nut from turning, and the bolts are provided with diamond-shaped heads, by means of which the position of the locking bit upon the inside may be determined.

Improved Lamp Extinguisher.

Professor Wm. H. Zimmerman, Chestertown, Md.—The object of this invention is to provide a means for extinguishing lamps, in which the danger resulting from blowing down the chimney is avoided, and the habitually foul snuffing devices dispersed with. It consists in a hollow rubber ball, or other compressible air chamber, combined with the burner of the lamp by means of a flexible tube, so as to direct a blast of air upon the wick by squeezing the ball. The vents or quenching tubes are of a construction adapted to any kind of lamp burner; and the blast directed by them upon the wick being horizontal, or inclined upwardly if desired, the danger resulting from the old way of blowing down the chimney is avoided.

Improved Corn Planter.

Silvanus P. Evans, Ash Ridge, Ohio.—The invention relates to improvements in walking planters. The machine includes means for adjustment of the shafts and longitudinal beams, also a conical-shaped seed-spreading or distributing device which is pivoted within the seed spouts, so that it may swing and adjust itself to the vertical inclination of the seed spouts, and also to devices forming an adjustable connection between the seed spouts and bars or devices for covering the seed in the furrow.

Improved Gate Latch.

Robert C. Bernard, Rocky Mount, Va.—This invention relates to certain improvements in gate latches. It consists in the combination with a double catch attached to the gate post, of a lever pivoted to the gate at one end and weighted at the catch, and a second lever pivoted in the middle and weighted at the end farthest from the catch, so that gravity causes both levers to latch the gate, one above the catch and the other below the same. These two levers are connected by a vertical bar, by means of which both levers are operated at once to open the gate, for the convenience of persons on horse back, in connection with which said bar and levers a knob is used for pedestrians.

Improved Hydro-Electric Lamp.

Professor Wm. H. Zimmerman, Chestertown, Md.—The object of this invention is to provide a safe and practical self-lighting lamp, and it consists in a hollow lamp pedestal filled with sulphuric acid and water, or some other suitable exciting fluid, and containing an inverted bell jar with suspended bits of zinc in the same to form a Döbereiner apparatus. To said pedestal are attached two brackets, in one of which is supported a small galvanic battery, and in the other an ordinary coal oil lamp having in its burner a tube connecting with the hydrogen generator, which directs a jet of hydrogen upon the wick of the lamp. Said jet passes over a piece of platinum wire conducting the two electrodes of the battery, which, when the elements of the battery are brought into operation, ignites the jet, the battery and the hydrogen generator being so connected that the depression of a single lever synchronously turns on the hydrogen, and brings the elements of the battery into contact.

Improved Lemon Press.

Henry Newberger, Fort Wayne, Ind.—The object of this invention is to press lemons so that the juice will be more thoroughly squeezed out and made to flow into the glass or receptacle without any admixture of dust or specks from the air. The device consists of a convex plunger which fits into a correspondingly concaved basin that receives the lemon or section of lemon, and has a med - an aperture through which the juice is expressed.

Improved Horse Hay Rake.

Benjamin Mellinger, Mt. Pleasant, Pa.—This invention relates to certain improvements in horse rakes, and it consists in a frame having a bent lever pivoted thereto, and provided with a stop hook, a traction rod with bifurcated ends and adjusting holes, and a cleaner attached to branched rods, all combined and arranged for the purpose of affording an improved means for lifting and manipulating the rake.

Improved Cartridge Belt.

David Taylor, U. S. A., Leavenworth, Kan.—The invention consists in a cross slotted belt provided with an interlacing strap, and a clamp having lower extensions bent backwards, and wings forwardly bent toward each other until the opposite edges nearly or quite meet.

Improved Motor.

John M. Cayce, Franklin, Tenn.—The object of this invention is to enhance the practical value of a gravity motor, by securing the best effects of the force of gravity, with a comparatively small expenditure of power for restoring the actuating weight to its original position for a continuance of the motion. It consists in the combination with a pivoted support bearing a weight, of a spring and rock seat, the latter rigidly attached to each other, and so combined with the support as to transmit the full power of the weight through the rock seat to the running gear, and yet to admit, through the auxiliary agency of the springs, of the shifting of the weight to the opposite side of its fulcrum by a smaller application of power than its own gravity. It also consists in the devices for shifting the said weight, and in means for adapting the principle of the motor to industrial purposes.

Improved Invalid Bedstead.

James Goodwin, Lennoxville, P. Q., Can.—This invention relates to certain improvements in invalid bedsteads, and it consists in an adjustable stretcher frame arranged above the bed and provided with hinges at the four corner posts, by means of which the whole stretcher may be adjusted inclinedly at one time, for adapting it to be used as a fracture bed. The stretcher is also provided with hinged head and foot frame operated by cords and pulleys for placing the patient in sitting posture. It also consists in a shaft under the bed provided with radial arms which are united at their extremities by a connecting rod passing through the hem of the sheet, by means of which the patient may be turned from one side to the other, the said device being operated by a windlass with a cord and pulleys.

Improved Blacking Brush.

Andrew McElrath, New York city.—The invention relates to a blacking brush constructed with a hollow back, which is adapted to receive the implements commonly required in the operation of polishing boots or shoes, such as a cleaning tool and brush, a brush for applying the blacking, a box of blacking, etc.

Improved Tea and Coffee Pot.

Louis Evans, Pittsburgh, Pa.—The invention consists in a coffee pot having a cone-shaped bottom, a perforated false bottom, and a cup, so arranged that, as the water percolates through the coffee and false bottom, all the essence thereof is carried into a separate chamber, all the internal parts being so connected that they can be lifted out together by a central handle.

Chief Engineer's Office, U. S. Navy Yard,
WASHINGTON, November 18, 1874.

Commodore Thos. H. Patterson, U.S.N. Commandant:

SIR:—In obedience to your order of October 9th, 1874, to carefully test the EMPIRE PORTABLE FORGE, manufactured at Troy, N. Y., I have the honor to submit the following report:

* * * * * * This is a very excellent and convenient forge. It works easy and with but little noise, and the power being applied with a lever, it can be worked without interfering with the manipulation of the fire.

I can recommend it as a very useful tool for work on ship board or shop use.

Very respectfully, your obedient servant,
[Signed] EDWIN FITHIAN,
Chief Engineer, U.S.N.

Business and Personal.

The Charge for Insertion under this head is $1 a Line.

Agricultural Implements, Farm Machinery, Seeds, Fertilizers. R. H. Allen & Co., 189 & 191 Water St., N.Y.

Magic Lanterns, Stereopticons of all sizes and prices, for Parlor Entertainment and Public Exhibitions. Pays well on small investment. Catalogues free. McAllister, Man'f'g. Optician, 49 Nassau St., N. Y.

We will sell the right of a few States for Cole's Automatic Boiler Feed Regulator cheap, if applied for soon. Has been in use over a year, and is a decided success. H. S. Cole & Co., Milwaukee, Wis.

Thomas's Fluid Tannate of Soda never fails to remove Scale from any Steam boiler; it removes the scale-producing material from all kinds of water; cannot injure Boiler, as it has no effect on iron; saves 20 times its cost both in Fuel and repairs of Boiler; increases steaming capacity of Boiler; has been tested in hundreds of Boilers; has removed Bushels of Scales in single cases. It is in Barrels 500 lb., ½ Bbls. 250 lb., ¼ Bbls. 125 lb.. Price 10 cents per lb., less than ½ price of other preparations, and superior to all others. Address orders to N. Spencer Thomas, Elmira, N. Y.

Partner Wanted—$5,000 to $20,000—in a Wilmington Coal Mine, 37 miles South of Chicago. Open, with good Established Trade. Address J. Q. A. King, Joliet, Ill.

Trojan Brick Machine—with Trucks and full set Moulds—been used part of a season—in perfect order—works well—made by Ferguson and Ralston, Troy, N. Y. For sale cheap, by Gridley & Reed, Waterloo, N. Y.

For Tri-nitroglycerin, Mica Blasting Powder, Electric Batteries, Electric Fuses, Exploders, Gutta Percha Insulated Leading Wires, etc., etc., etc., result of seven years' experience at Hoosac Tunnel, address Geo. M. Mowbray, North Adams, Mass.

Wanted—Estimates on finest wood engravings—4x5 inches—Landscapes. Send specimens. H. L. A. Culmer, Salt Lake City, Utah.

For Sale—A Valuable Patent, for what one State right can be shown to be worth. Address W. M. Coombs, Titusville, Pa.

Wanted—Second Hand Fire Brick Block Presses. S. B. Miller, 209 South 5th St., Philadelphia, Pa.

Miller's Brick Presses for fire and red brick. Factory, 209 South 5th St., Philadelphia, Pa.

A mechanical draughtsman, of 12 years thorough experience in different branches, is open to an engagement. Best of references given. Address A. B., care of Markt & Co., 145 Centre St., New York.

For Sale—Valuable Manufacturing Property: commodious buildings; driving-power, shafting, belting, etc; good order. Great sacrifice. For description, address "The Cosmos," St. Charles, Mo.

Carpenters Wanted—As Agents for "Patent Tool." Address Nicol Beach & Co., Rockford, Ill.

Speed Indicator—Every mechanic needs one: can carry in vest pocket. Satisfaction guaranteed. By mail, $2. Sam'l Harris & Co., 45 Desplaines St., Chicago.

Wanted—Parties to manufacture a first class Sectional Safety Boiler. Terms liberal. Profits large Address S. T. Russell. Springfield, Ohio.

The Whitmore Engine, 4, 5 and 10 H.P.—Cheapest, best, and safest. Vertical Tubular Boilers, all sizes, at reduced prices. Lovegrove & Co., Philadelphia, Pa.

For the cheapest and best Small Portable Engine manufactured, address Peter Walrath, Chittenango, N.Y.

See N. F. Burnham's Turbine Water Wheel advertisement, next week, on page 237.

Diamond Carbon, of all sizes and shapes, for drilling rock, sawing stone, and turning emery wheels, also Glaziers' Diamonds. J. Dickinson, 64 Nassau St., N.Y.

The Varnishes and Japans of the London M'f'g Co. compare favorably in price with, and are unexcelled in purity, durability, and color by, any first class houses in Europe or America. Hyatt & Co., office 246 Grand St., New York; Factory, Newark, N. J.

Steam and Water Gauge and Gauge Cocks Combined, requiring only two holes in the Boiler, used by all boiler makers who have seen it, $15. T. Holland, 57 Gold St., New York.

Price only $3.50.—The Tom Thumb Electric Telegraph A compact working Telegraph Apparatus, for sending messages, making magnets, the electric light, giving alarms, and various other purposes. Can be put in operation by any lad. Includes battery, key, and wires. Neatly packed and sent to all parts of the world on receipt of price. F. C. Beach & Co., 263 Broadway, New York.

Tin Manufacturers, who have waste strips, pieces, or round blanks to sell, address—giving sizes—Norton Bros., 44 & 46 River St., Chicago, Ill.

Zero-Refrigerator with Water Cooler. Best in the World. Send for Catalogue. A. M. Lesley, 221 W. 23d street, New York.

The Lester Oil Co., 183 Water St., N.Y., Exclusive Manufacturers of the renowned Synovial Lubricating Oil. The most perfect and economical lubricant in existence. Send for Circular.

For small size Screw Cutting Engine Lathes and Drill Lathes, address Star Tool Co., Providence, R. I.

Wash Stands, New Styles, Marble Tops, can be used in any situation. Prices very low. Send for a catalogue. Bailey, Farrell & Co., Pittsburgh, Pa.

Peck's Patent Drop Press. Still the best in use. Address Milo Peck, New Haven, Conn.

Genuine Concord Axles—Brown, Fisherville, N.H.

Spinning Rings of a Superior Quality—Whitinsville Spinning Ring Co., Whitinsville, Mass. Send for sample and price list.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon, 470 Grand Street, New York.

Send for Circular of a very Superior Boiler Feed Pump. D. Frisbie & Co., New Haven, Conn.

W. Campbell's Self-Acting Shade Rollers. The Trade supplied, 87 Center Street, New York.

The "Scientific American" Office, New York, is fitted with the Miniature Electric Telegraph. By touching little buttons on the desks of the managers signals are sent to persons in the various departments of the establishment. Cheap and effective. Splendid for shops, offices, dwellings. Works for any distance. Price $6, with good Battery. F. C. Beach & Co., 263 Broadway, New York, Makers. Send for free illustrated Catalogue.

For best Presses, Dies, and Fruit Can Tools, Bliss & Williams, cor. of Pirmouth and Jay, Brooklyn, N. Y.

Buy Boult's Paneling, Moulding, and Dove-tailing Machine. Send for circular and sample of work. B. C. Mach'y Co., Battle Creek, Mich., Box 221.

Small Tools and Gear Wheels for Models. List free. Goodnow & Wightman, 23 Cornhill, Boston, Mass.

For Surface Planers, small size, and for Box Corner Grooving Machines, send to A. Davis, Lowell, Mass.

Hotchkiss Air Spring Forge Hammer, best in the market. Prices low. D. Frisbie & Co., New Haven, Ct.

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

Temples and Oilcans. Draper, Hopedale, Mass.

For Solid Emery Wheels and Machinery, send to the Union Stone Co., Boston, Mass., for circular.

Mechanical Expert in Patent Cases. T. D. Stetson, 27 Murray St., New York.

All Fruit-can Tools. Ferracute, Bridgeton, N. J.

Grindstones—4,000 tuns. Berea Stone Co., Berea, O.

Notes & Queries

W. H. A. will find directions for bleaching beeswax on p. 299, vol. 31.—W. M. will find a recipe for silver-plating solution on p. 299, vol. 31.—W. H. M. will find directions for coloring putty on p. 107, vol. 31.—R. C. J. can plate iron with silver by the process given on p. 314, vol. 24.—W. H. W. will find an explanation of sailing faster than the wind on p. 176, vol. 28.—R. H. H. will find directions for bronzing on iron on p. 283, vol. 31.—H. E. will find directions for case-hardening iron on p. 69, vol. 31.—F. E. H. will find a recipe for marine glue on p. 43, vol. 32.—E. E. W. will find the recipe for furniture polish and also for finish for black walnut on p. 315, vol. 30.—J. K. S. and J. S. S. should each consult a physician.—C. G. M. will find a description of the wonder camera on p. 26, vol. 31.—C. C. S. will find directions for preparing muriate of ammonia for inhalation on p. 315, vol. 31.—W. H. and many others are assured that there is not and cannot be an instrument for indicating hidden treasure.—J. D. will find directions for softening and toughening wood on p. 319, vol. 31.

(1) W. J. A. asks: Will nitro-glycerin explode through a capillary tube? A. If we understand your question, yes.

(2) C. D. B. asks: What kind of oil is the best to preserve shoe leather, and to keep it soft? A. You will find neatsfoot oil the best.

Will a compound of cologne, hartshorn, tincture of cantharides, oil of lavender, oil of rosemary, and oil of nutmeg injure the skin? A. Probably not if used only a few times, and not in excessive quantity. Cologne is mostly all alcohol, which has a very injurious effect upon the skin, if used frequently, by dissolving out the natural oils, leaving the skin harsh and dry. If in the formula you present the oils are in excess of the alcohol or cologne, then the cologne is of no use on the skin and can be dispensed with; if, on the other hand, the cologne is in excess, the oils are of no use, as the uncombined alcohol is free to unite with the oils and fats of the skin. Unless the skin is diseased, the best lotion is cold water.

(3) F. S. asks: How can I use india rubber in either turpentine or naphtha without impairing its elasticity? A. Caoutchouc dissolves in bisulphide of carbon, coal naphtha, and rectified oil of turpentine. In these liquids it first swells up very considerably, and eventually forms a ropy liquid, which, on evaporation, leaves the caoutchouc with its original elasticity.

(4) F. W. asks: How is nitro-glycerin made, and how is it exploded? A. See p. 91, vol. 32.

Is there such an invention as the screw of Archimedes for elevating water? A. The screw of Archimedes, called after the philosopher that invented it, is one of the simplest machines for raising water, and operates at only short distances. It consists of a tube wound spirally round a solid cylinder, the lower end of which dips beneath the water at an angle of about 35°, the upper end being supported by a suitable arrangement, and fastened on a crank, which serves to rotate it.

(5) R. S. G. asks: What are the ingredients of Seidlitz powders? A. Rochelle salts 1 drachm, carbonate of soda 25 grains, tartaric acid 20 grains. Dissolve the two first in a tumbler of water, then add the latter, and drink immediately.

(6) N. P. K. asks: 1. How can I prepare hard enamel? A. Mix 100 parts of pure lead with 20 to 25 of the best tin, and bring them to a low red heat in an open vessel. The mixture then burns nearly as rapidly as charcoal, and oxidizes very fast; skim off the crusts of oxide successively formed, till the whole is thoroughly calcined. Then mix all the skimmings and again heat as before, till no flame arises from them, and the whole is of a uniform gray color. Take 100 parts of this oxide, 100 parts of white sand, and 25 or 30 of common salt, and melt the whole by a moderate heat. This gives a grayish mass, often porous and apparently imperfect, but which runs to a good enamel when afterwards heated. 2. How can I bring a low quality of gold to the color of 18 carat gold? A. Alloy it with the proper proportion of silver and copper. 3. I have a quantity of silver melted with lead; it is so brittle that I cannot roll it. How can I get it in condition to work? A. The desired object may be attained by melting the alloy in a cupel formed of bone ashes. The lead is gradually oxidized, melted, and absorbed by the porous material composing the cupel.

(7) H. P. A. says: I am now using the sap part of the white wood tree, cut to the thickness of 36 to the inch. In order to cleanse it of the sap and woody taste, I boil and frequently change the water, yet do not get it tasteless. How can I cleanse it of the taste without injuring the strength of the wood? A. Try weak lye, and water afterwards.

(8) T. B. C. asks: Is there any way of restoring marble that has been spotted with lemon juice? A. Marble being a carbonate of lime, the action of such an acid upon it would be to enter into combination with the lime, expelling the carbonic acid, forming a different body from the original marble; and from the fact of its being a mealy powder, it was easily wiped away without notice, leaving behind it the blur or depression in the surface of the polished plate you speak of. We do not think it can be remedied.

(9) H. S. says: What is the simplest way to make an apparatus for blowing glass, such as is used by men that travel the country? A. What you require is a current of air forced upon a flame produced from a wide illuminating surface, as a large wick, or, better, a gas flame widened and then subjected to the current of air.

(10) A. C. B. asks: 1. Is there any way to harden coin silver? A. We do not know of any. 2. Is there any hard metal or alloy that can be used for fine work, and will not scale when heated? A. Try the alloy known as packfong, or German silver, a compound of nickel, zinc, and copper, in which the proportions vary considerably. A good alloy consists of 5 equivalents of copper, 3 of zinc, and 2 of nickel. Packfong is of a yellowish white color, and, when newly polished, closely resembles silver in appearance.

(11) F. C. asks: Will anything dissolve lithia carbonate except carbonic acid water? A. Yes, ammoniacal salt.

(12) H. H. asks: How can I make bisulphate of tin? A. You probably mean bisulphide of tin ($Sn S_2$), known also as mosaic gold; it forms a beautiful yellow flaky compound, which is obtained by preparing an amalgam of 12 parts of tin and 6 of mercury; this is reduced to powder and mixed with 7 parts of sublimed sulphur and 6 of sal ammoniac. This mixture is introduced into a flask with a long neck, and is heated gently so long as any smell of sulphuretted hydrogen is perceptible; the temperature is then raised to low redness calomel and cinnabar are sublimed, and a scaly mass of $Sn S_2$ remains. If the heat be pushed too far, part of the sulphur is expelled and the operation fails; the sal ammoniac appears by its volatilization to moderate the heat produced during the sulphuration of the tin, which would otherwise rise so high as to decompose the bisulphide.

(13) F. C and others.—Most medical authorities agree that the right side is the better to sleep upon; but this is not always the case, the number of persons who sleep upon the left being as many as those who use the right side. It is simply a matter of convenience and ease, it being folly to insist upon a person to use one side when it is a discomfort.

(14) J. W. asks: 1. What is the tenacity of gold? A. It will take 24·20 lbs. weight to break a gold wire having a sectional area of a square millimeter, if the gold be annealed. If the gold be drawn, it will require 61·60 lbs. to break it. 2. When gold is consumed by fire, what is the color of the flame? A. Molten gold exhibits a sea green color. 3. What is the color of light transmitted through a pellicle of silver? A. Bluish. 4. When silver is consumed by fire, of what color is the flame? A. The spectrum of silver is green. 5. How can cinnabar be converted into a yellow pigment? A. Continued pulverization will change the brick red color of cinnabar to an orange yellow.

(15) F. W. B. says: I have some white silk which has become yellow by washing. How can I restore it to its original color, without injuring the silk? A. Try steeping it for a short time in vinegar or lemon juice, after having perfectly cleaned it. Rinse in cold water.

(16) J. H. L. asks: How can I illuminate tableaux with a strong light, and have changes of color without resorting to the use of disagreeable compounds? How can I prepare and use the calcium light for the above purpose? A. The magnesium light is sometimes used for this purpose. The method of obtaining it consists in burning magnesium ribbons which may be obtained from any chemist or dealer in theatrical goods. In the calcium or lime light, an ignited jet of the compound gas (oxygen and hydrogen) is caused to impinge against a small cylinder of caustic lime. In the apparatus used for this purpose, the gases are conducted by separate tubes to the burner, which they enter at opposite sides, a few inches from the tip of the burner. The burner or jet should be bent towards the vertical surface of the lime at an angle of about 45°. The lime should approach the tip of the jet within $\frac{1}{16}$ of an inch. The gases are kept in separate bags of india rubber. The oxygen gas is obtained by heating together, in an iron or copper bottle, chlorate of potash with one quarter its weight of peroxide of manganese. Hydrogen gas may be obtained by acting upon scraps of zinc in a large bottle with dilute sulphuric acid. The first portions of the gas, if obtained in this manner, should be allowed to escape, otherwise its mixture with the air in the apparatus forms a very explosive mixture. Ordinary illuminating or coal gas, if obtainable, will answer the purpose as well as pure hydrogen. Both the above gases are washed before being allowed to enter the bags. This is arranged as follows: A small bottle is obtained, which is partially filled with water; through a tightly fitting cork in the mouth of the bottle pass two glass tubes, one of which passes down and dips beneath the surface of the water, the other barely passes through the cork. In order to use this washer, the tube which dips under the water is attached by rubber tubing to the generating flask, and the end of the other tube, which just passes through the cork, is attached to the receiving bag. Thus arranged, the gas as generated is required to pass through the water. Care should be taken (in the generation of the oxygen) at the end of the operation that the water in the bottle does not run back into the generating flask, otherwise an uncontrollable quantity of steam will be generated from contact of the moisture with the hot metal.

(17) F. N. J. and others.—The statements made as to the preparation of musk are on the authority of a work recently published on perfumery, and presumably reliable.

(18) D. S. M. asks: 1. What effect will alum water have on flour when used for dampening wheat before grinding it? A. Probably the same as when applied after the wheat is ground, as is often done by bakers. 2. Will it toughen the wheat so as to give a better yield? A. We think not. 3. Is it injurious to health? A. Yes. This method of whitening the bread is prevented by heavy fines and penalties in England.

(19) S. C. B. asks: Does soap boilers' refuse contain anything unfavorable to its use for agricultural purposes? A. Not that we know of.

(20) W. O. P. says: We frequently find melted lead flowing from stove and grate in which we are burning coal. A boy once showed me a piece of what I presume was lead ore; I could cut it with ease with my pocket knife. A few days ago we heard a snapping report in the stove, and melted lead splashed out on the floor and burnt my brother's hand. Are not these facts indications of lead in quantity somewhere in the district? A. Yes. 2. If so, would it be found above or below the coal vein? A. It might be found below as well as above. 3. If there be lead, how could the vein be most easily found? A. By carefully examining the exposures of the rocks for the vein, and by surface indications of minerals containing lead.

(21) K. B. F. asks: Is carbolic acid a poison taken internally or applied outwardly? A. It is a poison in both cases. It acts similarly to creosote.

(22) S. T. asks: How are paper magnetic fish made, so that when they are put in the palm of the hand they will draw up and turn over as if alive? A. They are made of thin gelatin, called gelatin paper. Collodion films may also be used for the same purpose.

Will tobacco smoke have any effect upon soft rubber tubing? Will vinegar corrode it? A. Neither will have any permanent effect.

(23) J. S. & Co. ask: What is a good solution for tempering steel for drilling rock? A. Be careful not to overheat it in hardening and forging, and quench in salt water, drawing to a brown color.

(24) J. P. S. says: I recently came across a strange stone; it weighs 2 or 3 tuns, and is formed of small stones about the size of a hen's egg. It seems to have been ground off on the outside, for it is perfectly smooth. It lies half a mile from a small stream, and on a hill fully 100 feet above the stream. What is it? A. Such rocks are called conglomerates, and are quite common in some parts of New England and elsewhere.

(25) O. A. Jr. asks: How can I drill hard cast iron, without annealing it? A. Harden the drill to a straw color, and run it slowly.

Should an icehouse be set on or above the ground? A. See p. 251, vol. 31.

(26) W. W. B. says: An apparatus for gold and silver plating is constructed as follows: Bath: 4 ozs cyanide of potassium and 4 ozs. carburet of ammonia, dissolved in 1 gallon rain water. Then add 12 grains gold (or silver), apply battery, and add blue vitriol until a blue color is obtained. Battery: Put nitric acid in the porous cup, and diluted sulphuric acid in the outer. Suspend a carbon plate in the porous, and zinc in the outer, with small copper wires. I use the gold solution hot. I am very careful to clean thoroughly the articles plated, but the work will not last six months. Can you inform me of a process by which I can do plating that will last one, two, or three years? A. To make a silver solution, dissolve the silver in four parts of nitric acid and one of water; the diluted acid is heated in a vessel and the silver added by degrees. After the metal is dissolved, put it in a large vessel and dilute with water. Then add a solution of cyanide of potassium so long as a white precipitate is formed. When the precipitate of cyanide of silver has settled, the clear solution is carefully decanted, and the vessel filled with water, which is again decanted as soon as the precipitate has settled. Repeat this three or four times, and then add a solution of cyanide of potassium until the precipitate is all dissolved. The solution is then ready for use, after filtering. Dilute the cyanide of potassium so that the plating solution shall contain one ounce of silver to a gallon. A preparation of solution of gold is prepared by dissolving gold in three parts muriatic acid and one of nitric acid, which forms the chloride of gold. This is digested with calcined magnesia, and the gold is precipitated as an oxide. The oxide is boiled in strong nitric acid, which dissolves any magnesia in union with it. The oxide, being well washed, is dissolved in cyanide of potassium, which gives cyanide of gold and potassium. A Smee or Daniell battery is better than a carbon battery for silver and gold plating.

(27) B. D. T. asks: How are plow castings chilled? A. Cast them in an iron mold, and let them cool in the mold.

(28) L. G. asks: 1. What kind of grease is best to use in the oil cups of engine cylinders? A. Tallow. 2. Which oil is best to use on engine slides? A. Lard oil.

(29) Y. P. says: I have made a nickel solution of 1 lb. sulphate of nickel, and 4 ozs. sal ammoniac or chloride of ammonia to a gallon of sul-

phate of nickel. I used fluid ammonia to make it neutral. I use a 3 cell Smee battery. The work comes out black. Can you give me a remedy? A. Dissolve the nickel in nitric acid and then add carbonate of potash to precipitate the metal. Wash this well and dissolve it in cyanide of potassium. Use a plate of nickel for a positive electrode. Dissolve your platinum wire in a mixture of nitric and muriatic acids. Wash your silver plate in nitric acid and brush it until a frosted appearance is obtained. Then wash it in water thoroughly, and place it in a vessel containing dilute sulphuric acid and a little nitro-muriate of platinum. Place in the vessel a porous tube containing a few drops of dilute sulphuric acid. Put in the tube a piece of zinc and connect the zinc with the silver plate. In a few seconds the platinum will be deposited upon the silver as a black powder, and the platinized silver is ready for use.

(30) H. M. D. asks: What is the best method of truing up an ordinary carpenter's grindstone? A. Use a ¾ bar of iron, or a gas pipe, for a turning tool, below the center of the stone.

(31) A. J. G. says: I have a tin roof laid on matched boards, which is 20x34 feet. It is nearly airtight, without any windows. In cold weather, a very heavy coat of hoar frost collects inside; and when it thaws, the moisture drops down to the plastering and is spoiling all of the ceilings in the upper stories. Can I prevent the hoar frost collecting by putting a ventilator in the center of the roof? If so, what construction is best? A. The appearance of water in such quantities under your roof would seem to indicate a concealed leak in the tin; but if the frost shows itself in every part, and there is evidence that it arises from the condensation of water from the atmosphere, it is, to say the least, rather unusual, and the remedy should be sought in an increased ventilation. Your best plan to effect this will be to provide openings under the eaves of the house, and on two opposite sides thereof, so that the air may pass through the roof space: these may be placed close under the roof cornice, so that they may be protected from the entrance of rain, etc.

(32) W. M. L. asks: What kind of treadle should I put on a foot lathe to use either end of the lathe? A. Make your treadle as long as your lathe bed.

(33) F. E. W. says: In your answer to W. E. W. you say that musk is prepared from a root. In Griffith's "Universal Formulary" may be found the following: "Musk is a peculiar concrete substance obtained from the *moschus moschiferus*, a small animal of the deer kind, inhabiting the mountainous regions of Central Asia. The musk is secreted in the male, in an oval sac, situated near the generative organs. It is found in commerce in these sacs; it is concreted or granular, of a brownish color, soft and greasy to the touch, of a powerful, penetrating odor, and of a bitter, unpleasant, and somewhat acrid taste. From its high price, it is very liable to adulteration. It is antispasmodic and stimulant, and has been much used in spasmodic diseases of all kinds, as well as a stimulant in low states of the system. The dose from five to ten grains."

(34) W. M. N. asks: How can we temper steel springs made from the ends of Bessemer rails? A. Try a very low red heat, and quench right out in water.

(35) S. C. C. D. says: 1. F. wants an internal gear made with pinion turning on same center, both to revolve in definite proportions (say two or three to one). I contend that there must be an intermediate to transmit the motion. Am I right? A. Yes. 2. Please give the relative proportions. A. The proportions are the same as for outside gears. See p. 187, vol. 29.

(36) J. L. H. asks: 1. How can I temper cold chisels and punches? A. Heat to a red, and quench in water, drawing to a blue. 2. Can I make knives (for a shaping machine) out of vertical mill saws $\frac{5}{16}$ inch thick? A. They are excellent material for the purpose. 3. How can I anneal and temper them? A. Anneal in lime, and draw to a brown color.

(37) W. P. S asks: Will a circular cutter on a lathe mandrel answer for beveling the edges of pasteboard for bookbinding? A. No. Such material should be cut with shears, to avoid a burr on the edge.

What kind of wood is best for cutting screws with a chaser or screw box? A. Boxwood.

(38) R. T. W. asks: What can I use in lard oil to prevent it from chilling or becoming thick? A. A good variety of kerosene oil would answer your purpose much better.

How can I procure the drawings, etc., of all machinery patented in the United States? A. Apply by letter at our office for copies of the patents. See our prospectus in this issue.

I have a mercurial thermometer which indicates −55° Fah. this winter. Can it be correct? I thought mercury congealed at −39°. A. Mercury freezes at 39·5° Fah. Lower temperatures are measured by thermometers in which the mercury is replaced by colored spirits of wine.

(39) H. L. C. asks: How much fuel is required to melt 1 tun of cast iron? A. Probably 2 or 2½ times the weight of the iron.

(40) N. D. S. says: I have a water tank made of two inch pine planks. It is round and hooped like a barrel, and is about 4 feet high and 4 feet in diameter. It is about 20 feet above the supply. I want to attach a supply pipe to the tank, put in a check valve with a safety valve on the top, and fill the tank with steam; and as it condenses, let it fill itself by the supply pipe. Will the tank stand the pressure? A. It will most likely be difficult to make your wooden tank steam tight and keep it so. A better way to fill it by the direct action of steam is to provide a small cylinder below, supply the steam at the top of it, and have two pipes leading from the bottom, one down to supply the water to the cylinder, and the other up, through which to force the water to the tank. Provide proper valves to these pipes. Let the steam enter at the top and expel the air; condense the steam by a jet and the water will enter from the supply pipe and fill the cylinder; let the steam enter again on top of the water and it will force it down and out through the rising pipe to the tank; then condense the steam again, and the operation will be repeated. Now, if you make your valves work automatically, you have an automatic pump.

(41) N. C. H. asks: What will remove a coating of paint from windows? A. Try turpentine and linseed oil.

(42) W. B. W. asks: 1. Are the carbon points used for electric lights the same as used in Bunsen's batteries? A. Yes. 2. Would a double convex or a plano-convex lens increase the brilliancy of an electric light any more than a plain window glass with a strong reflector placed behind it? A. No.

(43) F. B. asks: What are the arrangements of the circuit in an induction coil, and what is the best material for the core? The coil is intended for a shocking machine. A. An induction coil consists of a primary and secondary coil wound into a bobbin, or each may be wound on a separate bobbin, and the one placed inside the other. The primary coil is made of wire $\frac{1}{10}$ of an inch in diameter and covered with cotton or wool; the secondary coil is made of silk-covered wire $\frac{1}{30}$ of an inch in diameter, and is ten or twenty times as long as the primary. The core consists of a bundle of iron wires. Attach a battery to the two ends of the primary coil, and when the circuit is closed or broken, a shock will be produced by taking hold of the two ends of the secondary coil.

(44) W. E. D. asks: 1. Which is the strongest magnet, one wound with fine or with coarse wire? A. For lifting weights, coarse wire; for working over long telegraph circuits, fine wire. 2. Does the size of the iron of which the poles are made make any particular difference as to the strength of the magnet? A. The iron should be about one third as thick as the coil. 3. I have made a magnet with spools 2¼ inches long x1¾ inches diameter, outside measurement, and made the poles of ½ inch iron. I wound the spools with No. 26 insulated wire, putting 600 feet on both spools. The power is not as strong as I expected it would be. What is the cause? A. If you use more battery, your magnets will be stronger. 4. Will lightning strike insulated wire? A. Lightning will strike anything. 5. Supposing a line of galvanized wire is used outside, and is connected with insulated wire where it enters the house, would that be dangerous if I do not use lightning arresters? A. It would be dangerous to the instruments. You had better use the arresters.

(45) B. J. K. asks: 1. Is it true that, with Edison's automatic telegraph, 500 words can be transmitted per minute? A. Yes, on short lines, say 100 miles long or less. 2. Do you think it will ever be generally adopted and drive the sounder out of use? A. No. 3. Can you give me a description of it? A. It is substantially the same as Bain's telegraph. The additions are a new mechanical puncher and a method of neutralizing, to some degree, the static charge. 4. What books should a telegraph student read to obtain a perfect knowledge of telegraphy? A. Culley's, Sabine's, Pope's, Turnbull's, Shaffner's, Prescott's, Jenkin's, and Bakewell's in English. In German, Schellen's is the most complete work.

(46) A. F. O. says: I have heard just enough about the single fluid bichromate of potash battery to cause me to desire to know more about it. If it is, in point of simplicity and efficiency, what it seems to be, it is a most desirable addition to the laboratory. It uses but a single fluid, that can be kept in bottles for any length of time; the zincs and carbons cannot deteriorate when laid away, and must be ready for immersion at any time. No porous cells are needed. What are the chemical reactions, and in what manner does the exciting fluid deteriorate, how may it be renovated, and when must it be renewed? A. The single fluid bichromate of potash, or Grenet, battery is a very good form of an experimental battery where constancy of current is not required, as, for example, in the laboratory and mechanical workrooms. The cell is in the form of a bottle, and contains a mixture of 2 parts bichromate of potash, dissolved in 20 parts hot water and 1 part sulphuric acid. The top is provided with a brass frame, to which is fastened a wooden cover. To this cover are attached two carbon plates which permanently dip into the fluid; and between the carbon plates a zinc plate is suspended, which may be plunged into the fluid or withdrawn at pleasure. When the zinc is withdrawn, the action ceases. The battery gives a powerful current for a short time, but rapidly polarizes. The length of time during which the fluid will retain its power depends upon the use which is made of the battery. It is not suitable for continuous use; but in all cases where a powerful current is required for a brief period, it is a very desirable and economical apparatus.

(47) C. E. G. asks: Can I warm a three story wooden building, 80x45 feet, thoroughly by putting two hot air furnaces in the cellar? A. Your building is not so large but that it may be heated by two good sized ordinary hot air furnaces. Apply to the party from whom you intend to procure your furnaces before you build, so that the location and size of the flues (which should be large) may be properly determined.

(48) I. O. T. says: 1. I am making an induction coil; it is 7½ inches long, has a center bundle of soft iron wires of ⅝ inches diameter, and I propose to make it with a diameter of about 4 inches. The inducing coil consists of copper wire (100 feet to 1 lb.) and there is about 40 yards of it. On this is now coiled 700 feet of wire (14,000 feet to 1 lb.) and I get quite a strong shock. How much more of a smaller size (18,000 feet to 1 lb.) ought I to coil on this to get a spark of at least ¼ inch long? A. You would require to add a condenser to accomplish this. 2. My battery is of the Callaud gravity kind, made in quart glass jars. How many of these will equal one of the Daniell kind? A. One. The electromotive forces of the Callaud and Daniell battery are similar. 3. In these batteries, what would be the effect of leaving the wire from the copper plate on the bottom of the jar uncovered? A. It would be eaten off. 4. If the strength of the induced current depends upon the intensity of the inducing current, why not pass the current into a small induction coil and then use the induced current as an inducing one for a larger coil? A. It does not depend upon the intensity, but upon the quantity. 5. What is the black substance that falls from the zinc to the bottom of the jar? A. Copper, deposited in a metallic form. 6. Does it do any harm to let it collect? A. It ought to be removed occasionally. 7. The zinc is sheet zinc, amalgamated. Is this right? A. It ought not to be amalgamated. 8. What is the best form of battery that can be transported, and used while it is being transported, or while the liquids are agitated a little? A. Daniell's or Lôclanché's. 9. What is the white salt-like substance that accumulates in the top of the jars? A. Sulphate of zinc, crystalized.

(49) C. M. B. asks: Should the follower pinch the rings of the piston, or should they be loose so as to be acted on by the springs? A. Let them be just movable by hand.

(50) C. F. B. says: 1. I made a battery of two cells, which fails to give a current. I filled the outer glass jar, 6 inches deep and 4 inches in diameter, two thirds full of a concentrated solution of sal ammoniac. In this I put an amalgamated zinc electrode (5 inches long by ¾ inch diameter. The carbons were packed tightly into the porous cups with a mixture of finely powdered black oxide of manganese and gas carbon, 3 parts of former to 1 of latter. Where is the mistake? A. You should use coarsely powdered manganese oxide. 2. In the battery made by C. and F. Fein, of Stuttgart, how are the platinum plates used to make the connection between the copper wires and the charcoal plates? A. They are clamped together. 3. How large are the plates? A. They vary according to the size of the jar. 4. How many Leclanché cells are required to ring an electric bell with 900 yards of ordinary telegraph wire, insulated? A. About 4.

(51) A. M. R. asks: How can I get intermittent rotary motion of a wheel, 12 inches in diameter, by cogs, an 8 inch wheel being on the driving shaft? A. Have cogs on the driving wheel that only act during a portion of the revolution.

Is there a dry color lighter than blue that will dissolve in water when cold? A. We think it quite likely. Apply to a manufacturing chemist.

(52) R. B. R asks: How does the engine, illustrated as operating the water belt on p. 278 of *Science Record* for 1875, operate? A. A reciprocating engine will answer, as all that is necessary is to make the large wheel revolve at a high speed. In the engraving it appears to be a rotary engine.

(53) J. V. asks: Will ice form on the bottom of a river as well as on the surface, on either rocky or sandy bottom? A. No.

(54) E. B. T. asks: What is a good preparation with which to cover the deck of a boat? A. Good timber, well seasoned, is advisable. There are numerous patent processes for preserving timber by which it is said that green wood is rendered durable.

(55) X asks: Why does the lead eccentric on any kind of a link motion engine wear away more quickly than the other? A. It ordinarily does more work than the other.

(56) H. P. asks: What sizes of cast iron and wrought iron screws are necessary for a cotton press, pressing 500 or 600 lbs. bales with one horse? A. Cast iron, 3 to 4 inches diameter; wrought, 2 to 3 inches. 2. Will an ordinary lifting pump raise water 32 or 33 feet? A. No. 3. What is the probable horse power of an engine, with a cylinder 6x12 inches stroke, pressure 50 lbs. at 100 revolutions per minute? A. From 10 to 12.

(57) F. H. H. asks: 1. Will any object sunk in very deep water remain suspended after reaching a certain depth? A. It is quite probable. 2. Is it true that divers have to hang weights upon themselves so as to keep at their work? A. It is frequently necessary, because the diving suit increases the displacement, and the water at the bottom is more dense than at the top.

(58) C. asks: Which part of a wheel revolving on the ground travels fastest going horizontally through the atmosphere? A. The top.

(59) L. E. D. asks: 1. Does a native of a tropical climate suffer as much from cold in his own country as in a temperate one? A. A person accustomed to a tropical climate suffers more from cold. 2. Will he, going from a colder climate into a warmer one, suffer as much from cold as in the colder climate? A. He will suffer more by a certain fall of temperature in the warm climate than by the same decrease of temperature in the cold climate.

(60) W. L. says: I have a private telegraph line about one quarter of a mile long, and use a return wire instead of the ground. During a recent storm, a bracket came off one of the poles and for about one hundred feet the wires are wound one around the other. I supposed that the current from the batteries at either end would follow one wire to where they came together, and then return by the other wire to its original battery, and so make two local circuits, but no through current. But on opening my key, I found I could communicate with the office at the other end without any difficulty whatever, and we have been working with the line in that condition for a week with scarcely any inconvenience. It recently rained nearly all day, and for a short time I was unable to get a circuit; with that exception I have had no difficulty. I have come to the conclusion that the wires are very rusty and thus insulated. The wires swing enough to scrape all the rust off of each of them. Am I right in supposing that they are insulated by the rust? A. When two or more paths are open for the passage of an electric current, it will follow each in proportion to the facilities afforded. In the case in point a portion of the current returned *via* the cross, but enough got through to work the instrument. If the two wires had been a couple of hundred miles in length, very little of the current would have reached the distant end. If your two wires were laid on the ground without any insulation, they would work, because the current follows the wire in preference to the earth for so short a distance.

(61) I. M. W. asks: What is the difference between a galvanic and a faradic current, or between galvanization and faradization? A. The term galvanic is sometimes applied to currents produced directly from a battery, and faradic to those produced by induction. In other words, the former term is applied to primary and the latter to secondary currents. The distinction is rather fanciful, and not sanctioned by the best authors.

(62) T. B. S. asks: What is the rule for determining the electromotive force necessary to overcome a given resistance? A. The force required depends upon the power you wish to develope. The Atlantic cable can be operated with a battery consisting of a percussion cap, a bit of zinc wire, and a pinch of salt. This minute battery, which has an electromotive force of only half a volt, is sufficient to overcome the resistance of a wire extending across the ocean, and then to possess power enough to work Thomson's galvanometer. On the other hand, a small electric motor frequently only has 50 feet of coarse wire, and requires a battery of 50 volts to work it. The power or strength of current is ascertained by dividing the electromotive force by the resistance. Thus if E represents the electromotive force, R the resistance, and P the power of the current, then the following formula will always give it correctly:

$$P = \frac{E}{R}.$$

(63) F. G. asks: What is the momentum of 1 lb. after 17 inches fall? What is its momentum after 198 inches fall? What is the formula used to solve such problems? A. Multiply the weight in lbs. by the time in seconds.

(64) J. L. B. says: 1. I am running an 8 horse power portable engine, and am troubled with foaming. What causes it, and how can I prevent it? A. It is probably caused by dirty water. Clean the boiler, and blow off frequently. It may be due to a defect in the boiler. 2. The barrel of my boiler is 30 inches in diameter, of ¼ inch iron, the firebox being a little thicker. According to Bourne's rule, I make the highest safe working pressure about 80 lbs. per square inch. Would it be unsafe to carry 100 lbs., which would be but little more than ⅓ of the bursting pressure? A. We would not recommend it. 3. In a recent issue you recommend a good feed water heater and frequent blowing off to prevent scale. Do you mean to blow off a portion of the water from the bottom of the boiler? A. Yes. 4. Suppose two tight cylinders or barrels, each having a perpendicular pipe inserted, the pipes being of equal hight but of different diameters (¾ inch and two inches respectively), and all these filled with water, would the pressure per square inch be the same in each barrel? A. At the same relative point in each, it would.

(65) W. H. G. asks: How is brass spun? A. The brass is secured to a pattern on a revolving mandrel, and a blunt tool is pressed against it. 2. Is there any work on the subject? A. We think not.

What is meant by mule spinning? A. The mule is a technical name of a machine for spinning cotton.

(66) W. H. C. says: 1. I supposed that water is only slightly condensed by the greatest pressure, but Steele's "School Philosophy" says the water at the bottom of the ocean is very much condensed by the great pressure. Is this correct? A. Water is compressed about 0·000053 for each pressure of one atmosphere that is applied. 2. How much does this condensation amount to at the greatest depths? Is it true that, in the deepest parts of the ocean, heavy bodies, such as rocks or even iron and lead, do not sink to the bottom? Does the great pressure upon deeply submerged substances tend to increase their buoyancy independently of the condensation of the water? A. It is easy to see that, even with this slight compression, water may become much more dense at great depths. A submerged body is pressed downward by its own weight, and upward by the weight of an equal volume of water, so, of course, if the water is sufficiently compressed, any substance will float in it. 3. Do you think the freshly drowned human body, divested of clothing, will sink to the bottom of the deep sea? A. No.

(67) E. G. says: 1. I am making a sawing machine to run by foot power. What sized saw can I use? A. About 6 inches in diameter. 2. How many revolutions per minute should the saw run? A. About 400 or 500. 3. How many revolutions should a bit in a boring machine run per minute? A. About 400 or 500.

(68) T. B. K. says: Our steam tug ordinarily draws 9 feet of water, when loaded 10 feet. Her propeller is 7 feet 1 inch in diameter, with 4 blades; the greatest width of blades is 20 inches. It is placed as low down as admissible, so that its ordinary immersion is 2 feet below the surface of the water. It is driven by an upright 24 inch direct action cylinder, of 24 inches stroke. With 45 to 50 lbs. of steam she handles the wheel like a toy, and tows well. We are about to build a new hull, with same draft of water. We can carry 80 to 100 lbs

Can we not, with perfect propriety, carry a larger wheel? Our present shaft is 5⅝ inches. If we enlarge the wheel, will it be necessary to enlarge the shaft? A. We think that you can safely increase the diameter of wheel to 8 feet, and that a 5½ inch shaft will be large enough.

(69) L. H. R. asks: 1. I heard a gentleman from Utica say, the other morning, that his mercury thermometer stood at —41° Fah. Is it not to be doubted? A. The thermometer could not quite indicate correctly, as mercury freezes at —39·5° Fah. 2. Has alcohol ever been frozen? A. No.

(70) J. D. S. asks: Why would not the rotary blower, described in the SCIENTIFIC AMERICAN of January 23, 1875, make a good steam engine by admitting the steam at D and exhausting at E? A. It would probably not be economical.

How much will a cubic inch of nitro-glycerin expand on explosion? A. About 13,000 times.

(71) C. S. A. says: The amount of rain that has fallen in this country for the past ten years will average about 46 inches. If a vessel is set to catch rain water, and the water allowed to stand in the vessel as it falls during the year, what percentage of the water will be in the vessel at the end of the year, allowing the water to escape only by evaporation? A. It will vary in different localities, and must be determined by experiment.

What is meant by dry steam? A. It is steam that has no water mingled with it, and is commonly produced in a well designed boiler.

What is the average cost of building a railroad embankment, 6 feet high, with upper base of 10 feet and lower base of 28 feet, of earth dug along the sides of the embankment? A. Your question is too indefinite. You will find some valuable estimates for different cases in Trautwein's "Engineer's Pocket Book."

Are the engineers now at work on the tunnel from Jersey City to New York? A. No.

(72) S. T. says, in reply to L. H. H., who asked what to do with belts that have become glazed and hard: Run the belt very slowly, and sponge with warm water on both sides; then with a scraper take off the gum, and oil with neatsfoot oil. Attend to it once a month with the scraper and oil; the scraper should not be too sharp nor be straight on edge, but rounded a trifle. If your belt cannot be run slowly, take it off: but it is better to keep it on if possible.

(73) C. L. says, in reply to M. W. H., who asked if cherry tree gum is of any value for mucilage: Having made use of it for two years, I can answer, yes. It is darker, but I think fully as strong as gum arabic.

(74) H. A. H. says, in answer to several correspondents' inquiries regarding the power necessary to propel steam yachts, and the speed to be obtained by the use of a definite amount of power: Assuming that we wish to give the vessel a moderate speed, we calculate the resistance from the greatest immersed section:

$V=\sqrt{\frac{K L H}{A}}$, and $H=\frac{V^2 A}{K L}$ where K=coefficient for speed and horse power, V=velocity in miles per hour, A=area greatest immersed section, H=horse power, L=length of boat on water line. In words, the speed in miles equals the square root of the length on water line multiplied by the horse power and by a coefficient, K, and divided by area of greatest immersed section in square feet. The second formula is: The horse power equals the square of the speed multiplied by the area of greatest immersed section in square feet, and divided by the length on water line multiplied by the coefficient. The coefficient mentioned above varies with the fineness of the lines, from 1·1 in very full lines to 1·9 in very fine lines. The above rules are found to agree very nearly with the performance of various steam yachts now constructed.

(75) H. M. W. says: It may perhaps interest F. C. G. and others to know of a method of taking off the tin from tinned plate without acid. I read a short account of it in the *Jahresbericht der Chemie*. It consists in boiling the scrap tin with soda lye in presence of litharge. This ought to pay, as there are plenty of objections to the use of acids, which unfit the iron for some uses.

(76) C. says, in answer to G. W. B., who inquires about removing clinkers from a stove: My experience is that if, when the stove is thoroughly hot, a few lumps of lime, or even oyster shells, are placed in the stove, as near the clinkers as possible, the latter will be softened or fluxed; and as the fire burns down, they may be scraped off with a poker or shovel.

(77) W. says, in reply to the question of A. B., asking the distance passed over by a fly on the rim of the driving wheel of a locomotive while the locomotive runs 50 miles, the driving wheel being 8 feet in diameter: The fly passes over a cycloid at each revolution of the wheel, and with such a wheel he will travel 32 feet at one revolution; and while the locomotive runs fifty miles, the fly will travel 63 miles, $3,494\frac{4}{10}$ feet.

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

J. F. W.—It is galena, a valuable lead ore.—A. B.—No. 1 is oxide of iron, with silex. No. 2 is copper pyrites, a valuable copper ore. No. 3 is black oxide of iron. Nos. 4 and 5 are talcose schist, not valuable. No. 6 is chlorite schist, not valuable. No. 7 is chlorite and micaceous schist. Nos. 8 and 10 are yellow oxide of iron in schist, not valuable. No. 9 is magnetite in steatite. No. 11 is red oxide of iron in schist. No. 12 is iron ore. No. 13 is copper pyrites, valuable. No. 14 is magnetic iron ore, good. No. 14 is mica schist, containing quartz, silex, and oxide of iron. No. 16 is mica schist. No. 17 is micaceous schist. Two other specimens are schist, somewhat stained with green carbonate of copper, not valuable.—J. M. H.—It is a carbonate of lime and magnesia, containing iron pyrites.—A. E.—No. 1 is clay, colored with hydrated oxide of iron. No. 2 is silicate of lime with augite. No. 3 is augite, a silicate of iron, manganese, lime, and magnesia. No. 4 is copper pyrites.—E. P. C.—It is bog iron ore, containing a large amount of insoluble silicious matter.—W. H. L.—It may be used as a polishing or cutting powder for metals and minerals.—G. S.—It is marcasite or white pyrites, and contains 47 per cent of iron and 53 of sulphur.—J. J. T.—It is composed of the same material as pure sand, which is used in glass making, etc., but it is too common to be of especial value. Finely crystallized pieces are prized as rock crystal. Some of the lower priced ornaments are sometimes cut from the last.—J. H. P.—The finer colored varieties of tourmalines are sometimes used as gems.—W. Y. T.—It is blende, and contains 67 per cent of zinc and 33 per cent of sulphur.—We have received, in a box without any address, 1 specimen of valuable hematite ore, 1 of trap rock, and 4 of a conglomerate containing red hematite, from Bucks county, Pa.

H. L. asks: What kind of a purchase is the best to pull up a drive well pipe with? I have used a chain and two jack screws, but it is a great deal of trouble and hard work to keep the chain from slipping.—C. W. J. asks: What is the best and speediest plant for a good, compact, and secure hedge?—G. W. W. asks: How can I pulverize mica very fine in large quantities?—W. E. C. asks: 1. Has chloride of aniline been successfully employed in the production of a good black on wool, more especially on felt hats? 2. Which is the best mode of dyeing a bright black on felt hats?—G. H. F. asks: What is the ornamental work on stove patterns made of? What will make it adhere to the wooden pattern?—A. J. H. asks: How is a silver gray color produced on fancy panel work, picture frames, etc.?—B. A. asks: Were any plants indigenous to the North imported into the South by means of our armies during the late war (see p. 131, vol. 32)?

COMMUNICATIONS RECEIVED.

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

On Talking Ants. By W. C.
On Alkaloids by Synthesis. By R. B. W.
On Spiritualism. By T. B.
On a New Tempering Composition. By T. J. B.
On a Prolific Snake. By A. A. R.
On High Lakes. By S. T. W.
On Glycerin in Boilers. By W. F.
On Domestic Medicine. By G. H. J.
On Kaolin. By C. T. S.

Also enquiries and answers from the following:

J. M. S.—J. D. H.—A. O.—W. M.—C. B. L.—C. C.—T. B. G.—R. T. P.—E. A. M.—L. A. E.—C. E.—C. S. B.—T. F. M.—S. E. P.—O. M.—W. P.—S. S. A.—O. C.

HINTS TO CORRESPONDENTS.

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

Enquiries 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 enquiries analogous to the following are sent: "Who sells aniline blue dyes? Who deals in manganese? Who makes wooden paper hangings? Who sells horse radish graters? Who sells giant powder? Who sells a substitute for cloth for billiard tables? Who sells the cheapest toy engine? Who sells boilers for heating large buildings? Who will sell a right to use a gold plating process?" 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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8,188 to 8,190.—OIL CLOTHS.—C. T. Meyer *et al.*
8,191.—SODA WATER APPARATUS.—F. H. Shepherd *et al.*, Lowell, Mass.
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4,445.—J. Thompson, Crestline, Ohio, U. S. Face Tester for Millstones. March 1, 1875.

4,446.—Wm. Trabue, Louisville, Ky., U. S. Needle machine. March 1, 1875.

4,447.—E. S. Yentzer, Ottawa, Ill., U. S. Pantaloon stays. March 1, 1875.

4,448.—T. Prior, Carroltown, Miss., U. S. Churn. March 1, 1875.

4,449.—D. F. Mosman, Chelsea, Mass., U. S. Steam Heater. March 1, 1875.

4,450.—E. Davids and C. K. Jones, Bronte, Ont. Fumigating and Fire-Lighting Coal Oil Can. March 3, 1875.

4,451.—Wm. J. Manchester, Jr., Stittsville, Ont. Folding sash window. March 3, 1875.

4,452.—C. A. Shaw, Boston, Mass., U. S. Oxidized Lamp Wick. March 3, 1875.

4,453.—J. G. Taylor *et al.*, Port Huron, Mich., U. S. Extension Fire Ladder. March 3, 1875.

4,454.—H. Neilson, Toronto City, N. Y., U. S. Gravity Battery. March 3, 1875.

4,455.—H. E. Casgrain *et al.*, Quebec, P. Q. Illuminating Gas Machine. March 3, 1875.

4,456.—C. C. Jordeson, Montreal, P. Q. Revolving Screw Windlass. March 4, 1875.

4,457.—H. Bolton, Elizabethtown, Ont. Dog Power. March 4, 1875.

4,458.—A. Trumble *et al.*, Ottawa, Ont. Washing Machine. March 4, 1875.

4,459.—R. P. Spice, 21 Parliament street, Westminster, Eng. Gas Apparatus. March 5, 1875.

4,460.—F. P. Laubach, Catasauqua, Pa., U. S. Water Cooler. March 5, 1875.

4,461.—J. S. Royce, Cuylerville, N. Y., U. S. Harvester. March 5, 1875.

4,462.—D. Moodie, Bell's Corner, Ont. Potato Digger. March 6, 1875.

4,463.—W. Harris, Danville, Vt., U. S. Stereoscopic Camera. March 6, 1875.

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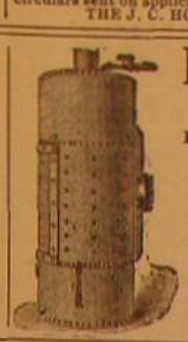
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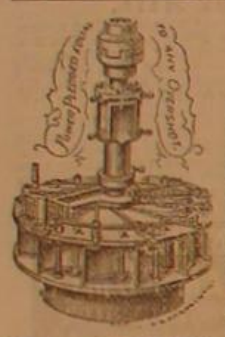
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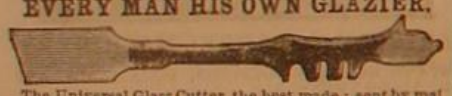
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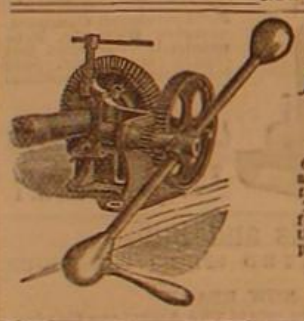
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THE PNEUMATIC DESPATCH SYSTEM IN THE WESTERN UNION TELEGRAPH BUILDING, NEW YORK.

We have recently examined, with considerable interest, the pneumatic system of transmitting telegraphic messages between the operating and receiving rooms in the newly constructed building of the Western Union Telegraph Company, in this city. In such an immense edifice, comprising eleven stories, it would obviously involve great delay to maintain the necessary communication by means of messenger boys, and consequently the apparatus which we describe and illustrate herewith has been introduced, with remarkably successful results. In the large engraving, Fig. 1, sections of several of the stories are represented, showing the manner of leading the numerous tubes through which the necessary current of air, which propels the packages, is maintained.

Those of our readers who have had occasion to send a telegram at the central office above named may remember that, after they had delivered the writing to the clerk, that functionary rolled the paper in a little parcel and inserted it in a wood and leather case, of the manner and form shown in the upper portion of the illustration, Fig. 1. He then dropped the case into an open tube, leading up through his desk, at A, and perhaps announced that the packet had reached the operating room, in the seventh story, almost before the curious watcher of his proceedings had had time to draw a second breath. The packet appeared to be sucked into the tube, and so in fact it is, and in about two seconds it is drawn up almost to the top of the great building. After leaving the clerk's hand it passes down through the wide curve in its conduit, at B, and thence ascends the straight portion of the same, until it jumps forth from the end of the tube in one of the compartments of the receptacle, C, in the operating room. A section of a portion of this receptacle is shown in Fig. 2, in one compartment of which a packet is seen emerging from its tube. The compartments, C, Fig. 2, are entirely cut off from the main portion of the case, being constructed within the same, so that above them and extending over all is a large empty chamber, E. With the latter, however, each compartment communicates by an orifice, F, which is provided with a cover opened or closed at pleasure, thus, as will be seen further on, throwing any tube into or out of action, or moderating the air current therein. In the center of the receptacle and opening into the upper chamber, E, is a large tube, D, which, as shown in Fig. 1, extends down beside the pipes, B, and connects with a blower in the cellar. Regarding this blower we have, on other occasions, had considerable to say, but a word with reference to it here may not be amiss. It is a positive blast rotary blower, invented and constructed by the well known firm of P. H. & F. M. Roots, of Connersville, Ind., represented in this city by Mr. S. S. Townsend, general agent, No. 31 Liberty street. The machine has long been in use in iron founderies, machine and blacksmith shops, pork-packing and other establishments, and, besides, has met with extensive employment for ventilating purposes in buildings, ships, mines, and other localities. It will be understood that, in the present instance, the blower forces the air out beneath, so that the current is drawn down the tube, D, through the chamber, E, in the receptacle above, thence through the orifices, F, and compartments, C, and finally up through the pipes, B. Thus used as an exhauster, and at the slow speed of 120 revolutions per minute, it draws down five cubic feet of air per revolution, or 36,000 cubic feet per hour, thus propelling the packets, and at the same time (by removing the last mentioned aggregate quantity of air from the atmospheres of the rooms with which the pipe orifices communicate) serving as an excellent and efficient ventilating apparatus.

After a packet arrives in the upper story, the person stationed at the receptacle lifts a little window in the compartment which it enters, takes out the case, extracts the paper therefrom, and passes the message at once to the proper operator, who immediately telegraphs its contents to their destination. The case is then returned to the first story by dropping it into the open tubes, G, through which it falls by its own gravity, landing in the box, H, whence it is again taken out to be filled and started back on its journey.

Of course there is a large number of the conduit pipes, B, as one opens before every desk at which telegrams to be despatched are received. The whole system, however, is so arranged as to be readily accessible, through movable panels placed in the walls at points traversed. Beside the general set of pipes there are auxiliary circuits, in some of which lateral tubes lead to the offices of the President, the General Superintendent, the Treasurer, and the Associated Press. In each of these rooms is a small case, I, provided with glass windows to be raised for interior access, similar to those in the large receptacle in the operating room. This case is divided vertically into two compartments by a wire gauze partition, and into each a tube enters, one tube leading to one of the compartments in the main receptacle above, the other being merely a drop pipe for return messages or empty cases. No explanation is needed to show that a constant suction, by the means already described, is maintained in one of these tubes, so that the officer wishing to forward a message has only to insert the packet, which travels, as before, to the operating room, and the answer to his question, from a station perhaps on the other side of the world, within a few minutes drops back in the opposite compartment. It will be noticed here that this return is accelerated along the lateral pipe by the exhaust from the first conduit acting through the former, through the wire gauze partition in the box.

The entire apparatus is quite ingenious, and for such extended use presents perhaps some advantages over the older application of the Root blower to the same purpose, illustrated in Fig. 3. This arrangement was employed in the old Western Union building, and as seen is operated by hand. The principal point of difference lies in the fact that in this case the packets are driven up by a blast instead of drawn up by suction. The cases are inserted in the receptacle shown near the hand wheel, and thence are blown upward until they strike a curved guide, which causes them to enter a box placed for their reception. In returning, they simply fall through the tube and slide into a suitable receptacle. This plan may be operated with horizontal or perpendicular pipes, with a single pipe, or with a series of tubes leading throughout a building.

The method which has been put in operation in the Western Union Telegraph building is similar to the design of Mr. A. E. Beach, of the SCIENTIFIC AMERICAN, for pneumatic postal transmission, which was first put in practical operation on the premises of the Broadway Underground Railway Company, corner of Broadway and Warren street, in 1870–1, and has heretofore been described in our columns. In that example a Root blower was employed in the same manner as here illustrated in Fig. 1, to exhaust the air from a general receiving box, with which the pneumatic transmitting tubes communicated. The latter curved about in various directions through the premises; and when letters or parcels of any sort were dropped into the tube, they were instantly carried forward into the receiving box. The latter was so arranged as to permit the removal of the contents at will. The successful operation of this method attracted much attention. Even the smallest bits of thin paper, pennies, envelopes, handkerchiefs of visitors, newspapers, and packages of considerable weight were unerringly transmitted and delivered. The highest velocity of transmission was between 40 and 50 miles per hour, the pipes being six and eight inches in diameter. This general design of postal

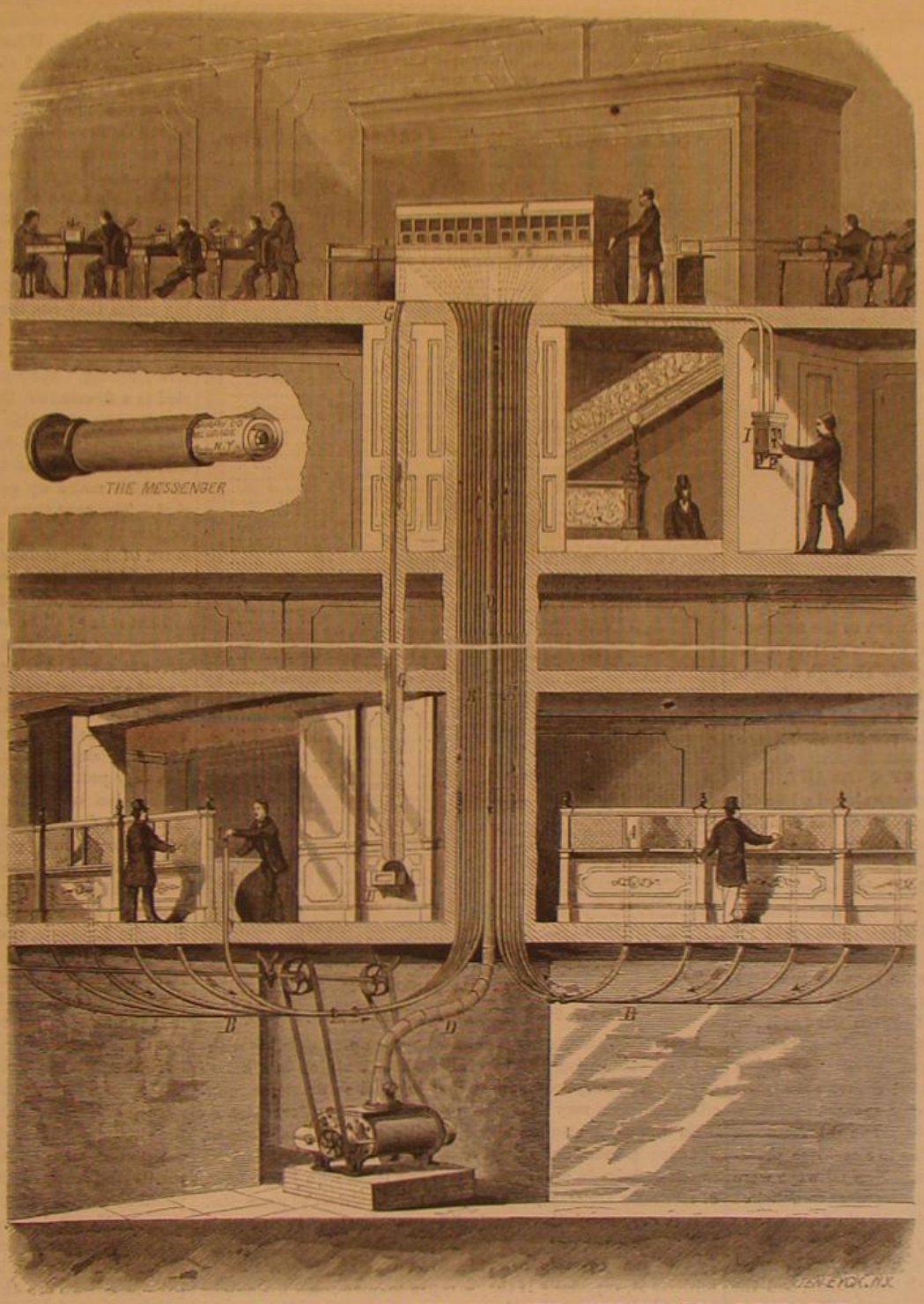
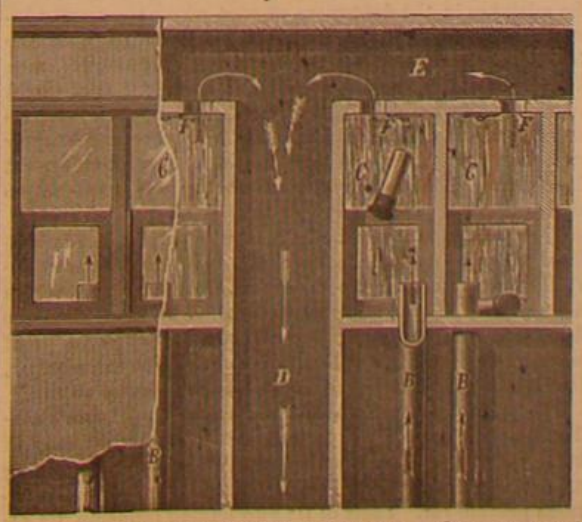


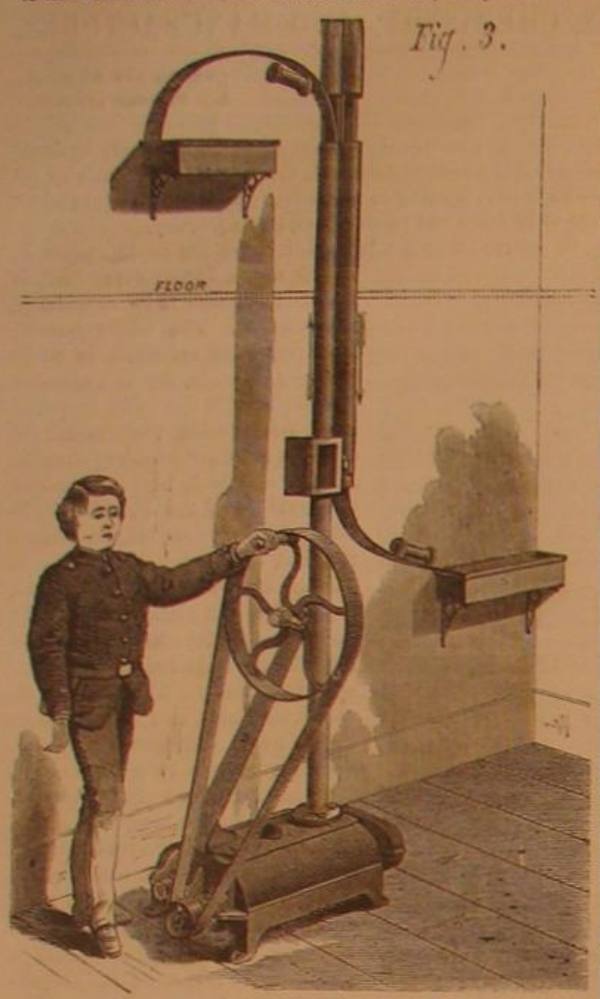
Fig. 1.—ROOT'S BLOWER, APPLIED TO THE PNEUMATIC DESPATCH.

Fig. 2.



transmission consists in having tubes of about eight inches in diameter, laid under the streets and made to communicate with the various lamp post letter boxes. These pipes radiate, in lengths of a half mile, in various directions from a postal station, where they communicate with receiving boxes in which an exhaust is maintained by Root blowers, as shown in our engraving. Thus, whenever letters are dropped in at the lamp posts, they fall at once into the pneumatic tube and are instantly carried forward, on the wings of the wind, to the nearest station, and thence delivered, or by the attend-

Fig. 3.



ant dropped into the tube that leads onward to the next station, and so on. The general adoption of this system by the post office, allowing that it will operate through tubes of half a mile length as effectively as it does at the Western Union office, would expedite the collection and delivery of city postal matter, and greatly promote the public convenience.

THE INDUSTRIAL CONDITION OF GERMANY.

The delusive prosperity which Germany enjoyed while the French indemnity was passing into the country has resulted as disastrously as the similar condition of things consequent to our war did with us. At the close of hostilities there was much to be done, money was plentiful, and wages high. Everybody believed that a new era had dawned for Germany, and that the speedy development of its resources could receive no check. A feverish energy of achievement took the place of sober calculation, and wild extravagance in every form of enterprize was mistaken for substantial business growth. The stolid German became as speculative as if he had been transported to America, and with precisely the same result so far as national prosperity went.

Describing the industrial and financial experience of the past five years in Germany, a *Tribune* correspondent pictures a condition of things very easily understood in this country:

"The abundance of capital gave rise to a reckless prodigality in all sorts of private enterprises. New railways were undertaken, great manufacturing companies were established to rival Krupp, and shipyards to compete with the Lairds were organized. Above all, new and costly houses sprang up in all parts of Berlin and almost every other city. The most popular sort of investment was in stock companies, and the multiplication of stock companies in 1871 and 1872 was marvelous. Money was plenty, wages were high, and hod carriers drank champagne at their daily work. But this did not last, and could not last. First the stock companies began to totter, and at length there was a general crash. Then wages began to fall, while the necessaries of life were stationary. The fortresses were completed, and thousands of workmen thrown upon the market. People began to leave Berlin on account of high prices until the evil spread and distributed itself throughout the country. The stock companies went to pieces one after another in all the chief cities, until that sort of organization became another name for everything unstable and treacherous. The new palaces of Berlin stood unoccupied, and fewer new ones were of course begun. In short, a complete transformation has taken place; and in spite of the five milliards, it is today very difficult to raise money, and still more difficult to realize it on investments. Now it will help no emigrant's fortune to return to Germany, even if he escape impressment into the military service."

Multitudes of great manufactories are unable to keep up operations, and wholesale discharges of hands are the result. The reduction in wages has been twice as severe as in this country, with a proportionally larger number out of employment. As an instance, the fact is mentioned that, in Berlin, last winter, it was difficult to get street laborers at two dollars a day, while this winter an indefinite number could be had at one third that price.

Scientific American.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS.

One copy, one year, postage included.....$3 20
One copy, six months, postage included..... 1 60

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VOLUME XXXII., No 15. [NEW SERIES.] *Thirtieth Year.*

NEW YORK, SATURDAY, APRIL 10, 1875.

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HOW SCIENCE IS ANNIHILATED.

Everybody admits that a man who sets up as a doctor without first submitting to a careful medical training is a knave or a fool. Everybody admits that to practise medicine properly requires a very thorough preliminary education, and no little practical observation of the ills that flesh is heir to. Yet nine persons out of every ten stand ready on all occasions to offer advice in case of sickness; and those who know least of medicine are least conscious of their unfitness to prescribe.

It is very much the same in Science. To be able to read a book of Science, or even floating paragraphs about it, is taken by very many people as evidence enough of their ability to criticise it, especially if they happen to have some little right to speak in some other department of thought. Unmindful of the fact that the errors of scientific theory have always been discovered by scientific men only, the unscientific and antiscientific hold themselves ready at all times to point out the mistakes in the deductions of men who have spent a laborious lifetime making themselves acquainted with the facts of the case, meeting the cautious suggestions of men like Lyell or Darwin with a confident assurance that would be justified by nothing short of infallibility. As a rule, we smile at these volunteer champions of ignorance, and let their vaporings pass. Now and then, however, they afford typical illustrations of antiscientific reasoning too good to be slighted.

Of this character was the lofty rebuke to Science administered the other day by a somewhat prominent Doctor of Divinity, in a morning paper; a rebuke, we may add, which has been the source of great consolation to more than one dear soul alarmed at the spread of knowledge, in proof whereof we have, in a subsequent issue of the same paper, letters of rejoicing in regard to the Doctor's championship.

The special science which falls under the Doctor's condemnation is geology—if, indeed, it is in any way worthy of being called a science. Particularly is it rebuked for talking of periods of time more protracted than the Hebrew scriptures provide for. Facts of its own finding condemn its assumptions. For instance, one of the remote periods of geology is the cretaceous, or age of chalk. Between that time and this, incalculable ages have come and gone, say the geologists. Sheer assumption, says the Doctor, for deep sea soundings prove that chalk is now being deposited in the Atlantic ocean; today is the chalk age, and your long drawn periods of time are pure myths!

Again, the geologists set the carboniferous epoch so far back that the six thousand years of Hebrew history dwindle to insignificance. All that time is wiped out with a paragraph, a floating paragraph which the Doctor has discovered going the rounds of the country newspapers, to the effect that the wooden supports used in certain of the Hartz mines have been converted into lignite since they have been put in, only a few centuries ago. See! cries the Doctor: a thousand years at most suffice to convert wood into coal; how dare you, in the face of such evidence, presume to say that sixty centuries would *not* suffice for the production of your carboniferous strata?

"What will geologists say to that?" asked an excellent lady, after reading the Doctor's triumphant overthrow of their science—"falsely so called."

We could not say, though we modestly surmised that, if compelled to notice the indictment, they would probably say: "What of it?" What has chalk to do with the antiquity of the cretaceous era? Who that knows anything of geology imagines that the age of a coal seam is in any way dependent on the time required to turn wood into coal? The chemist can do that in a few hours. Shall we say, therefore, that the carboniferous period was yesterday, and that all the stupendous changes that have since taken place in the earth and its inhabitants, happened last night?

Besides, if that is the line of argument, why stop halfway? Any geologist will willingly furnish the Doctor with arguments ever so much more sweeping than those he uses. For instance, in the South Seas, the corals of today are forming strata that are the exact counterparts (fossils excepted) of—say—the Trenton limestones. In other parts of the world sand deposits, such as composed the Potsdam sandstones, are now forming. Why not say, therefore, that the silurian period is a figment of the imagination: that it is now, yesterday, or any time this side of Adam's day? Still worse: it was discovered last year that, in the deeper parts of the Atlantic, strata of mud are now forming, precisely like the strata which make up certain slates of the so-called azoic period. The next time the Doctor demolishes geology, let him declare that this fact proves that the Laurentian period, instead of being countless ages old, is altogether modern! It will make his case seem much stronger to the ignorant, and will not weaken his argument in the least.

That it is at all necessary to comprehend a theory or an argument, or the bearing of known facts upon either, seems never to occur to critics of this sort. Indeed, the first requisite of an anti-science critic would rather appear to be a thorough and radical misapprehension of what Science teaches. That enables him to mispresent Science boldly, with no risk of being charged with a wilful perversion of truth.

A very pretty, though very mild, case of a scientific misapprehension occurs in an editorial in the last issue of the *American Garden*. It would not be noticeable in a strictly evangelical family paper, but seems a trifle odd in a publication devoted to a department of natural science.

The editor, very properly, dubs the article "Scientific Vagaries." Its subject is a paragraph from a recent lecture by Sir John Lubbock, upon the natural relations of insects and flowers. After mentioning the observations of Sprengel and Darwin, Sir John remarks that it is to insects that we owe the beauty of our gardens and the sweetness of our fields, and that the flowers owe to them, not only their scent and color, but their very existence in their present form. "Not only have the brilliant colors, the sweet smell, and the honey of the flowers been gradually developed by the unconscious agency of insects, but the very arrangement of the colors—the circular bands and the radiating lines, the form, size, and position of the petals, the arrangement of the stamens and pistils—all have reference to the visits of insects, and are disposed in such a manner as to insure the great object which these visits are destined to effect."

This, says our critical editor, scornfully, is a fair sample of the errors and vagaries into which intelligent men may be led—men who see things from only one point of view, and "endeavor to twist and bend every fact or circumstance in Nature to make it fit the theoretical structure of which their preconceived notions suggest the plan."

"No doubt," our critic adds, "the color and scent of flowers attract insects to them for the purpose of aiding or bringing about the fertilization and consequent fructification of the seed for the continuation of the species—this latter being the end and aim of all physical life." [What if Darwin had said that?] It is freely admitted, also, that the intricate and wonderful arrangement of floral appendages are often peculiarly striking, and apparently throw in the way of the fertilization of the flowers obstacles that can be counteracted only by the aid of insects. But—and this is the culmination of the argument, "but the idea that insects, ages and ages ago, went to work, consciously or unconsciously, to develop the various scents, the multitudinous shades and combinations of colors, and the marvelous structure of flowers (and this last as an obstacle to their own labors) is—what? We should say a curiously stupid misreading of very plain English; but the critic suspects nothing of the sort, boldly pronouncing it "something absurd and overtasking the credulity of man"!

"Is it not," he asks, "more easy to believe that there is an intelligent Creator, First Cause, or Primal Cause (as men have variously expressed it), who has created things as they are?" etc., etc.—as though easiness of belief had anything to do with the matter. Then he winds up with this ingenious double question: "Are not the ideas of Sir John Lubbock

as here expressed, most illogical? And is this not a good specimen of "'Science, falsely so-called?'"

True, O *Garden!* Very true—"as here expressed." Fortunately, however, Sir John entertains no such ideas; and we may set it down as a rule that, when men outside the ranks of Science—the foremost ranks at that—essay to demolish Science, it is usually their own "bogus" Science, as in the instances we have noted, that comes to grief.

HOW A PIECE OF COAL BURNS.

There is no mistaking the words of a genuine thinker. His subject may be most difficult, but what he says is sure to be "understandable of all men." No matter what Priestly wrote about, his sentences were transparently clear. Franklin's English was uniformly direct simple,and precise. Men may quarrel with Darwin's opinions, but they have themselves alone to blame if they mistake his meaning. Huxley's style of speech and writing is as idiomatic as Mark Twain's. Faraday's lectures conveyed the latest discoveries of Science in sentences which children could comprehend. When our own Professor Young speaks to a popular audience, they wonder how astronomy can be called abstruse: the exploration of the sun seems as easy as a trip to Jersey. Professor Meyer will illustrate the mysteries of sound or magnetism so simply and clearly that his non-scientific hearers never suspect the ingenuity of his way of putting things, or how easily a less exact thinker could make a mist of the whole matter. In Professor Barker's hands the spectroscope seems as simple as a child's toy,the analysis of the Universe with it as intelligible as the adventures of Robinson Crusoe; and Oliver Wendell Holmes will illuminate a social or metaphysical problem so happily that the average reader never dreams how keen is the intellect that sparkles so playfully about it, or how many duller men have broken their heads over it.

But it is needless to multiply examples. The least discerning reader can tell when a man knows what he is writing about, whether he has anything to say, and—"What has all this to do with the combustion of coal?" Do you ask? Not much directly, we admit. Still it may help us to intimate indirectly the scientific rank of the ambitious author of "The Sun and Earth as Forces in Chemistry," a work that aims at nothing less than a revolution in chemical science This is how coal burns, according to his system

"Carbon combines with oxygen, leaves its solid shape for a gaseous one forming carbonic anhydrid gas, and this greatly because of carbon's own heat constitution; and, further because of the intense nearness of the oxygen to carbon and our earth's comparative distance; this because also of the excellent heat capacity of oxygen itself; and thus carbon with oxygen leaps up into carbonic anhydrid gas, earth loosened into the highest sun forms, approaching that of oxygen itself, for the heat capacities of carbon are near those of oxygen; but the oxy-terric struggle for carbon is arduous; our earth has greatly in her favor her immensity, but then she is far off, and her forces decrease with distance; but even so, for freeing carbon from our earth's control, oxygen requires always, as we know, the further assistance of heat on carbon; we always for oxy-carbonic combination, have to set fire to carbon."

Nice and easy, isn't it? It's a wonder nobody ever thought of it before!

UP OR DOWN IN RAPID TRANSIT!

The clash of systems and the wreck of—plans, for rapid transit in New York, betokens great activity in the development of the question, if not an approaching settlement of it.

Eight years ago the State Senate Commission appointed to investigate this matter received for consideration five plans for underground railways, as many for mixed depressed and underground systems, and about twice as many for elevated roads. The Committee of the American Society of Civil Engineers,appointed last fall, found the number of projects increased to seventeen for underground roads, eight for depressed, and fifty for elevated. The latter style seems especially attractive to ingenious architects with little to do, and consequently the "elevated" devices put forth are out of all proportion to the rest. Speculative minds cannot but be attracted by speculative projects,the absence of demonstrated facts and known experiences leaving room for a free play of the imagination; besides, the opportunities for architectural invention afforded by elevated ways are so much more inviting than the severe simplicity of tunneled structures, to men naturally desirous of putting their work where it can be seen, that the temptation to make pretty plans and pictures of such roads seems all but irresistible. How far this preponderance of plans for roads above ground assisted the known original bias of some at least of the members of the Committee, in leading them to look most favorably upon the elevated system, it is not our purpose to enquire; it is enough to say that the adequacy of the reasons they give for reversing the decision of the Senate Commission will be questioned by very many able engineers.

It may be well at this point to recur to the conclusions arrived at by the Senate Commission, and notice how completely the judgments expressed by them have been justified since that time.

Their first position, that commercial, moral, and hygienic considerations all demand an immediate and larger addition to the means of travel in the city, needs no argument; it is admitted by all. Their second conclusion, that,if every avenue lengthwise of the island were to be occupied by surface rails, the relief afforded would be inadequate, has been substantially demonstrated. Every avenue, save Fifth avenue, has its line of street cars; yet it is true,as predicted,that "the pressure, with all its accompanying annoyances, inconveniences, and dangers," is as great as it was eight years ago, in fact much greater.

The third point, that the steam roads upon the surface, then in use, should be removed, has been largely complied with by the Harlem Improvement and the diversion of the principal trains of the Hudson River road to the east side of the city. That a central line alone would not suffice to meet the requirements for increased facilities is also admitted. The conclusion that elevated railways erected on supports in the middle or on the sides of the *present* streets cannot be *fully* adapted to the transportation of freight, and had not been tested in any practical way so as to warrant an unconditional recommendation of them for transportation of passengers, is but partially offset by the limited success of the Greenwich Elevated Railway in the transportation of passengers. The objections to a system of railways running wholly through blocks are urged as strongly by the Committee as by the Commission. That the growth of the city will soon demand, if it has not already, the construction of several lines of railways is also admitted on all sides. The only point directly combated by the Committee is the final conclusion of the Commission that underground railways passing under streets present the only speedy remedy for the present and prospective wants of the city in the matter of safe, rapid,and cheap transportation of persons and property Let us see how well the position of the Committee is sustained by their own showing

They claim, in the first place, that a prime condition of success with rapid transit in New York is that the roads be capable, as statistics clearly show, of accommodating a larger passenger business than is now done upon any steam railroad in the world, save the underground roads of London. The capacity of underground roads having thus been demonstrated, and their profitableness as well, it is difficult to see why a different plan should be experimented with, especially when, as the Committee justly observe, "rapid transit in New York is so nicely balanced between financial success and failure, that it cannot afford to pay for mistakes, either of principle, policy, or material detail." Another point urged by the Committee is that the required roads must not only be "absolutely safe, but appear so." As far as experience has gone the west side elevated railway is much safer than the surface roads; but it does not "appear so." Consequently multitudes of passengers take the surface roads in preference. This is true, even of those who live along the line of the road and thereby become familiar with its operation. Transient travelers, and in a city like this their number is very large, are still more doubtful of the safety of rapid transit on stilts. The underground road would be still safer, and what is more to the point, would appear safer. Besides, when the Harlem Improvement is complete, and the tunnel under the Hudson receives, as it necessarily will, the bulk of the travel from the South and West, the majority of the transient visitors to the city will of necessity make a large part of their suburban journey under ground; to complete the passage to the heart of the city in the same manner will be a matter of course, whatever the relative safety of possible routes may be. A road that has brought one safely four miles is not likely to be alarming for two or three or four miles more; and no comparison is forced with surface roads, as there would be were passengers compelled to leave the tunnel and choose between the street car and one twenty feet above the street.

Another condition of rapid transit, say the Committee, is that heavy trains shall not run over the lines. To our minds a very essential condition is that they shall be able to do so. If the wants of the city are to be adequately met, the rapid transit roads, the central ones at any rate, must be able to take up and convey the loads of passengers and freight brought in by the regular lines of railway leading to the city. To make elevated railways capacious and strong enough to perform the service is, we admit, impracticable: yet the work must be done. Unbroken transit is desirable for passengers and essential for freight. There must be as little breaking of bulk as possible. The superior advantages of underground roads (in connection with the Harlem Improvement and the Hudson River Tunnel) in this respect are immense: for freight could then be passed through the city, or from without to the centers of trade, with no change whatever.

Another condition insisted on,and very justly, by the Committee is that the interests of the public and of property owners along the line shall be thoroughly protected during the location,construction,and operation of rapid transit lines. "Some sacrifices (they say) are required of them, and they must suffer some inconveniences; the public must give the right of way upon two, or perhaps eventually four,avenues; the dwellers upon them must take the chance of some annoyance from passing trains, and the property owners, the risk of a possible depreciation of their property." And again they say: "Invasion of privacy is a part of the price which must be paid for rapid transit." The "cheekiness" of these assumptions—there is no other word for it—is amazing, when we call to mind the well established fact that the right of way *under* the streets already belongs to the city; that there is relatively no interference with private property or vested rights in the construction of underground roads; that there is no possible invasion of privacy below the pavement; that there is no possible invasion of privacy below the pavement; that the annoyance of passing trains underground is found in London to be practically *nil*; and that every road beneath the streets adds a new thoroughfare without reducing the already limited space above ground, and thereby helps to free the city of one of its most serious obstacles to individual comfort and freedom of outdoor travel, on foot or in private conveyances. The Committee also observe, with charming *naiveté*, that "the great obstacle to cheap rapid transit lies in the avenues," owing to their great width. This is certainly an unfortunate circumstance, if true, inasmuch as the avenues constitute the chief extension of the streets of the city in the direction of the greatest travel. It is consoling to think,however, that the objection applies only to elevated roads. The great width of the avenues fits them for underground roads peculiarly well.

It must not be inferred from anything we have said that we are opposed to elevated roads in principle. As temporary expedients in certain parts of the city, especially when traversing streets of little importance, they are undoubtedly a convenience. That they can be countedon for fully and permanently meeting the needs of the commercial and traveling community is quite another affair. Their alleged superiority on the score of cheapness holds only, if at all, when light structures for light service are taken into account. To compare in all cases slender elevated roads with broad and substantial underground ways,in point of cost,may be clever, but it is not convincing. As for the appearance of the elevated roads, the best the Committee can say is that they "need not be hideously ugly." No more need telegraph poles and telegraph wires; yet, with increasing public improvement in the matter of taste, the demand becomes more urgent that the poles be cut down and the wires run underground. How long could we count on public tolerance of elevated roads, though at first they might seem to be endurable?

A few words—in closing an article already too long—about the action of the Society of Engineers in maintaining as a society, a noncommittal policy touching the different projects for rapid transit now under discussion by the public. *The Engineering and Mining Journal* intimates that, in declining to publish the report of the Committee as an official expression of the Society's opinion, the Society stultified itself and jeopardized its hitherto well deserved reputation for honesty, independence, and impartiality. Still further, it is complained that, owing to the slim attendance at the meeting at which the report was received, a few members were able to compromise the Society in refusing to commit it to the line of policy which the *Journal* favors. To an unprejudiced mind, it would rather seem that the twenty-five gentleman who received the report acted with great discretion in avoiding any expression of opinion whereby the four hundred and twenty-five absent members would be involved, especially when it is well known that very many of those absent members favor other views than those arrived at by the Committee. To say that simply printing, on the cover of a report published by a society, a courteous resolution, to the effect that the society did not, as a body, endorse the views of the Committee, was a shirking of responsibility, or an endeavor to "smooth" or "ignore" the report, is simply childish

PROPOSED TUNNEL UNDER NEWARK BAY.

In approaching Jersey City from Newark, the tracks of the New Jersey Central Railway are carried across the marshes and over the broad waters of Newark Bay, on an elevated railway resting on wooden piles. The constant decay of this structure, especially that portion which spans the water, involves the practical rebuilding of the work once in about five years, and there are times, particularly in winter, when the concern is unsafe. It is at all times a source of expense, care, and trouble. "This," says the New York *Tribune*, "has led the Central Railroad to seriously consider the practicability of building a tunnel under the waters of the bay from Elizabethport to Bergen Point. Prominent engineers consider the project an easy one to accomplish, owing to the general flatness of the bottom of the bay and the solid condition of the earth to be found there, the driving of piles having demonstrated that little sand is to be met with, and that for only a short distance out from the Bergen Point beach. A rough estimate places the cost of a tunnel for double tracks, extending a distance of two miles and a half, at $6,000,000, and which, if built, would last for a century. The bay bridge has cost the company fully thrice its original cost, as the Chief Engineer estimates that it has been rebuilt three times since its first completion. An iron structure across the bay would be little improvement over the old bridge, whereas the building of a tunnel would leave the waters of the bay free to navigation. The matter will, in all probability, assume a definite shape within a year."

Another Trial of the Bessemer Steamer.

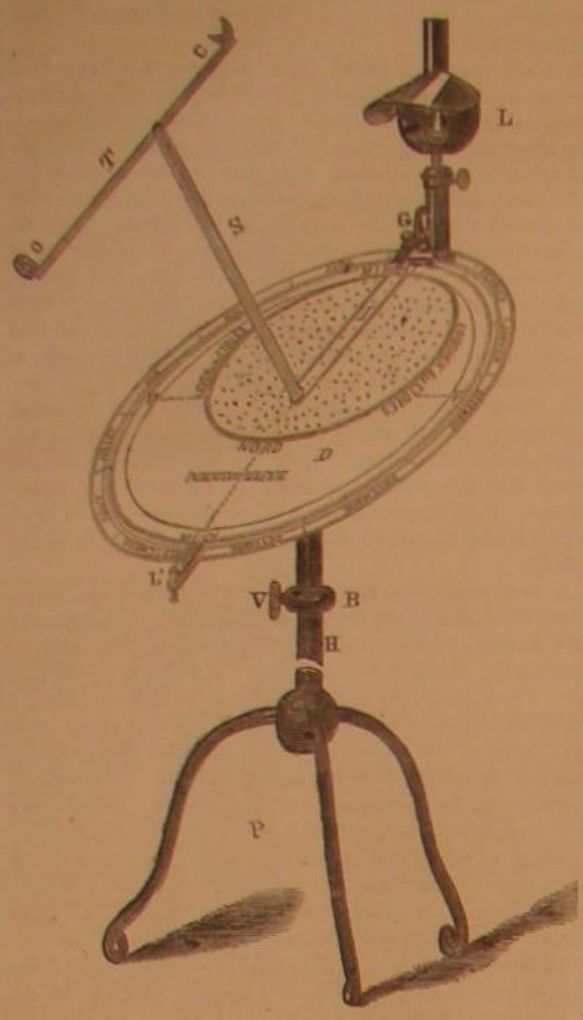
The Bessemer saloon steamer arrived at London, at the beginning of March, having made the passage from Hull in a heavy sea. The *English Mechanic* states that the hull rolls moderately and easily, and scarcely pitches at all. The machinery is believed to be capable of controlling the oscillation of the saloon; but the man employed to work it being of course inexperienced at the task, was not up to time in handling the levers. The vessel will be ready for Channel traffic in a few days.

DR. J. E. GRAY.—John Edward Gray, for many years the chief naturalist of the British Museum,recently died in London, aged 75. He published nearly 130 works during his connection with the Museum, the zoölogical collections of which were much increased, improved, and popularized under his care.

GENERAL GARIBALDI has brought forward a project for the improvement of the Roman Campagna. The general proposes to construct a canal in a straight line from Rome to Ostia. The canal is to be available for navigation and irrigation purposes. The cost of construction is estimated at $6,000,000.

A NEW STELLAR INDICATOR.

The annexed engraving represents a new and simple device for distinguishing the stars, which has lately been introduced in France. It consists of a suitable pedestal on which is placed a celestial chart, the latter being a projection of



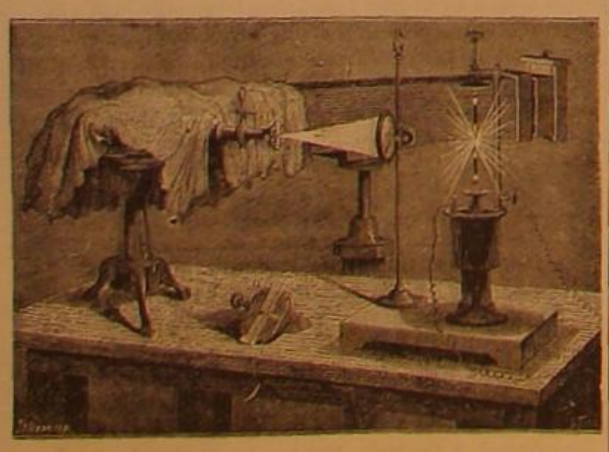
the heavens of the observer. It differs from ordinary charts in that the student is not obliged to hold it over his head and look up, in order to clearly define the positions of the stars; in other words, it is very much as if the sky were all reflected into a mirror, were such possible. Beneath the chart is an apparatus by which it may be oriented, the pole star serving as a guide.

When properly placed it suffices to regard the star, the name of which it is required to know, through the eye piece, O C, when it will be found on the chart between the branches of the alidade indicator, I. In the same way, inversely, by first settling the indicator, any star desired may be found in the heavens. The supporting card is marked around its circumference with the names of the months, and on an inner ring with the hours, midnight being above and noon below. From the portion devoted to the star map included between the branches of the indicator may be seen the aspect of the heavens at any day and hour, and also the hours of rising and setting of stars, of their passing the meridian, etc.

A small lantern gives sufficient light to illuminate the device without distracting the eyes of the observer.

SPECTROSCOPIC QUANTITATIVE ANALYSIS.

The spectroscope, through the discoveries of Mr. Norman Lockyer, is now successfully used as an instrument, not merely for qualitative but also for quantitative analysis. It has been found that the breadth and length of the spectroscopic



bands vary in proportion to the abundance of the simple bodies entering into the composition of any alloy. The variations being previously studied in alloys of known composition, a means of comparison is obtained whereby ingredients of a metallic compound can be determined instantly, thus saving the time and labor necessary to reaching a like result through ordinary chemical analysis, and at the same time with as great a degree of exactness. The appearance of the lines or bands used as standards, as well as of those to be examined, is permanently fixed by photography, so that careful study can be made of them by the observer at his leisure.

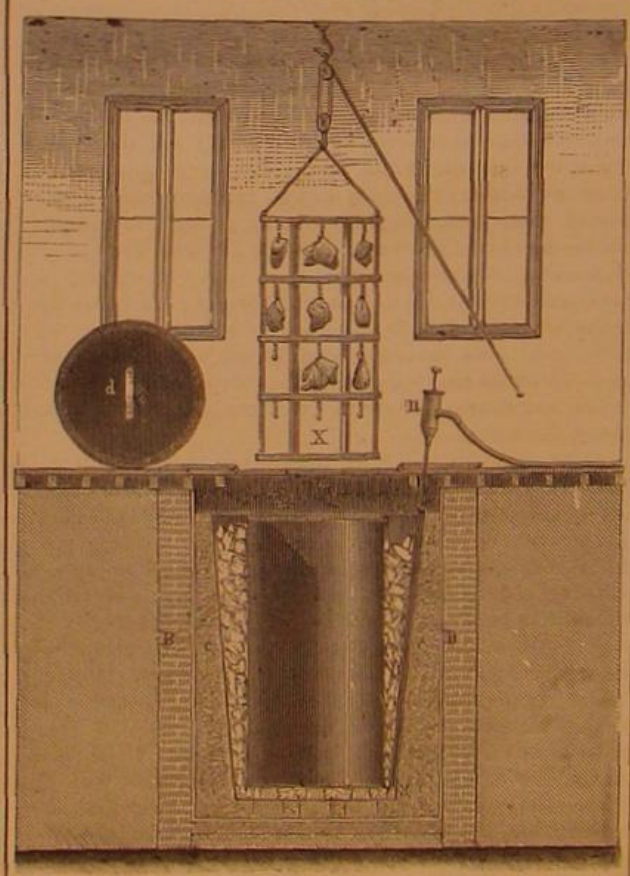
Mr. Lockyer has employed this method in testing alloys of gold and silver in the English Mint, in London, and the apparatus used by him is represented in the annexed illustration. It consists of an electric lamp, in the lower carbon of which a recess is made to form a little crucible in which to vaporize the alloy to be examined. This takes place very soon after the current is established, when the spectrum of the substance is thrown on a screen in a closed box, from which a photographic picture is at once taken. The slit in the spectroscope through which the light, after traversing a condensing lens, is admitted to the instrument is provided (0') with a movable cover which may be adjusted very accurately by means of a delicate scale. Three, four, or five spectral images may thus be photographed one under the other, so that the coincidence of corresponding lines may be rigorously compared. During day time sunlight is used instead of that of the electric lamp. The latter, at night, is operated by thirty Grove elements.

An Improved Poultice.

At a recent meeting of the *Académie de Médecine*, Paris, M. Le Fort read his report on a substitute for the ordinary linseed meal poultice, invented by M. Lelievre. It is prepared by saturating two superimposed layers of wadding with a solution of *fucus crispus*, or Carragheen lichen, and drying them in a stove after they had been submitted to strong pressure. In this way a sheet of the consistence of cardboard is produced, a portion of which is cut off when wanted, and soaked in hot water for fifteen or twenty minutes; this swells it out and fills its tissue with a mucilaginous fluid. It has been tried in several of the hospitals, to the great satisfaction of both patients and attendants. It can be prepared in large quantities beforehand, and will keep for a long time without undergoing any alteration. MM. Demarquay, Gosselin, and Verneuil pronounce it to be far superior to the linseed poultice; it keeps moist for more than sixteen or eighteen hours; it does not slip, is inodorous, does not readily ferment, nor does it soil the linen or bed of the patient. The new poultice is destined to render great service in hospitals and ambulances, and above all on board ship, where it is difficult to keep the linseed in a good state of preservation.

UNDERGROUND REFRIGERATOR FOR BUTCHERS.

The novel arrangement of a refrigerator for butchers' use, represented in our illustration, will perhaps be found convenient in that it admits of economizing space in a shop, and also of saving ice which would be preserved longer owing to the uniformly cool temperature of the soil. The de-



vice consists of a bricked cistern, B, lined with isolating material, C, and containing an iron tank between which and the isolating substance ice is packed. The meat is hung on a rack which is lifted in or out of the vessel by a suitable tackle. A small hand pump, *n*, serves to remove the water due to the melting ice, and *d* is a cover to the tank.

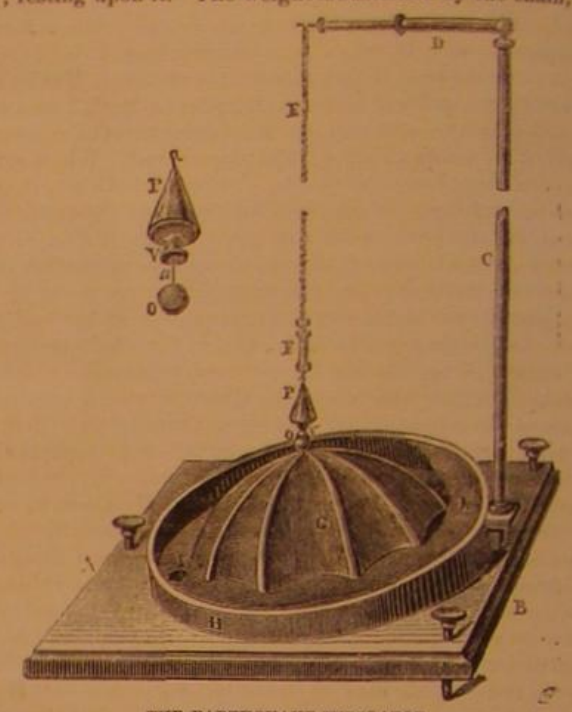
A Bear under Chloroform.

One of our Colorado exchanges gives a graphic account of an attempt to transfer a large cinnamon bear from a cage to an enclosure outside, that he might have greater scope for exercise; but a kindness he did not appreciate. The work of removing him from the cage was undertaken. It was first necessary to secure the bear so that a collar, with chain attached, could be put on him. Ropes were finally got around his legs, but he resisted violently, and it became a serious matter whether he could be secured at all. Once or twice he came near breaking away from his captors, and the surrounding crowd fled, panic-stricken, in all directions. Finally a happy thought struck some one, and a bottle of chloroform was sent for. To an application of this kind, the bear soon succumbed, and was secured in good shape.

It is not uncommon for beasts in cages to become wild with rage at times; and this incident suggests that possibly chloroform may be effectually used in producing quietude in all such cases.

THE EARTHQUAKE INDICATOR.

Count Malvaria, of Bologna, Italy, has recently devised an ingenious instrument for giving warning of earthquakes, and also for registering the direction of vibrations of the same. The construction will be understood from the annexed engraving. The table is adjusted level by the set screws, which serve as feet. Upon it is a circular inclined plane, K, surrounded by a rim, H, and carrying in its center a reversed hemispherical cup, G, the surface of which is divided into eight channels which are placed so as to correspond with the eight principal points of the compass. The summit of the cup is provided with a metal point which enters a shallow indentation in a ball, O. The ball is maintained in place by the concave lower portion, V, of a weight, P, resting upon it. The weight is sustained by the chain, E,



THE EARTHQUAKE INDICATOR.

which is supported by the standard, D C, and adjusted by the screw, F.

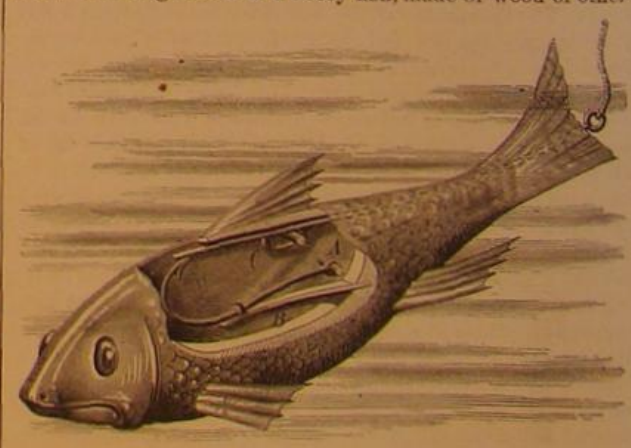
To set the apparatus, it is arranged as depicted in the engraving, the weight pressing upon the ball just sufficiently to hold it on the apex of G. The instant, however, a trembling of the earth occurs, the ball rolls from under the weight, down a channel in G, and thence to the inclined plane, K, through an aperture, L, in which it falls, striking spring mechanism, and so firing a gun, or else acting upon a clock so that the latter is caused to stop, thus registering the exact moment of the shock.

In order to determine the direction of the vibrations, a fine hole is made, from bottom up, in the weight, P. In this a needle, *a*, is placed so that its end rests upon the ball, although its body is then pushed up into the weight aperture. When the ball falls, the needle drops also, but is held by its enlarged head, so that it cannot escape from the weight. It rests, however, in the groove on the cup, G, down which the ball has rolled; and as this groove must be opposite in direction to that pointing to the course of the impulse of the soil, the true bearing of the vibration is at once determined.

The instrument is said to possess great accuracy, and, doubtless, will serve important ends in localities subject to earthquakes.

A NOVEL DECOY FISH.

Messrs. David Huard and Charles M. Dunbar, of Ashland, Wis., are the inventors of an ingenious device for trolling or still water fishing, which is quite certain to become a favorite with anglers. It is a decoy fish, made of wood or other



suitable material, and constructed with a cavity just back of the head. Inside of this is pivoted, at A, an ordinary fish hook, and beneath the latter is a spring, B, which tends to draw its barbed end up through a slot in the back of the fish. C is a piece of wire, pivoted as shown, but bent so as to slide longitudinally on its pin. This, when pushed forward, catches over the point of the hook, and therefore holds it down against the spring. The wire extends clear through the fish, and terminates with a little rubber plug which closes the rear aperture. An eye on the end of the wire serves for the attachment of the line.

The device in the illustration is represented as set, and the plug then tightly closes the rear opening. When a fish seizes the decoy, the jerk given causes the line to pull out the plug and, at the same time, to carry the wire, C, to the rear. The hook, then freed, springs up through the slot and holds the fish. This was patented May 26, 1874.

MACHINE FOR MAKING FENCE PICKETS.

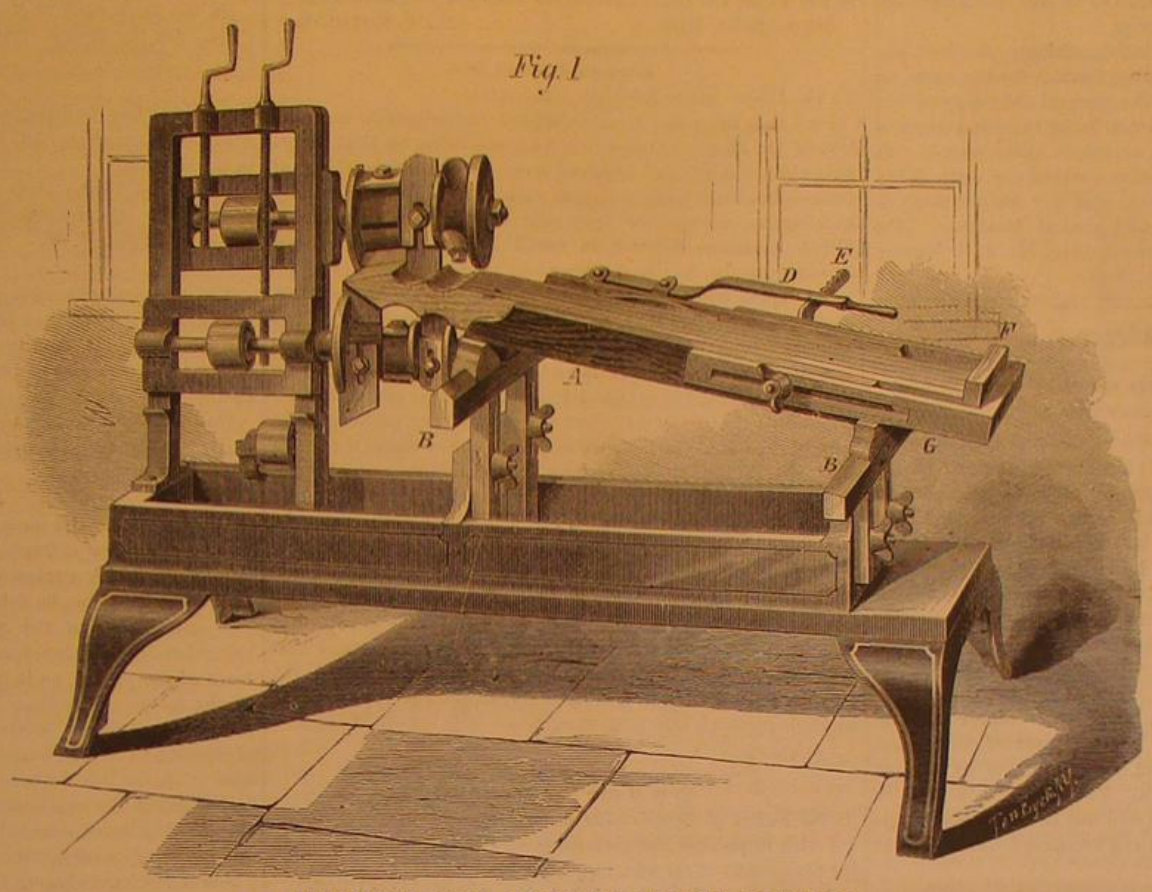
The object of the machine illustrated in the annexed engravings is to dress and shape the heads of pickets or palings. The novel feature consists in the sliding or reciprocating table which, by suitable attachments, supports and clamps pickets of different lengths, for presenting the same to the action of the revolving cutters. In Fig. 1 is given a perspective view of the machine, and in Fig. 2 a plan of the improved table.

The carriage, A, upon which the pickets are placed, travels upon ways, B, which are vertically adjustable to alter the inclination. The pickets are arranged side by side, and are secured by the pressure of the spring, C, Fig. 2, said spring being adjusted by the lever, D, connected therewith by a pivoted bar. The lever is held at any adjustment by means of the ratchet bar, E.

The rear extremities of the pickets rest against the end piece, F, of the carriage, by which they are so gaged to the saw that they are all cut in uniform lengths. The piece, F, is rendered adjustable, in order to suit different sized work, by the slotted side pieces, G, which are provided with clamping bolts, as shown. The cutting mechanism consists in two revolving heads, the bearings of which are adjusted in the frame to vary the space between them for wide or narrow pickets, by an independent screw for each. They are driven by a single belt which passes over both pulleys and over a guide pulley on the bed of the machine. Each head carries two molding cutters, a pointing cutter, and a saw, which are formed in the outline of the edges to cut the pickets alike on both sides when the latter are presented obliquely through the inclination of the carriage. By this arrangement the cutters are enabled to shear or draw out the wood, and thus to work smoother and easier than when operating crosswise the grain. The saws serve to remove the feather edge left by the pointing cutters.

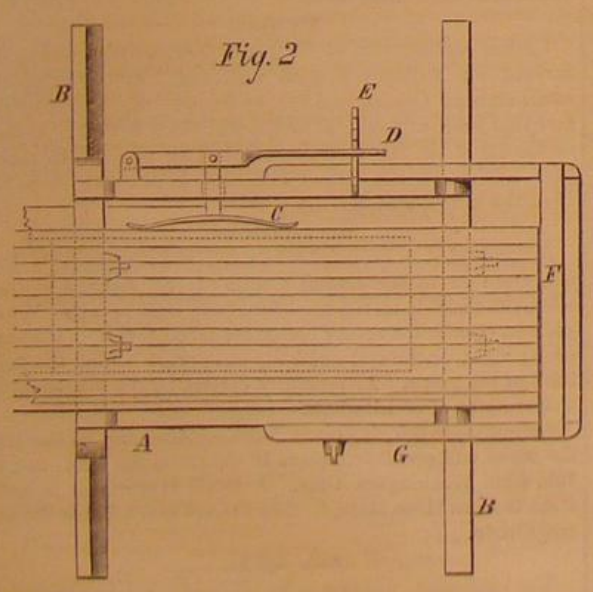
The device can easily be attended by a single man, and, it is claimed, can cut 5,000 pickets per day. From the adjustability of its various parts it is capable of executing a large variety of work, leaving the same in condition fit for immediate use. It is equally suitable for the purpose above described or for a tenoning machine, by simple adjustments of the cutter heads and carriage; and by suitable changes of the knives, picket heads of any desired patterns may be formed. The machine, we are informed, is the first which has been devised for producing the picket heads in complete state.

Fig. 1



MACHINE FOR MAKING FENCE PICKETS.

Fig. 2



It was patented through the Scientific American Patent Agency, December 29, 1874, to Mr. Isaac Levy. For further particulars address the owner of the patent, Mr. A.M. Lewin, Room 1, 302 Broadway, corner Duane street, New York city.

Kalsomining.

This is the time of year for house cleaning, and, *apropos* to the season, comes the following, from a correspondent of the *Country Gentleman:*

To kalsomine a good-sized room with two coats, take ten pounds of whiting, dissolved in hot or boiling water; one fourth of a pound of glue (which should have been put to soak in a pint of water the night before) may now be melted slowly on the back of the stove, stirring frequently. To color a beautiful tint, get two ounces of ultramarine blue and one ounce of Venetian red; mix separately with cold, soft water, and strain through a stocking or thin cloth, each in a separate vessel. The whiting may now be stirred well; if too thick, add more hot water, and strain through a flour sieve into a good-sized pot. Add some of the blue and red, alternately, till you get the desired shade, which may be ascertained by putting a little of the mixture on a piece of paper and drying by the fire. When your color is determined, pour in the glue; and after mixing well, apply the wash hot to the walls, brushing in any direction, as it mixes better than if put on too carefully. On white walls two coats are necessary; but after the room is once done, one coat is sufficient. Should the ceiling have to be done, put on the whiting alone first, then reheat the wash and add the paints and glue, the latter to be light colored, if the walls are to be white. Common glue will answer for a painted wall. A paper border finishes the room perfectly—makes any room neat and pretty. Should the second coat not be put on till next day, heat the mixture, as the glue will not mix with the other ingredients unless pretty warm.

Chemical Constitution of the Brain.

At a recent meeting of the Chemical Society, London, Dr. Thudicum delivered an interesting address on this subject. He said he thought the best way would be to explain the table of the constituents of the brain, which was hanging on the wall, comprising twenty-one compounds, besides fats and fatty acids. This subject, which was one of great difficulty, had occupied him many years, and he had found that it was quite useless to work on the small scale, in fact, before anything could be done, 1,000 brains had to be subjected to chemical examination. Of the constituents of the brain, nearly all the albumen present was in the insoluble form, and the sub-group of the phosphorized principles, to which he had principally directed his attention, consisting of the kephalins, myelins, and lecithins, all contained phosphorus. There were also present nitrogenized principles, oxygenized principles, inorganic matter, and about 80 per cent of water. The water is very difficult to remove from the brain matter, but it can be done by slicing it thin and soaking it in successive quantities of strong alcohol. The dried product is then finely divided, and rubbed through a sieve. Heated to 103° Fah., with alcohol, it leaves a white matter, consisting of the albumen, most of the phosphorized principles, all the nitrogenized, and much of the cholesterin. The alcoholic solution, when concentrated, deposits the lecithins, and, by further evaporation, the fatty ethers. The constituents of the white matter may be separated by treatment with ether, which extracts the kephalins; on concentrating the solution, and adding alcohol, these are precipitated. The myelins are only slightly soluble in ether, but may be dissolved by absolute alcohol, which leaves the cerebrin, phrenosin, and kerasin.

All the phosphorized principles are soluble in water, but the kephalins, as a class, are characterized by the property of oxidisability, turning brown in contact with ether; while the myelins, on the contrary, possess great stability, and are, therefore, readily obtained colorless and crystallized. Hydrochloric acid, or any salt, readily precipitates the phosphorized compounds; but when dialyzed these are removed, and the compounds again pass into solution, affording an excellent method of purifying them. The phosphorus is always present as glycero-phosphoric acid.

The author then explained his theory of the constitutional structure of the various compounds; after which he shortly noticed the members of the nitrogenized group, of which phrenosin, $C_{34}H_{67}NO_8$, may be considered as the mono-amidated form of a fatty acid, whilst cerebrin, $C_{34}H_{65}N_2O_8$, is the di-amidated form; kerasin, $C_{46}H_{91}NO_{91}$, the third on the list, is a colorless crystalline substance. All these compounds give a most magnificent purple color when treated with sulphuric acid and sugar, by Pettenkofer's reaction. Stearoconote has the same composition as cerebrin, and can easily be converted into it by boiling with hydrochloric acid and benzine; cerebrin can also be reconverted into stearoconote.

The amount of these principles is considerable, the phosphorized and nitrogenized compounds, with the cholestrin, constituting 5 per cent of the brain.

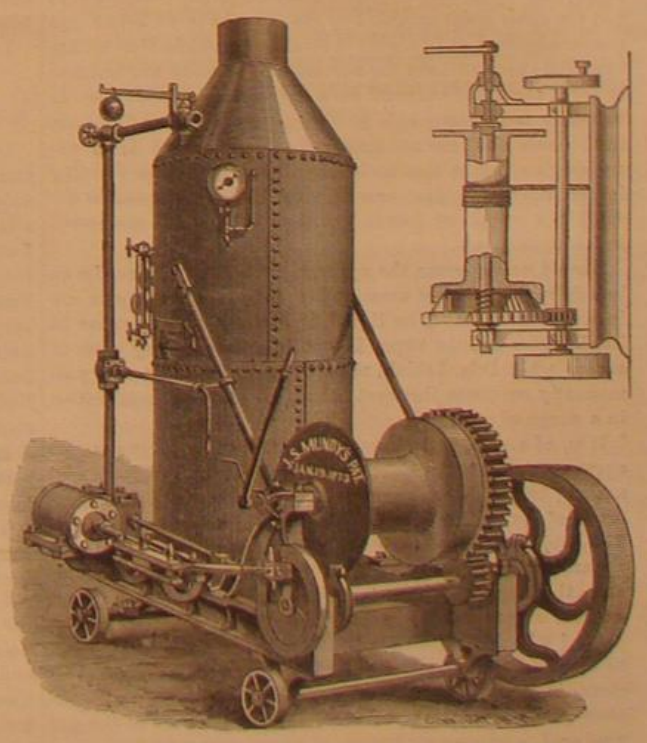
In answer to a question by Dr. Wright, Dr. Thudicum replied that the examination was conducted on the normal brains from human subjects, controlled by experiments on the brains of oxen. In softening of the brain, he had found free glycero-phosphoric acid and fatty acids.

The Electric Light.

It has long been known that the carbon electric light is not due to a direct luminous effect of the electric current, but merely to the property which this current possesses of heating the conductors which it traverses, and that with the greater intensity the more resistance they oppose to its passage. The intensity of the ordinary electric light(with carbon points) arises from the circumference that the stratum of air, a bad conductor, which is found between the two charcoal points, is heated to an excessive degree by the passage of the electric current, and thus produces indirectly the combustion of the coke or charcoal electrodes, heated to whiteness. It has also long been known that solid bodies may also be heated to whiteness without the presence of gaseous matter. Thus, slender platinum wires have often been heated by the current. The light from this source is more fixed and constant than that of the luminous arc between the carbon points; but it is too feeble and too costly. M. Ladeguin replaces the wire by slender rods of carbon (coke), hermetically sealed in a glass receiver, from which the oxygen has been removed.

IMPROVED HOISTING MACHINE.

The annexed engraving represents an improved form of



hoisting engine, the principal feature in which is a novel arrangement of friction attachment in connection with the drum. The device obviates the necessity of brakes and allows of the load being raised, lowered, or held suspended, with great ease. The diagram on the right of the engraving shows the drum loose upon the shaft while the driving gear is keyed firmly thereon. In the side of the large gear on the drum shaft, wood is dovetailed and turned off to receive the flange of the drum, which is forced thereon by means of a steel screw and pin, operated by the hand lever shown. A slight pressure of the hand on the lever causes sufficient friction between the flange of the drum and the gear to cause the lifting of from two to sixty tuns, according to the size of the engine.

This machine has been in use by the Department of Docks

of this city for the past year, and has been principally employed in pile driving. The raising and letting fall of the hammer is readily effected by manipulating the governing lever. A testimonial signed by the engineer-in-chief of the department expresses satisfaction with the working of the engine, and pronounces the same superior to other devices, in which clutches are used.

The engine has also been used for some time at the marble yards of Messrs. W. B. Smith & Sons, of this city, and we learn from a letter of that firm that a weight of 30 tuns was there easily lowered a distance of 23 feet, with one hand of the engineer managing the lever.

In the construction of boiler and machinery, the best materials are employed, and improved devices by the same inventor added, which increase the general efficiency of the working parts. The boiler is extra large in size, compared with the engine, so as to afford an ample steam supply. In general, the machine is excellently adapted for dock hoisting, pile driving, dock building, and for employment in quarries, mines, warehouses, and similar localities. For further particulars address the patentee, Mr. J. S. Mundy, No. 7 Railroad avenue, Newark, N. J.

Correspondence.

Extinguishing Fires on Shipboard.

To the Editor of the Scientific American :

In view of the inefficiency of the methods at present in use for extinguishing fires on board ship, and particularly in sailing vessels, I propose to make use of carbonic acid gas in a manner which, I believe, has not hitherto been proposed. The plan is to have, in some convenient locality, a flask or flasks, each about 3 feet in length and 1 foot in diameter, containing about 100 lbs. of the gas in a liquid state. From the top or upper side of the flask, a small iron pipe is to be permanently fitted along the water ways (or just under the deck), throughout the entire length of the ship. From this main pipe, at suitable intervals, are branch pipes, at right angles to the main, passing down next the skin, to every storeroom and hold of the ship; so that each compartment of the vessel shall have its own pipe, or pipes, reaching from its bottom to the main pipe at the spar deck. There is to be a cock in the main pipe near the gas flask and one in each branch pipe near the main, any one of which can be turned from the spar deck.

On the alarm of fire, the hatches are to be battened down; the cock in the branch pipe leading to the compartment where the fire is discovered is to be opened, and also the cock in the main next the gas flask. The liquid gas, which is under a heavy pressure in the flask, passes out through the pipe in the form of vapor, as soon as the pressure is relieved by turning the main cock, and is driven in an instant, by the great pressure behind it, to the compartment to which it is admitted. Arrived at this point, and being 1½ times as heavy as air, it fills the compartment from the bottom up, without being diluted with the air, and producing intense cold by its expansion at the same time; while the pressure with which it enters forces it into all interstices in the cargo, driving out every particle of air, which will all escape from the top, as no compartment on board ship is absolutely airtight. Knowing then the cubic contents of any compartment and the cubic space occupied by the cargo in it, sufficient gas can be admitted as to render it absolutely certain that no fire can exist there, without the necessity of opening the hatches to see if the fire is out until such time shall have elapsed as to render it perfectly safe to do so. By shutting the cock in the main pipe, the remainder of the gas is kept from vaporizing until such time as it may be required. On arriving in port, the flask is disconnected from its pipe, and can be refilled in a couple of hours, and then set up and connected in its usual place.

Should no fire occur, the apparatus can remain intact for an indefinite time, except occasionally to see that the cocks are in working order. The liquid is entirely non-corrosive in its character and the vapor is not injurious to any class of cargo; while it is, I think, the only substance that will permanently suppress the most advanced state of combustion in a cargo of coal.

It is, of course, well known that carbonic acid gas is the agent employed in the Babcock extinguisher and others of like nature; but in these the gas is produced on the spot by the action of an acid on marble dust or bicarbonate of soda. The objections to such an arrangement are that the apparatus is somewhat cumbersome and complicated, and the supply of gas is rather limited unless a great number of machines are used. Moreover it must all be expended when once generated; and before a fresh supply can be obtained from any one machine, the apparatus must be cleaned out and the requisite materials rearranged; while in consequence of the moderate and varying pressure of the gas produced, a permanent system of pipes cannot be employed to carry the gas to any great distance from the generator. What I propose is simply to carry on board ship the gas itself in its most condensed form, the liquid, of which 1 lb. is equal to a trifle over 8 cubic feet of pure gas, to be contained in vessels capable of withstanding the great pressure necessary to keep it from vaporizing at any temperature.

U. S. Torpedo Station, Newport, R. I. — F. M. BARBER, Lieut., U. S. N.

Drive Wells in Minnesota.

To the Editor of the Scientific American:

The city of Minneapolis recently purchased two steam fire engines for the protection of property situated beyond the reach of the city water works. A few cisterns for holding a supply of water for the steamers have been constructed, but they are expensive, are liable to leak, and require constant attention. Mr. Winn Buckett, Chief Engineer of the Fire Department, tried the experiment of sinking four drive wells of 2½ inch pipe, situated thirty feet apart or fifteen feet from a center, and brought together at the top, where the suction hose of the engine is to be attached. A trial was made on March 17; the engine threw a continuous stream, from a 1¼ inch nozzle, to a distance of 185 feet for one hour. When the cap was removed, there was found to be 9 feet of water in the wells, the same amount as when they commenced.

Minneapolis, Minn. — C. E. EASTMAN.

Loss of Life at Sea.

To the Editor of the Scientific American:

I see that there has been an official investigation into the loss of the steamer Cospatrick, and according to that report only three out of five hundred were saved. Something of course should be done to avert such calamities; but as long as steamers are built as they now are, there is no remedy. While steamers depend on small life boats to save four hundred or five hundred passengers in case of accident, we must expect what has happened so frequently in the last few years. It is strange that, with all the inventive talent in our country, some plan has not been thought of besides furnishing steamers with life rafts and boats, when it is so easy to make the steamer itself the life boat. There is not a steamer now afloat that could save five per cent of her passengers in case of accident; in fact, we may load the steamer with the best life-saving apparatus now in use, and, in case of accident, a panic follows invariably, and nearly all are lost. Why not build a steamer in which fire, leaks, striking rocks, or going on shore would not endanger the life of a single passenger? In order to do this, the freight and passenger business must be measurably separated, the life steamer carrying only the mails and other safe freight. It may be said that this would not pay; but let the public once understand that it is as safe to cross the ocean as it is to stay at home, the travel would double in less than a year, and the voyage could be made in much less time than now.

Lockport, N. Y. — D. WINER

New Cure for Wounds.

To the Editor of the Scientific American:

I wish to publish the following cure for punctured wounds for the benefit of all who may need it:

As soon as such a wound is inflicted, get a light stick (a knife or file handle will do), and commence to tap gently on the wound. Do not stop for the hurt, but continue until it bleeds freely and becomes perfectly numb. When this point is reached, you are safe; all that is then necessary is to protect it from dirt. Do not stop short of the bleeding and the numbness, and do not on any account close the opening with plaster. Nothing more than a little simple cerate on a clean cloth is necessary. I have used and seen this used on all kinds of simple punctures for thirty years, and never knew a single instance of a wound becoming inflamed or sore after the treatment as above. Among other cases, a coal rake tooth going entirely through the foot, a rusty darning needle through the foot, a bad bite by a sucking pig, several instances of file shanks through the hand, and numberless cases of rusty nails, awls, etc.; but I never knew a single failure of this treatment.

Lansing, Iowa. — S. W. HEMENWAY.

Government Licenses for Pleasure Boats.

To the Editor of the Scientific American:

I see it stated in your paper that a steam launch or other small steamer, intended and used for pleasure only, is not subject to United States inspection. Last October, I took a launch, 28 feet keel by 6 feet beam, to Florida. On arrival, I was notified not to get up steam until the boat had been inspected. After a delay of ten days or more, the United States Inspectors came to Palatka, and passed the boat. Inspection of hull and machinery cost $25. I was then required to have a regular engineer and also a pilot: cost of license for each, $10. After complying with all the regulations as regards fittings, life preservers, etc., I had hardly room left for myself and gun. I am not alone in this thing. It might be well for parties to know this, so as to save themselves trouble. I have a copy of the United States law, and I do not see how I can get rid of this tax each year.

Titusville, Pa. — H. R. LYLE.

Underground Railway at Constantinople.

A telegram from Constantinople announces the opening of the Pera and Galata underground railway. The station of Galata is situated between the Koumrou and Sevoud streets, and that of Pera, which is not yet completed, in the Rue Nadir. The tunnel is ventilated by two shafts, one of which is 80 feet in depth, and the other 65 feet. This railway is worked by a fixed engine, the carriages being hauled by a rope at the rate of 11¼ miles per hour; the trains are run at intervals of five minutes. The difference of level between the two stations is about 200 feet, so that the average gradient is about 1 in 10. It is estimated that the number of passengers carried daily will be 30,000.

The American Railway System.

The total length of the railways in the United States is nearly seventy-five thousand miles, or over three times the diameter of the earth. It would occupy a passenger five months' time, traveling night and day continuously, at an average speed of 20 miles an hour, to go once over all of our railways. At the average speed of the fastest ocean steamers it would require over eight months' time.

ASTRONOMICAL NOTES.

OBSERVATORY OF VASSAR COLLEGE.

For the computations of the following notes (which are approximate only) and for most of the observations, I am indebted to students. M. M.

Mercury.

Mercury was at its greatest elongation west of the sun on the 28th of March, at which time it could be best seen. But it must still be in good position, and will be up to the middle of April, and should be looked for in the early morning.

On the 1st it rises at 4h. 54m., A. M., and sets at 3h. 57m. P. M. On the 30th it rises at 4h. 44m. A. M., and sets at 5h. 58m. P. M.

Venus.

Venus is less brilliant than it has been, and its apparent diameter is smaller; but it is still a very conspicuous object in the morning.

On the 1st Venus rises at 4h. 10m. A. M., and sets at 2h. 42m. P. M. On the 30th Venus rises at 3h. 40m. A. M., and sets at 3h. 38m. P. M.

Mars.

The apparent diameter of Mars is increasing, but it is still very small; it rises very late, and is low in altitude when on the meridian. It may be known by its ruddy light and by being some 18° east of Antares, among the small stars of *Ophiuchus*.

On the 1st Mars rises at 0h. 23m. A. M., and sets 9h. 25m. A. M. On the 30th Mars rises at 11. h. 12m. P. M., and sets at 8 the next morning.

Jupiter.

Jupiter is now the most conspicuous planet, and, notwithstanding its low altitude, is the best situated for observations. Even with a telescope of small power, the movements of the satellites can be followed; and their eclipses, by going into the shadow of the planet, or their disappearance, by being behind the planet, as in occultations, or by passing in front of the planet, as in transit, can be noted. The largest of the moons of Jupiter is the third in distance from the planet. It will not be seen for several hours on the evening of the 5th of April, being behind the planet and in its shadow. On the 9th the second satellite in distance from Jupiter, which is the smallest, will not be seen for some hours of the evening, because it is in transit, or in front of the planet; and only very good telescopes will enable observers to distinguish it from the planet. On the 19th the same will happen in the case of the first satellite, or that nearest to Jupiter. For two hours in the evening it will be between the earth and Jupiter, and seemingly projected upon the face of the planet. On the 27th and 30th similar phenomena can be seen. On the 27th the first satellite is not seen for some hours, being behind the planet, and on the 30th the third is not seen because in front of the planet.

On the 1st Jupiter rises at 7h. 43m. P. M., and sets at 6h. 33m. the next morning. On the 30th Jupiter rises at 5h. 30m. P. M., and sets at 4h. 30m. the next morning.

Saturn.

It is of little use to attempt observations on Saturn at present. It does not rise until morning at the 1st of the month and being far south, the diurnal path is only 10 hours above our horizon.

On the 1st Saturn rises near 4 A. M., and sets at a little after 2 P. M. On the 30th Saturn rises at 2h. 10m. A. M., and sets at 26m. after noon.

Uranus.

Uranus continues to be in good position for evening observers, but requires a good telescope. It is among the small stars of *Cancer*, and can be known from a star by the fact that even a small telescope will show a disk. It rises on the 1st at 1h. 7m. P. M., and sets at 3h. 23m. in the morning. It rises on the 30th at 11h. 13m. A. M., and sets at 1h. 29m. the next morning.

Occultations.

A star is said to be occulted by the moon when it is hidden from us by the orbital motion of the moon, a motion, when the moon is on the meridian, from west to east. When such an occultation occurs before the moon is full, it is a very pretty sight, as the star suddenly disappears behind the dark limb of the moon. Astronomers determine the longitude by observations of occultations.

According to the *American Nautical Almanac*, on the 12th the moon will occult two stars in *Cancer* at 9h. 57m., and at 10h. 43m. Washington time. A small instrument is sufficient to show these stars, as they are not much below the 6th magnitude.

Sun Spots.

The large spot, which was mentioned in the last report as having just appeared, crossed the sun's disk nearly in a line with the equator. Photographs were taken of it on the five days during its passage, showing it to be a large and very black spot, surrounded by a broad and distinct penumbra. On March 17 a large spot appeared in about the same position; and as exactly twenty-seven days had elapsed since the appearance of the other, it is without doubt a return of the same spot. It appears somewhat smaller, and not so intensely black as at its first appearance, but is still very large. It will probably be visible for about twelve days longer. Besides the large spot, several small ones in groups and pairs have crossed the disk during the last month, and faculæ have been observed several times. On the 10th of March two spots, one upon the eastern limb and the other on the western, were seen surrounded by strongly marked faculæ; and remote from any visible spot, a luminous chain of the same appearance extended, from the edge, nearly one third across the disk.

Bronzes Incrustes.

This is the name given to a new style of bronze or copper work ornamented with gold and silver, and manufactured by Christofle & Co., in Paris. The ornamentation is produced by etching and electro-plating, and consists, according to Dr. Meidinger, in the following operations: After the object, which may be of massive copper or bronze, has received the desired form, the drawings are made with water colors, the body of which is white lead. If several pieces are to have the same design, it may be printed on as in porcelain and faience painting. Those portions of the surface not painted are covered with varnish. The article is then placed in dilute nitric acid, whereby the paint is dissolved and the surface of the metal is etched to a certain depth. When the etching is finished, the article is washed with water and immediately placed in a silver or gold bath, and a layer of the precious metal deposited by electricity on the exposed portions. When the latter operation is finished, the varnish is perfectly removed and the whole surface ground or polished, so that the ornamented portion is just even with the remainder of the surface. The contours are quite sharp. The surface is then bronzed, which does not change the color of the gold or silver. A specially fine effect is obtained by producing a black bronze of sulphuret of copper on portions of the surface between the silver ornaments. A copper vessel then has three colors, black and white drawings on a red brown ground of suboxide of copper.

This new process for ornamenting metals has been devised at Christofle's works since the Paris Exposition of 1867. Specimens exhibited at Vienna in 1873 show the high degree of perfection to which it has already been brought. Unfortunately, these goods are so expensive as to be only accessible to the few, although much cheaper than those in which the engraving is done by hand, and the gold or silver inserted by mechanical means. The production of an incrustation requires a high degree of manual skill and patience, but no costly machinery; indeed, every brass foundry contains all the necessary tools for the mechanical operations.—*Iron.*

THE STORAGE AND HANDLING OF FLUIDS.

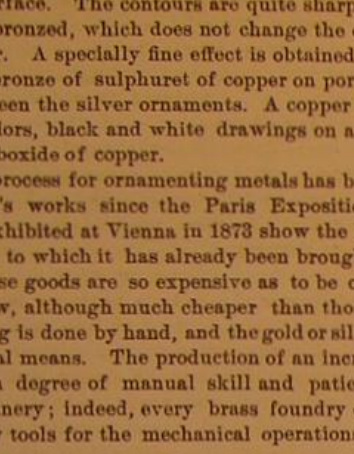
We propose, in this and in subsequent issues, to lay before our readers, from time to time, short articles descriptive of a large variety of mechanical tools and apparatus now in use in the industrial arts and processes. These papers will be illustrated by a series of excellent engravings, selected from the pages of Mr. G. H. Knight's "American Mechanical Dictionary," a very valuable and exhaustive work, which has for a long time been in preparation, and which has just been issued from the publishing house of Messrs. J. B. Ford & Co., in this city. The advantage of our proposed plan to the reader is that, besides his attention being called to a large number of very useful inventions, he will find the same presented in connected form. That is to say, instead of his being obliged to run over a whole volume to collect the component portions of a certain process, series of processes, or operations upon like articles, all will be carefully gathered together, arranged in an interesting and instructive group, and accompanied by explanation, as a rule, much more compendious than necessarily could or does exist in the original work. The subjects are not all new or novel inventions, and many of those described are in actual employment. For this reason, however, they are none the less interesting to the generality of readers unacquainted with each special branch of art or trade, while, at the same time, they become especially useful to inventors, as indicating the present status of any industry or any species of mechanism or process, upon which improvements or in which discoveries may be meditated.

Subjects as far as possible will be treated and grouped under general headings as pertaining to the shop, to the household, and to various callings. In some cases, which can be brought under no definite head, articles relate to each other will be arranged together in connected form. We begin with operations relating to the preservation of fluids; and from the various paragraphs in the dictionary before us on such subjects, we select the most interesting illustrations relating to bottling and kindred topics.

ALARM FUNNEL.

A useful apparatus, which gives warning when the liquid in a barrel has risen to a certain point (in filling), will be found in Fig. 1, which is an alarm funnel. The funnel being placed

Fig. 1



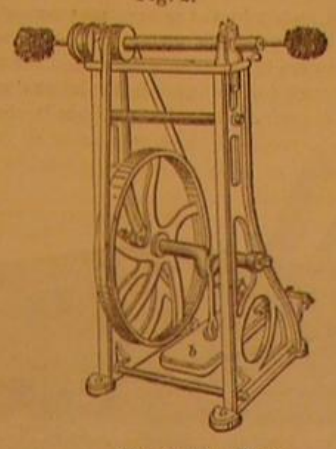
Alarm Funnel.

over the bung hole of the barrel, the liquid raises the float which, in turn, detaches the button in the upper casing from a stop. This frees the spring of the alarm bell, causing the latter to ring.

BOTTLE CLEANING.

For this purpose a bottle brushing machine is shown in Fig. 2. The brushes, fixed on a rotating shaft, are insertep

Fig. 2.



Bottle-Brushing Machine.

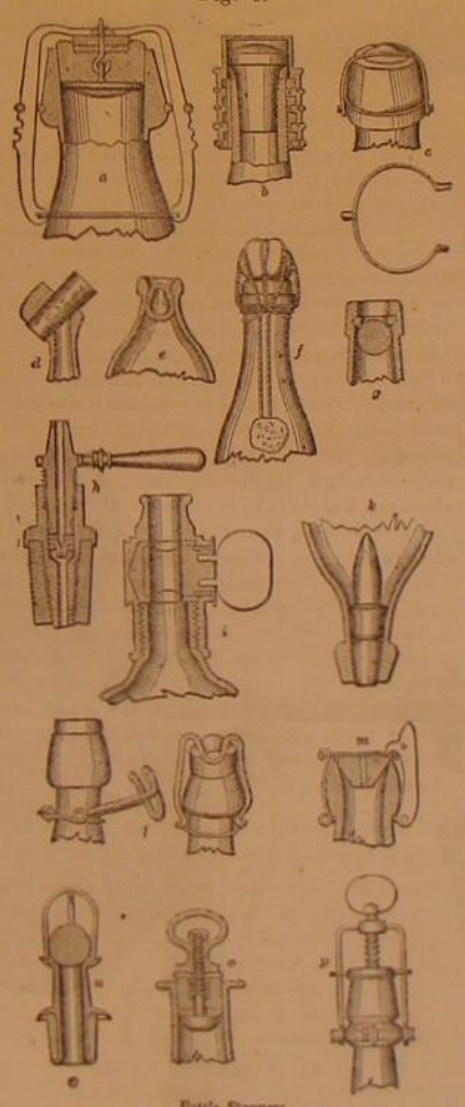
into the bottles, and rotation is imparted to them by means of the treadle, *b*. The operator can take one bottle in each hand, and thus cleanse two at once.

In Fig. 3 is represented a variety of

BOTTLE STOPPERS—SUBSTITUTES FOR THE ORDINARY CORK.

In diagram *a*, the stopper is attached to a bail. Spring arms, which are permanently fixed in an annular recess in the

Fig. 3.



Bottle-Stoppers.

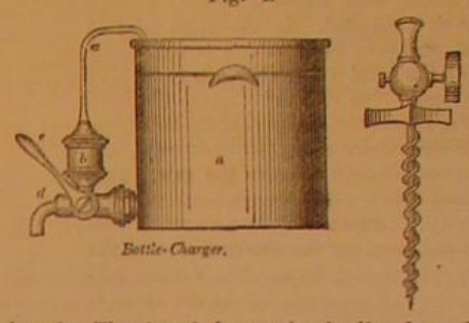
swelling of the bottle neck, catch into notches of the bail and hold it and the stopper securely in place. Diagram, *b*, shows a permutation lock, which is set on a given combination and serves to hold a cap over an ordinary cork or similar stopper. In diagram, *c*, a ring, represented separately, is divided so as to be easily slipped around the neck of the bottle. This carries a hinged bail which is forced over the cork. A peculiar-shaped bottle is required in diagram, *d*, the opening through the neck of which is diagonal. The pressure of the gas is upon the side of the cork, and does not tend materially to expel it. The cork may be ejected with a push, without a corkscrew. Diagram, *e*, represents a simple rubber ball driven by the pressure of gas inside the neck. It is removed by the pressure of a rod when it floats upon the liquid. The mode of tying champagne corks is represented in *f*. Diagram, *g*, is similar to *e*. The neck of the bottle is molded with an interior annular recess, filled by a packing ring against which a glass ball is sustained by pressure of the gas. The screw faucet in diagram, *h*, has a packing against its lower end, and is depressed into a seat. Another locking device is shown in *i*, which represents a simple one-way cock, opened by a key made to fit its indentations. Diagram, *k*, shows a glass rod which carries a packing around its enlarged head. One of its tapering ends guides it into the neck of the bottle, where it is held, when the latter is turned upright by the pressure of the gas. The stopper shown in *l* is a hinged wire bail, bent into U form so as to be swung up on to the cork while the same is held by the plunger of the bottling machine. Two views of this device are given. In diagram, *m*, a rubber stopper hinged on one side is held on the other by a simple metal catch, secured to a ring which encircles the neck. Another arrangement of a glass ball, very commonly used, is represented in *n*. The ball is restrained from falling off when the bottle is tilted by a cage. In diagram, *o*, a stopper of rubber is compressed between two disks which are brought together by a screw, and thus expanded against the inside of the neck; and in *p* a bail is hinged by a collar around the neck, and is provided with a screw which compresses a rubber-faced cap

Fig. 4 shows a

BOTTLE CHARGER

for charging bottles with a liquid under pressure, as, for instance, with air containing carbonic acid and with a graduated amount of sirup. *a* is the vessel containing the aerated water, *b* the sirup cup, *c* a pipe equalizing the pressure in the

Fig. 4.



Bottle-Charger.

vessels, *a b*. The size of the opening leading from the cup, *b*, to the nozzle, *d*, is adjustable, and *e* is the handle of the faucet, by which the liquid is discharged. Beside Fig. 4 is given a simple form of bottle faucet, the hollow stem of which is threaded. The latter is forced in through the cork. The device serves as a useful means for drawing soda water or other effervescent fluids.

That Odious Postal Law.

Complaints reach us from all directions at the act of our late Congress in imposing upon the people the new postal law, increasing the tax upon publishers, seedsmen, merchants, and all others having occasion to send newspapers or small parcels to their friends and customers. The nearest express offices to the homes of the majority of persons residing in the country are three to five miles distant, and the carrying of transient matter, newspapers, seeds, plants, books, and other light parcels through the mails is a great convenience, and a saving of time and trouble to many. The delivery by the post office in rural districts is quicker and more certain than by express, particularly to persons not generally known.

The public generally are aware that the last session of Congress made a partial revival of the franking privilege. Somebody must pay the Congressman's postage. So the same Congress which put a free frank on the public documents, which nobody reads, raised the price of postage on all transient newspapers, books, etc., one hundred per cent. This now prevents the people from sending many articles by post, and forces that traffic into the express offices, in whose interest the law, at the last hours of Congress, was enacted; and it withdraws from the postal revenue a large portion of its former receipts. The indignant public will have to wait till next meeting of Congress before relief can be afforded them, when we expect to see such amendments made as will reduce the rate of postage on newspapers and small parcels lower than it has ever been.

Models by Mail.

Persons sending models or other articles by mail should not be unmindful that the full postage of one cent an ounce, instead of one cent for two ounces, as formerly, must be prepaid at the office when mailed, to insure the sending. If a model is sent in a box, the cover must not be nailed or screwed to the sides; if sent in a paper or cloth wrapper, the bundle must not be pasted, sealed, or otherwise secured so that the officials cannot readily examine the contents by simply cutting or unfastening a string. In New York and other large post offices, there is a special department for examining all parcels on which postage has been paid on what is known as Third Class matter; and if any writing is found concealed, or if the package is so made up that these officials cannot readily gain access to the contents, full letter postage is demanded on the entire weight.

Free Lunch Suspended.

In consequence of the increase of postage and the necessity of prepayment, we are obliged to decline sending odd numbers or specimen copies of the SCIENTIFIC AMERICAN free, as has been our custom for a quarter of a century.

Hereafter persons desiring specimens or any special numbers of the paper will please to remit, for each copy ordered, ten cents.

NEW subscribers to the SCIENTIFIC AMERICAN will hereafter receive the papers from the time of our receiving the order, unless they specify some other date for commencing. All the back numbers from the commencement of the volume (January 1) may be had if requested at the time of sending the order, or on request, after receipt of first number.

PARIS EXHIBITION, 1875.—An International Exhibition, in which great prominence will be given to all matters connected with marine and river industries, is to be held in Paris, from July to November next. The building selected is the well known Palais de l'Industrie, in the Champs Elysées, where the Exhibition of 1855 took place.

IMPROVED CIRCULAR SAW TABLE.

There are two excellent improvements in the saw table represented in the illustration, which will at once bespeak for it the favorable consideration of woodworkers. The first is the simple and novel mode of raising and lowering the saw, and the second the system of squares and gages by means of which work can be cut to exact lengths, squared, or beveled without previous lining or marking. Besides these advantages, which are essentially prominent, there are others of nearly equal importance, among which may be especially noted the means of adjusting the table to a bevel, and the mounting of the saw mandrel so that it runs without jarring or rattling. A perspective view of the machine is represented in the engraving.

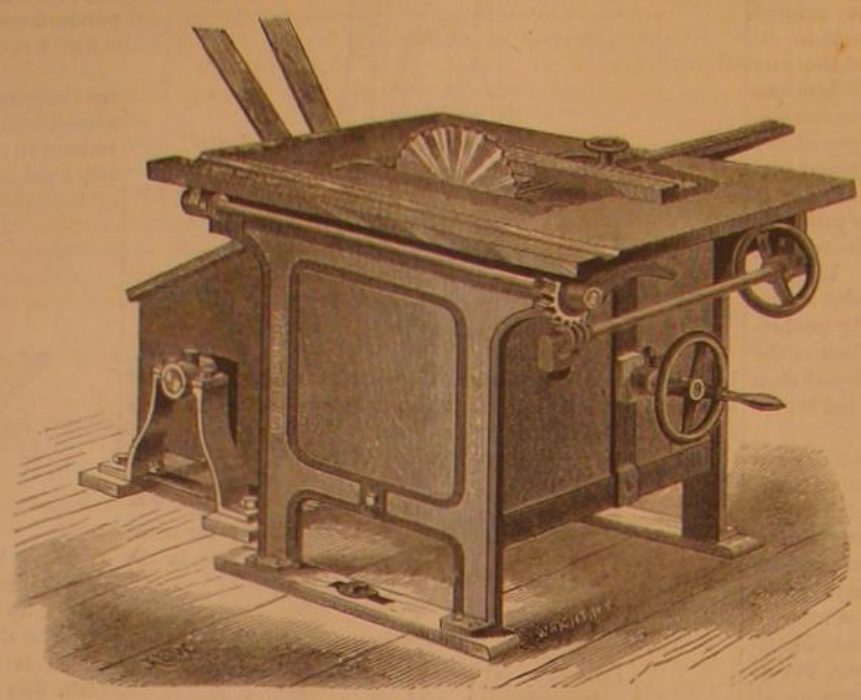
The saw blade is attached to a mandrel, which is journaled in an inclined frame. The latter, with a horizontal frame beneath, forms a kind of bell crank, with which a vertical toothed segment is connected. In the teeth of said segment engages a worm, which is rotated by means of the hand wheel shown in the side of the machine. The effect of turning the segment is to cause the upper part of the bell crank frame to slide down or up inclined ways, and thus correspondingly to move the saw. This mechanism is in a compartment partitioned off from the space immediately beneath the saw, so that the dust does not come in contact with the working parts to clog them. The driving pulley is on the saw mandrel; and as the latter is moved up or down, the belt is maintained uniformly tight.

The aperture in the iron table for the saw is lined with detachable pieces of wood, so that all danger of the teeth coming in contact with the metal is obviated. The bearing of the mandrel to the frame contains Vs, which, entering one within the other, prevent sideways motion and rattling. The blade is readily removed from the end of the mandrel, the latter being steadied by a wrench passed down through a small aperture in the table, and grasping a nut portion of the mandrel.

The hand wheel and shaft shown in front and under the edge of the table operate a worm which, engaging in segments, raises arms from a horizontal to an upright position. These carry the side of the table up with them, and thus dispose the latter for cross beveling. On the surface of the table will be noticed a longitudinal groove; another channel of somewhat different section is also provided at right angles to the plane of the blade. These serve to hold the squares and gages by which the work is adjusted to the saw. A flat piece of iron slips into the longitudinal groove, and to it is attached at right angles a straight edge. Against the latter the side of the board is placed, and the work is thus brought squarely up to the saw. The gage which traverses the other channel has a V which enters one part and a nut which slips into another portion of dovetail section of the groove. By turning a clamping wheel the nut is caused to bind, and thus to hold the gage at any desired point. The upper portion of the metal part of the device has an opening into which a high or low gage may be fastened by a simple wedge attachment; a bevel gage, tenoning machine, or any other suitable fixture may be quickly inserted and held. Other simple attachments in the grooves at once convert the device into an excellent miter table.

From our examination of the machine in operation, we believe that its use will tend to save both time and material, while ensuring accuracy in work. It will saw fillets or corner pieces, large or small, with rapidity, cut the edges of logs and ends of cants of any circle to a joint, saw chipping pieces with edges beveled at the same time, saw up or cross cut from the least draft on a pattern to an acute angle in very many kinds of work, and prepare the same ready to put together. For pattern makers, cabinet makers, carpenters, organ and stair builders, the machine is especially useful. It will cut up stair steps, drawer stuff, etc., into exact lengths with square ends, and will miter the ends of risers. For shelving, desk, and similar work, a dado head may be substituted for the saw, when the machine will groove crosswise the stuff with perfect accuracy, and without lines of measurements after the first cut.

This machine is the invention of Mr. W H. Havens, of 132 Broadway, Paterson, N. J., to whom letters for further particulars may be addressed.



HAVEN'S CIRCULAR SAW TABLE.

IMPROVED WINDMILL.

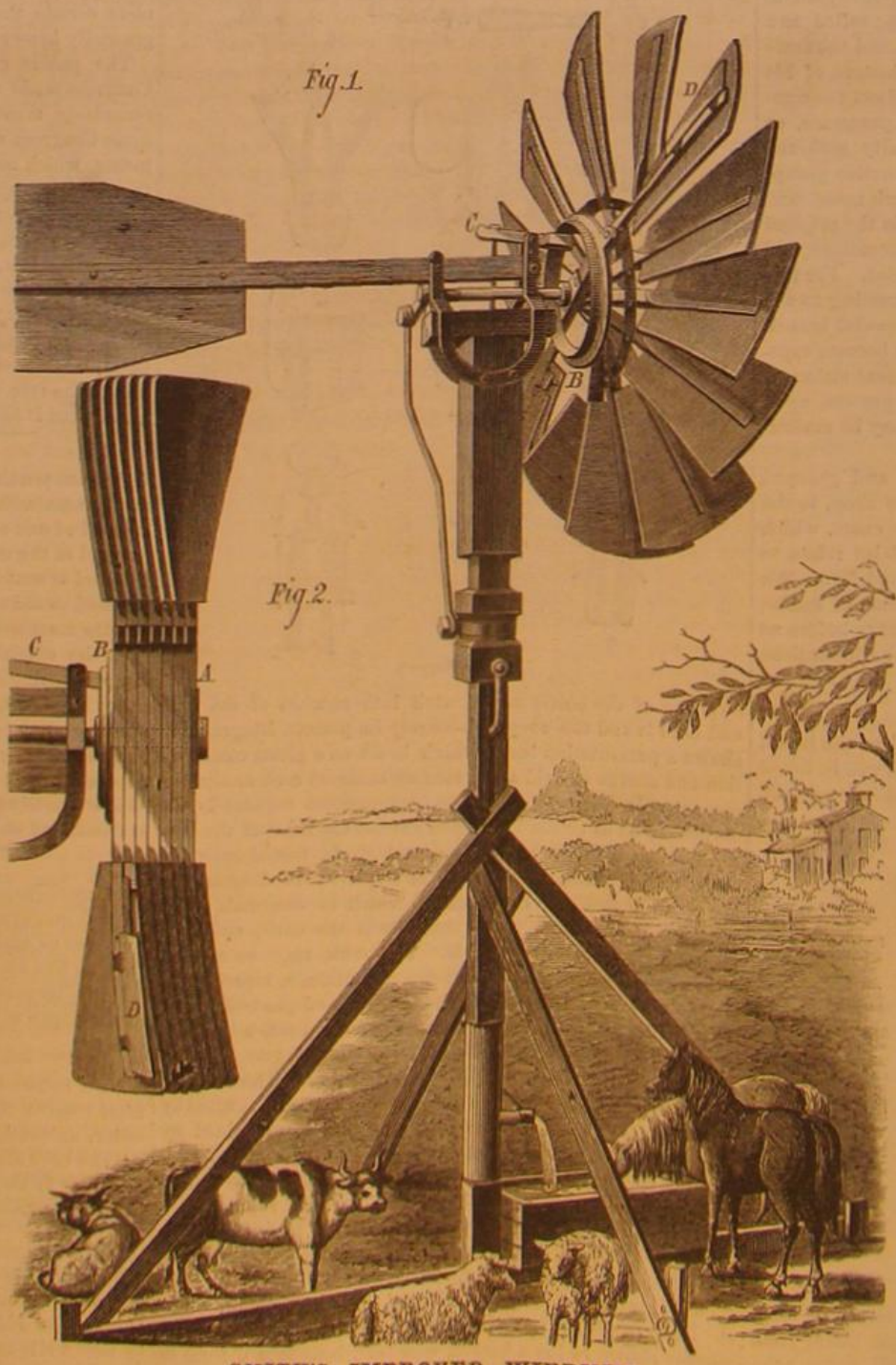
The novel windmill represented in the annexed engraving is from its simple construction and capability of self-adjustment, according to the strength of the wind, excellently suited for raising water for cattle, supplying water to houses, driving churns and other agricultural machinery, or to perform a number of the various duties for which a cheap and light motor may be required. The new features to which attention is directed are the mode of connecting the arms bearing the sails, so that an excess of wind tends to fold up the latter, and also a brake wheel, whereby the motion may be retarded.

The engraving shows the manner of constructing the device for adaptation to farm purposes; and on the left, the arms are represented as folded. In the latter figure the outer arm, A, alone is connected rigidly to the shaft, the other arms being free to revolve thereon. The sails, however, near their extremities, are connected by leather straps which allow the wheel to spread out only to its full size. The rear end of the shaft has a crank arm, and this communicates with the pump rod. On the rear of the rear arm the brake wheel, B, is secured, in contact with which is the pivoted brake, C, governed by a rod leading down the standard, which supports the box for the shaft. The tail board serves, in the ordinary manner, to cause the wheel to turn in whichever direction the wind may be blowing. When the wheel begins to revolve, and power is thus applied to the crank arm, the front arm, A, being rigidly fixed to the shaft, is retarded. The other arms, however, are free to spread out and complete the wheel, transmitting all their power through the straps to the front arm, A.

In order automatically to govern the speed in case of storms, the auxiliary wing, D, is applied to a sail of the rear arm. This wing is slightly held by a spring, and opens out when the wheel is in high motion, so as to form a plane at right angles with the sail proper, thus retarding the movement sufficiently to fold the wheel but not to stop the same.

To obtain very slow motions, the brake is employed as already indicated. A weight on the end of the brake rod may be employed to hold the wheel when the latter is not required to revolve; or instead of the weight, a float may be used, resting on the water in the well, and so arranged as to allow the wheel to pump only a certain quantity of water before the brake is put on.

The device was patented May 5, 1874, by Mr. Elijah S. Smith, of Good Hope, McDonough county, Ill., who may be addressed for further particulars relative to sale of rights, etc.



SMITH'S IMPROVED WINDMILL.

Animal Wonders.

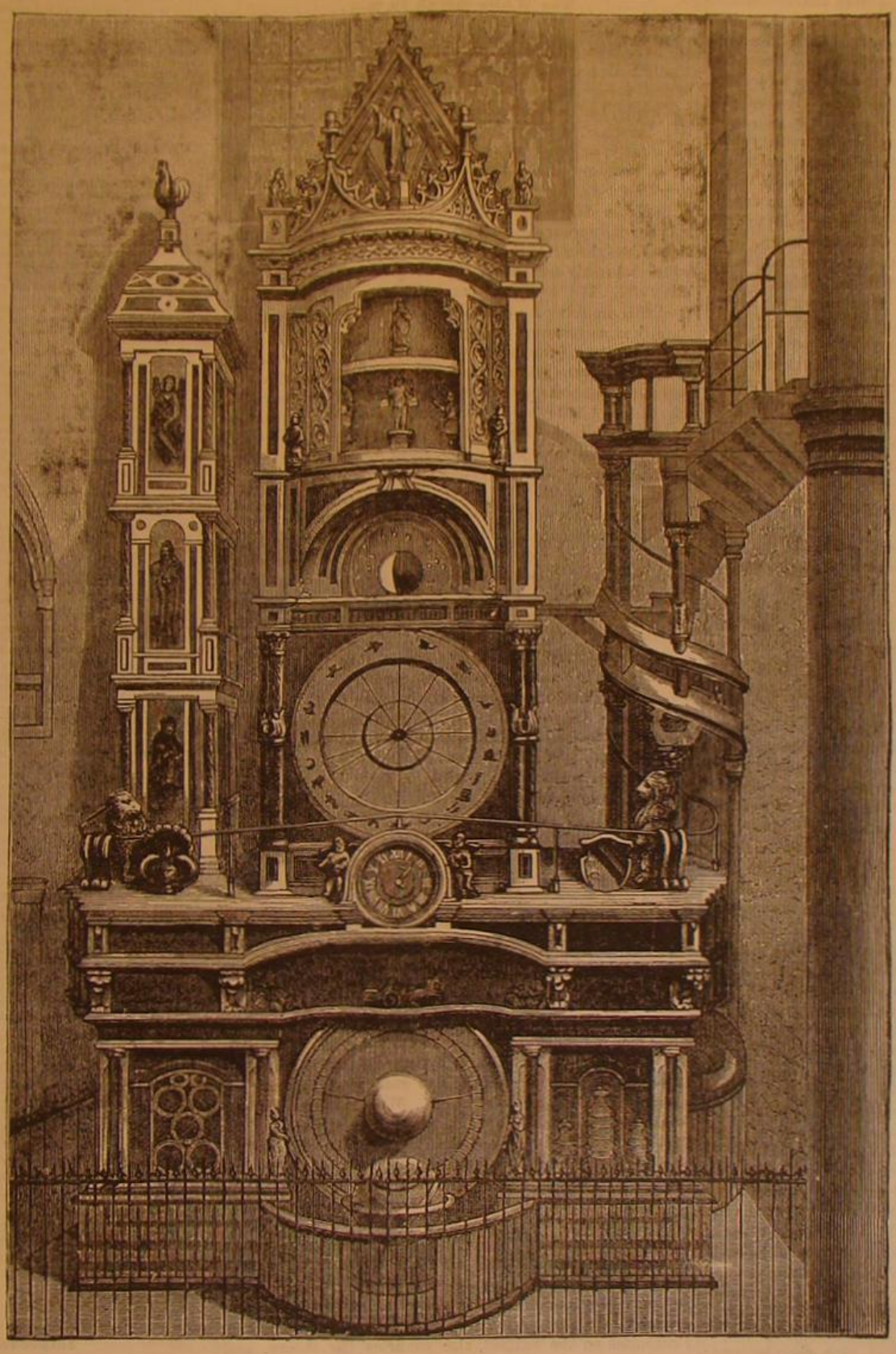
In each grain of sand, there are marvels; in every drop of water, a world. In that great spectacle called Nature, every being has its marked place and distinct *rôle;* and in that grand drama called life, there presides a law as harmonious as that which rules the movement of the stars. Each hour removes by death myriads of existences, and each hour produces legions of new lives. The highest as well as the lowest created organism consumes carbon and water to support life and its duties, and it is not uninteresting to glance at the food, the habits, and the ways and means, peculiar to some of the inferior animals. From their petrified ejections we know what such fossilized reptiles as the plesiosaurus, etc., are, and may some day be able to discover the fish and crustacea they hunted down. Animals, when not living by their own respectable efforts, are either parasites or dependents; many would seem to have positive trades, or are connected with branches of industry. There are miners, masons, carpenters, paper manufacturers, and weavers, lacemakers even, all working first for themselves, and next to propagate their kind. The miners dig into the earth, form natural arches and supports, remove the useless soil: such as the mole, the chinchilla of Peru, the badger, the lion ant, as well as certain worms and molluscs. The masons build huts and places according to all the rules of architecture, as the bees and tropical ants: there are fish that construct boats that the waves never can upset, and Agassiz has drawn attention to a fish which builds its nest on the floating sea weed in the middle of the ocean, and deposits therein its eggs. The wasps of South America fabricate a sort of paper or pasteboard. Spiders are weavers as well as lacemakers; one species constructs a diving bell, a palace of lace. When the astronomer has need of the most delicate thread for his telescope, he applies to a tiny spider. When the naturalist desires to test his microscope, he selects a certain shell of a sea insect, so small that several millions of them in water could not be visible to the naked eye, and yet no microscope has yet been made sufficiently powerful to reveal the beautiful variegated designs on the atomic shells! Aristotle remarked, and he has since been corroborated, that a variety of plover enters the crocodile's mouth, picks the remnants of food off the animal's tongue and from between its teeth. This living toothpick is necessary, as the tongue of the crocodile is not mobile. The Mexican owl, when enjoying a siesta, puts itself under the guard of a kind of rat, that gives the alarm on the approach of danger. Parasites are everywhere, depend on no peculiar condition of the body, and are as abundant in persons of the most robust as of the most debilitated health. They are at home in the muscles, in the heart, in the ventricles of the brain, in the ball of the eye. They are generally either in the form of a leaf or a ribbon, and are not necessarily, as was once supposed, confined to a special animal. The parasites of fish have been detected living in the intestines of birds; and there are some that, for the purpose of development, must pass into the economy of a second animal.

THE removal of foreign substances from the ear may be often accomplished by doubling a horse hair in the form of a loop, and, placing the patient upon the side, passing the loop into the ear as far as it will go, then turning it gently. The substance will generally come out in the loop after one or two withdrawals. The application will do no damage if the hair be carefully used

STRASBOURG CATHEDRAL AND ITS CLOCK.

We publish a view of the interior of the celebrated cathedral at Strasbourg, a city which suffered the horrors of bombardment in the late war between France and Germany; but the cathedral enjoyed almost complete immunity, and the renowned clock altogether escaped injury.

The view is taken from the north aisle, looking across the nave into the south transept. The great flight of steps in the foreground leads up into the choir, under which is a crypt, the most ancient portion of the existing edifice. In the south transept are seen the upper part of the clock and the celebrated Angel Column, a beautiful example of thirteenth century sculpture. The clock was completed in four years by Herr Schwilguè, to replace the one constructed in 1570, which had been itself preceded by the clock of Bishop Berthold. The maker of the first clock, according to the legend, was blinded by his fellow-townsmen lest he should construct a similar work for some other city. The second clock was designed by Conrad Dasypodius, Professor of Mathematics at Strasbourg, in conjunction with the Brothers Habrecht, mechanicians of Schaffhausen. The decorations of the case were due to the painter Tobias Stimmer, a native of the same town. This clock stopped in 1789, and in 1838 Herr Schwilguè undertook the task of restoration. The mechanical part of his work is completely new, and far superior to that of his predecessors. The old decorations and the general design of the former clock have as far as possible been preserved. The whole consists of an edifice of three stories, with a tower to the left, in which the weights are contained. In front of the bottom story is a celestial globe adjusted for the latitude of Strasbourg, and behind it a perpetual calendar with a dial in the center, on which the eclipses of the sun and moon are calculated. On either side are compartments giving the Dominical letter, the solar and lunar cycles, the true and mean time, etc. Above is the clock dial with two genii, one of whom strikes the first note of the quarters while the other marks the hour by inverting a sand glass. In the second story is an orrery on the Copernican system, a dial plate on which the phases of the moon are depicted in black and gold, and the group of the four ages of man, one of whom strikes the second note of each quarter, while Death in the center marks the hour. Above these in the third story the Savior waves the banner of redemption and blesses the twelve Apostles, who pass before him every day at noon, after which Death strikes the hour, the Genius below inverts his glass, and a cock upon the weight tower crows thrice in memory of the temptation of St. Peter. The procession of the puppets is as great an attraction to ordinary tourists as is the complicated mechanism of the works to scientific visitors.



INTERIOR OF THE CATHEDRAL AT STRASBOURG.

Bronzing Cast Iron.

By the process of Gaudion, Mignon, and Bouart, of Paris, the copper is said to be thoroughly adherent to iron; there is nothing between the two metals; and they are so completely united that, if an accident happens, the cast iron will sometimes scale off with the copper. It is said, moreover, that the deposit of copper is perfectly even, not thicker on salient parts than in hollows or under cuttings. A number of large statues have been covered with copper at Val d'Osne, and among other works, two bulls, larger than nature, presenting each a surface of at least one hundred and thirty-two square feet, and on vases, candelabra, and decorative castings of all kinds, and with invariable success. Some of these objects have been exposed to the air during one summer and two winters without suffering any injury. The copper deposited on the works is never less than 1-100 of an inch in thickness. The cost of the works is not more than doubled by this application, and the copper, when carefully treated by a French bronzist, presents an appearance very little inferior to true bronze. The same process is applicable to the tinning of copper or cast iron vessels, the adherence of the two metals is complete, and the coating of tin may be laid on any desirable thickness. The process consists in first scouring and then dipping the articles that are to be coppered into a bath of melted chloride or fluoride of copper and cryolite, to which chloride of barium is added.

Saving is Wealth.

One great cause of the poverty of the present day, wisely says an exchange, is a failure of our common people to appreciate small things. They do not realize how a daily addition, be it ever so small, will soon make a large pile. If the young men and women of today will only begin, and begin now, to save a little from their earnings and plant it in the soil of some good savings' bank, and weekly or monthly add their mite, they will wear a happy smile of competence when they reach middle life. Not only the desire but the ability to increase it will also grow. Let clerk and tradesman, laborer and artisan, make, now and at once, a beginning. Store up some of your youthful force for future contingency. Let parents teach their children to begin early to save. Begin at the fountain head to control the stream of extravagance—to choose between poverty and riches. Let our youth go on in the habits of extravagance for fifty years to come as they have for fifty years past, and we shall have a nation of beggars, with a moneyed aristocracy. Let a generation of such as save in small sums be reared, and we shall be free from want. Do not be ambitious for extravagant fortunes, but seek that which it is the duty of every one to obtain—independence and a comfortable home. Wealth, and enough of it, is within the reach of all. It is obtained by one process, and one only—saving.

Oil Fuels.

At a recent meeting of the Scientific and Mechanical Society, at Manchester, England, a paper on the "Combustion of Oils for the Generation of Steam," was read by Mr. Wm. Gadd, who said: "My special object is to describe to you an apparatus, which I believe successfully accomplishes the purpose, and from the use of which I hope to render the combustion of oils for the generation of steam a practical reality.

"The means employed in this method are of almost the simplest character possible, and consist of, first, an open vessel, by preference flat-shaped, composed of cast iron or fire clay, or any other suitable material, which is placed upon, and covers, the fire bars in any ordinary furnace. In and upon this vessel are formed projections, of a conical or other shape, as many as are found to be necessary; which projections have holes passing completely through them, so as to allow of a free passage of atmosphere, for the supporting of combustion in all parts of the fire or flame. A range of steam pipes of small dimensions (half inch gas pipes are quite sufficient) is laid along the bottom of this vessel, having fine holes pierced therein, at the required intervals, for the emission of numerous small jets of steam. This range of pipes is put in communication with the boiler, and regulated by means of a valve, or stop tap. Another pipe is in communication with the cistern or reservoir of oil, and another with the water supply. The oil supply is made self-acting by means of a ball tap, which gives at once mechanical stoking of the simplest and most perfect character possible.

"Upon proceeding to start this apparatus, I first let into the vessel a little water, and then as much oil as will nearly bring the liquid to the top of the range of steam pipes, or, in other words, to the depth of three eighths or half an inch; but either a greater or less depth will act about equally as well. I then light the oil, and when it is fairly started I turn on the steam; and according to the force and quantity will be the intensity of the flame produced, giving a very perfect combustion at all pressures. Of course, in starting a boiler when cold, it becomes necessary to borrow steam from another boiler for a short time, or to raise a few pounds of steam at the expense of a little smoke. The use of the water, which to some may seem strange, is of great service with the very heavy hydrocarbons, in assisting to produce perfect combustion, and acts, as far as I can ascertain from prolonged observation and thought, in this way: The oil being the heaviest substance, the water rises to the top, and thus retards the combustion of the oil, until it escapes through the water in the form of gas, or at any rate until it assumes a much lighter form than it originally had; furthermore, the constant influx of atmosphere to all parts of the flame, produced by the action of the steam, has such a cooling effect on the surface of the liquid as to prevent the same from boiling, no matter how hot it is above. This retardation, I believe, assists very much the economical consumption of the fuel. But with some oils the water is not needed. In fact, the particular details of this method may be varied according to the character of the oils desired to be used. Thus I find it capable of adaptation to the light, as well as to the heavy, hydrocarbons.

"My experiments, as yet, have not been made on such a scale, or for a sufficiently protracted period, to enable me to give you any tables or exact calculations, either as to temperatures under the various conditions, or the evaporative capabilities of the fuel. But I will give you one clearly de-

termined result, which was obtained in the open air, without the aid of a flue or draft, and which will enable you to form an approximate idea of the value of these fuels used in this manner. A quart of oil, the cost of which was a little under one cent, was put into the vessel along with water, and lighted, and, by means of the steam jets, was caused to produce a flame 3 feet long by 2 feet 3 inches wide, and 3 feet high, which continued to burn fiercely, at those proportions, for very nearly thirteen minutes. Now you will readily form a notion of the amount of flame, and the length of time it will burn, which can be derived from the combustion of a quantity of coal purchasable by one cent.

Useful Recipes for the Shop, the Household, and the Farm.

In hardening and tempering steel, a clean charcoal, anthracite, or coked bituminous coal fire is required; such as is fit for taking a welding heat on iron is entirely unfit for hardening purposes. The sulphur contained in the coal combines with the steel to form sulphuret of iron, and ruins its texture.

The employment of cyanide of potassium in electroplating and other arts often results in painful ulcers on the hands of the workmen. Protosulphate of iron in fine powder, rubbed up with raw linseed oil, is the best remedial application.

When a cork gets pushed down into the neck of a bottle, insert a loop of strong twine and engage the cork in any direction most convenient. Then give a strong pull, and the cork will generally yield sufficiently to be withdrawn.

In case a finger ring becomes too tight to pass the joint of the finger, the finger should first be held in cold water to reduce any swelling or inflammation. Then wrap a rag soaked in hot water around the ring to expand the metal, and lastly soap the finger. A needle threaded with strong silk can then be passed between the ring and finger, and a person holding the two ends and pulling the silk, while sliding it around the periphery of the ring, will readily remove the latter. Another method is to pass a piece of sewing silk under the ring, and wind the thread in pretty close spirals and closely around the finger to the end—that below the ring--and begin unwinding.

The easiest way to hold pearls, in order to drill or otherwise cut them, is to fit them loosely in holes bored in a piece of wood. A few drops of water sprinkled about the aperture cause the wood fibers to swell and hold the gems firmly. When the wood dries, the pearls fall out.

The best mode of oiling a belt is to take it from the pulleys and immerse it in a warm solution of tallow and oil; after allowing it to remain a few moments the belt should be immersed in water heated to 100° Fah., and instantly removed. This will drive the oil and allow all in, and at the same time properly temper the leather.

A simple and usually successful mode of extracting a a needle or any piece of steel or iron broken off in the flesh is accomplished by the application of a simple pocket magnet. An acquaintance of ours had a little daughter who recently broke a needle off in her hand. A surgeon was called, who made several efforts to find the needle by probing and incision, but without success. After the surgeon had left, he mother conceived the idea of trying a magnet; one was procured, and after one or two applications of it the broken fragment of needle was discovered attached to the magnet. This idea will be of especial utility to workers in iron. Machine shop surgery is not the most delicate nor least painful, though men heroically undergo it rather than stand the loss of time due to an inflamed eye or festered finger. Iron filings have a way of imbedding themselves in the eye, which defies almost every ordinary means for their extraction. For their removal, a small, blunt, pointed bar of steel, well magnetized, will be found excellent, and we should recommend that workmen liable to such injuries keep such an instrument about them. It would be a good plan to insert such a bar in a penknife, in a manner similar to a blade.

An easy method of breaking glass to any required form is by making a small notch, by means of a file, on the edge of a piece of glass; then make the end of a tobacco pipe, or a rod of iron about the same size, red hot in the fire, apply the hot iron to the notch, and draw it slowly along the surface of the glass, in any direction you please; a crack will be made in the glass and will follow the direction of the iron. Round glass bottles and flasks may be cut in the middle by wrapping round them a worsted thread dipped in spirits of turpentine, and setting it on fire when fastened on the glass.

To clean and restore the elasticity of cane chair bottoms: Turn the chair bottom upward, and with hot water and a sponge wash the cane: work well, so that it is well soaked; should it be dirty, use soap, let it dry in the air, and it will be as tight and firm as new, provided none of the canes are broken.

Guns and rifles may be easily cleaned from lead by the following: If a muzzle-loader, stop up the nipple or communication hole with a little wax, or if a breech-loader insert a cork in the breech rather tightly; next pour some quicksilver into the barrel, and put another cork in the muzzle, then proceed to roll it up and down the barrel, shaking it about for a few minutes. The mercury and the lead will form an amalgam, and leave the barrel as clean and free from lead as the first day it came out of the shop The same quicksilver can be used repeatedly by straining it through washleather; for the lead will be left behind in the leather, and the quicksilver will be again fit for use.

All light woods may be dyed by immersion. A fine crimson is made as follows: Take 1 lb. of ground Brazil, boil in 3 quarts of water, add ½ oz. of cochineal, and boil another half hour; may be improved by washing the wood previously with ½ oz. saffron to 1 quart of water; the wood should be pear wood or sycamore. Purple satin: 1 lb. logwood chips, soak in three quarts of water, boil well an hour; add 4 ozs. pearl ash, 2 ozs. powdered indigo. Black may be produced by 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 japan. A blue stain: 1 lb. of oil of vitriol put in glass bottle with 4 ozs. indigo; lay on the same as black. A fine green: 3 pints of the strongest vinegar, 4 ozs. best powdered verdigris (poison), ½ oz. sap green, ½ oz. indigo. A bright yellow may be stained with aloe; the whole may be varnished or polished.

A good way to clean black kid gloves is to take a teaspoonful of salad oil, drop a few drops of ink in it, and rub it over the gloves with the tip of a feather; then let them dry in the sun.

The White Streak in Silk.

For a number of years the silk manufacturers of this country have been troubled by the appearance of what is commonly called a "white streak" in dyed silk. This name describes the appearance about as well as any other term we can apply, and has been adopted for lack of any more positive information respecting it. It makes its appearance, principally, on black silk after it has been wound on the spools ready for use on the sewing machines. It is not however confined to black machine twist, but is visible in many of the other dark colors.

It has the appearance of a slight roughness or fuzz on the side of the thread as it lies on the spool. It is invariably white and easily recognized, especially when it occurs in the black silk. We, as manufacturers, have not been exempt from this troublesome difficulty. The combined talents of the silk manufacturers and dyers in this country have been employed during the last few years to discover some method of overcoming the white streak, either by varying the process of manufacture, or by covering it in the dye. As yet all efforts have failed to be completely successful. Various theories have been proposed to account for its appearance; much time and money have been spent in the study of the question, without arriving at any certain knowledge concerning it.

Some manufacturers believe that it is due to carelessness during the process of dyeing: that the silk is not thoroughly washed from the soap suds in which it is boiled, leaving particles of soap adhering to the silk. Others stoutly affirm that it is due to the dead wood which the silk takes on as it passes over the wooden rollers of a machine known as the stretcher.

The Nonotuck Silk Company's present theory is that the streak is due in some way to the process of adulteration to which the silk is subjected as it is wound on to the reel from the cocoon. They think it possible that the cocoons when wound may be soaked in warm water to which a quantity of rice starch has been added, thus making a kind of rice water or thin paste, which the silk takes up as it is wound, thus adding a cheap weighting material to the silk.

That this theory does not account for the appearance of the streak is evident; since some of our brands of silk, we are confident, are perfectly free from any adulteration, but yet the streak occurs abundantly in them. A careful examination with the microscope and chemical reagents, for the purpose of obtaining some definite idea of its nature, soon settled the fact that it is a vegetable substance of some kind; but exactly of what nature, I was unable at once to determine. This slight clue enabled our dyer to apply a dye that would partly cover it. This new process of dyeing, however, was attended with many objections. It was more expensive, while it took a much longer time to dye the silk. Our greatest objection to this method of dyeing was that it increased the weight of the silk with the dye stuff, thus injuring its quality, and affecting its strength. We could ill afford to sacrifice the strength of the silk for the sake of covering the streak, so we sought to avoid the difficulty by using another brand of silk. I finally became convinced by careful examination that it was of the nature of a parasite, or a fungus growth on the raw silk. All of my researches tended to confirm this theory.

I have lately submitted samples of the streak, which were found both in the raw silk and in the dyed silk, to Professors Verrill, Eaton, and Johnson, of Yale College, New Haven, who all confirmed the theory of its being a fungus growth on the silk. An eminent naturalist of Boston, whom I consulted on the subject, also confirms the theory, and thinks that we may find that this growth is connected with the disease with which the silk worms of Europe have been troubled for so long a time.—*C. A. Burt, Oneida Circular.*

DECISIONS OF THE COURTS.

United States Circuit Court.--District of Massachusetts.

PATENT LATHE.—SPRING *et al.* vs. PACKARD.—SAME vs. HOWARD.

[*In equity.—Before* LOWELL, J.—*October*, 1874.]

LOWELL, J.:

The plaintiffs are the inventors and owners of a valuable and ingenious improvement in Lathes for Turning Irregular Forms, for which a patent was issued to them in May, 1869, but which they testify was completed in the summer of 1867. They describe the machine with fullness and accuracy in their specification. Its principal application was intended to be, and is, for turning sewing machine needles and similar articles, which are to be brought to a point; and the claim is for—

The combination of a gripping chuck, by which an article can be so held at one end as to present the other free to be operated upon, with a rest preceding the cutting tool, when it is combined with a guide cam, or its equivalent, which modifies the movement of the cutting tool, all operating together, for the purpose set forth.

There is no doubt, upon the testimony, that the plaintiffs were original and meritorious inventors of an improvement over the machines then in general use for turning sewing machine needles. But a machine was brought forward by the defendants, which one Pernot swears he made in New York in 1863, and operated there for thirteen consecutive years in turning needles in great quantities, for several of the principal manufacturers of sewing machines, and which appears to contain all the elements of the plaintiffs' combination, working together in the same way, and producing the same results. The dates are proved by Pernot and by another witness, and corroborated by circumstantial evidence, and might have been disproved if untrue, because the manufacturers could have testified concerning the needles which they are said to have bought of Pernot. No such contradiction is given. This machine has the gripping chuck, the rest, the cutting tool, and instead of a guide cam, a pattern, which, so far as this case is concerned, appears to be an equivalent; and, as we understand the testimony, it is that a fixed pattern was, generally speaking, a well known equivalent for a cam pattern or guide in machines of this kind, at the date of the patent. (Waters, p. 110.)

It has been argued that Pernot's machine had no adjusting screw. It had a screw which it is insisted should be called a set screw, and which was no doubt less useful, in some respects, than the adjusting screw of the plaintiffs' machine. The plaintiffs however, do not claim the adjusting screw as part of their combination. Mr. Waters, being asked whether it is part of the combination, says—

"Hardly that—that is to say, hardly an element. I regard as essential that the organization should be such as to admit of the convenient use of a screw; and that that screw should make a part of the organization I regard as essential as an adjunct to the combination—so essential that, as I have said, I would not give a sixpence for any one of them, for the purpose of turning sewing machine needles, without it."

It is then an important adjunct, rather than an essential element, and Pernot's screw was a sufficiently good adjunct to enable his combination to work successfully in making needles in the way of his business; and the difference in the screw would have been no defence if his machine had been later in date than the patented one.

It is further said that Pernot did not turn his needles to a point in the machine. He gives reasons for not doing this work, but says that he did turn points for a carding machine; and that his lathe needed only a change of pattern to make it applicable to turning the points of needles. This is obviously true, and as the particular form of pattern used was not of the essence of the invention, we are of opinion that Pernot's machine contains the whole patented combination.

It is not denied that all the elements of the combination were old and well known before 1857; it is only contended that the precise combination was new, as it undoubtedly was to the trade generally, and to the patentees themselves; but we are obliged to say that Pernot's machine, which was not patented, and was somewhat guarded from view, perhaps for the very purpose that its mode of operation might not be generally known, was yet, by the law, such an anticipation of the plaintiffs' combination that they were not the first, though they were original, inventors thereof.

Bill dismissed with costs.

[*George E. Betton*, for complainants.
James B. Robb, for defendants.]

United States Circuit Court.---District of Connecticut.

PATENT LOCK.—THE RUSSELL AND ERWIN MANUFACTURING COMPANY *vs.* THE P. & F. CORBIN MANUFACTURING COMPANY AND FREDERICK H. NORTH.

[*In equity.—Before* WOODRUFF *and* SHIPMAN, J J.—*April*, 1874.]

The claim of the letters patent granted to Rodolphus L. Webb, December 31, 1867, for an "Improvement in Reversible Locks and Latches"—namely, "The combination of a lock and latch when the latch bolt and its operative mechanism are arranged in a case or frame independent of the main case, and constructed so that the latch bolt may be reversed, substantially as described, without removing the said independent case from the main case," is infringed by the combination of a lock and latch in which the latch bolt and its operative mechanism are arranged in a skeleton frame within an outer or lock case, which operates to preserve the proper relations of the yoke and tumbler while being moved forward and backward, although it does not so operate when the latch and latch mechanism are removed from the outer or lock case.

Infringment is not avoided by the fact that, when the patentee's latch bolt is drawn forward for the purpose of reversing it, the case or frame moves forward with it in a straight line, and that the defendants' frame, when the latch bolt is drawn forward, moves in a curved line.

Nor is infringement avoided by the fact that the defendants introduce a catch and spring to hold the latch and its mechanism in position, after reversal until the knob spindle is inserted. This superadded device may improve the aggregate structure, but it has no effect whatever upon the functions or mode of operation of the patented devices, nor does it justify the defendants in appropriating them to their own use.

The word "independent" in the claim does not mean that the latch and its mechanism operate without any contributory aid from the main case or adjuncts thereto. All that it imports is that there is an outer case and a separate inner frame or case in which the latch mechanism is arranged and held in position.

A decree must be entered for the complainant, agreably to the prayer of the bill of complaint, with costs to the complainant.

[*Charles E. Mitchell* and *Benjamin F. Thurston*, for complainant.
Charles R. Ingersoll and *Charles F. Blake*, for defendants.]

United States Circuit Court.---Southern District of Ohio.

JAMES F. TRADER, SAMUEL R. COLLIER, AND GEORGE VLEREBOME, PARTNERS, AS TRADER, COLLIER, & VLEREBOME, *vs.* A. L. MESSMORE AND JAMES COULTIS, PARTNERS, AS MESSMORE, COULTIS & CO., ROBERT M. BOWMAN, AND W. H. BOWMAN.—PATENT SEED PLANTER.

[*In equity.—Before* SWING, J.; *January*, 1875.]

Where complainants had used their device for thirteen years without ascertaining that their patent covered such a device as that which formed the alleged infringment, and this latter had become the subject of a patent and possessed superior utility to that of complainants: Held, that the patent sued on should be interpreted strictly.

It becomes important, in interpreting the language of a patent, to know what construction the patentee himself placed upon it; and to this end recourse may be had to the files of the application, to ascertain what changes were made in the original specification and claims, and the significance of those changes as revealed by the history of the case.

The patent of William Blessing, December 13, of 1859, for "an improvement in seed planters," must, in view of the application record, be narrowly interpreted, so as to limit the invention to a particular arrangement of a particular top with particular openings, so that the chaff may be removed in a particular way.

Thus constructed, it does not control a device in which there are no lateral chaff openings in the periphery of the distributer, through which the chaff is worked by the vibrations of the feed bar, but in which, instead, the chaff falls directly to the ground.

While patents are to be construed liberally, they should not be so construed as to enable patentees to reach out and cover every improvement of invention which, after seeing the same, they conclude they might have embraced within their patent, but which was not so embraced and included.

Complaint dismissed

[Wood and *Boyd* for complainants.
Fisher and *Duncan*, for defendants.]

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From March 1 to March 6, 1875, inclusive.

ARTIFICIAL FUEL.—D. F. Packer, Mystic River, Conn.
BOTTLE STOPPER, ETC.—N. Thompson (of Brooklyn, N. Y.), London, Eng
CARTRIDGE HOLDER.—H. Metcalf, Springfield, Mass.
FURNITURE CASTER.—J. Crist, New York city.
GAS, ETC., REGULATOR.—H. W. Shepard, Brooklyn, N. Y., *et al.*
GENERATING STEAM, ETC.—D. F. Mosman, Chelsea, Mass.
MULE AND SHUTTLE SPINDLE.—J. H. Le Moyne, Boston, Mass.
MUSICAL MOUTHPIECE.—C. G. Conn, Elkhart, Ind.
PUMP.—G. G. Hartwick, Jersey City, N. J., et al.
SMELTING COPPER, ETC.—S. L. Crocker, Mass.
SNAP HOOK.—F. C. Nye, New York city. (Two patents.)
SPOOLING THREAD, ETC.—J. W. West, Boston, Mass.
TREATING FARINACEOUS MATTERS.—W. Adamson, Philadelphia, Pa.
VALVE.—T. Shaw, Philadelphia, Pa
WATER CLOSET.—W. S. Cooper, Philadelphia, Pa.

Recent American and Foreign Patents.

Improved Car Spring.

Andrew Jackson Culbertson, San Andreas, Cal.—The centers of bent metal bars are connected with the body frame by king bolts. The ends of the bars are attached to blocks, which are placed in recesses in the truck frames. To the blocks are attached rods, the upper ends of which are attached to springs. The lower parts of the springs rest upon seats attached to the truck frames. To the cross spring are attached the longitudinal springs, which are interposed between the cross bars of the frames and the truck frames, and diminish the rocking of the car body.

Improved Apparatus for Stamping Embroidery Patterns.

John McGavin, New York city, assignor to Isaac S. Van Deusen, Passaic, N. J.—The essential feature of this invention consists of a rotary and traversing brush for printing the patterns on the cloth through the perforations of the pattern sheet or plate; also, mechanism for revolving it, and at the same time moving it over the pattern and the cloth; and also a carriage for the roller, and the operating mechanism, combined with the pattern and cloth-holding table. Another feature of the invention is the table for holding the pattern and the cloth, provided with adjusting supports, having inclines by which the table can be raised readily from time to time, as the cloths to be printed (of which a number are put together, one above another) are removed; and another feature consists of an extension table for holding long or short cloths. There is also an extension frame for long or short patterns, and contrivances for detachably fastening and unfastening the patterns and the cloths readily.

Die for Forming Spring Shanks for Shoes.

Emil Briner, New York city.—At the uppermost part of the main casing is arranged rigidly a steel cutting plate, which has above the cutting edge a vertical guide frame, through which the piece of sheet metal from which the shank blanks are made is fed along the face of the cutting plate to projecting guide plates arranged at one side of the main casing, at such a depth below the cutting plate that the exact width of the shank is cut off therefrom by a plunger. The plunger is constructed with a top cutting plate, for the purpose of shearing off the blank gradually without cutting across its whole width at the same time. A sliding spring-acted bolt comes in contact with the punched-off blank on each stroke of the plunger, pressing the same, while receding against the face of the cutting plate of the plunger, and preventing the dropping of the blank. The shaping die of the plunger corresponds to the form of the spring shank to be produced, the curved part of the same being, however, curved to a greater extent than the shape of the finished shank, for the purpose of allowing for the elasticity of the metal. The correspondingly curved convex shaping die imparts the required degree of spring to the shank. When the shank is released by the return motion of the plunger from the shaping dies, the same springs forward toward a slotted recess for assuming its permanent curved shape, and drops through the same to the pan below.

Improved Device for Baling Cotton.

William Iler, Shreveport, La., assignor to himself and John W. Iler, of same place.—A lever has attached to its end a clamp which turns freely on a bolt. An arm comes in contact with the end of the lever, so that when the end of the band is between it and the end it may be securely clamped and held when the lever is operated. The draft bar passes through a mortise in the lever, so that it will turn freely on a pivot pin. At the other end of the draft bar is another clamp for clamping and holding the other end of the band.

Improved Car Coupling.

Albert A. Kellogg, Montgomery, Mich., assignor to himself and Miles E. Cartwright, of same place.—This is a drawhead with longitudinal top slot and swinging coupling hook, that is seated, when carried into downward position, into a bottom hole of the drawhead, locking thereby the coupling link. The coupling hook is attached to a lateral shaft, and swung, by a spring-acted lever frame provided with handles at the sides of the car, into raised position, being retained therein by the action of a bell-crank lever, with hook end, pivoted at the outside of the drawhead. A spring rod with broad front head slides in a guide recess of the drawhead, and connects with the other end of the dog, so that by the concussion of the drawheads the shaft of the coupling hook is released, and the hook carried down by the spring power of the lever frame for coupling the link.

Improved Sleeve Button.

Herbert N. Mason and Orville P. Richardson, Attleborough, Mass., said Richardson assignor to said Mason.—The shank which connects the shoe to the front portion of the button is attached to the back of the front, and also to the disk of the shoe, by fitting a tenon on the end through the plate, and heading it down.

Improved Thill Coupling.

Ephraim Soper, Brooklyn, N. Y.—A clamp is bolted to the shaft, and has a stud going through a mortise, and a pivoted cam lever, so as to force the clamp together and hold it fast. The safety trap is connected to the cam lever instead of the eye plate, so that, besides serving the purpose of the strap itself, it prevents the cam from working loose. An elastic cushion is made with a wide groove, and the eye in the eye strap clamp is contracted along the middle portion, so that the collars of the cushion are interposed between the ears and the eye strap, and thereby prevented from striking against the ears and rattling.

Improved Car Coupling.

George W. E. Row, Steele's Tavern, Va.—When any car is thrown off the track, so that thereby the relative position of the link and drawbars is changed, a retaining spring is arranged to give way and release the link, so as to uncouple thereby the cars.

Improved Dressing of Millstones.

John Williams, Dresden, assignor to himself and George J. Stonebreaker, Fayetteville, Tenn.—This consists of a metallic frame, having slides which run in grooves, moved by racks and pinions, and two guides which connect the slides, between which is confined the marker, which is moved in the guides at right angles with the slides. The object of the device is to cut the face strictly with the staffed face of the stone, and by so doing retain the true face.

Improved Miter Box.

Herman Hempel, Syracuse, N. Y.—The guide block of a miter box is constructed with a rotary base plate and sectional blocks, made right-angled in front and formed circular in the rear. The rapid adjustment of the clamps to the required mitering angle and the molding is effected by the simple pressure on the treadle.

Improved Process of Coloring Tobacco.

Oscar Knab, Newark, N. J.—This consists in treating tobacco leaves for imparting or restoring a dark color to the same by passing the leaves, in a soft and moistened state, through a solution of sesquichloride of iron.

Improved Method of Tubing Wells.

William T. Dobbs, Pana, Ill.—This invention consists of plastic tubing formed of cements to shut off caves, slides, or other formations of the earth that give way and slip down, causing a break in the walls of wells or other deep borings in the earth. The compound with which the cave in the wall is filled and crammed is perfectly soft and plastic, adjusting itself to the cavity. It undergoes a chemical change and hardens under water at any depth in a few hours, completely binding and securing all fragments and loose particles, so that being subsequently drilled through it will leave a solid and strong wall. The compound used is a mixture of gypsum, hydraulic cement, and fine sharp sand, in any proportion that will form a solid cement.

Improved Adjustable Cut-Off for Steam Engines.

Henry Webster, Cassville, Wis.—An oscillating toe piece works in the regular manner when rack pieces do not touch raised top rails; but as soon as the top rails are set to engage them, pawls are instantly released thereby from the shoulders of the toe piece, and produce, by the weight of the levers thereon, the dropping of the respective toe and lever, and the cutting-off of the steam. The nearer the top rails of the rack pieces are placed to the pivoted arms of the toe piece, the shorter will be the cutting-off action, and the quicker the speed of the engine.

Improved Folding Store-Shelf.

Minter P. Key, Waxahachie, Tex.—This store shelving is so constructed that it may be readily folded for convenience in removing it from the store, and for transportation. Each section of the shelving is divided into three equal parts. The lower part is occupied by drawers and a closet. The middle part is hinged to the lower part, so that it may be turned down. The upper part is hinged to the middle part, so that, as the middle part is turned back and down, the upper part may descend without changing from a vertical position. To the upper part are attached caster wheels, upon which the said upper part rests when the shelving is folded. The caster wheels, when the shelving is arranged for use, enter recesses.

Improved Corn Sheller.

William Smith Broyles, NolaChucky, Tenn.—A shelling cylinder is provided with teeth and made tapering in form, and is rotated either fast or slow by a crank. The teeth of said cylinder come in contact with the ears of corn, remove the kernels, and at the same time move the ears longitudinally through an adjustable shield. As the cobs reach the farther end of the shield, they enter an inclined spout, down which they slide into a receiver. The shelled corn falls upon the inclined screen and then upon an apron, hinged at its lower edge, so that it can be turned up into a vertical position when the corn is to be measured, to allow the corn to fall into the measuring pit, which is provided with a sliding top, which, when the pit is full, may be pushed in to prevent the entrance of any more corn until its contents have been drawn out.

Improved Cotton Harvester.

La Fayette K. Miller, Austin, Tex.—This invention consists in a system of revolving rods, so arranged as to be continually going down into and emerging from the cotton branches while in a vertical position. The whirling motion of the rods causes the fibers of the cotton, as soon as they come in contact with the rods, to take hold of said rods or pickers, wind round them, and remain attached till stripped off by clasps or strippers that slide down the rods after they come up from among the branches of cotton stalks, and scrape the cotton into a receiver below. The pickers are caused to turn by friction against broad bands that pass across the frame of machine. These bands are corrugated, so as to increase the friction, and are broad enough to act on the pickers and turn them during their descent from the top to bottom of cotton stalks. The bands work on rollers, each pair standing about forty-five degrees from a perpendicular, with base journals near each other, but at top standing inclined in opposite directions, giving the form of a trough. The strippers are cuffs that fit around the pickers loosely enough to slide upon them easily and work in two grooves, one on each side of the pickers, by which provision the cotton is the more easily removed. Presser levers or bars are arranged on each side of frame, arranged and connected so as to throw the strippers to points of pickers one or more times while passing the receiver. These levers are to work rapidly and with long strokes, causing two or three strippings to take place while the pickers are passing over the cotton box.

Improved Self-Regulating Gas Burner.

Duncan D. McMillan, La Crosse, Wis.—The invention consists of a gas burner with flexible diaphragm and valve. The lower chamber of the same is connected by suitable perforations with an annular channel concentric to the diaphragm, which channel conducts the gas to the delivery tube in any position of the tip section by means of two or more channels, the flow being regulated in the customary manner by the pressure of the gas on the diaphragm and the corresponding opening and closing of the valve.

Improved Thrashing Machine.

Theophilus Harrison and William C. Buchanan, Belleville, Ill.—A fan has a tapering blast channel, the latter under the thrashing concave. The blast thus strikes the wheat, chaff, and straw as they pass from the thrasher, hoisting the chaff through an opening. A hinged door at the outlet of the thrasher is made adjustable by a rod fastened to the top by a pin passing through one of its holes. This deflects the grain, and causes it to fall on the ordinary vibrator. A plate is hinged and pendent from the frame, for the purpose of preventing the ejection of loose grain. A trap door covers the chaff escape.

Improved Draft Equalizer.

Liberty J. Seely, Waldron, Ind.—This invention consists of a slotted clevis, secured by supporting braces and bars at the front end of the plow beam, at suitable distance toward the landside of the same. The clevis carries, in a sliding and adjustable draft eye, a draft rod with the usual three horse doubletree, being strengthened by draft and stay rods attached to a lateral cross bar and the rear and front part of the plow beam.

Improved Miter Machine.

Daniel A. Fisher, Allegheny, Pa., assignor to himself and O. Chambers, of same place.—This invention consists of a circular saw with mechanism for dropping it below the table, shifting it from one bevel to the other, and lifting it up through the table in regular succession for utilizing it to saw right and left bevels for miters without shifting the stick to be sawn.

Improved Saddle Horse Apparatus.

Adrian Hitt, Flora, Ill.—This invention consists in a stay strap extending from the crupper on each side of the horse, and connecting with the strap which supports the breast pulleys. The stay straps counteract the forward pull of the forked strap when the rider draws upon the reins, and prevents folding or wrinkling of the girth, or its being drawn forward toward or between the fore legs of the horse, as happens when the ordinary martingale attachment is used.

Improved Registering Machine.

Charles E. Rand and John T. Dupont, New York city.—This invention consists of two or more ranges of counters for special objects, combined with another range which counts the totals of the special counters, all so contrived that any one of the special ranges may be worked together with the range for totals independently of the others.

Improved Car Axle Box.

Charles A. Hussey, New York city.—The main feature of this invention is the provision made for keeping the bearing cool by means of a circulation of water or other liquid, or of air through the bearing in any direction. It will be found fully described and illustrated on page 166, vol. xxxii.

Improved Apron for Stock Cars.

Chapman R. Jones, Berlin, Ill.—This invention consists in the combination of the bails and the hooks with the apron, to enable it to be readily secured to and released from the door posts of a car, so that it cannot be displaced by the tramping of stock in passing into and out of the cars, or by the moving out and in, handling freight.

Improved Revolving Rack for Holding Stockings.

Daniel K. Wertman, Shenandoah, Pa.—This invention consists of an improved device for suspending socks, stockings, or other goods from a revolving rack. The stockings may be suspended in pairs or clusters of a dozen, with their size, quality, and price marked for the accommodation of purchasers. The said rack revolves on an iron pin in the base, and stands on the counter, or in any suitable position, for exhibiting the goods.

Improved Lamp for Lighting and Heating.

Edward A. Rippingille, Holborn, England.—The oil reservoir and cone plate can be slid into and out of position. The cone plate is formed to fit the body of the lamp, and thereby shut off air communication between the upper and lower sides thereof, except through the cone. The top of the lamp stove is formed of two plates in the lower one of which is fixed a short metal tube, while in the upper one is formed a hole to serve as a seat for a kettle or other article; and at one side is fixed a chimney. A space is left between the two top plates to allow the heat and products of combustion to circulate around the kettle. Openings are formed in the sides of the lamp to admit air freely to the under side of the cone plate, and to enable the wick to be regulated without disturbing any part of the lamp.

Improved Machine for Tinning Sheet Copper.

William Jenkins, Newark, N. J.—Sheet copper and other soft metals (as sheet brass and other composition metals) are usually tinned by "wiping" the fused tin or tin and lead with cloths or waste, no machinery being employed for the purpose. To spread the melted tin evenly by this hand process requires much care and skill, and a great waste of time. The present invention is a combination with a vat of two rolls, the former running in the molten metal within said vat, and provided with a surface that will cause the adhesion thereto of said metal, while the latter has a dead surface, or one that will not permit the adhesion of said metal, so that a sheet of copper may be tinned on one side.

Improved Spring Bolt Fastening for Tongues, etc.

Ethan H. Pettit, Twin Lake, Mich., assignor to himself and Dellamar Wade, of same place.—A semicircular plate on the end of the tongue has circular portions to receive a tongue yoke, which consists of a hook part and spring-held straight part combined, and their ends meeting, so as to form a flush joint. This leaves an open space for the introduction of the trace or other article to be secured.

Improved Whiffletree Hook.

Othniel J. Smith, Wauwatosa, Wis.—A hook is formed of a stationary part, having a downward extension at the end, and a pivoted correspondingly curved part is arranged to fold or lap thereon. The trace is first placed over the lower part, and carried back toward its rear end; the upper part is then brought down, and the trace placed over both, so as to lock them tightly together and prevent their opening. The trace is thereby not liable to be detached in going down hill, or by other causes, but is retained in the hook, without the use of a spring, in a strong and secure manner.

Improved Milk-Cooling Apparatus.

Orrin J. Stickles, Canton, N. Y.—In this device any desired number of pans and tubes may be arranged in a series, and connected by the same water pipe. Cold water or ice is allowed to flow into and stand in an inner tank. The milk in contact with the cold walls of the tank will become cold, will sink and be replaced by the warmer particles, thus establishing a circulation that will soon cool the entire mass of the milk, however large the tank may be.

Improved Carriage Curtain Fastening.

Henry Foster, Westerly, R. I.—That portion of the fastening which is attached to the curtain is a wedge-shaped slide having a shank extending through the curtain. On the under side of the wedge is a pin, forming the lock. The slide travels in a socket plate, which has a series of holes, into which the pin will rest when the curtain is drawn to the desired tension. When it is desired to unfasten or adjust the curtain, the operation is performed by tilting the wedge sufficiently to release the pin from its hold in the plate. This being done, the said wedge may be moved backward or forward.

Improved Step Ladder.

Robert S. Van Zandt, Williamsburgh, N. Y.—The standards of the ladder are made of the same width, and the adjacent ends of the side bars are hinged to each other, so that they may be turned into line with each other to form a ladder, turned at an angle with each other to form a step ladder, and turned parallel with each other for storage and transportation.

Improved Alarm Lock.

Jonathan Walton, Brooklyn, N. Y.—This device may be used as a lock, a latch, a bolt, and an alarm, as may be required. When the pin is held forward and a bolt pushed outward, the end of the bolt strikes against the head of the pin and pushes the catch outward, allowing the door to be opened. When the pin is left free, the outward movement of the bolt simply pushes the pin outward, and does not move the catch. A button is pivoted to the catch, so that it may be turned down over the pin to hold it, so that the outward movement of the bolt may push back the catch and allow the door to open. When the button is turned back, its free end strikes upon a projection, so that the catch cannot be pushed back, thus forming a double lock. The bolt is thrown into or out of gear with the knob spindle by means of a key. A gong, which serves also as a cap for the clock, is sounded by turning the knob.

Improved Car Coupling.

John B. Winters, Attica, Mich.—In this coupling a pivoted hook is arranged within a drawhead, and acted upon by a spring, which enables it to operate automatically for connecting with the coupling link. The lever for car coupling is connected with a cranked lever on the platform. Said lever is pushed to the left to uncouple, is held back by a pin when the hook is coupled, and is held forward to keep the hook raised for the escape of the link by like means.

Improved Check Box.

Somers Van Gilder, Knoxville, Tenn.—This is a contrivance of apparatus whereby the cash receiver of a store or other business place will exhibit to the customer the amount of his bill by means of checks presented to his view from the inside of a case, where they are placed by the operator by means of slides. The checks prevent the withdrawal of the slides after so exhibiting the bill, and fall into locked receptacles, where they record the amount for which the receiver is responsible.

Improved Reversing Link for Steam Engines.

John Simpson, of Meadville, Pa., assignor to Dick & Church, of same place.—This invention relates generally to valve gearing, but particularly to that shown in the patent No. 125,709. Two slotted links, having a large circular recess at each end of the slot, are bolted to a block, and also together at each end. One of the notched pivots of the eccentric rods is fitted in each end of the link, and a collar in the middle of each pivot is fitted between the two plates to hold the pivots in place, making a simple and cheap contrivance, well adapted for durability. The wrist pin of the valve rod works in the notched pivots.

Improved Cranberry Separator.

Daniel T. Staniford, New Egypt, N. J.—As the cranberries fall upon inclines, such of the perfect berries as are unobstructed bound upon the upper inclines and roll down aprons into a receiver, and are the marketable berries. The imperfect berries do not bound, but slide, down one incline to another, and, falling from the last incline into a receiver, are thrown away. The berries that fall from the last upper incline fall into a receiver, are called middlings, and are again passed through the separator.

Improved Compound Engine.

Jackson W. Bell, McKinney, Tex.—This invention consists of a series of engines for working the steam over by exhausting it from the first into the second, and so on, for utilizing the pressure lost when the steam is exhausted from a single engine into the air. The engines are all connected to one driving shaft at different points around the axis, and all connected by a revolving tube, which serves for supply and exhaust pipes and valves to all.

Improved Water Wheel.

William J. Thompson, Springfield, Mo., assignor of one half his right to Springfield Iron Works.—This invention applies more especially to a water wheel for which letters patent have already been granted to the same inventor; and the improvement consists in an improved mode of operating the gates; in a spring for each gate, to insure the simultaneous closing thereof; and in a three-chamber box around the main shaft, having an arm, which extends over the sector gears and supports the pinion shaft.

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Patent Right for $30, will net you $250 per month. Address Renner & Co., New Midway, Frederick Co., Md.

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Two good 2 Horse Power Engines and Boilers for Sale cheap. E. Ware, Astoria, N. Y.

Order Wanted for Spool Blanks, &c., or Hard or Soft Wood Sawn any Size. Address E. H. Webster, Brandon, Vt.

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Miller's Brick Presses for fire and red brick. Factory, 309 South 5th St., Philadelphia, Pa.

For Sale—Valuable Manufacturing Property; commodious buildings; driving-power, shafting, belting, etc; good order. Great sacrifice. For description, address "The Cosmos," St. Charles, Mo.

For the cheapest and best Small Portable Engine manufactured, address Peter Walrath, Chittenango, N.Y.

Dickinson's Patent Shaped Diamond Carbon Points and adjustable holder for working Stone, dressing Emery Wheels, Grindstones, &c., 64 Nassau st., N. Y.

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Notes & Queries

W. H. G. will find directions for silvering mirrors on p. 267, vol. 31.—W. H. P. can make a battery for plating by following the directions on p. 232, vol. 32.—J. F. P. will find a recipe for black ink on p. 263, vol. 29.—J. C. can clean gilt frames by following the instructions on p. 27, vol. 31.—W.E. will find on p. 251, vol. 29, a formula for rubber varnish applicable to textile fabrics.—W. A. B. will find an explanation of the pyrometer, for indicating the fusing points of metals, on p. 171, vol. 32.—L. B. A. will find details of the threads to be cut in bolts of various sizes on p. 27, vol. 29. D. K. will find rules for ascertaining the strength of boilers on pp. 155, 186, vol. 32.—C. B. will find details of the process of making artificial butter on p. 246, vol. 29.—H. M. B. will find a description of nitro-glycerin on p. 283, vol. 30.—E. L. will find a rule for determining the curvature of the earth on p. 122, vol. 30.—H. M. A. will find a full description of the pantagraph on pp. 99, 179, vol. 28.—W. C. W. G. will find an article on steam on the Erie canal on p. 96, vol. 28.—F. W. P. will find directions for cleaning files on pp. 363, 379, vol. 28.—W. B. A. will find that iron can be softened by following the directions on p. 123, vol. 31, for steel.—P. McL. can cast Babbitt or other metal free from air holes by following the directions given on p. 409, vol. 31.—G. M. E. will find on p. 11, vol. 31, a recipe for a shellac varnish which will do for making leather airproof.—G. A. McL. will find that Greek fire is described on p. 267, vol. 31. The manufacture of starch from potatoes is described on p. 315, vol. 31.—J. M. S. and others will find a description of Hero's fountain on p. 59, vol. 29.—F. H. W. and C. S. P. will find directions for making rubber stamps on p. 156, vol. 31.—W. J. C. will find a recipe for cement for leather on p. 119, vol. 28.—J. K. and others will find full descriptions of tools for lathe work in the early chapters of "Practical Mechanism."—E. D. W. will find full directions for constructing a filter cistern on p. 251, vol. 31.—A. R. will find a recipe for laundry blue on p. 219, vol. 31.—G. A. B. will find directions for bluing steel on p. 123, vol. 31.—C. J. H. will find directions for bending timber on p. 25, vol. 31.—G. C. & S. and J. O. will find directions for casehardening wrought iron on p. 202, vol. 31.—M. K. W. will find complete instructions for coloring photographs for the magic lantern on p. 330, vol. 30.

(1) G. E. F. says: A machinist proposes the following: Three up and down saws (with two upright iron rollers), the sides of the rollers to be fluted so as to press against the deal and feed it to the saws. He thinks that the deal, however crooked, will be always straight between the pulleys. Would this answer the purpose? A. The principle is old. One of the upright rollers is stationary or fixed at any desired position, the other yielding to irregularities.—J. E. E., of Pa.

(2) C. C. D. and others.—A one inch objective ought to divide Castor, but no power of 100 should be used. One of 50 is better.

(3) L. C. H., of Heidelberg, Germany, asks: How can I become a good practical master mechanic of a railroad? A. You must commence in the shops, and make yourself acquainted with the theory as well as the practice of the profession, and work your way up by industry and perseverance.

(4) G. W. L. says: I am working on a boiler 36 inches in diameter by 20 feet long, of $\frac{5}{16}$ inch iron, with cast iron heads 1¼ inches thick, without flues, tubes, or braces. What is the safe working steam pressure to be carried? I asked a theoretical engineer, and he gave a rule of algebra that I cannot work out, as I have never went beyond the rule of three in arithmetic. Is there any book that gives rules for finding the strength of iron, distance apart of stay bolts, braces, and rivets in a boiler without algebra? I asked the above mentioned engineer also what rule there is for getting the proper distance apart of stay bolts in flat surfaces of a boiler of $\frac{5}{16}$ inch iron, to carry 70 lbs steam in salt water. He gave the following: $\sqrt{\frac{5530}{70}} \times 9 = \sqrt{79} \times 0{\cdot}9 = 8$. This is all Greek to me. Will I have to learn algebra before I can get such a rule to work? A. You will find the information as to working pressure in the article on "Strength of Boilers," pp. 153, 186, vol. 32. Your remark about the formula being all Greek to you suggests that, in common with many others, you doubtless look upon algebra as a sealed book, entirely different from arithmetic. In a large measure, however, it is only a kind of shorthand for expressing rules, and we think that a few days devoted to the study of algebra would aid you greatly in your business. To illustrate how the use of algebraic expressions condenses an expression, we will translate the example quoted for you. $\sqrt{\frac{5530}{70}} \times 0{\cdot}9$ expresses that the number 5530 is to be divided by the pressure of the steam, and that the square root of the quotient is to be multiplied by $\frac{9}{10}$. A little practice will enable you to translate all similar expressions.

(5) A. M. A.—The inventor must sign and make affidavit to the papers. But he may use his middle name, with first initial letter; and may give only the temporary residence where he is when the papers are signed.

(6) R. E. B. says: I find that the fire pot in my parlor stove never has clinkers on it. It is of cast iron. Why would not cast iron answer in place of brick in a cooking stove, which in a few days becomes coated with a substance like slag, which has to be cut off, causing a great deal of trouble? A. Probably its form would have to be changed as well as the material, to prevent it from burning out.

(7) S. H. H. asks: I have been perplexed in hardening two draw plates for drawing wire. When tempered and cleaned off, I discovered cracks or flaws all over the plates, on the side where the holes were smallest, but not entering the holes. I have made a great number of plates of this kind, and never met such an accident before. What is the cause? A. The plates were probably made of a different quality of steel from that which you had been accustomed to use.

(8) P. R. B. says: 1. I propose to bring a stream of water through a siphon, from a pond on top of a hill to base, through a pipe 2 inches in diameter. The distance from pond to summit of hill is 30 rods; perpendicular hight from pond to summit, 25 feet. Distance from summit to base is 300 rods: perpendicular hight from pond to base, 150 feet. What would be the amount of water discharged with a 2 inch pipe? A. The pipe will probably deliver between 40 or 50 gallons per minute, or the water will have a velocity of 5 or 6 feet a second. 2. How heavy a pipe would be required to stand the pressure? A. Ordinary iron pipe will answer.

(9) E. H. R. asks: What is the best shape, size, and hight for a brick chimney for a stationary engine of 50 horse power? A. A general rule is to make the cross section of the chimney, which may be either round or square, from ⅛ to ⅛ of the grate surface, and the hight from 50 to 75 feet.

(10) H. D. W. says: 1. I have a small engine, with a cylinder 2 by 2½ inches stroke, to run a lathe jig saw. I intend making a copper boiler. Of what capacity should it be? A. From 10 to 12 gallons. 2. How much pressure could such a boiler stand if made of $\frac{1}{16}$ or $\frac{3}{32}$ inch copper? A. It will depend upon the diameter. 3. How much pressure would be sufficient to run the engine? A. Fifty or sixty lbs. 4. How much weight should I put on my safety valve? A. Determine it by means of a spring balance.

(11) C. W. says: In an article recently published in your paper on combustion, the practice of admitting air to the top of a fire for the purpose of consuming the carbonic oxide is recommended. The theory of course is an old one, but is it a correct one in an economical point of view? In practice it is found, I believe, that, the more air you admit to a fire, the more rapidly is the heat evolved carried up the chimney. It is no use making the fuel give out more heat if we cannot retain that heat and utilize it. At the great factories at Mulhouse in Germany, a series of experiments was tried in relation to the combustion of smoke, with a view to the saving of fuel. The result was disappointing. When the necessary amount of air for the perfect combustion of the smoke was admitted to the fires, there was a loss of heat. The same result was described by practical engineers in London. At Mulhouse the practice now is to admit as little air as possible to the fires (⅓ of the amount formerly admitted) and to "feed a little at a time and often." A. We do not think these matters are so definitely settled that a general rule can be given which will be applicable to all cases. We have known of a number of cases in which it seemed to us that there was an advantage arising from admitting air above the fire. We do not at present recall the experiments to which you refer, and would be glad if you would send us a record, in case it is convenient.

(12) G. M. E. says: 1. I wish to construct a boiler for a 2 inch cylinder engine to carry from 20 to 30 lbs. steam. What should be the size and thickness of boiler? A. It should be 20 inches in diameter and 3 feet high. 2. Would the engine be large enough to run a small round-bottomed boat, 4 feet long and 4 feet beam? A. Yes.

(13) W. H. M. asks: How can I make something to resemble snow, suitable for making a miniature winter scene? A. Use small pieces of paper.

(14) G. W. T. asks: 1. I am building a small engine, 1½x3 inches stroke. Will ports ⅛x¾ be too large to drive a small 6 inch foot lathe with 40 lbs. steam pressure? A. The engine will answer very well. 2. What weight of fly wheel would I want for such an engine? A. From 15 to 20 lbs. 3. Of what size should the steam pipe be? A. Use a steam pipe of about ⅝ of an inch in diameter.

(15) C. W. McC. says: I have water which I bring in a wooden conductor, of two inches bore and thirty rods long with fifty feet fall, using the same on a fifteen inch wheel to drive a churn. Would the power be increased by erecting a bulkhead at the lower end of the conductor 20 feet high, closed at the top and connecting the wheel with the bulkhead? A. We cannot see, from your description, how it could be.

(16) J. R. says: A plate is 10 feet long by 6 inches wide by 2 inches thick; 6 inches of its width is iron and 2 inches steel, welded together. At each end and in the middle, on both sides, I desire to weld on square pieces of iron, each piece 8 inches square and 2 inches thick. Can these six pieces be welded by passing them with the plate through the rolling mill in the same way as the plate was rolled, and welded at the last passage of the plate through the rolls? I suppose that the pieces could be welded by hand. A. There would be some difficulty in effecting the weld as you suggest, as it probably never has been done, so that the question could only be decided definitely by experiment.

(17) J. C. asks: 1. I wish to place a small engine in a boat 18x2 feet, and am told that it will be very dangerous to have an upright boiler, on account of the boat's rolling. Would it be so? A. It is very common to use vertical boilers in small boats. 2. What speed could be got from such a boat, drawing 8 inches water, with an engine 3x3 inches, and a boiler pressure of 50 lbs.? A. If the boat is well designed, you might get a speed of 6 miles an hour.

(18) C. H. P. asks: What is the difference between one square mile and one mile square? A. None.

(19) H. S. says: I am building a small steam engine 2x6 inches; the exhaust is ⅝x¾, and the steam ports ¼x¾. Do you think the exhaust is too small for the steam? What size of boiler will I have to get for the engine, and what pressure of steam will I have to carry to get the most power? This engine is a beam engine with side pipes and two steam chests, as on river boats, but I shall have slide valves instead of the usual poppet valve. Do you think they will admit it up to the Fair next year? I have only been at my trade two years. I designed and made my own drawings and my own patterns for the engine. A. The dimensions of ports will answer very well. A boiler 1 foot in diameter and 3 feet high will answer to run the engine, but not to do much work. The higher the pressure of steam, the more power you can obtain from the engine. You will have no difficulty in exhibiting your engine at the American Institute Fair. We should judge that you were doing very well at your trade.

(20) L. M. asks: Will a stack 30 yards high, without artificial heat, ventilate upwards regularly? If so, what is the cause of it? A. It will, for the same reason that the products of combustion from a boiler pass up the chimney.

(21) H. H. C. says: 1. I am building a steamboat with 15 feet keel and 4 feet beam. She is 2 feet deep. She has an upright engine, cylinder 2 inches bore by 4 inches stroke. Her propeller wheel is 15 inches in diameter; boiler is horizontal, 25 inches long, with 11 two inch return flues working at a pressure of 100 lbs. Firebox is 20 inches long. How much weight will the boat carry? A. It would be necessary to make a calculation from the drawing of the boat, but you can easily settle the matter by experiment, either with the boat or a model. 2. How fast will she run? A. The boat will probably have a speed of from 6 to 7 miles an hour, under favorable conditions.

(22) S. D. asks: A few weeks since I saw, on exhibition in Chambersburg, Pa., a machine called a perpetual motion. It worked with levers and balls. It drives a balance wheel and several cog wheels. I could not see where the power to drive it was applied. The machine was placed on a boxed table that looked suspicious. How is it driven? A. We never heard of it before; but it reminds us of a story we once read of a wheel that started itself and never stopped, but which did stop when the horse that was turning it got tired.

(23) F. D. asks: 1. Will water flowing from a hight of fifteen feet perpendicularly through a two inch tube, the lower end of which tube is gradually contracted to one inch in diameter, turn an overshot water wheel three feet in diameter with sufficient force to drive a small two gallon churn? A. It ought to drive a number of such churns. 2. What amount of water would flow through such a tube in an hour? A. From 300 to 400 cubic feet. 3. Could not more work be obtained from an overshot water wheel than from any other with the above conditions? A. We think it likely.

(24) T. R. says: I am desirous of discharging grain from the cars to a flouring mill at a distance of 350 feet. The discharging point can be a few feet the lower, if desirable. Can it be done through an airtight tube, by suction or otherwise, and would an exhaust fan produce a sufficient vacuum to do the work? A. We think a suction fan would answer very well. See our front page of this issue.

(25) E. W. P. asks: Is it true that the lateral pressure of water against a perpendicular surface of any hight is just the same when the water extends back only one inch, as it would be if it extended back twenty feet or any greater distance? A. Yes, it is true; and the reason is that the pressure of water is transmitted equally in every direction, so that it only depends upon the hight of the column and the area of the surface pressed.

(26) C. S. B. asks: What size of engine is necessary to propel an ordinary Whitehall boat, 18 feet long, at a speed of eight miles an hour? What should be the size of boiler and screw? A. Engine 2x3 inches; boiler 24 to 28 inches in diameter; propeller 22 to 24 inches in diameter, with 3 feet pitch.

(27) P. F. M. says: 1. Our fire engine has a 9 inch cylinder with 12 inches stroke; pump is 5 inches in diameter and 12 inches stroke, double acting. The boiler has about 165 square feet of heating surface. We have two checks on our air

chamber. Do you think we could throw any further by connecting a single line of hose to both of these checks, "Siamese" fashion? A. We think not. 2. The boiler foams badly; is it not better to blow from the surface than from the bottom, in case the foaming is caused by violent boiling of the water, and by changing from fresh to salt water? I do not mean to let the bottom blow remain idle altogether, but to use it occasionally. A. It does not make much difference in such a case, as it is necessary to blow very freely until the water is changed. 6. Is it necessary to blow at all, in case we are working fresh water? I think the water simply lifts but does not foam, and by working the engine slowly (say at 70 revolutions) I think the water would settle. A. If the water is perfectly fresh and clean, it is not necessary. 4. We experience great trouble with our engines when we feed with dock water. Can this be remedied? A. The only plan that occurs to us is not to use that kind of water. Fresh, clean water is almost indispensable for the satisfactory action and durability of an ordinary fire engine boiler.

(28) M. B. B. asks: How much power should I require to propel a boat 10 miles an hour against a current of 3 miles an hour, the boat being 15 feet long over all, with 12 feet beam, depth 4½ feet, width of bottom 9 feet, to draw 2½ feet of water? A. Probably from 25 to 30 effective horse power.

(29) P. R. S. asks: 1. I wish to put in a steam engine of 8 horse power. How many gallons water will it require? A. You will require from 8 to 16 gallons of water per horse power per hour. 2. I shall have to dig 20 feet to water and then get hard water. Would it not be better to put in a cistern and use rain water, and run the escape pipe 1 foot under the water, and condense the steam to use over again? A. If you introduce the exhaust into the well or cistern, it would be best to use a coil with holes in it through which the steam could escape.

(30) P. M. asks: Is the curve which a cannon ball describes a cycloid or a parabolic curve? A. It is neither, but a curve depending on so many varying elements that its general equation has never been precisely determined.

(31) J. T. L. asks: Will an expansion valve fitted to a steam engine economize fuel to any great extent? A. Probably. 2. How much space is generally allowed between grate bars used in burning wood? A. There is great difference of practice; from 5/8 to 3/4 of an inch will answer.

(32) A. D. P. asks: 1. Is the plan of filling a boiler full of water and applying heat a safe and correct method of testing the strength? A. Yes. 2. In cleaning flues with steam, is it necessary for the bore of the pipe to be diminished at the end? A. No.

(33) L. S. G. says: I have a small telescope of about 15 inches focus; the object glass is 1⅝ inches in diameter, and the eyepiece is composed of 2 double lenses. If I get a new object glass of 48 inches focus, and use the old eyepiece, would it be any better for viewing objects at a distance? A. No.

Can I mold rubber and give it a red color? A. Dental vulcanite is made on royalty by patent process.

(34) W. C. B. says: It is supposed that oak timber will support a safe strain of 800 lbs. per cubic inch. If this is so when the bearings are placed 1 inch apart, what will it support when placed 12 inches apart? In what ratio does the strength diminish as the bearings are separated? A. The strength varies about in the inverse ratio of the distance between supports, so that it would be about 1/12 as great in the second case as in the first.

(35) J. T. S. asks: Do the steam chest and cylinder of an engine require oiling? Some engineers contend that it is an injury, and causes priming. A. Generally it is best to use oil, but we have known cases in which it was not employed. It is certainly not advisable to use so much that it causes priming.

(36) J. A. B. asks: Could a worn cotton gin be made to cut straw, etc., by taking off the saw teeth and putting a hopper over the saw, the straw being fed to the cutter by its own weight? A. This would probably succeed, as this device, as we understand your description, is somewhat similar to straw cutters in common use.

(37) J. A. G. asks: What is the reason that boiler plate steel is straighter than boiler plate iron? A. We doubt if it is a fact, for similar grades of the metals.

(38) R. W. T. asks: I have two hot bed sashes, side by side; one was used last year, the other is new. The panes of the former are dry, while those of the latter are so clouded with moisture that I cannot see through them. There is one new pane in the old sash which is also clouded with moisture. Has the glass undergone any change from the action of the sun? A. Air has been admitted by some opening near the sash having no moisture. The right conditions for a hothouse are fulfilled when the moisture collects upon the under surface of the glass.

(39) J. C. asks: Who was the inventor of the fish joint on railway rails, and when was it first brought out? A. W. B. Adams, of England, 1847.

(40) H. C. B. asks: If arsenic (arsenious acid) is dissolved in water raised to the boiling point, will the water retain all the poison? If not, what proportion, and is there any residuum, if the arsenic is pure and sufficient water be used? A. Arsenious acid is soluble in 12 parts of boiling water. In order to form a solution of the acid containing 1 part of the acid in 12 parts of the water, it is necessary to boil an excess of it with the water; if 1 part of the acid be boiled with only 12 parts of water, a considerable quantity remains undissolved, even with 1 part of the acid to 50 or 60 parts of water.

Will chloride of lime impart its strength to alcohol the same as it will to water? A. Yes. Chloride of calcium is soluble in 0·25 parts water at 59° Fah., in 8 parts alcohol at 59° Fah.

(41) W. M. asks: Is there any preparation that may be put upon cast iron to prevent the action of dilute sulphuric acid? A. Yes, paraffin.

(42) W. S. W. asks: What elements are to be found in the onion? A. Onion consists of carbon, hydrogen, oxygen, nitrogen, and sulphur, combined into various bodies, one of which, the sulphide of allyl, gives to the onion its most characteristic properties.

Please name a few tests by which a soil can be analyzed. A. Soil cannot be analyzed by a few tests.

(43) N. S. B. Jr. asks: I have a fernery, the case of which is 1½ by 2½x2 feet; the tray to hold the earth (prepared by a florist) is galvanized iron, 6 inches deep. Why should the plants mold? They have been watered once a month and air frequently admitted, but the plants will mold and apparently decay. They look perfectly fresh, but break and fall when touched. A. The fernery must have plenty of strong sunlight at first. It must not be watered too often; the earth must not be too strongly impregnated with stimulants. You do not state what plants you have; they may not be proper ones. We do not know from your description what the cause of the mold is, and we cannot of course recommend a remedy.

(44) E. P. W. asks: What is celluloid? A. Celluloid is a compound of gun cotton and gum camphor. The processes used in its preparation and the quantities of the ingredients, etc., have not been made known.

(45) F. D. B. asks: 1. Can copper and brass be melted in small crucibles in a flame of common illuminating gas? A. No, although brass may be fused by gas furnaces of suitable construction. 2. 2. What is the cheapest way to build a small furnace for melting as above? A. Dr. Faraday described a small furnace used in the laboratory of the Royal Institution as follows: The exterior consists of a blue pot, 18 inches high, and 13 inches in external diameter at the top. A small blue pot, 7½ inches internal diameter, had the lower part cut off, so as to leave an aperture of 5 inches. This when put into the larger pot rested upon its lower external edge, the tops of the two being level. The interval between them, which gradually increased from the lower to the upper part, was filled with powdered glass blowers' pots, moistened with water, and pressed down into a compact mass. A round grate was then dropped into the furnace of such a size that it rested an inch above the inner edge of the lower pot; the space beneath it, therefore, formed the air chamber, and the part above it the body of the furnace. The former is 7½ inches from the bottom to the grate, and the latter 7½ inches from the grate to the top. A horizontal conical hole, 1½ inches diameter on the exterior, is cut through the outer pot, forming an opening into the air chamber at the lower part for receiving the nozzle of a pair of double bellows. The furnace must be perfectly dry before being used. The fuel is coke. The bellows are mounted on an iron frame, and the furnace is raised upon an iron stool, so as to bring the aperture of the air chamber to a level with the nozzle of the bellows. This furnace is sufficiently powerful to melt pure iron in a crucible in twelve or fifteen minutes, the fire having been previously lighted. It will effect the fusion of rhodium, and even pieces of pure platinum have sunk together into a button in a crucible heated by it.

(46) L. Y. L. says: I have a cistern constructed of brick, laid in mortar and cement; and the water is filtered through a brick partition. The water is very hard, so as to form an incrustation on vessels used for boiling it 6 or 8 times. Lime water has but little effect on it. How can I remedy the evil? A. The trouble probably is that you have not hit upon the right proportion of lime water per gallon of cistern water.

(47) T. K. says: I have green paper window blinds in my house. Are they injurious to health? I enclose a sample of the paper. A. We have examined and tested the sample of paper, and have discovered a minute trace of arsenic.

(48) J. R. D. & Co. say: We send you a portion of a bar of zinc which was put in our steam boiler and left there for ten days. Will you please analyze it, and let us know what has produced such a remarkable change in it? We are now building our third boiler in eight years, the other two having been entirely destroyed by the water we are compelled to use. A. An analysis shows that the interior of the zinc contains a great number of particles of sulphuret of iron, and has undergone decomposition by acid water. It would be impossible to say what the water contained without analyzing it, and what would be the best remedy to apply before knowing this.

(49) C. R. B. asks: The eggs of the *pelmatoiytes palustris* (marsh wren), when blown and dried, fade from a dark mahogany to a light chocolate color. The eggs of the *melanerpes erythocephalus* (red-headed woodpecker) before being blown are of waxy, translucent appearance. After being blown, they are of an ivory white. What will make them retain their original color? A. Try varnishing them.

(50) J. H. B. asks: Can you tell me of a process by which I can alloy potash or other easily melting glass with metals? A. Mix the oxides of the metals in with your glass until the requisite tint is obtained on melting.

(51) H. M. H. says: Enclosed I send you a piece of silver ore from the celebrated Legal Tender mine at Clancey, Montana. You will see that it consists of zinc blende, galena, and ruby silver. What kind of varnish or preparation can I put upon such specimens to bring out and preserve the colors? A. A solution of clear shellac in alcohol is sometimes used for this purpose. We should be very happy to receive the other specimen of ore you speak of.

(52) F. D. S. says: Oil exposed to the air absorbs oxygen and becomes oxidized. Is there any substance or chemical agent which can be employed to arrest this tendency to oxidation, or prevent it altogether? A. Such a substance is not at present known.

(53) J. E. says: W. H. S. describes a cheap galvanic battery set up by one Baron: I made one in a 2 quart jar, 4¼ inches in diameter. I placed a round plate of rolled iron 3/16 thick in the bottom, and soldered a piece of copper wire to the under side, long enough to come out from the top of the jar by a foot; then I took another piece of iron as above, and suspended it about 4 or 5 inches from the other plate, and about 2 inches from the top (and under) of the water, to which I also soldered a piece of wire, and connected the ends together. I then placed 1 lb. of blue vitriol on the top of the piece of iron at bottom, and then poured on sufficient clean rain water to cover the topmost piece of iron nearly two inches, and then allowed it to remain still for 72 hours. I put into the water ¼ oz. of sulphuric acid. At the end of this time I tested it, and found, when I passed the current through 2 coils of 3 inches long and 1 inch thick, there might be perhaps power sufficient to tickle the proboscis of a fly, but certainly not any more, for I could not with the end of my tongue feel any electrical commotion. Where is the difficulty? A. Two iron plates arranged as described would produce an electro-motive force of about one tenth of a volt, or about one tenth as much as a copper and zinc plate arranged in a similar manner.

(54) E. asks: 1. Can a magnet be constructed that will sustain a weight of 100 lbs. with one coil of a powerful battery? A. Yes. Bend an iron rod one inch in diameter and eighteen inches long into the form of a horseshoe, and wind around each leg 50 feet of No. 16 insulated copper wire. Use, for a battery, the largest sized Bunsen cell. 2. Would it attract 10 lbs. at a distance of 3 inches, provided that it moved without friction? A. No.

(55) O. C. says: I am making a machine which I want to start by the aid of an electromagnet acting on a lever, which in turn acts on a wheel. Where shall I place the electromagnet so as to get the most power at the end of the lever that disengages from the wheel? If the force of an electromagnet is inversely as the square of the distance, it seems to me that, the nearer I place my electromagnet to the fulcrum, the more power I will get at the end of the lever. A. You are right.

(56) W. M. asks: Can I construct an electrical machine or a dry galvanic battery that will occupy a space not exceeding one cubic inch, and that will produce a visible spark? A. You might make a miniature electric machine which would do it, using the form of the ordinary plate machine for a model.

(57) J. S. P. asks: How can two or more messages be transported over one wire? A. Probably you mean to ask how two or more messages can be sent on one wire at the same time. By so balancing the outgoing current that no effect is produced upon the receiving instrument at the sending station, while the instrument responds to the signal received from the distant station.

(58) T. E. B.—The alleged new motive power in Philadelphia that you allude to is doubtless the "Keely Motor," one of the perpetual motion humbugs, by which the owners claim to generate a great force out of nothing. Once in a while they have a juggling exhibition of the thing for the purpose of selling stock. Keely or one of his confederates is the operating juggler. The power "generator" is a combination of small tubes or cylinders, communicating by pipes. First they run water through, then air, to prove that there is nothing within, and that the show is "honest." Then Keely turns a faucet, and "now you see it." The pressure gage goes up. He turns again, and "now you don't" see it. The gage falls.

(59) J. L. L. asks: 1. Is it more difficult for an amateur to nickel plate than silver plate? A. No. 2. Do all metals require coating with copper before they are nickel-plated? A. Only iron and steel. 3. Does nickel require more battery power than silver? A. No.

(60) D. M. G. says: In your answer to my question as to the comparative strengths of gas pipe and solid rod, you made a misstatement. What I wished to know was this: Which would be best for supporting a weather vane on a church spire, 1¼ inch gas pipe or 1⅛ solid iron rod, supposing both to be of equal length? A. The lightest would be the best, if it has sufficient strength. What was the misstatement?

(61) S. S. G. asks: Is there any cure for that disease which is shown by a purple color on the skin? A. This disease is called nævus, and includes the various affections termed mother's marks, vascular growths, etc., constituting an important section of surgical affections. The nature of the disease depends upon the predominance of the tissues affected, as the arterial, capillary, or venous elements predominate. From the description given by you, we would class yours under venous nævi, which is of a dark purple color, usually quite prominent and often forming into tumors. The first point to consider is whether the case is to be left to Nature, or if operative measures are to be taken. If it is small and does not show any tendency to increase, it should be left alone, as very probably it will shrivel up and disappear of itself, or turn into a mole. If, however, it is large, there are five principles of operation, which Erichson states as follows: 1, to excite adhesive inflammation in the tumors, and so to produce plugging and obliteration of the vascular tissue of which they are composed; 2, to destroy the growth by caustics; 3, to remove it by the galvanic cautery 4, to remove it with a knife; 5, to remove it by ligature. All the methods above stated should be performed by a surgeon, as delicate treatment is required. Your letter is not definite enough for us to decide which of the methods is best suited for you.

(62) L. S. H. asks: Does the weight of a body increase or decrease, the nearer it approaches to the earth's center? A. It decreases, because it is attracted towards the center by a less mass.

(63) C. A. P. asks: 1. Can a locomotive running in full forward gear at any speed be reversed to full backward gear without shutting any of the steam off? A. The chances are that some of the parts will give way. 2. How can it be known when a locomotive is priming? A. By looking at the glass gage, trying the gage cocks, or, in aggravated cases, by the pounding of the engine; also by the sound of the exhaust and the appearance of the exhaust steam. 3. Is it necessary to use both pumps in supplying a locomotive with water? A. Generally, no.

(64) F. T. D. asks: Last season I ran a side wheel boat, length 60 feet, beam 15 feet, draft 4 feet. The diameter of the side wheels is 6 feet, with 14 inches dip; rate of speed running light is 6 knots, laden about 2 knots. Would it be better to raise the shaft up 1 foot, thereby giving the wheels 2 feet more diameter, and about 4 inches more dip in the water? A. We doubt whether you would gain anything by the change. It seems to us it would be better to use feathering floats.

(65) W. T. H. asks: What shall I burn to make red or purple light, and how shall I burn it? A. If you have gas, surround the flame by the colored glass. A red fire can be made by intimately mixing 61 per cent chlorate of potash, 16 sulphur, and 23 carbonate of strontia. Dampen it, and drive it into a paper cylinder, and dry thoroughly for a week or more. Pink fire: 20 per cent sulphur, 32 niter, 27 chlorate of potash, 20 chalk, 1 charcoal. Purple light: 60 per cent chlorate of potash, 16 sulphur, 12 carbonate of potash, 12 alum. It must be borne in mind that the red and purple fires are liable to ignite spontaneously, and serious accidents have thus happened. These lights can be purchased much cheaper than you can make them, and will satisfy you much better.

(66) J. H. C. asks: In the tabulated results of the duties of English steam engines, what is the weight assigned to a bushel of coal? A. Ninety-four lbs.

(67) C. F. asks: We bought a second hand 2 horse railway power and thrasher, which are both gummed up, and I would like to know if there is any way to clean them without taking them apart. A. You will find it better to take the machines to pieces.

(68) A. R. C. says: I have invented an expansion steam engine, and I want to know the most successful method of jacketing the cylinder to keep down radiation. A. The most successful plan is to jacket the cylinder with live steam. The next best is, perhaps, heated air.

(69) C. P. M. asks: Will ports 1/8 by 2½ inches be large enough for a cylinder 3½ by 5 inches? A. Yes.

(70) G. C. B. asks: Using steam at a pressure of 60 lbs. per square inch, would a boiler and furnace combined, 5 feet high, 28 inches in diameter, so proportioned as to give 54 square feet of fire surface, be sufficient to run an engine 4½ inches diameter by 7 inches stroke? A. The boiler would be too small. 2. Would such an engine be powerful enough to run a 24 inch saw for sawing hard oak wood? A. The engine, with plenty of steam, will drive the saw very well.

(71) G. H. W. says: 1. I have built a model of a steamship 7½ feet long, 16 inches wide, and 9 deep. Please tell me the proper dimensions of cylder, diameter and pitch of screw, and dimensions of boiler. A. Make an engine of ¾ inch diameter and 1 inch stroke; boiler 10 inches diameter and 18 inches high; screw 4½ inches diameter and 12 inches pitch. 2. What ought to be her speed? A. Probable speed, 2 to 2½ miles an hour. 3. Would small pieces of coal burn properly under boiler, fitted with 4 tubes, and give sufficient heat? A. Use charcoal for fuel.

(72) J. A. J. asks: How can I erect a furnace suitable for melting from 100 to 800 lbs. cast iron? A. The general principle of such a furnace is to have it lined with refractory material, such as firebrick, and to create a strong draft by artificial means.

(73) J. S. asks: 1. Will a double leather belt hug the surface of a pulley closer than a single leather one? A. We suppose your questions refer to the friction between the belt and pulley. If the tension is the same in each case, the friction will be the same with either a double or single belt. 2. Will a belt hug a smooth iron pulley closer than it will a leather-covered one? A. We are not sure that a pulley covered with leather is better than one with a smooth iron face. If any of our readers have any data in regard to this matter, we would be glad to hear from them.

(74) E. E. asks: Will soft water become hard by long standing in cemented cisterns? A. The hardening of waters is due to their taking up an increased proportion of lime. It is doubtful whether this would occur in the case mentioned, to influence the character of the water in a marked degree.

(75) L. B. S. asks: 1. Will a steam engine, with a cylinder 1½x3 inches stroke, be large enough to drive a boat 15 feet long and 4½ feet wide, flat-bottomed and sharp at bow and stern? A. The proposed engine will not answer. Use one three or four times as large, and connect directly to the paddle shaft. 2. Can I heat the boiler with a kerosene lamp? A. We doubt if you could make sufficient steam with any lamp.

(76) J. & D. N. ask: At what distance will two magnets attract each other? We have experimented with a small magnet, and we cannot find anything to place between the magnets to prevent them attracting each other. A. Magnetic induction takes place through all substances, independent of their character or composition. This induction decreases as the square of the distance.

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

J. T. C.—It is plumbago.—C. A. L.—It is franklinite, a mineral consisting mainly of the sesquioxides of iron and manganese combined with the protoxides of zinc and iron. The attempts to work it for zinc have proved unsuccessful; but it is ground up to a dark paint, and can be used also as an ore of iron. The zinc is said to give increased tenacity to the iron.—N. H. S.—A number of specimens of black oxide of manganese have been received, and all have been reported upon; so if yours was not reported upon, it has not been received.—W. S. N.—It is a part of a trap column, the angle between two of the faces in the specimen sent being 120°, showing that it is hexagonal. It is a silicate of alumina, iron, magnesia, lime, potash, and soda. It is not valuable.—F. L. R. C.—It is iron pyrites, some of it in cubic crystals. Not valuable as an iron ore.—H. P. W.—It is prehnite, which is a silicate of alumina and lime (the greenish portion) in traps. It is not an ore. The magnetic action is due to a slight percentage of iron oxide in the mineral.—C. R. M.—It is a water-rolled mass of fragments of feathers of waterfowl and similar *débris*, mixed up with sand and saline matters.—L. A. A.—It is rock crystal. It is of little value except when in fine clear crystals. It is very common in many parts of the country.—S. N.—It is probable that the substance found is not quicksilver. Send a specimen.—J. W.—They are iron and copper pyrites, specimen No. 2 being richer in copper. The reduced metal is mostly black protosulphide of iron, together with some sulphide of copper and carbon derived from the fuel. The iron ladle is covered with metallic iron and a little copper.—D. O.—It is copper pyrites, and is composed of 35 per cent sulphur, 35 copper, and 30 iron. The white rock through which the pyrites is scattered is quartz.—D. W. D.—It is a mixture of iron ore, clay, and carbonaceous matter, not valuable as an iron ore.—M. McC.—It is very fine sand; it would not answer as a molding sand, although it might be employed for grinding, polishing, etc.—D. K.—This ore is sometimes also called purple copper ore, and is abundant at the copper mine at Bristol, Conn. It is found oftentimes with heavy spar and malachite, and is often contained in copper-bearing shales. Copper 63 per cent is a large amount, but it must be remembered that the percentage of a selected sample may be much higher than the average yield.—A. H.—It is pyroxene, a silicate of lime and magnesia with a small percentage of oxide of iron and manganese, but not sufficient to make it an iron ore.—W. W. B.—Ores cannot be analyzed without the use of chemicals, and no book describing such a process exists.—G. Y. R.—It is of the order *hemiptera*, family *aphidæ*, but the genus we cannot state positively. Aphides are found upon every part of plants. Some species which are wingless are found on the roots of plants, others on the stems of twigs; others roll up leaves, or form gall-like swellings on leaves.—*Packer*.—J. W. S.—Your liquid would require a long and costly analysis.

G. W. W. asks: How can I pulverize mica very fine in large quantities?—H. W. M. asks: How are glass pendants for lamps and chandeliers drilled?—E. C. asks: What is a good way of dyeing silk black, and for finishing and putting on the gloss?—S. B. asks: How can I soften a bird's skin after it has been dried?—C. R. asks: How can I restore the color to kid gloves, which I had cleaned and which then got damaged by water?—D. R. asks: Why do hens eat off each other's feathers? Is there anything that will prevent them from doing it?

COMMUNICATIONS RECEIVED.

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

On Scale in Boilers. By C. L.
On Watch-Making Machinery. By A. P. B.
On Marriage. By B. F.
On the Language of Animals. By L. H. R.
On the Pendulum and the Elliptic Valves. By J. W.
On Freezing Fire Pidgs. By J. L. K.

Also enquiries and answers from the following:

A. G.—R.—C. G.—J. M. W.—A. C.—T. W.—K.—T.—A. R.—A. V. H.—W. K.—P. M.—C. W. B.—G.—S. B. H.—B. F. S. Jr.—A. A. W.—L. D.—J. M.—W. H. P.—E. M.—J. J. W.—G.—B. F. P.—P. F. O'S.—W. H. W.

HINTS TO CORRESPONDENTS.

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

Enquiries 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 enquiries analogous to the following are sent: "Who sells oil that is not affected by frost, suitable for clocks? Who makes aluminum spoons, etc.? Who makes the smallest portable engines? Who sells telegraph instruments? Which is the best lens for photographic portraiture?" 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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Telegraph solution, chemical, T. A. Edison..... 160,580
Thill coupling, E. Jarrell..... 160,681
Thill coupling, G. F. Smith (r)..... 6,331
Thill coupling, S. M. Strader..... 160,728
Thill coupling, G. Wright..... 160,758
Tool handle, H. Staples..... 160,725
Trap, fly, Rukgabee and Clarke..... 160,719
Tyre shrinker, D. Strattan..... 160,729
Umbrella handle, E. Layman..... 160,603
Umbrella handle, etc., G. W. Tucker..... 160,627
Valve for street water mains, J. Bird..... 160,640
Vehicle end gate rod, W. J. Lewis..... 160,531
Vehicle fender, N. Jackson..... 160,679
Vehicle, spring, Phenix and Curtis..... 160,709
Vehicle spring and side bar, J. W. Gosling..... 160,586
Vehicle spring equalizer, N. Jackson..... 160,678
Vehicle torsional spring, C. W. Saisdee..... 160,549
Vehicle wheel, J. H. E. Boykin..... 160,642
Velocipede, J. A. Crandall..... 160,575
Ventilator, chimney, J. Howes..... 160,522
Vest, bricklayer's, J. Moore..... 160,538
Vise, T. L. Bayliss..... 160,505
Wagon, axle and thimble skein, I. L. Anderson.. 160,502
Wagon end gate, S. C. Myers..... 160,612
Wagon seat, W. H. H. Snellbaker..... 160,623
Walls, coping for, J. C. Wright..... 160,737
Washing machine, G. Huntington..... 160,597
Washing machine, T. Patterson..... 160,706
Watch case spring, J. Menegay..... 160,610
Watches, reversible pinion for, J. Gordon..... 160,585
Weather strip, E. C. Underwood..... 160,555
Weed cutter and hiller, J. Robson..... 160,545
Well strainer, drive, W. C. Macomber..... 160,692
Wind wheel, J. M. Kauffman..... 160,599
Windlass, M. G. Imbach..... 160,675
Windlass, F. S. Rowland..... 160,617
Windmill, A. and W. Graf..... 160,588
Windmill, Sheckler and Bolender..... 160,620
Wood planing machine, W. W. Carey..... 160,807

DISCLAIMERS FILED.

31,445.—LIME KILN.—R. Donaldson, Mount Nebo, Pa.
105,599.—CONCRETE PAVEMENTS.—J. Schillinger, N. Y. city.

DESIGNS PATENTED.

8,194.—DRAWER PULLS.—O. F. Fogelstrand, Kensington, Ct.
8,195, 8,196.—MATCH SAFE.—O. F. Fogelstrand, Kensington, Ct.
8,197, 8,198.—CARPETS.—A. Heald, Philadelphia, Pa.
8,199.—COFFIN HANDLES.—W. Smith, West Meriden, Ct.
8,200.—WRITING PAPER.—H. Bainbridge, Brooklyn, N. Y.
8,201, 8,202.—BREASTPIN, ETC.—L. S. Beals, Astoria, N. Y.
8,203.—BREASTPIN.—L. S. Beals, Astoria, N. Y.
8,204.—INKSTANDS.—O. F. Fogelstrand, Kensington, Ct.
8,205.—PAPER WEIGHT.—O. Fogelstrand, Kensington, Ct.

TRADE MARKS REGISTERED.

2,275.—CIGARS, ETC.—Batchelor Bros., Philadelphia, Pa.
2,276.—FERTILIZERS.—H. N. Hooper, Dedham, Mass.
2,277.—CIGARS.—Roberts *et al.*, Philadelphia, Pa.
2,278.—WHISKY.—Torlina & Co., St. Louis, Mo.
2,279.—PERFUME.—S. C. Upham, Philadelphia, Pa.
2,280.—CARPET LINING, ETC.—Chipman & Co., Boston, Mass
2,281.—ALPACAS.—Farr Co., Holyoke, Mass.
2,282.—GIN.—C. A. Hubbard, Haddam, Ct.
2,283.—HAMS, ETC.—Michener & Co., Philadelphia, Pa.
2,284.—FERTILIZER.—Patapsco Guano Co., Baltimore, Md.
2,285.—AXES.—Patrick & Co., San Francisco, Cal.
2,286. SPECTACLES, ETC.—Sussfeld & Co., New York city.

SCHEDULE OF PATENT FEES.

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On application for Design (14 years).....$30

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA, MARCH 6 to 10, 1875.

4,464.—H. C. Futler, Minneapolis, Minn., U. S. Gang saw hangers. March 6, 1875.
4,465.—P. J. Ayres, Lindsay, Ont. Stump raising machine. March 6, 1875.
4,466.—E. C. Tozer and R. D. Southwood, Newcastle, N. B. Freezer. March 6, 1875.
4,467.—W. R. Wagoner, Syracuse, N. Y., U. S. Churn. March 6, 1875.
4,468.—K. Knott, London, Ont. Slaughtering, preparing, and packing meat. March 6, 1875.
4,469.—C. T. Cleaveland, Oldtown, Me., U. S. Joint for furniture. March 6, 1875.
4,470.—L. Coté, St. Hyacinthe, P. Q. Extension 1 of No. 526. Trimming and finishing machine. March 10, 1875.
4,471.—L. Coté, St. Hyacinthe, P. Q. Extension 2 of No. 526. Trimming and finishing machine. March 10, 1875.
4,472.—T. S. Elliott, Guelph, Ont. Washing machine. March 10, 1875.
4,473.—R. H. Hudgin, Whitby, Ont. Farm and carriage gate. March 10, 1875.
4,474.—R. N. Merism, Worcester, Mass., U. S. Expansion gear for planer feed rolls. March 10, 1875.
4,475.—J. H. Stone, Hamilton, Ont. Milk can bottom. March 10, 1875.
4,476.—J. B. McCune *et al.*, Hamilton, Ont. Ramming and molding machine. March 10, 1875.
4,477.—J. S. Rood, Waterbury, Conn., U. S. Sewing machine caster. March 10, 1875.
4,478.—E. Wright *et al.*, Denmark, Iowa, U. S. Carriage spring. March 10, 1875.
4,479.—J. Hodgson, Toronto, Ont. Consuming smoke. March 10, 1875.
4,480.—R. G. Blamey *et al.*, Petersburgh, Ont. Churn. March 10, 1875.
4,481.—W. O'Hara *et al.*, Fall River, Mass., U. S. Non-conducting covering for boilers, etc. March 10, 1875.
4,482.—M. Deal, Bucyrus, Ohio, U. S. Scouring case for smutters and separators. March 10, 1875.
4,483.—E. Andrews, Williamsport, Pa., U. S. Attaching saw handles. March 10, 1875.
4,484.—A. A. Murphy *et al.*, Montreal, P. Q. Pneumatic fire extinguisher. March 10, 1875.
4,485.—J. H. Dorion, St. Anne de Tamachiche, P. Q. Improvement in architecture. March 10, 1875.
4,486.—J. L. Wilson, Woodstock, Ont. Setting device for stem-winding watches. March 10, 1875.

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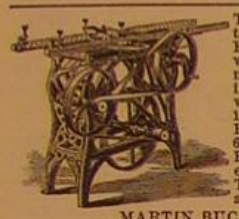
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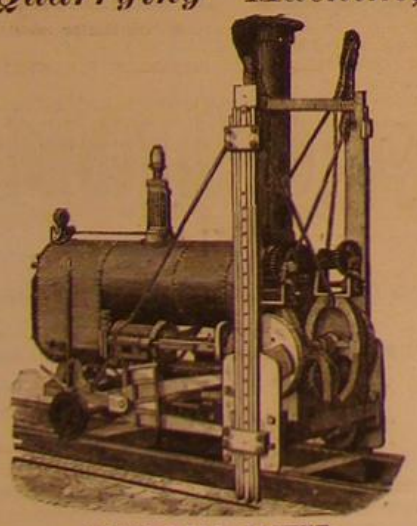
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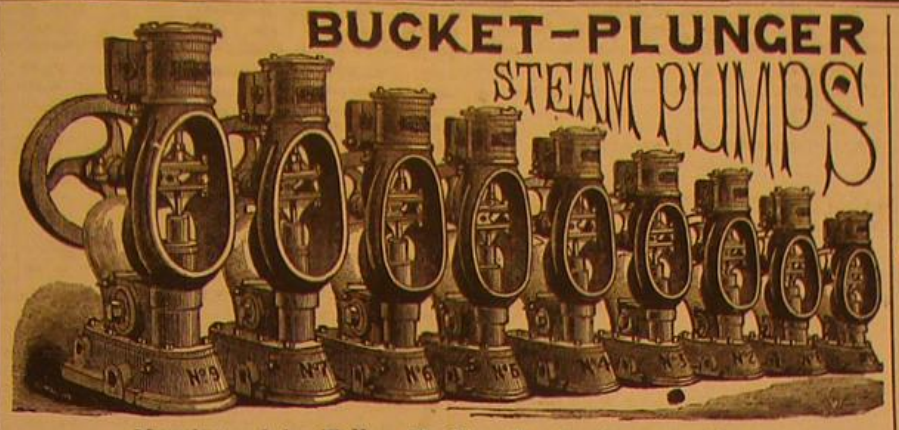
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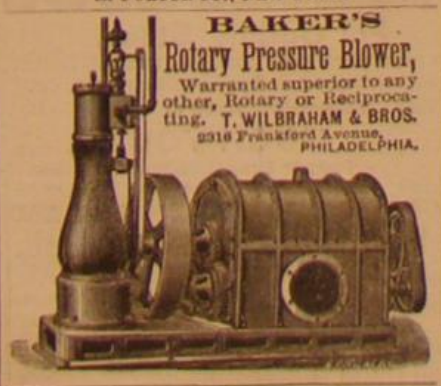
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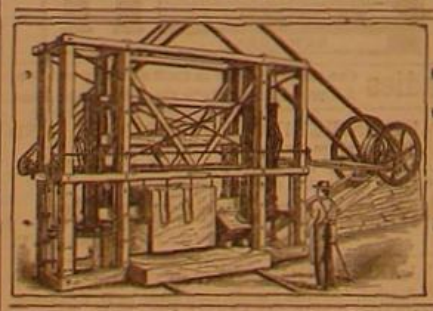
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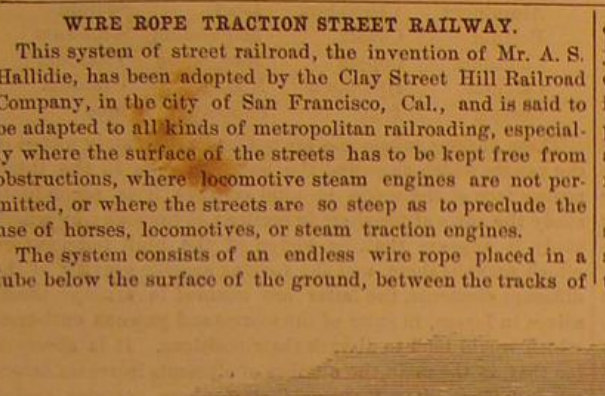
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WIRE ROPE TRACTION STREET RAILWAY.

This system of street railroad, the invention of Mr. A. S. Hallidie, has been adopted by the Clay Street Hill Railroad Company, in the city of San Francisco, Cal., and is said to be adapted to all kinds of metropolitan railroading, especially where the surface of the streets has to be kept free from obstructions, where locomotive steam engines are not permitted, or where the streets are so steep as to preclude the use of horses, locomotives, or steam traction engines.

The system consists of an endless wire rope placed in a tube below the surface of the ground, between the tracks of a railroad, and kept in position by means of sheaves, upon and beneath which the rope is kept in constant motion during the hours the cars are running, by a stationary engine. The power is transmitted from the motor to the rope by means of grip pulleys, and from the rope to the cars on the street by means of a gripping attachment attached to the car, which passes through a narrow slot in the upper side of the tube.



From the illustration, Fig. 1, which is prepared from a photograph of a portion of the route in San Francisco, it will be seen that the ground is exceedingly irregular. The average grade is 580 feet, and the steepest 850 feet, to the mile. The entire length of the endless rope operated, which is of steel wire, three inches in circumference, is 6,800 feet, and the line is supported in the iron tubes, every 39 feet, on 11 inch sheaves. Other sheaves hold up the rope in turning angles, etc. By referring to Fig. 2, which shows a cross section of the tube, will be seen the opening or slot, seven eighths of an inch wide, in the upper side of the tube, which enables the foot of the gripping attachment to pass by and under the upper sheaves and over the lower sheaves. This attachment is shown in Figs. 3 and 4.

Fig. 3 shows a perspective view of the attachment from above, and Fig. 4 represents the wheel by which it is operated. A vertical slide, A, works in a standard, and is moved up and down by a screw and hand wheel. This screw is shown on the dummy, Fig. 1. The small upper screw, going down through the large screw, operates it. At the lower end of this slide is a wedge-shaped block, which actuates two jaws, B, horizontally, which open and close according to the direction in which the slide is moved, closing when the slide is moved upwards. These jaws have pieces of soft cast iron placed in them, which are easily removed when worn out, and which are of proper shape and size inside to grip the rope when they are closed over it.

On both sides of the jaws, and attached to them, are two small sheaves, C, which are held by means of rubber cushions sufficiently in advance of the jaws to keep the rope off from them, and, at the same time, to lead it fairly between them, allowing it to travel freely between without touching them. When it is required to grip the rope, the slide is drawn up by means of the small screw before described, and the wedge at the lower end closes the jaws over the rope, at the same time forcing back the small guide sheaves on to the rubber cushions.

The standard containing the slide, etc., is inclosed in a cast iron bracket, and raised and lowered bodily through an opening in the tube from above the surface of the street to the rope in the tube by means of a worm and nut or rack and pinion. The dummy is coupled to the passenger cars, at the bottom of the incline, and uncoupled at the top, and *vice versâ*, horses then being coupled to the car for the level road. In order to stop the car, the jaws of the gripping attachment are opened slightly; when they release the rope, the guide sheaves take it, and the car stops. All the essential working and wearing parts of the gripping attachment are made of steel.

The turntable at the foot of the incline is double. The available space at this point was very limited; and in view of this, some ingenuity had to be employed. When the traction car reaches the foot of the incline, it is uncoupled from the car, and run on a turntable, the slot in the turntable allowing the shank of the grip to pass down freely. The table is then turned around one quarter of its circumference, and the track and slots are then brought in the same line. The traction car is then run on a second table, which is turned back, and the traction car is run on the up track. The car is then transferred in the same manner and coupled to the traction car, ready for the ascent. This course is necessary, as there are double tracks; and the traveling wire rope runs down beneath one pair and up under the other. As the gripping attachment passes down under the street through the slot, it is necessary to have a slot in each turntable, to allow the traction car to be turned.

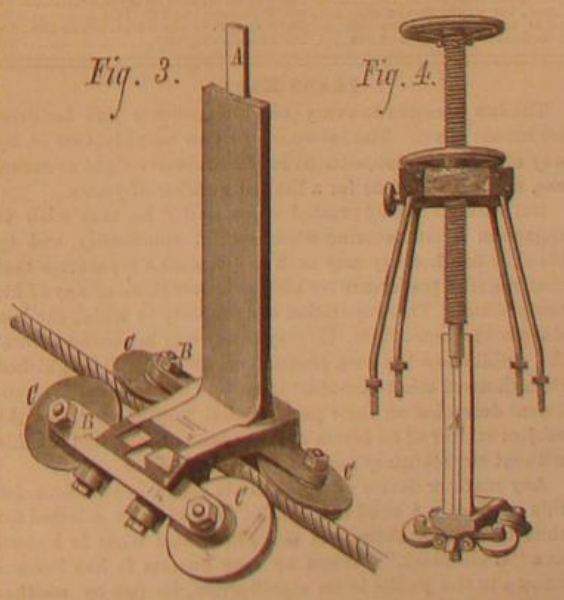
The method adopted at the upper end of the road is more simple. A turnout is made for the car, and it runs down to a common single turntable. The dummy is turned as follows: A circular table connects both tracks, with a slot described around a center. A small iron triangle connects the dummy at two points with the center of the slot and tube. By pushing on the dummy, the center of this triangle being held in position by appropriate means, the dummy turns around in a very small circle, and is ready for the return trip when attached to the car, which has already been turned on the turntable.

The road has a gage of 3 feet 6 inches. An ordinary 20 pound T rail is used, which is set flush with the street and and presents a neat, smooth appearance. The rope runs at the rate of about four miles per hour, and the ascent is made, including stoppages, in about 11 minutes, the distance being 3,300 feet. The motive power is supplied by a steam engine of 30 horse power.

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VOLUME XXXII., No 16. [NEW SERIES.] *Thirtieth Year.*

NEW YORK, SATURDAY, APRIL 17, 1875.

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TRADE MARKS.

The law presents to every one inducements and facilities for honest effort. The inventor of a new manufacture is, by way of compensation, secured in the exclusive right to make, use, and sell the same for a limited number of years.

But without having created a new entity, he may wish to engage in manufacturing some special commodity, and by his skill and honesty may seek to establish a reputation that shall secure a preference for his goods over those of any of his competitors. This reputation is a property in which the law also aims to protect him. He may, in any way he pleases, inform the public how his own productions are to be distinguished from those of other manufacturers, and any attempt at fraudulent deception on their part, in that respect, will be the subject matter of an action at law against them, and all this without any statutory regulation on the subject.

Any mark or device attached to his goods is sufficient for this purpose. A word or a symbol is generally selected for thus designating them, and this constitutes what is known as a "trade mark." When by long custom it has become known to the public in its signification, its use by another person embodies a falsehood, and can be dealt with as such, so far as that can be done in a civil suit. It is morally the same as a theft, a forgery, or a counterfeit, but cannot be punished as a crime without a special statutory provision to that effect.

The statute in relation to trade marks operates in aid of the common law on this subject—modifying it to some extent, fixing specifically the penalties attached to transgression, facilitating the giving of the requisite testimony in any remedial proceedings, and providing for a registration which fixes at once the rights of the proprietor, of which every one is bound to take notice at his own peril. In other respects the rules fixing the rights and liabilities of the respective parties seem to remain substantially unchanged by the statute. Some of these rules will now be briefly considered.

The Commissioner of Patents is prohibited from receiving and recording any proposed trade mark which cannot lawfully become such. This condition refers to the rules and principles on this subject which are dictated by reason, and especially those which have been adopted by the courts.

One of these rules prescribes that the name sought to be used as a trade mark should not be descriptive. If one should seek to appropriate the word "inexplosive" as a trade mark on his preparation of an illuminating fluid, or the word "indelible" on a new marking ink, such a trade mark would not be received or recorded at the Patent Office, or sustained by the courts as legitimate. Any other person who had contrived preparations for such purposes would have a just right to commend them to public favor by like designations respectively. Any law or regulation that should prohibit him from the exercise of such a right would be wholly tyrannical and unjust.

Again it has been held that the name of any particular locality could not, as a general rule, be selected as a legal trade mark. A party who had sought to appropriate the name "Lackawanna" as a trade mark for his anthracite coal, was not sustained in that attempt by the highest of our courts (*see Canal Company vs. Clark*, 1 *Official Gazette, p.* 279.) The ground on which this decision chiefly rested was that no other person who should be engaged in mining coal in the Lackawanna district could legally be prevented from designating it by that name.

For a similar reason, the statute prohibits the registration of a trade mark which is merely the name of a person, firm, or corporation, unless such name is accompanied by a mark sufficient to distinguish it from the same name when used by other persons. And also, as a matter of manifest justice, no one is permitted to select as a trade mark a word or symbol which so nearly resembles one, previously appropriated by another person, that it will be likely to deceive the public.

But it must not be supposed that any one can with impunity attach a name to his productions, although such name could not have been appropriated by any other person as a trade mark. The great underlying rule that fraud will not be allowed to achieve success, wherever it can be detected, will interpose to prevent the consummation of an effort to compass its ends by falsehood or deception. If, therefore, a salt manufacturer at Onondaga should adopt the word "Onondaga" as his trade mark—although that trade mark would be wholly invalid as such, unless at all events he had monopolized all the manufacture of salt at that locality—still, if another manufacturer at Saginaw or Kanawha should label his commodity "Onondaga salt," he would be liable to an action by the Onondaga manufacturer. This would not be on account of the trade mark adopted by the latter. He might maintain such an action irrespective of his trade mark, and so might any other person who had sustained an injury by the fraud.

A trade mark then should be novel, that is to say, so far differing from any one previously attached to a like commodity that there will be no danger of causing deception; it should not be descriptive of the quality of the goods to which it is attached; it should not consist merely of the name of any person, firm, corporation, or locality; and finally it should not be attempted to be used for an immoral or illegal purpose. Subject to these conditions, it may consist of any device, symbol, or word—no matter how arbitrary or unmeaning in itself—that the proprietor sees proper to select.

These rules are believed to be sufficient to serve as guides in most of the cases which shall present themselves to the mind of the honest inquirer.

HOME NEWS BY WAY OF THE SUN.

"Go abroad to learn the news" is a very old saying. Just now the study of the sun's constitution furnishes a remarkable verification of the correctness of the proverb: that far away orb affording a better and closer view of the early stages of the earth's development than could possibly be gained at home, and furnishing at the same time an altogether unexpected means of estimating the relative character of the earth's chemical structure as compared with the other members of the solar system.

It is well known that the elements which compose the earth and its atmosphere are very unequally distributed. Of the part which we are acquainted with, oxygen constitutes by weight fully one half. Silicon makes up a quarter. Aluminum, calcium, magnesium, potassium, sodium, iron, and carbon, in decreasing proportions, constitute nine tenths of the remaining quarter. There is left only one tenth of a quarter to be made up of the other fifty-five non-metallic and metallic elements. Nor are these various elements uniformly mixed in the parts of the earth open to our investigation. The outer portions, being mainly sedimentary strata, derived from an original nucleus of primary rock, are of no assistance in determining the primal distribution of the elements. For this we must interrogate the basic rocks. These are naturally divided into two great divisions, holding on the whole a definite relation to each other. The upper mass consists of granite and other plutonic rocks rich in silica, moderately rich in alumina, and poor in lime, iron, and magnesia. Below are basaltic and volcanic rocks poorer in silica, equal in alumina to the upper series, and much richer in iron, lime, and magnesia, and containing also a great variety of other elements as occasional constituents: the proportion of the denser metals increasing downward. These relatively precious constituents of our earth, as we all know, reach the surface only through veins which traverse the outer layers.

How did it happen that a few of the elements are provided so plentifully for us, while there is such a scanty provision of the rest? And why are the useful metals chiefly hidden in the depths?

The Pope, the Turk, and—not the devil, as the old litanies ran, but his chief opponents—the clergymen, (some of them at least) reply: "It is the will of God," and that ends the inquiry with them. But Science rests with no such thought-repressing dogma. Present conditions are, because some other conditions were: what were those conditions? In pursuit of the answer to this question scientific men stop at nothing short of "interviewing" the Universe. Naturally the ruler of our planetary system is the most instructive witness in regard to the genesis of his family, the earth included.

It appears to be pretty conclusively shown, by spectroscopic analysis of the sun's light, that the following twenty terrestrial elements (with indications of perhaps two otherwise unknown elements which need not be taken into this account) exist in the sun's atmosphere:

Aluminum	Chromium	Lead	Sodium
Barium	Cobalt	Magnesium	Strontium
Cadmium	Copper	Manganese	Titanium
Calcium	Hydrogen	Nickel	Uranium
Cerium	Iron	Potassium	Zinc

These various substances are not indiscriminately mixed in the vapors which surround the sun. Thanks to the interposing face of the moon in total eclipses, it is possible to study the sun's atmosphere in sections, so to speak: by which study it appears that, by virtue of the high temperature which prevails there, and the varying specific gravity of the different elements, the latter are enabled to arrange themselves in layers, in spite of the storms and gaseous outbursts which would tend to disturb their positions. It is observed too that, in the main, the number of elements increases downwards. The outer "coronal" atmosphere contains cooled hydrogen. The "chromosphere" shows incandescent hydrogen, magnesium, and calcium. The "reversing layer," which lies next the photosphere, exhibits sodium, chromium, manganese, iron, nickel, and the rest, with the probable exception of aluminum, the place of which has not been determined by observation, but which most likely lies between magnesium and calcium.

Theoretically the metalloids should lie, as a group, outside the metallic atmosphere: and Mr. Lockyer has submitted some evidence to show that they probably do, explaining why, under the conditions which prevail, their record among the Fraunhofer lines should be a feeble one, and insisting that, in the lack of such lines, we have no argument against the presence of some quantity of the metalloids in the sun, although that quantity may be small. As collateral evidence it is proper to add in this connection that, in the spectra of granite, greenstone, and lava, no trace of metalloids is seen, notwithstanding the (chiefly) non-metallic character of those rocks.

Assuming, in accordance with the nebular hypothesis, that the earth was once in the condition which the sun now presents, we can readily understand why its chemical constitution should be what it is. From the known behavior of the elements, it is inferable that, as the external metalloidal vapors cooled, they would condense and fall upon the underlying layer forming these binary compounds capable of existing at a high temperature, such as the vapors of water and hydrochloric acid, silica, carbonic acid, and others.

As the cooling went on, the precipitation of these binary compounds would give rise to numerous reactions, forming silicates, chlorides, sulphates, etc. With still further cooling, the condensation of water and the formation of minerals would ensue, and the consolidation of the outer shell would begin. The condensation of the metals would come much later and nearer the center.

The same line of facts and reasonings give a clue to the probable constitution of the planets. Assuming the solar nebula to have once existed as a nebulous star at a temperature of complete dissociation, and to have contracted with loss of heat, throwing off the planets successively, we may infer that the outermost would be chiefly if not entirely metalloidal; the inner ones would be increasingly metallic as their orbits approached the central portion of the nebula. Mr. Lockyer considers that the low density and the gigantic and highly absorbing atmospheres of the outer planets accord with their being more metalloidal than the earth: on the other hand the high density and comparatively small and feebly absorbing atmospheres of the inner planets point to a more intimate relation with the inner layers of the original nebulous mass, and consequently a more metallic constitution. For the same reason we should expect to find the metalloids scarcer in the sun than in the earth. The otherwise mysterious fact that the moon is of lower density than the earth, and the moons of Jupiter similarly less dense than their primary, is easily explained by this hypothesis.

The news which we have briefly summarized awaits confirmation, though (as the newspapers say) it comes direct, and from a trustworthy source. It is certainly good enough to be true, commending itself, as Professor Prestwich observes in his review of the present aspects of geology, not only by the simplicity and grandeur of the views presented, but for their high suggestiveness for future inquiry and research.

GERMAN PATENT LAW.

At present the various States, comprising the German Empire, have each a separate patent law. At the time of the Vienna Exposition it was proposed to initiate a general patent law, and to abrogate the State laws. For this purpose the German Patent Protective Association was formed, and they have prepared the details of a new law, which has been presented to the Federal Council, with a petition for its enactment.

The proposed new law is substantially a codification of existing provisions, and embodies the current continental notions about patents and inventors. The latter are regarded

as interlopers or trespassers, who must be watched, surrounded by restrictions, and compelled to surrender their property to whoever demands it.

In this country, the inventor is regarded as a public benefactor, enjoys entire freedom in the possession and working of his patent, is encouraged in his work, and honored by the people. It is chiefly when he goes before Patent Office officials that he meets with rebuffs and discouragements.

The proposed German law provides for a commission who shall decide as to the propriety of granting patents. Official fees small. Duration of the patent, 14 years. Annual payments to be made; neglect to pay forfeits the patent. Within six months after the application is made, but before the patent is granted, the applicant must show that the invention has been actually worked within the Empire. The Patent Office may extend the term for working to a year in special cases, and will then decide whether or not to grant the patent. Patentees are compelled to grant the right of use to any persons who desire; and if the parties cannot agree as to terms, the Patent Tribunal shall name the price which the inventor must accept. The government may use any invention, without negotiating with the patentee; the Tribunal will name a sum, which the patentee must accept, or get nothing.

A STREET RAILWAY IMPROVEMENT WANTED.

We publish in another column a note from the president of the Third Avenue Railway of this city, inviting the attention of inventors to a needed improvement in the joints of the rails of street railways. The Third Avenue Railway is one of the most extensively patronized roads in the world. Its length is eight miles, and it carries about thirty millions of passengers per annum. Its rails are spiked down upon longitudinal wooden beams, with an iron plate under the ends of the rails. In addition to the enormous traffic of the company, the rails are subjected to much wear and tear from heavy street vehicles. The improvement called for must be of such a nature as to be readily applied to existing rails.

A NEW DODGE.

We have frequently had occasion to warn patentees against the persistent efforts of designing persons in all parts of the country to abstract money from their pockets under various pretexts. The most numerous class of these impostors have hitherto been those who send circulars and letters to patentees, announcing their extraordinary facilities for selling patents, insinuating that they have a customer for the invention, etc., and all they require to consummate the sale is a power of attorney and a small fee in advance.

Our exposure has very nearly effected an extermination of their operations in this line, but now they turn up in a new *rôle*.

Instead of sellers of patents, they now appear as solicitors. They look through the list of patents each week, and write to the patentees, stating that their claims do not appear to cover the whole of their inventions, and advise reissues in each case, and set forth special facilities for obtaining these reissues. We have before us a letter from one of these reissue solicitors which a gentleman has sent us, with the usual enquiry as to what we know of the writer. The solicitor's letter goes on to state that his only means of judging of the *strength* of the patentee's claims was from the published report. The writer had not even read or seen the gentleman's patent, but he has written advising him to apply for a reissue, stating that for $70, including all fees, payable when the order is given, he will do his best to get broader claims; but, he adds, the inventor must take all risk of failure. The writer is evidently a novice at this new dodge, and is either very stupid or has a streak of inherent honesty left; for he admits, as before stated, that he has never seen the patent, and he also frankly states in another portion of his letter that he does not know whether the patent can be strengthened, adding truthfully that the result would depend altogether on what had been done in this line before the patentee made his application. But he winds up by stating that he believes that better claims can be "engineered through." What is meant by "engineering through" is not explained; but the expression would seem to be a part of the means used for impressing the patentee as to the magnitude of the solicitor's influence in getting allowed such claims as he may ask for.

It is not a large number that will be deceived by such specious communications; but some will be made nervous, and wonder to themselves if they have a valid patent. We would advise such persons to consult their own agents for information, but under no circumstances to place their business and money in the hands of these letter-writing solicitors, with whom they have no acquaintance.

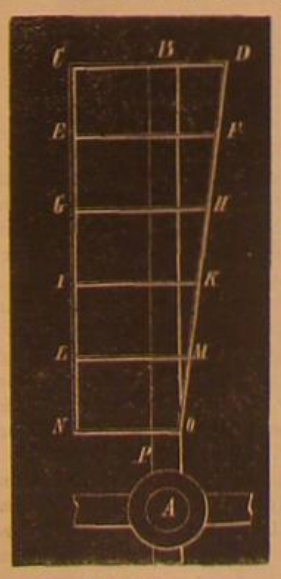
It is not often that unsolicited advice from a stranger is worth very much, and the motive that prompts it may usually be looked upon with suspicion. We do not assert that advice thus tendered is necessarily given from pernicious motives; but we believe that it is not wise to follow the advice of strangers whose opinion is volunteered; and that those who place their business in the hands of such persons will be likely to find the experiment an expensive one.

HOW TO BUILD A WINDMILL.

The principal data connected with windmills were discovered by experimenters early in the present century, the best proportions for sails being ascertained, and most of the important details of construction being worked out. We do not mean to say that manufacturers have made no improvements since that time, only that nothing of any great novelty has been produced. We must refer the reader to some standard treatise on mills and millwork, and to the circulars of manufacturers, for information in regard to the various details and patents, and will content ourselves with a description of a standard mode of construction and proportion. Windmills can be either horizontal or vertical, but the latter are almost exclusively employed. In the vertical windmill, the shaft is inclined to the horizon at an angle of from 5° to 15°, when the wheel is placed at the top of a tower; so that the wheel will clear the sides of the building, and allow space for the action of the wind. If the wheel is supported by a post, the shaft may be horizontal. The connection of the shaft with the pump or other mechanism may be made either with gearing, or by means of a crank and connecting rod. The shaft must be free to swing around in any direction, so that the wheel can always face the wind. It is moved, in the case of small windmills, by the use of a weather vane on the end of the shaft opposite to the wheel. With large windmills supported on towers, the top of the tower is generally arranged so that it can be rotated, and a small auxiliary wind wheel, connected by gearing, moves it into the proper position as the direction of the wind changes. The wheel of a windmill may be covered with cloth, or with slats of wood or metal, the cover in either case being technically known as the sail. It is frequently necessary to reef the sails, when the force of the wind increases; and windmills are often arranged so that this reefing is performed automatically. A common method of effecting this is to make the sail of a series of jointed slats, that present a close surface to wind of the ordinary velocity, and open, thereby decreasing the surface, as the velocity of the wind increases. A good number of the windmills in use, however, are covered with cloth, and reefed by hand as occasion requires. The best velocity for a windmill is such that its periphery moves about $2\frac{1}{2}$ times as fast as the wind. Thus, if the wind is moving at the rate of 20 feet a second, the tips of the sails should move at the rate of 52 feet a second, so that, if the wheel were 12 feet in diameter, it should make about 83 revolutions a minute. Of course, if the velocity of the wind varies greatly, it will be impossible to keep the speed constant, so that windmills are not ordinarily well suited for work requiring steady motion; although they answer very well for moving pumps, if an intermittent supply of power is not a serious obstacle. In some sections, however, the prevailing winds are quite steady, and in such cases windmills can be applied with advantage to grist mills and other useful work. The force and velocity of the wind can only be determined by experiment, but the results of previous experimenters may be useful to our readers, and we give below a summary of the most recent and reliable:

Velocity of wind. In feet per second.	Velocity of wind. In miles per hour.	Perpendicular force, in pounds per square foot.	Common expressions of the force of the wind.
10	6·82	0·33	Gentle pleasant wind.
20	13·64	0·91	Brisk gale.
30	20·56	2·04	Very brisk.
40	27·27	3·92	High wind.
50	34·09	6·25	Very high.
60	40·91	9·25	Very high.
70	47·73	12·75	A storm.
80	54·55	16·34	A storm.
90	61·36	20·74	A great storm.
100	68·18	25·28	A great storm.
110	75·02	30·89	A great storm.
120	81·84	36·75	A hurricane.
130	88·65	43·26	A hurricane.
140	95·47	50·82	A violent hurricane.
150	102·29	37·56	A violent hurricane.

In the accompanying figure is shown one of the four sails of a windmill, it having been found that four sails of proper proportion produce the best effect. The piece, P B, is called the whip of the sail; C D, E F, G H, etc., the bars of the sail. The bars are inclined to the plane of revolution, at different angles, the angle made by any part of the sail with this plane being called the weather of the sail. Making the distances A O, N L, L I, etc., each equal to $\frac{1}{12}$ of the diameter of the wheel, the best values for the angle of weather are as follows:



For C D—7°
For N O—18°
For L M—19°
For J K—18°
For G H—16°
For E F—12½°

The sail stretched over these bars will be a warped surface, somewhat resembling the blade of a screw propeller. The part B D O, called the leading sail, is triangular, and B D is $\frac{1}{12}$ of the diameter of the wheel, B C being $\frac{1}{19}$, and C N, $\frac{5}{12}$, of the diameter. The main body of the sail, B C N O, is commonly rectangular. A windmill of the best proportions, running under the most favorable circumstances, utilizes about $\frac{2}{10}\frac{9}{0}$ of the energy of the wind that acts on an area equal to a circle having the same diameter as the wheel. It would not be advisable to count on realizing more than half this power in general practice; and on this assumption, we have the following empirical rule, for determining the diameter of a wheel, to give a certain amount of power, with an assumed velocity of the wind:

Divide the required horse power by the cube of the velocity of the wind in feet per second, take the square root of the quotient, and multiply it by the number 2024·8. The product will be the required diameter in feet. An example illustrative of the preceding principles is appended. A windmill is to be erected in a locality where the general velocity of the wind is about 20 feet per second. It is to be attached to a pump, the work required of it being to raise 1,000 gallons of water per hour through a hight of 20 feet: 1,000 United States gallons of water weigh about 8,320 pounds, and, taking into effect the resistance of the pump, the power required will be about $\frac{1}{4}$ of a horse power, or 0·167 horse power. Dividing this by 8,000, the cube of the velocity of the wind, extracting the square root, and multiplying by 2024·8, we obtain $9\frac{1}{2}$ feet as the required diameter of the wheel. Referring to the figure, we find that, in this case, C N is 3 feet $10\frac{1}{2}$ inches, B D, $7\frac{5}{8}$ inches, and B C, $11\frac{3}{32}$ inches. The velocity of the tips of the sails should be 52 feet per second, or the the wheel should make about 108 revolutions a minute. These explanations will probably be sufficient to enable any of our readers who desire it to construct a wheel, and we shall be glad to hear of the success of their efforts.

SCIENTIFIC AND PRACTICAL INFORMATION.

NITRO-GLYCERIN.

Professor Mowbray, in a recent lecture before the Stevens Institute of Technology, on the subject of explosives, stated that nitro-glycerin is now largely made from the fatty waste of stearin and soap factories. Its density, which is 1·6, water being 1, enables it to exercise its tremendous force; for in a given bulk, there is 60 per cent more gaseous matter than would be contained in it were it only of the density of water.

NEW IMITATION SILVER ORNAMENTS.

In several stores in Munich various objects of art have lately been displayed, which are remarkable for their brilliant silver hue. It appears that they are mere plaster models covered with a thin coat of mica powder, which perfectly replaces the ordinary metallic substances. The mica plates are first cleaned and bleached by fire, boiled in hydrochloric acid, and washed and dried. The material is then finely powdered, sifted, and mingled with collodion, which serves as a vehicle for applying the compound with a paint brush. The objects thus prepared can be washed in water, and are not liable to be injured by sulphuretted gases or dust. The collodion adheres perfectly to glass, porcelain, wood, metal, or *papier maché*. The mica can be easily tinted in different colors, thus adding to the beauty of the ornamentation.

NEW PROCESS OF GILDING ON GLASS.

Professor Schwarzenbach, of Berne, has recently devised the following new method of gilding on glass: Pure chloride of gold is dissolved in water. The solution is filtered and diluted until, in twenty quarts of water, but fifteen grains of gold is contained. It is then rendered alkaline by the addition of soda. In order to reduce the gold chloride, alcohol saturated with marsh gas and diluted with its own volume of water is used. The reaction which ensues results in the deposition of metallic gold and the neutralization of the hydrochloric acid by the soda.

In practice, to gild a plate of glass, the object is first cleaned and placed above a second plate slightly larger, a space of about one tenth of an inch separating the two. Into this space the alkaline solution is poured, the reducing agent being added immediately before use. After two or three hours repose the gilding is solidly fixed, when the plate may be removed and washed.

The Clark Revolving Shutter.

It is announced in the advertising columns of this issue that Messrs. Clark & Company, of London, Eng., patentees and manufacturers of self-coiling shutters made of steel, iron, or wood, have an agency at 218 West 26th street in this city. Messrs. Clark & Company's shutters are to be found in all parts of the world, and are known for their ease in working, security against burglars, and finished and ornamental appearance. The firm have other branches at Boston, Mass., Dublin, Edinburgh, Manchester, Liverpool, Melbourne (Australia), Paris, Berlin, and Vienna, their headquarters in London being a very large and complete manufacturing establishment. In New York city, the Clark shutters are to be seen on the new building for the Lenox library, 100 of them having been put into the structure; and the Delaware and Hudson Canal Company's new building and the *Tribune* offices are also being supplied with them. They are to be seen in many other of our principal cities, and there cannot be two opinions as to their convenience and efficacy in use and light and ornamental appearance.

NEW subscribers to the SCIENTIFIC AMERICAN will hereafter receive the papers from the time of our receiving the order, unless they specify some other date for commencing. All the back numbers from the commencement of the volume (January 1) may be had if requested at the time of sending the order, or on request, after receipt of first number.

PREPARING SOIL FOR POTTING.—We find the following under the heading of "House Plants" in a popular and excellent family magazine: "Ladies who find their efforts to raise house plants frustrated by worms may be able to win success by boiling the earth before setting the plants. Use little water, and allow it to simmer away after a few minutes of hard boil."

THE New York city authorities, who once peremptorily refused to allow the American Telegraph Company to lay its wires underground, are now seeking to compel all the companies to bury their wires.

NEW MODE OF SLAUGHTERING CATTLE.

The present mode of killing cattle, by striking the animal with a hatchet or ax, is a cruel operation, as in most cases repeated blows are required to produce the death of the animal. Different methods have been recommended and tested for the purpose of executing the operation with the greatest possible dispatch, so that the animal be not unnecessarily exposed to protracted suffering.

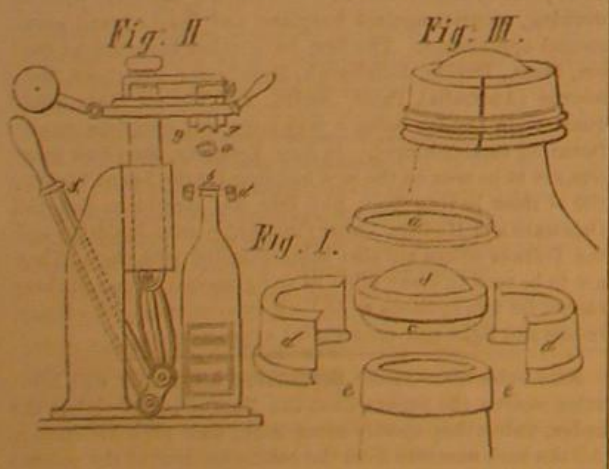
The device represented in the illustration is a French invention, and promises to meet all requirements, being so simple in construction that it may be readily employed anywhere. The head of the animal is covered by a mask of suitable material, which closes the eyes entirely, and is at the center provided with a circular plate of sheet iron, rivet-



ed thereto, which guides in a central perforation a strong steel bolt or pin, in a direction vertical to the plate. The inner end of the sliding bolt faces the head of the animal, and is made hollow, while the outer projecting part is provided with a large knob. The masked or blindfolded animal has no idea of his fate, a single blow of the hammer or club on the knob being sufficient to drive the bolt into the brain, and produce the instant dropping of the animal as if struck by lightning. The theory is that the small quantity of air in the hollow end of the bolt is forced with the same into the brain, and, being heated by the compression, exerts a pressure on the brain, and causes thereby almost instantaneous death. The whole operation is completed within half a minute. Several cities of Germany and France have provided by special ordinances for the introduction of this device, which recommends itself to the attention of all humane persons.—*Science Record for* 1875.

IMPROVED BOTTLE STOPPER.

We publish herewith an illustration of a stopper now in use in Europe for corking bottles containing mineral waters, which was exhibited at the recent Vienna Exposition. It is the invention of M. J. de Becker, of Paris, France. It consists of a metallic ring, *a*, two semicircular parts, *d d*, and a cap piece, *b*, which last is provided at the underside with one or more cork disks, *c*. A disk of parchment paper is placed below the cap, *b*, over the mouth of the bottle, the cap and paper being then forced in by suitable pressure, for which purpose the small corking machine, shown in Fig. 2, can be employed. The forcing-in of the cork admits the application of the semicircular sleeve parts, which bind, by their upper flanges, on the cap piece, and by bottom collars



on the rim at the mouth of the bottle. The ring, *a*, is then placed over the sleeve parts and carried down by the lever, *g*, of the corking machine, producing thereby a strong and perfectly airtight closure of the bottle. The machine enables three or four bottles per minute to be corked, the stopper being able to resist, according to trials made at the Conservatoire des Arts et Métiers, an interior pressure of thirty atmospheres (450 lbs. to the inch), which makes it applicable to the bottling of aerated waters.

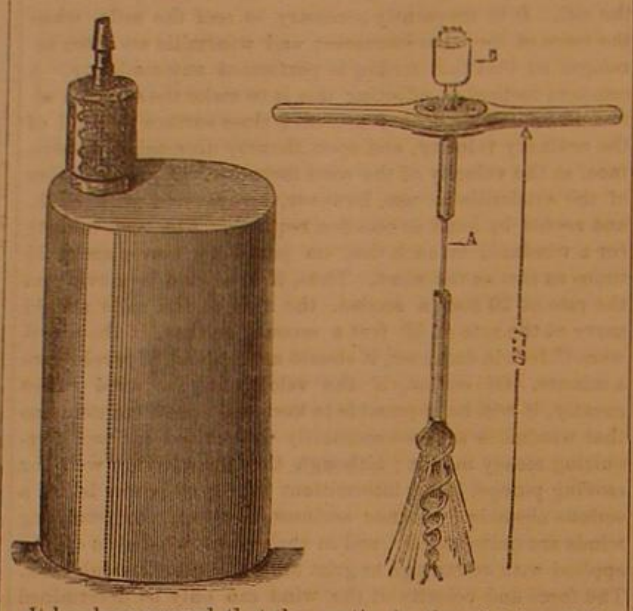
The opening of the bottle is accomplished by simply placing the thumb on the cap piece, and pulling the binding ring, in an upward direction, with the forefingers. The sleeve parts and cap piece are then taken off, and the bottle is open. For sparkling wines and other carbonic acid beverages, the cork is driven in far enough to produce a report on opening.

The advantages of this stopper are that it requires no corkscrew, and allows the utilization of smaller pieces of cork, as only one tenth part of a common cork is necessary for the cap piece. The bottle is closed in about one third of the time required for corking, wiring, and tin foiling, as in the present style; and the device gives a neat and ornamental appearance without adding to the expense. It may be used over again by applying it to the bottle by hand, the parchment paper preventing the contents from taking up any taste of metal or cork, which is of importance in the bottling of liquid beverages.

EXTERMINATION OF THE PHYLLOXERA.

The best results thus far gained, in the repeated efforts made in France to rid the vineyards of the phylloxera, have been obtained by the use of alkaline sulphurets, and more especially the sulpho-carbonate of potassium. The latter substance decomposes slowly, giving off hydro-sulphuric acid and sulphide of carbon.

Fig. 2. Fig. 1.



It has been proved that the earth, in the vicinity of the infected roots, must be thoroughly poisoned. Solid poisons, however, are of no avail, and liquids are apparently shed from the covering of the insect, which seems to be water-

Fig. 3. Fig. 4.



Root of vine, covered with phylloxera, in an advanced stage. Swollen roots of vine, caused by phylloxera.

Fig. 5.



Swellings of root fibers of vine—commencement of the disease.

proof. The action of water and carbonic acid in the soil is sufficient to disengage gases, from the materials named above, which exterminate insects, while the potash acts as an excellent fertilizer for the injured vine.

The instruments used for introducing liquids, from which poisonous gas is to be developed, are represented in Figs. 1 and 2. Fig. 1 shows an auger, having a hollow shank and perforated just above the cutting portion. This is provided with handles, above which is placed a small cylindrical vessel, shown separately, enlarged, which serves as a measure into which the liquid is poured in determined quantities. These last are measured by means of the vessel shown in Fig. 2. The insecticide is placed in the large receptacle, and thence, by tilting, the latter is allowed to fill the smaller can above. The orifice between the two is then closed, and the smaller can removed, and its contents turned into the hollow portion of the auger, as represented at B, dotted lines.

The effect of the ravages of the phylloxera upon the roots of the vine is represented in Figs. 3, 4, and 5. At the beginning of the attack, the radicles swell, as shown in Fig. 5, and also enlarged in Fig. 4. When the disease is far advanced, the roots appear as shown in Fig. 3.

Phylloxera Prize.

It will be remembered that several months since we published the text of the law passed by the French Assembly, decreeing a prize of $60,000 to any person who should invent a means of effectually exterminating the phylloxera. To this large sum, various vine growers, corporations, and municipalities throughout France added other amounts, forming a total, the aggregate of which, though not definitely known to us, might certainly be placed as a very handsome fortune for the lucky discoverer. The report of the committee, to whom the descriptions of the various plans have been sent for adjudication, has recently appeared; and although some six hundred schemes have been considered, no one is awarded the prize. The offer, however, remains open, and for this reason the advice of the committee is valuable to intending future competitors. The report says that "the Commission is authorized to conclude that the communications which have been submitted to it have in no instance been accompanied with the record of sufficient experiment and application to the soil over a long enough period," and therefore the prize cannot be decreed. The document then calls particular attention to the following, from the observations made by M. Dumas, President of the Commission, when the offer of the award was first announced:

"Processes imagined but not tried are no longer of interest, since it would be very difficult to indicate, at the present time, any method not already suggested. The fact of tobacco, sulphur, ammoniacal gas water, coal tar, petroleum, sea water, etc., being urged as sovereign remedies, twenty times or more, adds nothing to the confidence in such means. Experience alone can teach us their value, and unhappily the occasion for inventors to try their processes is anything but wanting. In order to compete with a chance of success, it is necessary that the experiments be repeated, prolonged, and authentic, and they must prove, beyond doubt, that the means tends either to cause the phylloxera to disappear from the vines by an economical process, or to preserve healthy vines against the ravages of the pest, or to check its inroads while insuring the life and fructifying the attacked plant.

"The prize cannot be awarded until after an absolute demonstration, sufficiently prolonged, of the reality of the discovery."

About Spiders.

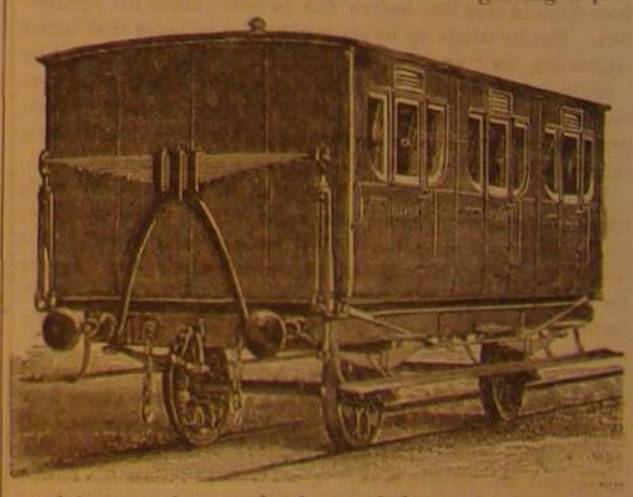
Professor E. S. Morse says: Only the female spiders spin webs. They own all the real estate, and the males have to live a vagabond life under stones and in other obscure hiding places. If they come about the house so often as to bore the ruling sex, they are mercilessly killed and eaten. The spiders skin is unyielding as the shells of lobsters and crabs, and is shed from time to time in the same way, to accommodate the animal's growth. If you poke over the rubbish in a female spider's back yard, among her cast-off corsets you will find the jackets of the males who have paid for their sociality with their lives—trophies of her barbarism as truly as scalps show the savage nature of the red man.

Water Ditches.

The ditches of California are the great arteries which bring life to the mines. Their even and constant flow secures a healthy and vigorous state of industry, while the dearth of water in the mines throws a pall over the business world of California, money becomes tight, and hard times are the consequence. The engineering skill displayed in the construction of ditches in this State is of the highest character, accomplishing the most daring feats, hanging flumes on steep, rocky bluffs, and crossing gorges of a thousand feet in depth, and it must seem almost a presumption to inquire whether any improvements can be suggested.

GIFFARD'S RAILWAY CAR.

M. Henri Giffard, inventor of the celebrated Giffard injector, has succeeded in constructing a railway car, the body of which is so supported on springs that all oscillation and jarring is entirely obviated, and the passengers within are enabled to read, write, and otherwise employ themselves with as much facility as if not in motion. Our engraving is pre-



pared from a photograph of one of these vehicles, now in use on the railway between Paris and Lille, France. The platform is supported on heavy springs of its own, and carries at each extremity standards, which, in turn, are surmounted by ponderous leaf springs, to the ends of which the body of the car is suspended. It was found, on a first trial, that the peculiar horizontal oscillation which is so very fatiguing to the traveler was entirely suppressed, and that a light vertical elastic movement which remained was easily obviated by adjusting the suspending rods.

The weight of the car is somewhat more than that of those ordinarily employed on European railroads, and its cost is higher.—*Science Record for* 1875.

A NOVEL DESIGN FOR A BRITISH CHANNEL TUNNEL.

We illustrated, on page 306 of our volume XXXI., a new method of building submarine structures, the invention of Jerome Wenmaekers, a Belgian engineer; and we refer our readers to the description there given, which fully shows the adaptability of the system to works of any extent, and however difficult of execution. The inventor of the plan now publishes a detailed account of a tunnel under the British Channel, to be constructed on his plan, which shows many new features which are worthy of consideration.

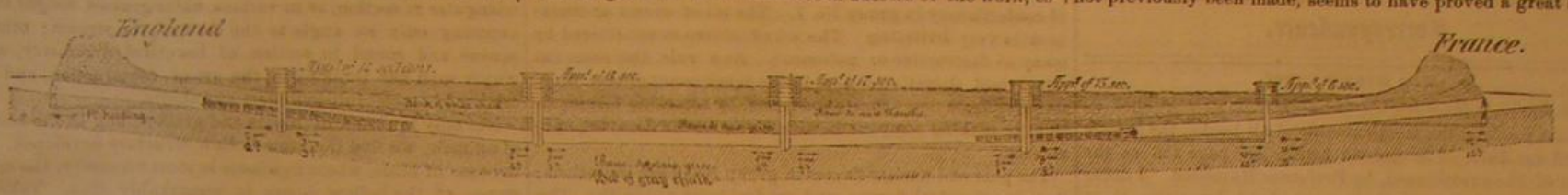


Fig. 1.—WENMAEKERS' BRITISH CHANNEL TUNNEL—LONGITUDINAL SECTION.

He proposes to sink five caissons (as shown in our longitudinal section, Fig. 1), the deepest of which, in the center, will require seventeen sections, the depth of water being about 40 meters (about 130 feet). The erection of these structures, if practicable at this depth, would enable the tunneling to be done in twelve headings at once, and would give an easy means of hauling away and disposing of the *débris*, an important consideration in a tunnel of this length Moreover, a very large means of ventilating the tunnel would be afforded, and thus the great difficulty anticipated in working such a submarine railway would be obviated. M. Wenmaeker's idea is to insure solidity to the tunnel by perforating the white chalk which underlies the sand of the ocean bed, and to construct the work in the hard gray chalk still lower down. The magnitude of the proposed works may be seen by inspection of the plan, Fig. 3, which shows the diameter of the caisson to be 162·5 feet. This dimension would allow the work of hauling the loose earth to the surface of the water to be done on a very large scale and with great rapidity

M. Wenmaekers prefers to construct the tunnel at the depth indicated in the engravings, on account of the increased solidity of the substratum of gray chalk, although he claims that his system is equally useful for building the work at a depth of 6 or 8 feet only below the bed of the sea. A tunnel made in the durable stratum, and lined, as he proposes, with masonry of *béton aggloméré*, or other well tried artificial stone, would doubtless be a work of great strength and permanent value.

The distance between each two caissons would be about three miles and a half, and between those nearest the shores and the entrances to the tunnel, respectively, rather less Tunnels of such lengths are trifling works compared to those of Mont Cenis and St. Gothard. It is proposed to take a route between the nearest points, namely, St. Margaret's, about three miles east of Dover, and a point about the same distance west of Calais, half way between that city and Cape Grisnez.

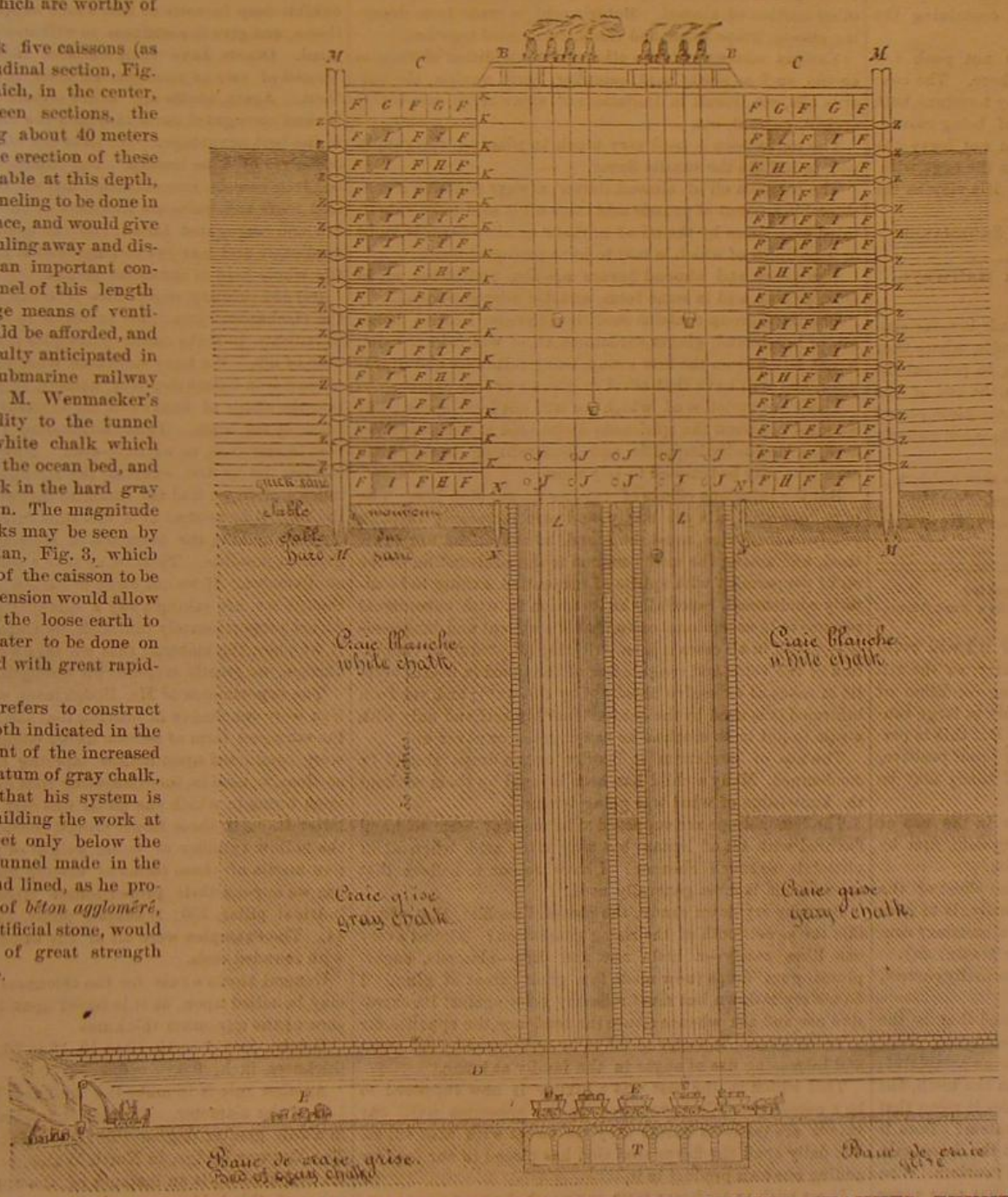


Fig. 2.—SECTION OF THE PROPOSED CAISSONS FOR THE BRITISH CHANNEL TUNNEL.

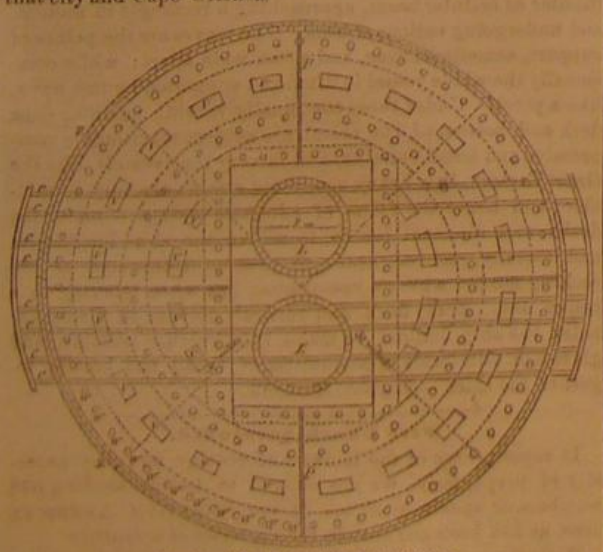


Fig. 3.—PLAN OF THE CAISSON.

M. Wenmaekers certainly deserves credit for the boldness of his scheme. His tunnel is to be for a double track railway, being 26 feet wide and 13 feet high; and he has carried out his design into detail, proposing to use perforating machines (Fig. 4) capable of excavating a bore 9 feet 9 inches in diameter. The use of a compressed air chamber, of the full diameter of the tunnel, is shown in Fig. 5. He is, moreover, sanguine as to the commercial success of the work, estimating its cost at $24,000,000, including the necessary junction railways on both shores. He anticipates a gross revenue of $6,000,000, and believes that the working expenses can be kept down to $1,000,000, leaving a profit of nearly 21 per cent on the expended capital.

There is reason to believe that the work of constructing a channel tunnel will be seriously taken in hand. The corporation most likely to be benefited by its construction is the Northern Railroad of France, a line which is largely owned by the Paris branch of the Rothschild family. A joint commission to investigate the whole subject has been appointed by the English and French governments and the capitalists interested, and M. Wenmaekers' plans have already been submitted for their consideration.

Fluorescence of Bodies in Castor Oil.

Charles Horner states that certain natural organic coloring matters, which exhibited no fluorescence when in aqueous or alcoholic solution, were observed to fluoresce brightly when dissolved in castor oil; while other substances, possessing naturally a faint fluorescence, were found to have this property considerably augmented.

In this solvent, cudbear exhibited a brilliant orange-colored light, and extracts of logwood and camwood a powerful apple-green fluorescence. The well known fluorescent light of turmeric solutions was increased in brilliancy at least threefold, and is described as a vivid emerald green fluorescence, comparable only with the appearance presented by the best uranium glass under similar circumstances. It is suggested, therefore, that, in studying the phenomena of fluorescence, advantage should be taken, when possible, of the solvent property of castor oil.

Compounding Marine Steam Engines.

A somewhat novel experiment in the way of applying the compound principle to existing oscillating paddle engines has been carried out in the case of the Royal Mail Company's steamship Eider, and the attempt, which it is believed has not previously been made, seems to have proved a great success. The Eider is a paddle steamer of 1,564 tuns, builder's measurement, and 310 horse power, built specially for the intercolonial service of the Royal Mail Company in the West Indies, and has been engaged in that capacity for several years. She was recently sent home to Southampton to be refitted and have her engines compounded; and this work having been completed, she will shortly sail again for her old station. The Eider's engines have oscillating cylinders, which were originally 66¼ inches in diameter and 6 feet 6 inches stroke, working at 30 lbs. pressure, and consuming about 35 tuns of coal per day. In order to adapt the compound principle to these engines, and do so with as little alteration and expense as possible, Mr. J. Bowers (the company's superintending engineer at Southampton) decided to retain the whole of the existing engines, with the exception of the cylinders, pistons, and slide valves. As the new cylinders had to oscillate between the old columns supporting the entablature, it was found impossible to make the low pressure cylinder of a larger diameter than 72 inches, and the high pressure cylinder was therefore made 42 inches diameter, both, of course, having the old stroke of 6 feet 6 inches. The contract for the new compound cylinders, new high pressure boilers, steam pipes, etc., was given to Messrs. Day, Summers & Co., of the Northern Ironworks, at Southampton, who have carried out their engagement to the entire satisfaction of the company's superintendents. The Eider was taken to Stokes Bay a day or two since, and the results of two runs on the measured mile were as follows: First run, 4 minutes 30 seconds, equal to 13·333 knots per hour; second run, 4 minutes 46 seconds, equal to 12·587 knots, giving a mean speed of 12·96 knots per hour; revolutions of engines, 20½ per minute; steam, 65 lbs.; vacuum, 27½ inches; indicated horse power, 1,251. The space saved in the Eider by the diminished size of the boilers and coal bunkers enables her to carry between 200 and 300 tuns more cargo than heretofore, and the consumption of coal will be reduced from 35 to 22 tuns per day. The improvement in the general arrangements of the ship, in consequence of the decreased space required for the machinery, have added much to the comfort, and improved the appearance, of the Eider

Female Voters.

The Supreme Court of the United States has lately decided, in the case of Miner *vs.* Hoppersatt, that women, although they are citizens, are not therefore voters. Women are citizens of the United States, and of the State where they reside. The court unanimously held that the Constitution of the United States does not confer the right of suffrage upon any one. The right of suffrage is not made, in terms, one of the privileges of a citizen. The elective officers of the United States are chosen directly or indirectly by the voters of the

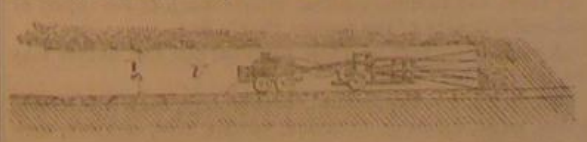


Fig. 4.—PERFORATING MACHINE.



Fig. 5.—CONSTRUCTION UNDER COMPRESSED AIR.

States. The United States has no voters. No one can vote for Federal officers without being competent to vote for State officers. It follows from this decision that women cannot become voters until they are authorized by the States in which they live.

Correspondence.

The Grasshopper.

To the Editor of the Scientific American:

I have received the most valuable of all books, the *Science Record*, for 1875. I notice an article on page 456, on the habits of the grasshopper, by Professor Humiston. I differ from his description of their method of depositing their eggs. He says: "The tail of the female locust consists of a hard, bony, cone-shaped substance, capable of being thrust into ground from ¼ to 1 inch in depth. Just above this, on the body of the insect and attached to it, is the egg cell; the grasshopper is able to push its conical tail down into the ground and leave it there, with the cell containing the eggs."

I wish to state that the grasshopper does not push her tail into the ground, nor does she leave it there. The cone part, as he describes it, is a hard, forked, bony terminus, both above and below the anus. It is capable of being moved, and the female uses it as a drill She does not leave the tail (as he calls it) with the eggs; but deposits the eggs, with draws the tail, and goes about her business. His view as the hatching in spring time are correct.

Leroy, Kan. J. G. Shoemaker.

An Improvement Wanted in Street Railways.

To the Editor of the Scientific American:

One of the greatest needs of street railroads is some simple and economical invention to keep the rails, where they meet, in a level condition; or in other words, to prevent the end of the forward rail from sinking below the end of the near rail. The device at present used is an iron plate placed under the junction of the two rails; but this does not entirely prevent the evil.

I invite the attention of inventive minds to this subject.

Sam. L. Phillips, President.

Office of the Third Avenue Railroad Company, New York city.

Is Candy Injurious to the Teeth?

[From a paper by Dr. John T. Copman, read before the New York Odontological Society.]

Most certainly it is. For outward proof of it I will refer you to any candy-making village in our country, as the village of Neponset, Mass., where the shocking condition of the teeth, of the youth brought up in proximity to large candy manufactories, shows plainly the cause. But this is perhaps negative proof, and we should seek for proof positive, because other causes than those of the use of candy may be the reason, in this instance, of the disease.

But by far the most injurious consequence in the use of candy is in its indirect action through the system, first by its constituents, second by its disturbing action.

By long research I have discovered that the effect of the use of cane sugar, in small or in large quantity, is to produce a more or less constipated state of the alimentary canal, more particularly the refined sugar of the present day.

If, then, the balance of intestinal action is normally correct, the presence of sugar always disturbs it.

There is a point that may be stated here, and that is the action of sugar on an exposed nerve. We eat bread, meat, vegetables, and our "exposed nerve" makes no complaint; but the moment a little sugar is dissolved in the tooth, the tissue sets up a cry. What does it mean? Does it mean that it dislikes it—that it is discordant to the system? Does it mean that it is injurious to the fleshy or to the bony substances, or both? I have as yet not solved the problem. Who will do it? By an analogy we must conclude that cane sugar is injurious, and yet there may be other reasons and other causes for the pain produced in the tooth.

Besides the sugar contained in the candies of the present day and the coloring matters (mostly made of tincture of cochineal, which is harmless) are occasionally other material, such as pigments of green and yellow, which are poisonous.

We have a large number of essential oils, or medicaments, every one of which has a peculiar medical effect on the system, toning it up or down, binding up its parieties or loosening them, and to these medical effects much of the injury of the confectionery of the present time is due.

A small catalogue of these essential oils and flavors may be interesting:

Group No. 1.—Peppermint, checkerberry, sassafras, lemon, clove, anise, cassia or cinnamon, vanilla, rose, caraway, coriander, cayenne.

Group No. 2.—Jargonelle pear, strawberry, pineapple, banana, peach, almond.

Group No. 3.—Boneset, licorice, horehound, ginger, cardamom, chocolate, butter, cocoanut, cordial, brandy, gum arabic, acids.

In purchasing a pound of mixed candies, you may perchance get all of these flavors in one lot.

Now I do not pretend to say that one is likely to be poisoned by such a compound, but I do say that, when a mother gives a three year old child an ounce of peppermint drops to eat, she should know the effect of them when eaten—that she ought to know she is giving the child a medicament as well as an ounce of sugar; she ought to think and be taught that the effect of the oil of peppermint is definite, and that an ounce of peppermint drops will, if they are strong—and of course they are supposed to be good only as they are strong—contract the walls of the stomach and the small intestines, producing in a young child sometimes a spasm and inflammation, shown by a thirst for water, and a general disturbance of healthy action.

Such is, I believe, the general action of the essential oils of confectionery in group No. 1. The oil of cassia or cinnamon is very irritating. The oil of cloves is considered by many as destructive or poisonous. As a rule, the essential oils retard digestive action in the same manner that they preserve from decay meats and fruits, by retarding fermentation, or making compounds with digestible or decaying substances.

The pear and similar flavors in group No. 2 are imitations; they are chemical flavors, and are decidedly unhealthy. The composition of them I have found to be as follows:

The jargonelle pear flavor is made of the acetate of amylic ether, which is prepared by distilling a mixture of fusel oil, acetate of potash, and concentrated sulphuric acid.

The pineapple is made from butyric ether dissolved in another portion of alcohol. Butyric acid is made from decaying cheese, grape sugar and chalk, fermented together.

Various mixtures of the ethers, with addition of various agents, such as acetic acid, camphor, orris, vanilla, the volatile oils, etc., result in imitations of strawberry, raspberry, apricot, currant, etc.

The tonka bean is used very much in place of the vanilla pod, to imitate the vanilla flavor.

The common oil of almond (bitter) always contains a considerable amount of prussic acid; this oil is said to be substituted sometimes by the oil of mirbane or nitro-benzole, eight or nine drops of which is said to have produced death.

The peach and almond flavors are also imitations, made from prussic acid in some form, and are very poisonous.

The third group contains medicinal flavors: licorice, boneset, or horehound, ginger, cardamom, all of which have a different action from the first group, being relaxants and diuratives, and will have that effect in greater or less degree.

There are varieties of which we will not here speak; but we must condemn the spirituous drops sold at the street corners, as decidedly impolitic and demoralizing to the little ones who may be tempted to buy them.

But the injurious effects of candies do not stop here. The pure essential oils are costly and are increasing in price yearly; substitutes must be found, adulterations are practised, and among the most common is the adulteration of the oil of peppermint with spirits of turpentine, a thing to be utterly condemned, especially as its action is, with exceptional persons or in exceptional cases, that of a violent and dangerous poison, and in all cases it is an irritating oil, producing congestion of the veins and coagulation of the blood (a useful styptic in cases of excessive bleeding, by the way); and yet I am informed it is used by the confectioner himself, and only with a rule to put in as much as he can disguise or cover up.

The use of laudanum in licorice cough drops should be condemned. Many a child has been injured by them without the knowledge of what was going wrong.

The lemon drops are supposed to be made of citric acid, and flavored with oil of lemon; but why citric acid, when oil of vitriol is so much cheaper? I have reason to believe that tartaric acid is most generally used.

But why cry down candy, the pleasant pacifier, that which fills the sweet tooth of the rising generation? Almost every one likes candy—a little now and then—almonds, sugarplums, gum drops (now made to a great extent of glue). I do not cry it down, but must raise my voice against its excessive use, and ask whence comes the tendency, the appetite, for so much sweet? It seems to me to be occasioned by the great and increasing use of sugar in the family at home.

That which in the past was a luxury is now supposed to be a necessity. We have toned up our appetites until our viands are tasteless unless they are sweet with cane sugar. We daily spoil the flavor that God has placed in our food, by adding our own product to it.

If we wish to eradicate from our youth the very strong tendency toward high seasoning or high sweetening, we must begin at home, and tone down instead of toning up, and teach ourselves and our children to love the inherent flavors of the grains, the fruits, and vegetables; and as we and our children cultivate a love for them, so will their tastes grow, until this excessive sweetness will bear disgust, and their appetites will turn away from what cloys and sickens, and disturbs the normal condition of the human body.

I should refer to an article used to adulterate sugar, called *terra alba*—a white earthy substance—quite harmless, being sulphate of gypsum (anhydrous calcic sulphate)—profitable to increase the weight without being suspected by the buyer. It is said to be used in large quantities. It can be easily found by dissolving the candy in water; if any sediment remains, it is likely to be *terra alba*, or perhaps chalk, which is also used.

Hollow Structures.

Nature teaches us one of the grandest lessons in her economization of structures and materials. The stems of water plants are hollow and of various sections, as cylindrical, angular, or furrowed. Many of them, as all know from the revealings of the microscope, are of cellular or tubular construction. Examining the stem of a young dicotyledon cut across, we find the inner portion full of radiating cells of fibro-vascular bundles, of wedge-shaped section, the pith occupying the center. If we minutely examine these vascular bundles we shall find a layer of cells traversing the bundles; on the inside of this, toward the center of stem, the cells form the proper wood of the fibro-vascular bundle, and on the outer side, toward the circumference, the cells are closer and more compact. The layer between these portions is called the *cambium* layer, and the stem of the oak and other *exogens* is strengthened by continual increase of woody fiber outside this layer, or the *liber* of the stem. We might go on illustrating, from a variety of plants, the remarkable adaptation of stems to their habitats and conditions of growing; some triangular in section, as in various water grasses, sedges, etc., exposing only an angle to the flow of the stream; others square and round in section, of beautiful symmetry, and which man has imitated in the art of construction, and in casting his metal into cylinders and shafts.

Not only in stems of plants and grasses, but in the bones of animals, we find the same hollow structure developed. In the case of birds, where lightness is most necessary, the substance of the hollow bones is remarkably thin. Take a feather. What a wonderful union of strength and lightness is there in it! We find this hollowness particularly evident in that end of the feather at which the muscles act, or at the short end of the lever.

Leaves show a similar adaptation of matter. Some leaves exhibit deep furrows or ribs which support the membrane or tissue, and give it a stiffness to withstand the pressure of the wind. Others have their surfaces indented or voluted, or formed of two or more convex lobes, thus giving rigidity to them. Again, shells and other organic forms possess cellular and corrugated parts in which the material is distributed to the best advantage. We have not been slow lately to avail ourselves of these lessons. Our tubular and cellular bridges, our iron vessels, our columns, and shafts of machinery, our iron roofs and walls, are instances of the employment of hollow and corrugated forms, and the extent to which they are applicable and may yet be employed is almost co-equal with the whole field of inventive genius.

But our primary object here is to call attention to some of the mechanical principles involved in these structures, and to indicate how the same principles may be applied to the uses of art. We have shown on what elements the strength of cast iron beams depends, namely, in putting all the metal into the shape of flanges on the extreme side of the neutral plane of the beam. Thus the inverted T shape answers this best in cast iron, as we have seen. Now, keeping this form in view, let us first examine the strength of a hollow cylinder. Here we find the material thrown at a distance from the central or neutral axis, and thus fulfilling the great principle of making the moments of resistance of the fibers the greatest possible. Thus let us take a solid cylinder of a given diameter. If we cut away or hollow it we shall find, although we are taking away a quantity of the material, we do not proportionately diminish its transverse strength; but if we place the material that we take out round its external surface, we greatly increase the strength.

The experiments of Mr. Hodgkinson upon columns of cast iron were conclusive in proving that the hollow cylinder was the strongest form of section under compressive force. These were conducted upon hollow tapering columns, upon cross sections, as used in the connecting rods of steam engines, and upon forms in which the metal was cast in the shape of the letter H. All these forms proved considerably weaker than the hollow cylinder of equal weight of metal. As the relative merits of these forms of casting metal are of constant use we append their proportionate strengths: Hollow cylindrical pillar, 100; H shaped pillar, 75; + shaped pillar, 44. The examples were all of the same weight and length, with rounded ends.

General Morin's rule for the thickness of cast iron pillars may be relied upon, as it is based upon the founder's experience of the minimum thickness.

Height, feet, 7 to 10, 10 to 18, 18 to 20, 20 to 27; minimum thickness, inch, 0·5 0·6 0·8 1·0

Another rule is to make the thickness in no case less than 1-12 of the diameter. Cellular or tubular girders exemplify to a still greater degree the value of hollow construction. The Conway bridge, in North Wales, designed by Mr. Robert Stephenson, is an instance of the application. The two tubes of this bridge are each 25 feet high in center, and 14 feet wide externally, 420 feet long, and weigh 1,300 tuns. The material is chiefly disposed in the top and bottom parts or flanges, and these are also composed of small tubes or cells to give additional stiffness. The sides are of plate iron riveted together, and each tube is really an immense beam, of slight diminution toward the ends. An iron ship is really a tubular or cellular beam, approaching a rectangle in section, and undergoing various strains. The waves are the points of support, sometimes near, and often wide apart; while occasionally the whole vessel is lifted and supported by one wave, like a pivot. Under these continually varying conditions, the deck and bottom of the vessel are subject to alternate compressive and tensile strains, and in very long vessels, like the Great Eastern, in a heavy sea, these strains are very formidable; and hence the value of adequate stringers under the decks, and diagonal braces, to stiffen the ship lengthwise and laterally, and bulkheads to prevent transverse or the rocking motion which a vessel often has when laboring in a heavy sea. Every deck and vertical division in a ship enables the ship builder to make his structure cellular, and gives him admirable opportunities of tieing and bracing together the sides.—*English Mechanic.*

Free Lunch Suspended.

In consequence of the increase of postage and the necessity of prepayment, we are obliged to decline sending odd numbers or specimen copies of the Scientific American free, as has been our custom for a quarter of a century.

Hereafter persons desiring specimens or any special numbers of the paper will please to remit, for each copy ordered, ten cents.

PRACTICAL MECHANISM.

NUMBER XXI.

BY JOSHUA ROSE.

HAND TURNING.

Turning work in the lathe with a tool held or guided by hand, or, as it is commonly termed, hand turning, is at once one of the most delicate and instructive branches of the machinist's art, imparting a knowledge of the nature and quantity of the resistance of metals to being cut, of the qualifications of various forms of cutting tools, and of the changes made in those qualifications consequent upon the relative position or angle of the cutting edge of the tool to the work; and this knowledge is to be obtained in no other way than by the practice of hand turning.

It is the work of an instant only to vary the relative hight and angle of a hand tool to the work, converting it from a roughing to a finishing tool or even to a scraper, which operations are difficult and sometimes impracticable, if not impossible, of accomplishment with a tool held in a slide rest.

The experience gained from the use of slide rest tools is imparted mainly through the medium of the eyesight, whereas in the case of a hand tool the sense of feeling becomes an active agent in imparting, at one and the same time, a knowledge of the nature of the work and the tool: so much so, indeed, that an excess in any of the requisite qualifications of a hand tool may be readily perceived from the sense of feeling, irrespective of any assistance from the eye; and in this fact lies the chief value of the experience gained by learning to turn by hand.

For instance, there is no method known to practice whereby to ascertain how much power it requires to force a slide rest tool into its cut, or to prevent its ripping in; so that a wide variation, in the tendency of such a tool to perform its allotted duty easily and without an unnecessary expenditure of power, may exist without becoming manifest to any save the experienced workman; whereas the amount of power required to keep the cutting edge of a hard tool to its work, to hold it steadily, or to prevent it from ripping, is communicated instantly to the understanding through the medium of the sense of feeling. Nor is this all, for even the sense of smell becomes a valuable assistant to the hand turner. Several metals, especially wrought iron, steel, and brass, emit (when cut at a high speed) a peculiar smell, which becomes stronger with the increase in the speed at which they are cut and the comparative dullness of the edge of the tool employed to cut them, more especially when the cutting edge of the tool is supplied with oil during the operation of cutting. The reason that this sense of smell becomes more appreciable during the operation of hand than during that of slide rest turning is because the face of the operator is nearer to the work, and because hand turning is performed at a higher rate of cutting speed.

If a tool for use in a slide rest is too keen for its allotted duty, the only result under ordinary circumstances is that it will jar or chatter (that is, tremble, and cut numerous indentations in the work), or that it will lose its cutting edge unnecessarily quickly. But a hand tool possessing this defect will in many instances rip into the work, because the power, required to prevent the strain, placed by the cut upon the tool, from forcing the tool deeper into its cut than is intended, is too great to be sustained by the hand; and the tool, getting beyond the manipulator's control, rips into the work, cutting a gap or groove in it, and perhaps forcing it from between the centers of the lathe. If, on the other hand, a tool is of such a form that it requires a pressure to keep it to its duty, the amount of such pressure, when the tool is held at any relative hight and angle to the horizontal center line of the work, and the variation in that amount, due to the slightest alteration of the shape of the tool, are readily appreciated by sensitiveness of the hand; when they would be scarcely if at all perceived were the same tool, under like conditions, used in a slide rest.

These considerations, together with the great advantage in the relative rapidity with which the form and applied position of a hand tool may be varied, render hand turning far more instructive to a beginner than any other branch of the machinist's art. And since the subject is of equal importance to apprentices, to amateur turners, and to those who have learned their trade without having the opportunity to study this important branch of it, the subject will be treated in detail so as to be available to the merest tyro.

The first lesson will be to learn to turn a piece of plain iron, and the tools necessary for this operation are a bench vise, a file, a center punch, a hammer, a center drill, a graver, and of course a lathe, with the requisite hand rest and driver or dog. Having fastened the piece of iron to be turned in the vise, with the top face not more than an eighth of an inch higher than the jaws of the vise, so as to prevent the iron from jarring while it is being filed, file the end as nearly level and square with the body of the iron as possible. The next operation will be to centerpunch it by holding the pointed end of the centerpunch as near the center of the end face of the iron as the eye will direct; and while pressing the point of the punch sufficiently firm against the work to prevent the punch from slipping, strike the other end of the punch with a hammer, which will make a conical indentation in the end of the work, to receive the lathe center. This operation should be performed upon each end of the work so that it may be turned between the centers of the lathe. It is a common practice to center one end of the work only, and to fasten the other end in a chuck, thus making the chuck serve as a driver and obviating the necessity of centerpunching more than one end of the work. This method will, it is true, save a little time, but is objectionable for the following reasons: Chucks will run quite true while they are new, and indeed for some little time, but they do in time get out of true; and as a result, if the work requires to be reversed in the lathe so as to be turned from end to end, the part of the work turned during the second chucking will be eccentric to that part turned during the first chucking. If one end only of the work requires to be turned, and needs be true only of itself and irrespective of the part held in the chuck, the latter may be employed; this subject will, however, be treated hereafter.

The most desirable shape for the centerpunch, and the manner of holding it, are shown in Fig. 58, A being the

Fig. 58.



Fig. 59.



punch, and B, the work. The work being provisionally centered, we must make those centers true, so that the work will true up without requiring to have too much metal cut off in the operation; to this end, we place the work between the centers of the lathe, and adjust the back center so that the work will revolve easily if the hand is drawn lightly across it, and yet it must not be so loose as to be able to shake at all. We then adjust the hand rest so that it will well clear the work; and using it to steady the right hand, we hold a piece of chalk near to the work, revolving the latter by brushing the fingers of the left hand quickly and lightly across it; by then slowly advancing the chalk towards the work until the two touch, the chalk will mark the eccentric side of the work if it does not run true, and a ring around the same if it is true. If it be so much out of true as to require alteration, it must be placed in the vise again and the center drawn by striking the centerpunch while it is at an inclination, the point being in the direction of the chalk mark, as shown in Fig. 59, A being the chalk mark, and therefore the direction in which the center requires to go.

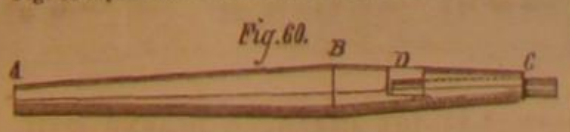
Having removed the center according to the judgment, the chalk mark should be effaced, and the work placed again in the lathe and tested as before, the whole operation being repeated until the work runs sufficiently true.

Our next performance must be to drill a small hole up the center of the work, using the centerpunch mark as the center wherein to insert the drill point. The object of this is to ease away the bottom of the center in the work, so that it will not press against and wear away the extreme point of the lathe centers, and to prevent the centers in the work from moving their position in consequence of the wear due to the friction caused by their revolving between the lathe centers, as they would do in the absence of the center drilling. For this purpose the universal chuck and a twist drill about a sixteenth of an inch in diameter are the most desirable tools, they being purchasable from any store keeping machinists' supplies. The chuck must be screwed on to the running spindle of the lathe; and the drill being fastened in the chuck, the work is placed so that the point of the drill is in one of the centers and the center of the back head of the lathe is in the other center. Then, by starting the lathe and holding the work still by the left hand while the right hand is gently screwing out the back lathe center, the work will be forced over the revolving drill, thus drilling the hole referred to. While the drilling is being performed, the drill should be freely supplied with oil to assist it in cutting and to prevent it from wearing away and becoming dull. It is very important, during this operation of center drilling, to relax, every few seconds, the hold upon the work sufficiently to permit it to make about a third of a revolution, which may be done while the other hand is supplying oil to the drill. The object and effect of this is to cause the center drilling to be true, which otherwise it would not be, especially if the work is comparatively heavy, or heavier on one side than on another.

In the absence of the possession of a drill chuck and twist drills, they may easily be made, the best forms being as follows:

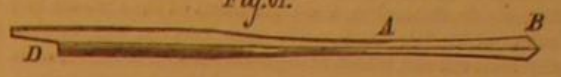
Fig. 60 represents the drill chuck with one end of the drill

Fig. 60.



in its place, while Fig. 61 represents the drill separate. The cone, from A to B in Fig. 60, is the part which fits into the socket or hole in the lathe spindle; from the end, C, to the nearest side of the slot, D, is drilled a hole, the slot, D, being cut down to half the diameter of the hole; and its bottom face is left taper as shown, so that the taper, D, of the drill

Fig. 61.



(Fig. 61) will, when forced into its place, serve to lock the drill and prevent it from turning in the chuck.

The drills may then be formed of steel wire (Stubs' is the best for the purpose) by simply filing the flat taper, D (Fig. 61), on one end of the wire, and forging out the other end to a drill of the required size, care being taken to forge the drill end (as shown in Fig. 61) smaller at A than at the drilling end, B, from B to A being a gradual curve: which is called the clearance, and which serves, in consequence of the decreased diameter of A, to permit the cuttings of the drill to pass out of the hole while the drilling is being done. If the drill is not given sufficient clearance, the cuttings will become jammed in the hole, and, binding fast to the drill, will arrest its revolving motion, and cause it to twist and break off, leaving the cutting end of the drill fast in the hole; in which case, unless one end of the broken piece happens to protrude so that it can be extracted by a pair of pliers or a hand vise, and unless it can be jarred loose (as is sometimes the case) by striking it against a block of iron or wood, the work must be heated to a low red and permitted to cool of itself, so as to soften the point of the drill to allow it to be, by another drill, cut or drilled out.

Important Researches on Explosive Substances.

Roux and Sarrau have previously shown that two different kinds of explosions can be produced by dynamite, according as the substance is made simply to deflagrate (explosion of the second order), or to detonate by the percussion of fulminate of mercury (explosion of the first order), and that the force of the explosion produced by the same quantity is very different in the two cases. They now find that the majority of explosive substances, gunpowder included, possess the same remarkable property.

The reciprocal of the weight (due corrections made) of each substance, which when exploded in one and the other manner sufficed to rend similar cast iron shells, gave the relative explosive forces. Some results of the experiments are given in the following table, the explosive force of gunpowder ignited in the ordinary manner being taken for unity:

Name of substance	Explosive force	
	2nd Order.	1st Order.
Mercury fulminate	—	9·28
Gunpowder	1·00	4·34
Nitroglycerin	4·80	10·13
Pyroxyl (gun cotton)	3·00	6·46
Picric acid	2·04	5·50
Potassium picrate	1·82	5·31
Barium picrate	1·71	5·50
Strontium picrate	1·35	4·51
Lead picrate	1·55	5·94

Of the highest practical importance is the discovery of the detonative explosion of gunpowder induced by the detonation of nitroglycerin (itself set off by the fulminate of mercury): for the force of the explosion is more than forefold greater than that obtained by igniting gunpowder in the ordinary manner. (The increased force of gunpowder and gun cotton, when exploded by the agency of detonation, was fully demonstrated by Abel six years ago). The authors observe that the mass of the substance employed for exciting detonation must usually bear a certain proportion to that of the substance to be exploded, but in some cases the action is propagated throughout the latter when once up at any given point.—*Comptes Rendus, Journal of the Chemical Society.*

Self-Watering Locomotives.

The self-supplying water apparatus for locomotives is coming into very extensive use in this country. It consists of a water trough from 800 to 1,200 feet long, laid between the tracks of the railway. As the engine passes along at a velocity of, say, 20 miles an hour over the trough, the fireman, by means of a lever, lowers one end of a pipe into the trough, and the water is carried up into the tender. The water is prevented from freezing in winter by means of steam pipes. The use of this device, by saving time in stoppages, permits a more moderate average of speed, and so results in economy.

Chromo-lithographic Process.

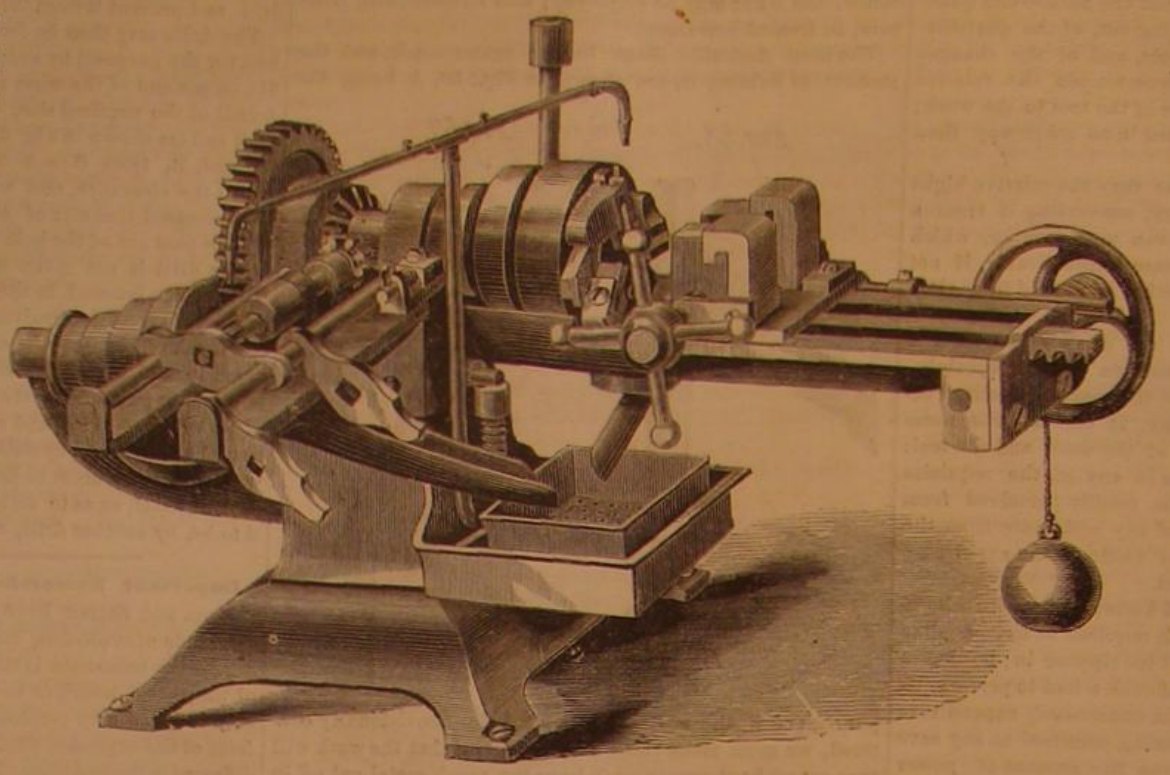
In place of using a special stone for each color, necessitating as many separate impressions as there are colors, the entire subject is drawn upon a single stone, and a proof is taken on a thin sheet of copper. This sheet is then cut out carefully according to the desired contour of the colors, and upon each of the portions is fixed a solid block of color, previously prepared. The whole is combined into one form, and is printed on an ordinary lithographic press, all the colors at once, the moisture of the sheet being sufficient to take off and hold the colors as the sheet goes through the press.

KANGAROO LEATHER.—In Australia kangaroo skins are becoming an important article of traffic, and experts declare that they make the toughest and most pliable leather in the world. Boot uppers of this material are said to be both comfortable and durable. It also makes the best of morocco whips, gloves, etc. Of these skins some are exported in their raw state, and others after being manufactured. The kangaroo is widely distributed throughout the colonies, and great numbers are slaughtered, yearly, for their skins.

IMPROVED BOLT CUTTER.

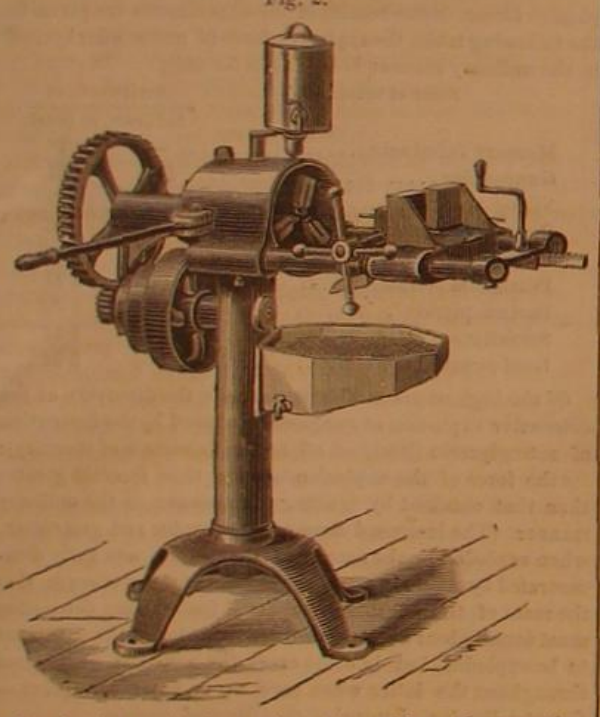
The annexed illustrations represent two sizes (Nos. 5 and 6) of a new automatic bolt-cutting machine, recently invented by Mr. E. Schlenker, Superintendent of the Howard Iron Works, of Buffalo, N. Y. The dies revolve, and may be easily removed and others of different sizes substituted, without taking out a screw. When inserted, they become instantly automatically locked. The dies open automatically to receive the bolt, upon which a perfect thread is cut by a single passage through the machine, when other automatic devices cause it to be discharged. The opening of the dies is effected by a gage rod which is set to correspond with the length of thread to be cut.

The smaller machine, illustrated in Fig. 2, may be operated by hand or belt power, and will cut from one quarter inch to one inch and a quarter inclusive. The next size, No. 5½, will cut from three eighths of an inch to two inches inclusive, and the No. 6 machine, which, in the larger engraving, is shown provided with a nut-tapping attachment, operates on from three eighths to three inches, also inclusive. Dies and master taps are furnished with the two machines first mentioned; with the third, the purchaser may order the nut-tapping attachment, and, in addition, as many dies and master taps as he requires. The apparatus is constructed entirely of strong and durable materials, and offers throughout, besides its special features of advantage, a simplicity of construction which will doubtless commend it favorably to mechanics.



SCHLENKER'S IMPROVED BOLT CUTTER.

Fig. 2.



For further particulars, prices, etc., address the manufacturers, R. L. Howard & Son, Buffalo, N. Y.

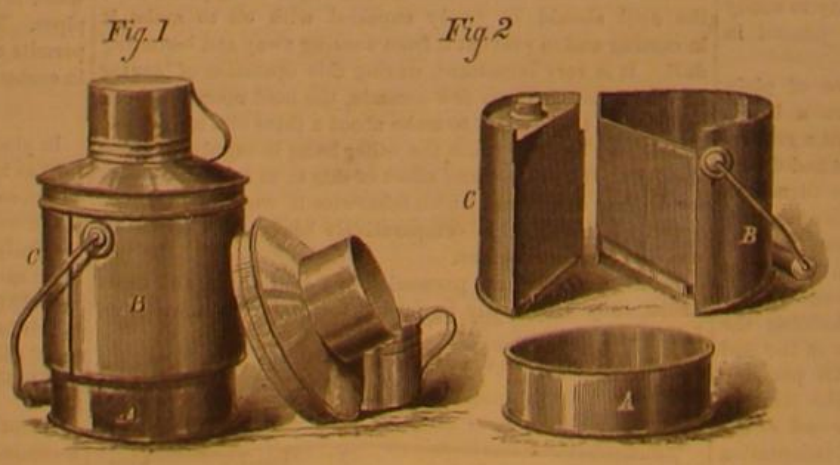
IMPROVED DINNER PAIL.

The construction of the dinner pails in daily use by the millions of working men throughout the country is, it is claimed, open to several objections, not the least of which is that the greater portion of the surface of the receptacle, into which the hot coffee is poured, is within the pail proper containing the meat and other edibles. The latter, by this arrangement, lose their flavor, and acquire an insipid, sodden taste. To remedy this and other disadvantages, the pail represented in the accompanying engraving has been invented by Mr. F. E. Heinig, of Louisville, Ky., who has obtained thereon two patents, one dated in 1873, and the other since the commencement of the present year.

Fig. 1 shows the pail complete as carried in the hand. In Fig. 2, A is a pan (to be used for meat, vegetables, or soup), the upper wired edge of which fits tightly within the lower wired edge of part B. The latter is in section a little over a half circle, and is intended for meat, bread, or pastry. C is the coffee bottle, which also fits over the wired edge of part A, and has a wired bottom describing a little less than a half circle. It has, besides, a simple tin hook on the lower edge of its flat surface, which, catching on the standing edge of the flat surface of part B, holds the bottle firmly in its place. The cover with the cup fits over parts, B and C, and holds them fast together. The size and weight of the pail can be reduced by dispensing with the pan, A, when desired.

Besides the evident lessening of the probability of spoiling the flavor of the edibles (owing to the greater portion of the surface of the coffee bottle being on the outside, and there being two sheets of tin and a thin layer of air between the hot fluid and the contents of part B), the inventor claims the following further advantages for his pail over those hitherto in use: Less chance of the introduction of dirt among the edibles, on account of all the edges fitting outside; greater economy of space; the convenience of separate apartments; simplicity of construction, and easy putting together; saving of material in construction, besides the permitting of much greater utilization of scraps.

For further information address the patentee, F. E. Heinig, 89 Floyd street, Louisville, Ky.



HEINIG'S IMPROVED DINNER PAIL.

Temperature of the Earth.

At the recent annual meeting of the Geological Society of Glasgow, the president, Sir William Thomson, gave a lecture on "The Conditions of Underground Temperature at Different Depths." The various classes of variations occuring, and the mathematical investigations which had been made by various eminent observers of the phenomena referred to, notably those of Fourier, who had done much on the subject of underground temperature, were considered. Such observations were difficult to make with correctness, on account of the changes of temperature caused by the opening of the ground for the placing of the thermometers. The best form of thermometer was that having a long-shaped bulb.

It was found that, generally speaking, the temperature of the earth increased by 1° Fah. for every 50 feet of depth. There were some considerable exceptions to this, the temperature increasing faster, which was apparently due to volcanic action.

By making use of the knowledge acquired by observations and supposing the earth at one time to have been in a molten state, this condition could not be placed further back than about 400,000,000 years.

The Lick Donations.

Some time ago Mr. James Lick, of San Francisco, deeded a large portion of his great estate, in trust for public purposes of an educational and philanthropic character, reserving a modest income for himself. For this good deed he was highly commended all the world round. Now he revokes the trust; and concluding that he has not done justice to his relatives, and that he can carry out his own purposes more satisfactorily, he confirms the steps hitherto taken by the trustees, and resumes possession of his property. The world will be obliged to revoke much of the praise heretofore bestowed on Mr. Lick, unless he shows that his change of mind in this instance does not involve the abandonment of his great scheme of good.

Among others of his bequests was the sum of $700,000 for an observatory on the summit of the Sierra Nevada, which all lovers of Science hoped would be accomplished. Alas! how uncertain are both man and riches!

TOMLINSON'S IMPROVED CHIMNEY COWL.

The construction of the new chimney cowl herewith illustrated is such as to prevent currents of air descending the chimney cap in stormy weather, this being effected by suitable provision for imparting an upward impetus to the incoming currents. The flue which constitutes the cowl is secured to the chimney by a flange, and carries above a suitable cap or hood. In the sides are a series of air openings, from the top edges of which, and exterior to the flue, project shields, A, which are adapted to shed water or wind, should the latter tend downwardly. From the lower edges of the air openings extend inwardly projecting deflectors, B, the length of which, as well as of the openings, is less than the diameter of the flue. By this means a space is created beside the ends of the deflectors, as well as between their inner edges, through which the products of combustion can pass and readily escape at the top of the flue. The air openings can be formed on all sides of the flue, or on but two, as in the present instance.

If a current of air strikes the cowl on either side, it will enter through the openings and be turned upward by the deflectors. A suction is thus created within the flue, and the eduction of smoke accelerated. If the current enters the flue from above, and tends downward, the deflectors will turn it sidewise and outward.



State and county rights for sale. Patented February 9, 1875, to Mr. Joseph Tomlinson, Mount Vernon, N. Y., who may be addressed for further information.

Magnetization.

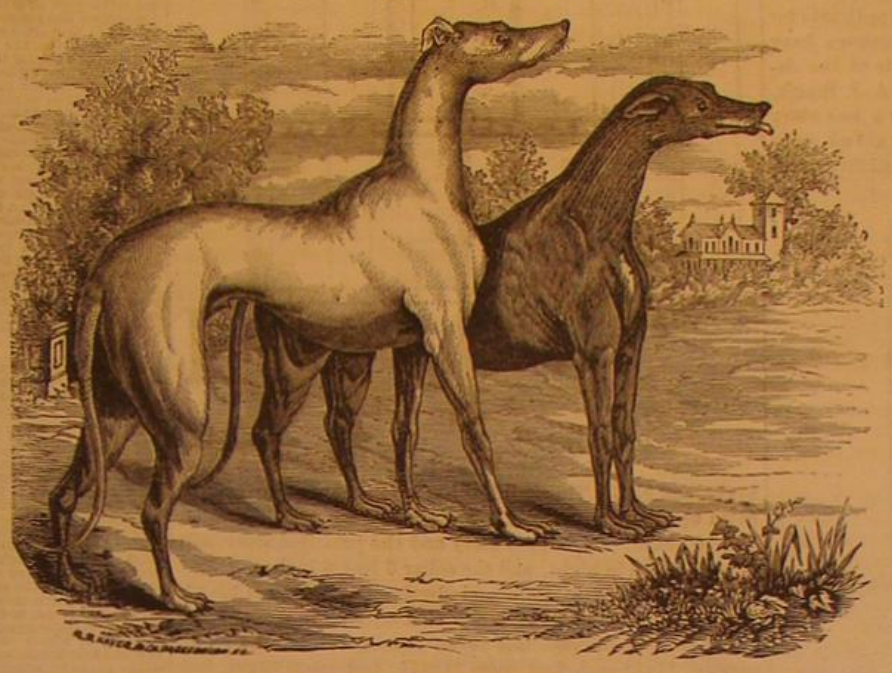
M. J. Jamin's researches point to an important modification in the construction of magnets. Suppose that a great number of plates, which, after being separately magnetized to saturation, are placed together. The magnetism of the combination will be seen to increase up to a limit which cannot be passed, and which is reached when the polar surfaces are filled. Suppose that ten plates are required. If now we re-commence the same experiment, applying the same plates against two iron armatures of a large surface, the intensities will increase much more slowly, because the sum of the magnetism is diffused over a more considerable extent, and the limit will not be reached till this extent is full. For this it may be needful to superpose twenty, thirty, or forty plates, and, generally speaking, a number so much the greater as the armatures are larger. The total power of the magnet will, therefore, increase with its armatures.

THE GRAYHOUND.

The grayhound is one of the tallest of the canine race, growing commonly to the hight of about thirty inches, but sometimes exceeds this by ten or twelve inches. The legs being long and muscular, the abdomen contracted, and the loins strong, the dog has advantages over any other kind for speed and endurance. His jaws are elongated so that he may seize his prey when at full speed; his neck is long so that he may lift his head high for sighting game, and he is as remarkable for his keenness of vision as the bloodhound for his scent.

Representations of the grayhound are to be found on the oldest Egyptian monuments, and the breed is supposed to have originated in Western Asia. The color and fur of the animal have been much varied by climatic influences. The English grayhounds, kept for centuries for the sport of coursing, are the fastest of the species, and their hair is moderately smooth, the colors being black, slaty gray, or fawn. The power of following game by scent is entirely absent in the English dog; while the Scotch grayhound (probably somewhat crossed with a deerhound) is remarkable for its keenness of nose. The Irish grayhound is very strong, muscular, and courageous, and will generally come off best in a combat with a wolf.

In coursing, it is usual to match two grayhounds against each other, and they are fastened by their collars to a leathern thong, with a snap hook operated by a string. Boys go into the field, and beat the grass or other crop with long sticks; a hare gets up and runs. The starter, when the hare has attained some distance, pulls the string of the leash, and away go the dogs, side by side and close together, with the speed of the wind. The hare would soon be run down were it not for its remarkable facility for suddenly doubling on its pursuers; and it will execute this maneuver so rapidly as to run right past the dogs and away in the contrary direction before they can turn to catch it. But the superiority in endurance of the grayhounds in time wears out the hare, and the fleeter of the two dogs will surely catch it at last, killing it instantly by one squeeze on the ribs with its long and powerful jaws.



ENGLISH GRAYHOUNDS.

THE KAGU.

New Caledonia, in common with other countries lying in the South Pacific Ocean, contains a variety of ornithological species, peculiar to that region of the globe, and, besides, remarkable for the beauty of their colors and the singularity of their forms. A number of curious birds have, of late years, been transported from the colony above named, and confined in the various zöological gardens of Europe, where their habits have been carefully studied by naturalists. Among the specimens which quite recently have been added to the *Jardin des Plantes*, in Paris, is the kagu, or *rhinochetus jubatus*, a representation of which we have reproduced from the pages of *La Nature*. The bird presents the characteristics of the herons in general appearance, but careful study of its osteology has resulted in its proving to be a species of crane.

The plumage, during life, is of a soft grayish blue, but after death changes rapidly to a dirty yellow. The beak is long and curved, and, with the claws, is of a bright red. The plumes of the neck and breast are rather short; but as if to make up for this deficiency, those on the posterior portion of the head are long enough to form a hump, which the bird can raise or lower at will. The tail is poorly developed and the wings are ill formed and short. The pin feathers are streaked with white and covered with bands of black and brown. The size of the body is about that of a chicken, and its conformation shows very plainly that the bird cannot support itself in the air but for a very brief period.

The kagu is easily tamed, and even in its native state will follow the plow to pick up grubs and earth worms, as readily as the crow. In its habits it resembles the rails, especially in approaching prey, when its serpentine and brusque movements of the neck and body closely resemble those of that class of birds. The hen lays two eggs, but conceals them with great care.

Measures are to be taken to acclimatize the kagu in France, as a protection to farmers against insects; while its present rapid rate of disappearance in New Caledonia will probably result in the careful guarding of the species in that colony.



THE AUSTRALIAN KAGU.

BATTERY carbons can be readily cut with a handsaw moistened with water.

The Great Pen Maker.

At the recent ceremony of laying the foundation stone of the science college which he is about to give to Birmingham, Eng., Sir Josiah Mason said: "The trade of steel pen making, I have now followed for more than forty-seven years until I have developed the works into the largest pen factory in the world. This business and that of the split ring making were my sole occupations until 1840, when accident brought me into close relations with my late valued friend and partner, Mr. G. R. Elkington, who was then applying the great discovery of electro deposition; and through my association with him in this undertaking I may claim a share in the creation of a form of scientific industry which has so largely enriched the town of Birmingham, and increased its fame throughout the world. I mention these facts to show you how the means with which God has blessed me have been acquired, and to show, also, how natural it is that I should wish to devote some portion of those means to assist in promoting scientific teaching to advance the varied forms of scientific industry with which, throughout my Birmingham life, I have been so closely connected."

Paint for Shingle Roofs.

A correspondent of the *New England Farmer* says: "In regard to shingles, I have seen the highest cost shaved pine fail in ten years; and I expect the cheapest, sappy, sawed pine will last that length of time. Roofs are so expensive to keep in repair that it behoves every man who has had experience with them to contribute what he can for the general good on this all important subject.

In the future I intend to lay low priced shingles—say from $2.75 to $4 per thousand—and paint them with a coat of tar and asphaltum—say one barrel coal tar, costing $3; ten pounds asphaltum at 3 cents, 30 cents; ten pounds ground slate at 1 cent, 10 cents; two gallons dead oil at 25 cents, 50 cents, which should be added after the other has been wetted and thoroughly mixed.

I consider the above mixture as good as anything that can be put on to shingles, as it will thoroughly keep the water out; and if dry they will not rot under the lap, nor will the nails rust, and I know of no reason why they will not last as long as I shall want shingles. The mixture should be put on hot, on a dry day, and upon a dry roof. Ground slate or asbestos is fireproof; so, also, is the tar, after it has dried thoroughly. The last shingles I had cost $2.75 per thousand; laying, $1.75 per thousand; nails, 25 cents per thousand; paint, 12 cents per thousand, and I now consider it as good as any roof I ever had or saw."

Street Pavements.

In a paper read before the Edinburgh and Leith Society, Mr. J. H. Cunningham describes very ably the relative merits of the various kinds of street paving used in the cities of Great Britain, namely, the Macadam, Telford, granite block, asphalt, and wood. He says:

On the whole, we may conclude that macadam and macadam concrete roadways, although they may answer well in secondary streets, should not be laid in main thoroughfares. We may also conclude that neither this system of road-making, nor any development of it, is likely to produce the street of the future.

Wood and asphalt pavements are in several respects superior to granite. Much less mud and dust is formed on them, and they are comparatively free from noise. They are also safer, except when thoroughly wet. I am not aware that granite is in any respect superior to either of them. Even if they should turn out to be more costly, owing to their requiring repair more frequently and having to be renewed sooner, I think the advantages already mentioned will more than compensate for the extra price. Only long and extensive experience can settle this point satisfactorily, because many indirect benefits are secured by their use, which it is not easy to estimate in money; and there are many expenses connected with all pavements which are not usually included under the head of maintenance. On the whole, it seems probable that either wood or asphalt is destined gradually to supersede granite as a paving material, at least in large and wealthy towns.

It therefore only remains for us to find out which of them makes the best, or, to quote the *Pall Mall Gazette*, the "least objectionable" road surface. Mr. Haywood has fully reported to the Commissioners of Sewers of the city of London as to the relative advantages, together with the probable expense and durability of these pavements. In 1873 he made a very extensive series of observations, in order to ascertain their relative safety. Allowing for all modifying influences, he found that wood is safer than asphalt, as not only fewer accidents occur on it, but those which do happen are of the kind least injurious to horses and obstructive to traffic.

Further, Mr. Haywood considers that wood is the most quiet, but also the dearest; that they both can be kept equally clean, and will probably be found equally durable. That they can be laid and repaired with about equal facility, but that the best repairs can be made in asphalt.

The general impression left in reading the report is that, except as regards safety, there is not much difference between them. Wood is, however, about twice as safe as asphalt.

Let us see which of these two pavements is likely to endure best, judging from theoretical considerations alone. Wood pavement is constructed according to Macadam's principles, asphalt according to Telford's. Wood is laid on a comparatively soft foundation, and the whole roadway forms a kind of elastic arch, which partly resists vertical pressure, by distributing the thrust horizontally through its entire substance. In asphalt roadways, on the other hand, the concrete foundation may be considered the real road, the asphalt being merely a sort of protection, which gives a smooth surface, and can be easily renewed as it is worn away. But this combination is, I fear, devoid of elasticity. Elasticity is without doubt essential to the permanence of a roadway. This quality certainly appears to be secured in improved wood pavements, though not in asphalt. But it may be contended that the asphalt covering has in itself sufficient elasticity, and that it acts like a sheet of vulcanized india rubber. Possibly a concrete bed covered with a sheet of vulcanized india rubber might form a good road. I think a less yielding surface is desirable, and that elasticity of form is likely to give better results than mere elasticity of volume. For these reasons I venture to think that improved wood pavement will ultimately be found superior to Val de Travers asphalt, and that the introduction of the former has been a decided step in the right direction. I also think that we may look for further improvements in modifications of this system, and that a roadway having the requisite surface qualities, combined with elasticity of form, will always be

superior to one whose chief recommendation is mere solidity.

The first cost of the improved wood pavement and the asphalte pavement in London is the same, namely, $4 to $4.50 per square yard. Cost of repairs per annum also about the same, namely, 50 cents per square yard.

A PRIZE PLAN FOR A FIREPROOF HOUSE.

On page 280 of our volume XXXI., we announced the offer, by the Merchants', Farmers', and Mechanics' Savings Bank, of Chicago, Ill., of a premium of $1,000 for the best set of plans and specifications for a fireproof dwelling house, of not less than five rooms, and a total capacity of at least 5,500 feet. Up to the end of last year, thirty applicants for the prize had put in an appearance, and a committee have since been occupied in investigating the merits of the designs. They recently awarded the prize to Mr. A. J. Smith, of Clark street, Chicago, whose plans were for a one story house, 20x48; a two story house, 18x26½; and a two story store and dwelling, 22x57. The cost of these buildings, respectively, is to be $1,200, $1,700, and $3,600.



Fig. 1.—FRONT ELEVATION.

The one story dwelling house is a building 43x20, of five rooms, consisting of parlor 13x10½, and two bed rooms 10x6½ each. The hight of each room will be 10 feet in the clear between floor and ceiling. An important feature in this plan is that, should a fire occur in the front part of the building, the rear portion may be preserved intact, and *vice versâ*. The outside walls are hollow from foundation to roof. The floor, beams, and rafters are wood, protected from fire by concrete, one and one half inches thick on the ceilings and underneath the floors; and the roof is covered with tin on the

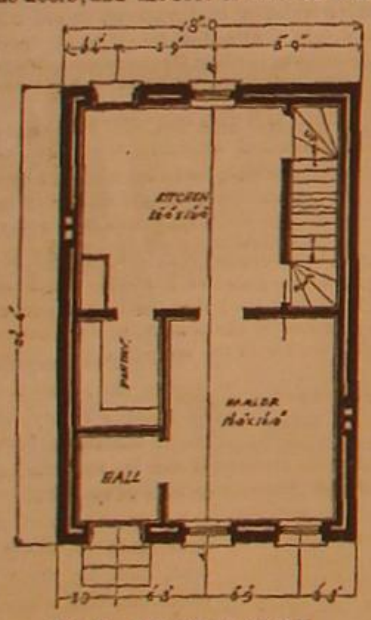


Fig. 2.—PRINCIPAL STORY.

top of the concrete. Thorough ventilation is provided by flues adjoining the fire flues, and topped out in the chimney. There is a ventilated air space underneath the ground floor, preventing dampness from arising; and there is also a ventilated air space between the ceilings and roof, to prevent the

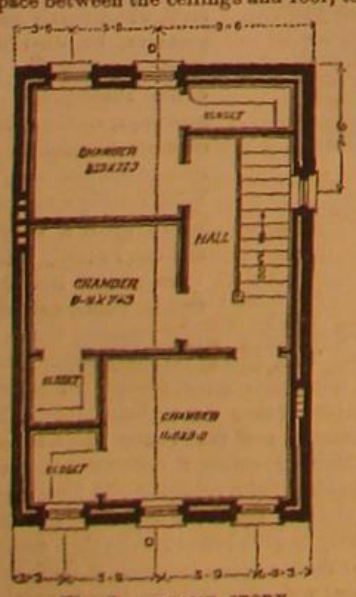


Fig. 3.—SECOND STORY.

heat of summer from affecting the rooms. The fire flues will be lined with flue pipes eight inches square. There will be a drain pipe, connected with sinks and closets and with main sewer, to carry off all surface water, slops, etc.

The two story dwelling, of which we present a front elevation, Fig. 1, and the ground plans, Figs. 2 and 3, is a building 26½x18, with five rooms, two on the ground or principal floor, and three on the upper floor, the sizes of which are: Parlor 12x10, and kitchen 12x12. The three upper rooms are for bed rooms, the sizes of which are, respectively, 11x9,

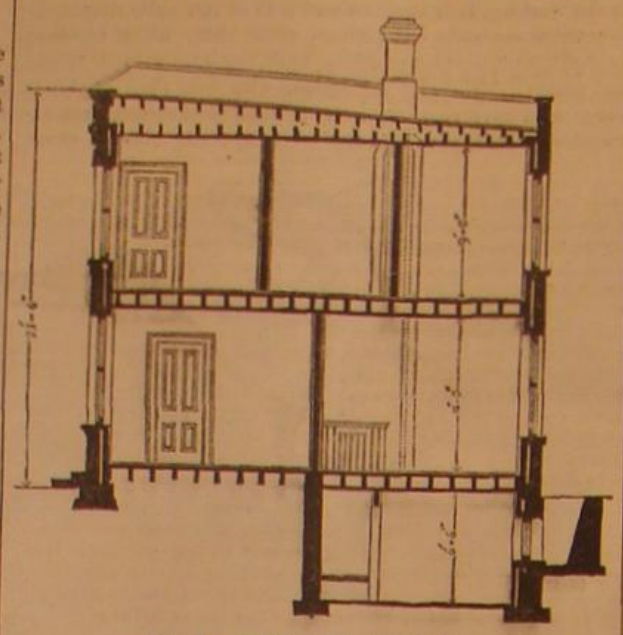


Fig. 4.—SECTION AT A, B, C, D.

8½x7½, and 8½x7½. This building has a cellar for coal and wood, fitted up with water closet. The size of cellar, within walls, will be 12x20. The upper story and the principal story will be each 9 feet in hight, and the cellar 6 feet 6 inches.

The building with store and dwelling combined is 22x57. The entire principal story is occupied with store room. The upper story is divided into seven rooms, consisting of two parlors, 11x12 each, bed room 11x11½, bed room 13x9½, bed room 10½x9½, kitchen 13x11, dining room 13x11.

The three buildings are similar in construction. The cheapness of the structures is unquestionable, and we trust it will be long ere their fire-resisting qualities are put to the test.

A Water Rat taking an Artificial Fly.

A correspondent writes to *Land and Water* as follows: "In Mr. Buckland's chapter on 'The Rat,' he mentions the catching of a rat by one of the flies of a friend while fishing, hooked by chance; but I remember fishing with my father for trout in the May fly season, in one of the Derbyshire streams, when a water rat dashed out from his hole in the bank and took the fly in his mouth (the fly was the natural drake or May fly). After playing with him some time, he swam to the side, became entangled in some dead branches, and, breaking the hook away, escaped. Although I have been an ardent fisherman, this is the only instance I have known of the rat actually seizing the fly."

A SHAFT has been sunk at Lawton, England, for the purpose of pumping up brine, to be conveyed by pipes to the coke ovens in connection with a colliery, a distance of two or three miles, there to be converted into salt by means of the waste heat from the ovens. The cost of the undertaking will, it is said, exceed $200,000.

DECISIONS OF THE COURTS.

United States Circuit Court.—Southern District of Ohio.

PATENT LUBRICATOR.—WILLIAM W. PELTON AND HIRAM TAYLOR *vs.* GARDNER WATERS, JOSEPH J. STARR, AND CHARLES D. JOHNSON.

[*In equity.—Before* EMMONS *and* SWING, *JJ.—December*, 1874.]

STATEMENT OF FACTS.

[Gardner Waters filed an application for letters patent for an "Improvement in Lubricators," March 31, 1868. On the 21st of April, 1868, Hiram Taylor made an application for a patent for substantially the same improvement. Both applications were rejected by the examiner. Waters narrowed his claim, and thereupon received a patent of limited scope; but Taylor persisted in his claim, and upon appeal secured his patent, which was issued to him June 23, 1868.

When Waters learned that a patent had been issued to Taylor with a "broad claim," he filed a second application, asserting therein a claim for the invention substantially as covered by the Taylor patent, and demanded an interference. This was granted him; and upon the final appeal to one of the Judges of the Supreme Court of the District of Columbia, he was adjudged the prior inventor; and accordingly letters patent were issued to him June 29, 1869.

The present suit under the Taylor patent had been begun in November, 1868, complainant's testimony being duly taken after the issue was joined.

In December, 1869, defendants filed an amended and supplemental answer, claiming that Waters was the first inventor, and setting up the interference decision.

Issue was joined upon this answer, and testimony for defendanas, and rebutting proofs for complainants, taken and filed in 1870.

This hearing was had at the October term of 1874.

At the hearing the defendants objected to a certified copy of an application for a patent made by the complainant Taylor in September, 1867, which, it was claimed, described the device in controversy, on the ground that the copy of the application referred to drawings as being a part of the original application, no drawings, however, being attached to the copy. The objection was sustained by the court.]

EMMONS, Circuit Judge, delivered the opinion of the court.

The patent of the complainant, Taylor, antedates that of the defendant, Waters, and he is entitled to the presumption that his invention is novel.

This presumption is of importance only where the testimony is conflicting, and any considerable doubt is involved as to who is the first inventor. It is of but little consequence in this case. It has, however, been much argued.

The defendant insists that his application was made earlier than that of the complainant, and therefore his patent is to have relation to the date of its filing. As a general rule, this is undoubtedly true.

We do not intend to question, or even qualify, any of the cases on the subject, which we recently considered and applied in the case of the Dental Vulcanite Company *vs.* Willis. These judgments assert several exceptions to the application of the rule.

If, intermediate the first and second application, the patentee manifests an actual intention to abandon the first, his patent will have relation to the last one only. His actual intention severs the proceeding. The law deems the application terminated and as bearing no relation to the patent, which rests solely on the last one.

A withdrawal of a first application, and the reception of the fee paid back from the department, under the statute, is also a severance of the proceedings. The application so withdrawn is not deemed part of any proceeding, under a subsequent proceeding for a patent.

These are but illustrations of exceptions to the general principle, which deems the first in a series of applications for a patent as that upon which a patent depends.

We think the case before us comes within the reason of these exceptions.

Under the first application of the defendant he actually received a patent, after having amended his specifications so as to exclude the present device. We think the action wholly terminated the first proceeding. It was ended in the accomplishment of its object. The decision of the department was acquiesced in, and its final judgment obtained.

The subsequent application in such circumstances must be deemed the commencement of a new proceeding, and as that alone upon which the patent granted in pursuance of it depends.

This last application was subsequent to that of complainant's patent; and, as they are both for precisely the same device, the presumption is in favor of priority of invention on the part of complainant.

The complainant swears that in the fall of 1866 he cast an impervious joint upon the neck of a bottle. He proves his statement by a blacksmith, who came to present an account, and saw such a bottle in his shop; and the complainant's brother testifies that he also saw it at a subsequent period.

If his rights depended upon our adopting the theory that he completed his invention at that time, by such means, we should dismiss the bill. Positive as the testimony is, the fact of success at a period so early is too inconsistent with his subsequent conduct, manifestly evincing an entire ignorance of the thing we think he subsequently invented. Such singular stories are incident in nearly all these controversies in reference to priority of invention.

Parties frequently prove the making of some fixture which is destroyed; of some model which is lost; and some conversation which has never been acted upon sufficiently early to antedate his opponent. We could give many reasons why we fear the history of this castor bottle finds its origin in the fact that the defendant in his testimony places his discovery about a year earlier than we think it was invented by any one.

Far more satisfactory and convincing is the proof that the complainant, in the latter part of 1867 and subsequently, was making and vending, in large quantities, the patented device. The defendant's agent, Pelton, who was selling at that time a different article for the defendant, in the fore part of 1868, bought of the complainant a number of lubricators of the kind in question, to supply the place of an inferior article, manufactured by the defendant, which he had sold for him, and which, on account of their leaking, had to be supplied by a better.

It is needless to recapitulate the proofs; they are abundant and uncontradicted, to show that, from the latter part of 1867 forward, the complainant was in the full manufacture and sale of the patented device. There is no satisfactory evidence of its invention before that date. It is with this concession that we grant him a decree.

To overcome this case and prove the defendant to be a prior inventor, he himself swears that, in the latter part of 1866, he too made an impervious joint upon the neck of a glass globe, tested it with steam, and placed it upon the crosshead of an engine, where it worked successfully, as he proves by Henderson, the colored engineer, for three successive years. The witnesses, Reynolds and Phillips, with more or less confirmation, sustain Henderson.

We are absolved from the duty of contrasting this proof with other unquestioned facts in the case, for the purpose of ascertaining whether it was not 1867 instead of 1866 that this successful lubricator was made, because the defendant's own statement as a witness renders it wholly unnecessary. He says, most explicitly, that though he did succeed accidentally in making one close joint upon the neck of that single globe, he tried in vain, for five months thereafter, to make another. He says he broke many bottles in the attempt; that he did not even partially succeed but in a single instance during the five months; and that one leaked so badly it was unfit for use. It was not until 1868 that he learned how to produce a close joint, and at a time considerably after complainant was publicly manufacturing them. The accidental making of this one joint without any knowledge on the part of the producer of how to accomplish it, with utter inability on his part to produce another like it, is not invention. His ignorance was so complete concerning the mode of its production that he himself swears he not only did not attempt their manufacture, but laid aside a large stock of material during this period for the making of a wholly different article. These he did manufacture, and put upon the market through Starr & Pelton, his agents. He not only had not invented a close joint, but he had so little hope of success that he prepared extensively for the making of a different and inferior lubricator. In these circumstances a single fortuitous success is by no means invention, within the protection of the patent law. He not only did not and could not give it to the public, but he did not possess it himself. It might as well be claimed that he, that should be carrying three bottles in a basket, which being accidentally broken, their contents mixing in unknown quantities upon the earth makes some useful compound, and enters upon a series of experiments for the purpose of ascertaining, if possible, its relative proportions, but who does not succeed in doing so until after another has successfully completed the discovery, can antedate him by proof of the casualty by which he saw the same thing produced. When the defendant saw the first bottle on the crosshead of the engine, without any knowledge of the mode by which he could make another, he stood in no other relation to it, as far as the patent law is concerned, than if it had been placed there by somebody else.

It is not necessary to consider the many other facts in the case which tend to show that the defendant in fact obtained his knowledge of the device from the complainant. We refer to a few of them only, as illustrating the rightfulness of the principle we apply to the defendant's testimony. When Pelton, his agent for the sale of a different manufacture, as late as 1868, presented the defendant with one of the complainant's lubricators, he pronounced it impracticable. He said they could not be profitably made, and that Pelton did not know how many bottles must necessarily be broken by the complainant in making his lubricator.

Other analogous proofs exist. We refer to these single instances only to show the inconsistency of treating that man as an inventor who is so discouraged by his own failures, and the repeated breaking of his bottles, that he pronounces the attempt impracticable, and is himself at that time manufacturing a different and poorer article nearly a year and a half after the mysterious production of the close joint which the court is asked to believe was placed upon the crossheads in 1866.

We think the presumption of the law arising from the anterior patent of the complainant is consonant with the inference of the fact to be drawn from the testimony.

The complainant was the first inventor of the lubricator described in his patent. The accidental making of one in 1866 by the defendant, if everything occurred precisely as he swears it did, is not invention in any sense. There can hardly be said to be a conflict of testimony in reference to the fact that the complainant, for many months before the defendant did so, manufactured and put these articles on the market.

There may be a decree for the complainant in the usual form.

[*Reuben Syler*, for complainants.
E. W. Kittridge, for defendants.]

NEW BOOKS AND PUBLICATIONS.

TRANSITS OF VENUS, a Popular Account of the Past and Coming Transits, from the First, observed by Horrocks in A. D. 1639, to the Transit of A. D. 2012. By Richard Proctor, B.A., Author of "Other Worlds than Ours," etc. With Twenty Plates and Thirty-Seven Woodcuts. Price $3. New York city: R. Worthington & Co., 750 Broadway.

The subject of this volume and the renown of its author combine to render it most acceptable at the present time. The signal success of the recent observations has given a universal impetus to the public interest in the question, and there is no doubt that the transit of 1882, which will be visible in all parts of New England and the Middle and Southern States, will be watched by millions of our people, anxious to behold the strange spectacle on which the solution of so many mighty problems depends. Mr. Proctor's work is complete as a history of the phenomenon, and as a lucid and authoritative explanation of its phases, and its great import to scientific investigation; and the maps and illustrations, executed in a beautiful and very accurate manner, give additional value to a book which we unhesitatingly pronounce to be the best treatise which has yet appeared on the subject.

THE ORBITAL SYSTEM OF THE UNIVERSE. By Antony Welsch, Clinton, Iowa. Clinton: Allen & Bowers.

We have been led, by a brief perusal of this volume, to wonder upon the facility with which books get into print. Here is a work full of chaotic ideas, written in gross violation of the English language, on a subject of which the author gives us no reason to believe that he has the slightest comprehension himself, and on which he does not begin to attempt to enlighten his readers; yet 160 pages of it are printed in good style and well bound, and some hundreds of dollars must have been disbursed, which the author or his publisher will never see again, unless there comes a cataclysm of the intelligence of the human race,

THE INEXPEDIENCY OF AN IRREDEEMABLE PAPER CURRENCY. By John Stuart Mill. New York city: Henry L. Hinton, 744 Broadway.

A timely reprint of a convincing argument against unlimited and perpetual indebtedness.

OUR CURRENCY, WHAT IT IS, AND WHAT IT SHOULD BE. By John G. Drew. New York city: Henry L. Hinton, 744 Broadway.

A REVIEW OF SENATOR JONES' SPEECH ON THE BANKING AND CURRENCY BILL. By Henry S. Fitch. San Francisco, Cal.: Bosqui & Co., Clay and Leidesdorff streets.

These two pamphlets are earnest protests in favor of the policy of paying an old debt with a new one, and are not above the average of their class of literature.

TRANSACTIONS OF THE AMERICAN INSTITUTE OF MINING ENGINEERS. Volume II. Easton, Pa.: Published by the Institute, T. M. Drown, Secretary, Lafayette College.

The American Institution of Mining Engineers has a high reputation among our scientific bodies, and certainly none is doing or can do more valuable work. The future prosperity of this country depends in chief on the development of her enormous and varied mineral wealth; and the profession which is to pioneer this progressive movement fortunately contains many of our most illustrious scientists. We commend this volume to the perusal of all who are interested in the present industries and the future possibilities of the United States.

ON THE ALLEN GOVERNOR AND THROTTLE VALVE, a Paper read before the Institution of Mechanical Engineers, London, by F. W. Kitson, of Leeds, England.

Recent American and Foreign Patents.

Improved Method of Softening Umbrella Ribs.

John McAuliffe, New York city.—This improvement relates to the softening of the ends of umbrella ribs, to facilitate the boring or punching of the holes for the wire by which they are fastened to the collars. It consists in standing the ribs in a bath of hot lead, and letting them stand while the bath is cooled down gradually to atmospheric temperature.

Improved Apple Slicer and Corer.

Henry H. Siler and Thos. A. Brooks, St. Lawrence, N. C.—The invention consists in arranging a series of cutters so as to be adjustable to and from the center, to cut out a core of greater or less diameter; in a cutter bed made up of sections that slide upon each other and upon base blocks; also in a ring plate provided with slots and perforations arranged in a circle.

Improved Device for Soldering and Capping Cans.

Richard Henry Smith, Baltimore, Md.—This invention relates to certain improvements in machines for capping cans; and it consists in a soldering iron holder having a rear recess, and adjustable both vertically and horizontally by a sliding support and binding screws. The invention also consists in the combination with a revolving table of separate detachable and independently rotating plates, having clamping devices for holding different sized cans.

Improved Gang Plow.

Stephen S. Scheumack, Victoria, Tex.—The invention consists in combining a crossbar—placed above and having arms that straddle the axle—with another crossbar having a vertical adjustment, whereby the gangplow can be equally well employed for preparing, cultivating, and seeding land.

Improved Soldering Machine.

Wm. D. Brooks, Baltimore, Md.—This invention comprises a series of valuable improvements by which the caps and heads of fruit, oyster, and other cans may be soldered in a rapid, thorough, and economical manner, the cost of manufacture being thereby reduced from twenty to forty per cent, while the joints are close and reliable.

Method of Securing Pins to Artificial Teeth.

Orin S. Bixby, Syracuse, N. Y.—It is well known that in the manufacture of artificial teeth platinum is employed as the material of the pins that fasten the teeth to the plate, because it is the only commercial metal that will not fuse or oxidize in the heat and ventilation to which the teeth must be subjected in baking them. By this invention the pin cavities are made in the inner or back side of the teeth before the latter are baked, and the pins are not set in the cavities until after the teeth are baked, so that material other than platinum may be employed.

Improved Sugar Cane Cutting Machine.

Julius Robert, Gross Seelowitz, Austria, assignor to Dr. Otto Kratz and R. Sieg, New Orleans, La.—This invention relates to a patent granted to same inventor October 30, 1866. It consists essentially of detachable cutter-holding plates for connecting the cutters to the cutter-carrying wheel, contrived for the ready removal of the cutters for grinding, and the application of other plates with sharpened cutters, to be used while the dull cutters are ground and attached to their attaching plates, two sets of plates and cutters being used. These plates are also useful for adjusting the cutters for cutting thick or thin.

Improved Lever Press.

William O. Watson, Albany, Ga.—This improvement in lever presses consists of toggle levers to work the main lever, connected to the capstan by a rope passing over intermediate pulley blocks in a manner calculated to increase the leverage without the corresponding diminution of the speed consequent to the ordinary method.

Improved Butter Worker.

Frank B. Aldrich, Chicago, Ill.—In this butter worker the rollers are so formed as to take hold of the lumps of butter and draw them through the machine, and to prevent the butter from working out to the ends of the rollers, and there sticking. The rollers are grooved longitudinally in such a way that the projections between said grooves are concaved upon the forward side, and rounded upon the rear side, and concaved or beveled upon their end parts.

Improved Dental Reflector.

Francis M. Osborn, Port Chester, N. Y.—This reflector may be applied to a dental clamp to show the cavity of the tooth distinctly, so that the dentist can see just what is to be done, and also watch the progress of the work. The invention consists in a disk provided with a reflecting surface upon its front side, and a ball stem upon its rear side, and the arm provided with a spherical socket upon one end, and spring clamps upon its other end.

Improved Vegetable Slicer.

Aimé Vuillier, Newark, N. J.—This consists of an implement having a spiral cutting blade, with side-extending cutting rings at the upper end, for entering the vegetable and slicing out of the same a twist of two separated spiral pieces. The implement is very simple, and executes its work with remarkable celerity.

Improved Hoof Trimmer.

Andrew Shirran and William J. Givens, Pacheco, Cal.—In operating the knife a disk is given a revolving motion, thereby winding more or less of a band on its surface in cutting, and in releasing the band in every backward movement of the knife. In operating with the machine the shoulder of a slotted head is placed against the outside of the hoof. The bearing surface of this shoulder is faced with a concave piece of brass, which receives the rim of the hoof. This arrangement throws the knife toward the center of the hoof, and by working the lever back and forth the knife will be made to work from the center to the outer edge of the hoof. The knife is convex and attached to the lower end of the handle.

Improved Land Pulverizer.

Angeline Underwood, Carrollton, Ill.—Two strong wooden frames are placed side by side, and to the middle parts of the side bars are bolted bearings for shafts. Upon the shafts are placed a number of circular disks. The two frames incline freely in either direction to adjust themselves to any unevenness in the surface of the ground, and small friction rollers keep the frames from twisting when the machine is in use. The frames turn freely, and at the same time the ends of the tongue crossbar are prevented from dropping down. To the rear bar of the frame are attached scrapers of a width to scrape off any soil that may adhere to the cutters, and which might otherwise prevent the cutters from entering the ground to the required depth. The cutters are designed to enter the ground to the same depth as the plows, so as to cut in pieces all sods, clods, and lumps that may have been turned under by said plows.

Improved Washing Machine.

Gideon Huntington, Toronto, Canada.—In this washing machine a clothes-holding open work drum is arranged to rotate in a tub set over a furnace. The drum is reciprocated by a rocking standard, a horizontal bar pivoted thereto, and straps which are wound in reversed directions around a pulley of the drum shaft, and attached to said bar. By applying the foot to the rocker, the standard is vibrated and the desired motion imparted to the drum.

Improved Animal Hopple.

John D. Wilson, Round Grove, Kan.—The animal is placed within an enclosure formed by a fence made of a single wire, supported at a short distance above the ground. To its leg is attached a hopple on which are devices which catch on the wire fence when the animal attempts to pass over or crawl under the same.

Improved Flour and Middlings Purifier.

George Washington Brown, Metropolis, Ill.—A pressure chamber is arranged at the head of the reel to receive the air from a blast fan. A perforated tube surrounds the shaft, and is considerably larger, to form an air conductor extending along the reel about three quarters of its length, with one end opening into the pressure chamber to receive the air, conduct it along in the reel, and discharge it outward to the cloth, to aid in separating the bran and light matters from the middlings while falling about in the reel. The partition between the pressure chamber and the reel is perforated to allow the air to blow in the reel and along it. Below the reel is a long triangular air conductor over the conveyer, receiving air from the pressure chamber, and delivering into the space below the bolt. Along the top of the case is a wide conductor, and along each side is a narrow one; and under the wide conductors is another one, in triangular form, receiving and discharging air in the same manner, but discharging it more directly upon the cloth, mainly to keep it clear, while from the other conductors it is more particularly designed to fill the space with air to counterbalance that blown into the reel, and prevent the latter from unduly forcing the impurities through the reel. At the top of the fall boards there is a conductor for taking up the impurities from the flour and middlings as the air rises up through them while descending from the reel to the conveyer below.

Improved Saw Set.

Josiah B. Titus, New York city, assignor to himself and John McLean, of same place.—This consists in a sliding jaw piece in a slotted frame or plate having a bridge which supports an adjusting screw. The screw turns freely in the bridge and moves the slide, so that the jaw can be adjusted to suit the thickness of the saw.

Improved Candlestick.

Wells Kilburn, Napa City, Cal.—The invention consists of an improved candlestick, formed of spring jaws and a loose tube, provided with a cross wire in its lower part. In using the candlestick, the candle is placed in the tube, the wire is placed between the jaws, and the tube and candle are pressed down to the saucer. The inclined or rounded side edges of the jaws guide the wire, and enable the said wire to push back and pass said enlarged upper ends, both in passing down and in passing up. When the candle is burned down to the top of the tube, the tube is raised, which brings the wire against the lower end of the candle and raises it. When the candle has been raised sufficiently, the tube is again lowered, leaving the candle supported by the jaws.

Improved Clothes Line Support.

John N. Fuller, Cleveland, O.—The top piece consists of two circular prongs which branch off, with suitable interval between them, from the socket part of the head piece of a pole. The hooks are left open at opposite sides for admitting first the introduction of the rope or line into one hook, and then into the other, so as to be secured rigidly by the same. The pole or supporter is then raised with the clothes line and firmly planted into the ground by the pointed socket.

Improved Toy Arrow Shooter.

John H. Wales, Milford, Mass.—This invention consists of a toy formed of a tube, provided with an open ring upon one side of the arrow and the rubber band. In using the toy the tube is held in one hand, the arrow is passed through the tube from its forward end, and the rubber band is passed over the rear end of the arrow. The rear end of the arrow is then grasped with the thumb and finger of the other hand and drawn back to put the rubber band under any desired tension. The arrow is then released, and the elasticity of the rubber band will throw it from the tube with considerable force.

Improved Stove Grate.

William Walsh, Albany, N. Y.—This consists in a grate made in two parts, one of which parts is vibrated laterally similar to ordinary grates, while the other part is susceptible of a perpendicular movement to raise the fuel from the other part.

Improved Device for Holding Pipe Fittings.

Thomas P. Hardy, New York city.—This improved chuck for holding pipe fittings and other objects while being tapped is so constructed as to allow the fittings to center themselves upon the taps. The device opens its jaws to receive and discharge the fittings, and will move said jaws out of line with the taps to allow the fittings to be conveniently inserted.

Improved Top for Salt and Pepper Boxes.

George D. Paul, Brooklyn, E. D., N. Y., assignor to Paul Brothers & Co., New York city.—A gridiron-shaped stirring and crushing frame is arranged close under the top, to slide on a rod. It is provided with a thumb piece projecting out through one side of the cup, and also with a spring, the thumb piece and spring acting to push the crushing frame along beneath the top of the cup forward and backward, to crush the lumps that may fall upon it and stir the finer particles when packed against the cap, all so that the perforations will always be kept free.

Improved Butter Worker.

Jacob L. Englehart, New York city.—In using the device, the butter is placed upon a cloth, which rests on a bench, and is crushed and worked by a flexibly pendent corrugated block, as it is moved up and down by the revolutions of a crank shaft. The excess of liquid flows down the grooves of the bench. When the butter has been sufficiently worked upon the cloth and bench, it is transferred to the finishing table.

Improved Chimney Top.

Henry Becker, Blauveltville, N. Y.—This is a conical chimney top, whose base plate is provided with outwardly curved lugs, that bind after passing through the corners of the flue opening on the sides of the chimney coping.

Improved Molding Machine.

Aaron Miller, Ringtown, Pa.—This improved foot power molding machine, for working regular or irregular moldings upon the edge of lumber, may be adjusted to run the cutter head in either direction, as may be desired. Devices are provided which serve to drive the cutter head at a uniform velocity.

Improved Cotton Scraper and Chopper.

William H. McClaugherty, Seguin, Tex.—This is an improved machine for scraping cotton and chopping it to a stand, which is so constructed that it may be readily adjusted to leave the hills at any desired distance apart, and to scrape the ridge to any desired depth.

Improved Gun Carriage.

Nels E. Johnsen, Chelsea Naval Hospital, near Boston, Mass.—This consists in the peculiar construction of a compressor or friction bar and compressing device for holding the carriage in position, and for lessening the recoil of the same when the gun is fired; also in a novel device for locking the carriage to the compressor bar, and in a windlass and rope mechanism for running the gun in and out.

Improved Breech-Loading Ordnance.

Nels E. Johnsen, Chelsea Naval Hospital, near Boston, Mass.—The breech block is raised and closed down by a screw, and is hinged to the breech. The screw works through the extreme of breech as through a nut, and when it is turned back the breech block is raised by virtue of a joint bar. The piece to which the joint bar is hinged, and through which the screw works, is fastened by a small sleeve, and is carried back and forth with the screw. The breech piece is carried back and forth by the screw on guides. A piece on the end of the screw is connected with the breech piece by a fork, which allows the screw to turn and move the breech piece back and forth on its ways, and a lip on the end of the breech block closes down into the groove in the screw piece. A spring plunger in the breech block is drawn back by a lever when the breech block is closing, and prevents the block from being blown upward when the piece is discharged. This gun may be loaded at the muzzle, if preferred; but ordinarily the breech block will be elevated to a perpendicular position, and the charge inserted, the screw being drawn back.

Improved Animal Trap.

Isaac V. Newsom, Eatonton, Ga.—The animal enters a dark bait chamber, and, on attacking the bait, pulls down a treadle and shuts the door of the trap behind him. At the same time, he opens an orifice into a light chamber, into which he escapes, and in so doing moves mechanism which sets the trap back to its original condition, ready for another visitor.

Improved Shoe Brush.

Israel Joseph and J. Albert Joseph, New York city.—This is a box made with rounded side edges, and open at the top and one end. The cover is made with rounded sides and open at one end, and the whole is combined with the back of a shoe-blacking brush. Two small brushes have their backs and handles formed to fit upon each other and the blacking box, and into the cavity of the box attached to the back of the blacking brush.

Improved Neck-Tie Shield.

Reginald R. Parker, Indianapolis, Ind.—This invention consists in providing the shield with a strap loop for receiving a neck-tie and and button loop.

Improved Screw Plate.

George R. Stetson, New Bedford, Mass.—The ways are each fixed on a pivot, at the side of the opening next to the adjusting screw, so that they can swing out of the opening freely at the other end to facilitate the changing of the dies. At the opposite side of said opening is a stud, which enters a socket in the back of the die to fasten the dies and the ways in working position.

Improved Watch Case Spring.

Constant W. Wadsworth, Peekskill, N. Y.—The spring is made in two parts, which may be readily adjusted upon each other to bring the screw holes of one part into line with the screw holes of the watch case, so that it may not be necessary to mar said case by forming a number of screw holes. With this construction, also, the spring will not be liable to break when in use.

Improved Peat Molding Machine.

Jean François Bocquet and Victor Alexis Bénard, of Paris, France.—This invention relates to an improved machine for molding peat that has been crushed and mixed or reduced to a homogeneous condition in a grinding or other mill. The peat thus prepared is received into a hopper or box, above a set of traveling molds, formed chiefly of a series of suitably articulated plates, said molds being revolved by and around polygonal drums, and the peat being thus formed into blocks, and deposited on the ground or other surface. The molding machine travels along a rack or toothed rail, whereby the peat blocks are laid regularly and close together in a row.

Improved Smoke and Cinder Conductor.

Daniel Brancher, of Lincoln, and Jacob L. Ring, of Mount Pulaski, Ill.—The conductor is made of separate pieces of pipe slipped together, having flanges and telescopic slides between the cars to allow the cars to move back and forth. Slots in the outside pieces and pins limit the longitudinal motion of the parts. This joint section and flange, made of rubber, gives additional flexibility to the conductor. Spring hooks, placed on the outer slotted pieces in reversed position, hook over the flanges and hold the parts together. This forms the coupling of the conductor, and enables the conductor to be pushed back over the projecting roof of the car when not in use.

Improved Combined Clothes and Quilting Frame.

Melvin Churchill, Helvetia, Wis.—This is a quilting frame combined with a clothes rack, the two being connected so as to be used for either purpose when required, so that they may be folded into a small space for storage, transportation, or when not in use.

Improved Ice Former.

Stephan Krauss, Clifton, N. Y.—A small stream of water is allowed to flow upon the apex of an upper tier of spouts. As the concavities of the spouts of the upper tier fill with ice, the water will drip from their edges upon the spouts of the tiers below. The water will also fall upon pins, and will thus be further subdivided. In this way the water will be exposed to the air in films, drops, and very small streams, and will be very rapidly frozen. When a sufficient quantity of ice has been formed, the apparatus may be covered with a shed, so as to serve as an ice house for storing the ice.

Improved Grain and Straw Lifter.

Donald Crane, Knight's Landing, Cal.—This is composed of ropes interlaced, and forming a kind of net, made in two parts and attached to timbers or bars, and divided in the middle. When the load has been transported to the desired place for unloading, a derrick is provided, on the hook of which rings attached to the ropes are placed, and the entire load is lifted from the wagon and swung round over the place where it is to be discharged. Suitable mechanism then allows the parts of the lifter to separate and discharge the load.

Improved Stencil Cutter.

Patrick L. O'Brien, New York city.—This invention consists of a stencil-cutting device, which is guided longitudinally and laterally on suitable supporting and sliding frames, and adjustable to produce single and double, straight, circular, or curved lines, being readily operated by one hand, while the stencil plate or sheet is fed to the cutting knife with the other hand.

Improved Bag Fastener.

Charles W. Harvey, Waterloo, Iowa.—This bag fastener is formed by the combination with each other of a rubber block, a screw, and two metallic washers. The mouth of the bag is gathered in the usual way, the string is passed one or more times around it, and is then passed once or twice around the outer washer, and is drawn in between the said washer and the body of the bag, where the elasticity of the rubber will hold it securely in place.

Improved Watch Case Spring.

Jules Menegay, Brooklyn, N. Y.—This consists of a watch case spring, made of uniform thickness throughout its length, and fitted in a dovetail groove in the inner face of a section of the rim of the case. The latter is split for a short distance from one end, and is provided with a clamp screw for pinching the split parts upon the edges of the spring, so as to hold it at any point. The spring can thus be shifted to any needed extent for adjusting it to the case after the spring holder has been fixed in the rim of the case, and can thereby be adjusted more accurately.

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Wanted—Willow Peeling Machines. Send description and price. H. B. Bear, Harrison, O., Shaker Box.

Parties requiring Oil for heavy work will find E. H. Kellogg's "Excelsior Cylinder Oil," manufactured by E. H. Kellogg, 17 Cedar St., New York, not only superior for Cylinders (from the fact of its cooling qualities as well as its clearing away all verdigris accumulating by the use of Tallow), but as well adapted to all heavy bearings where heavy bodied oil is required.

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For Sale—A lucrative patent on Christmas Tree Candle Holders. Address Wm. Ulrich, 49 Montgomery Street, Newark, N. J.

For Sale—Two Sturtevant Pressure Blowers (Nos. 8 & 9). Perfect condition. Price $200 each. Address W. H. Adams, Bridgeport, Conn.

For Sale—One 2d Hand 4 H. P. Roper Hot Air Engine. Price $105. E. F. Landis, Lancaster, Pa.

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Wanted—To take charge of a Cotton Mill as Superintendent. Best of references given, if required. Address W. B. Hurst, Box 25, Fall River, Mass.

How to lay out teeth of Gear Wheels. Price 50c. Address E. Lyman, C. E., New Haven, Conn.

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For Sale—Factory. Two Stories, 36x80—Engine and Boiler, 40 horse power—Shafting, Steam Dry House, Sheds, etc. Lot, 340x220 ft.. Good chance for manufacture of cheap furniture or agricultural implements. Hardwood lumber in abundance and cheap. Address, for particulars, Sayer & Co., Meadville, Pa.

Agents.—100 men wanted; $10 daily, or salary, selling our new goods. Novelty Co., 300 Broadway, N. Y.

Waggener's "Standard Wages Tables"—the best in use—showing Wages for 1 to 60 hours at $1 to $50 per week. Extra cloth, $1. Sent post paid. Catalogue of Practical Books free. D. B. Waggener & Co., 424 Walnut St., Philadelphia, Pa.

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For Sale—Valuable Manufacturing Property: commodious buildings; driving-power, shafting, belting, etc; good order. Great sacrifice. For description, address "The Cosmos," St. Charles, Mo.

For the cheapest and best Small Portable Engine manufactured, address Peter Walrath, Chittenango, N. Y.

Faught's Patent Round Braided Belting—The Best thing out—Manufactured only by C. W. Arny, 301 & 303 Cherry St., Philadelphia, Pa. Send for Circular.

Price only $3.50.—The Tom Thumb Electric Telegraph. A compact working Telegraph Apparatus, for sending messages, making magnets, the electric light, giving alarms, and various other purposes. Can be put in operation by any lad. Includes battery, key, and wires. Neatly packed and sent to all parts of the world on receipt of price. F. C. Beach & Co., 263 Broadway, New York.

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See N. F. Burnham's Turbine Water Wheel advertisement, next week, on page 269.

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

Notes & Queries

S. A. T. will find a description of making plaster molds on p. 58, vol. 24.—E. L. will find directions for making colored paper for manifold writing on p. 363, vol. 31.—E. L. will find a correct rule for ascertaining the curvature of the earth on p. 335, vol. 31.—S. H. M. will find directions for preparing bones for manure on p. 75, vol. 31.—J. W. R. will find a recipe for a gold wash on p. 43, vol. 30.—C. R. B. will find a recipe for fine blacking on p. 283, vol. 31.—W. S. R. will find directions for making a pot for melting metals on p. 235, vol. 32. Plaster of Paris is the best material for making molds for small castings.—J. E. M. can repair the silvering on looking glasses by following the directions on p. 233, vol. 31.—J. S. H. will find full directions for mounting chromos on p. 91, vol. 31.—C. E. will find a good recipe for axle grease for heavy bearings on p. 90, vol. 31.—W. H. T. will find a recipe for waterproof cement for aquariums on p. 202, vol. 38.—A. A. will find a recipe for bronze for use on brass on p. 283, vol. 31.—E. F. can make his tent waterproof by using the varnish described on p. 347, vol. 31.—L. K. Y. will find a description of water glass on p. 154, vol. 32. Furniture polish is described on p. 315, vol. 30. Muriate of ammonia can be bought for a small fraction of what it would cost an amateur to make it.—L. J. B. will find a description of the manufacture of rubber stamps on p. 156, vol. 31.—J. P. A. will find a formula for the proportions of a safety valve on p. 197, vol. 31.—W. W. H. will find a description of sailing faster than the wind on p. 176, vol. 28.—E. W. will find directions for waterproofing muslin on p. 347, vol. 31.—C. M. B. will find that etching on glass is described on p. 409, vol. 31.—J. R. M. will find directions for calculating the diameter of the driven pulley on pp. 26, 73, vol. 25.—C. D. will find directions for making colored lights on pp. 58, 154, vol. 30, and pp. 90, 219, vol. 31.—S. F. S. will find an answer to his queries as to lime light in our reply to J. H. S., p. 218, vol. 32.—C. C. will find directions for casehardening plow mold boards on p. 202, vol. 31.—C. L. and W. B. A. will find directions for imitating bronze on gun barrels on p. 171, vol. 32.—W. B. A. will find that iron can be softened by following the directions on p. 123, vol. 31, for steel.—C. L. D. will find directions for laying out a sun dial on p. 409, vol. 29.—H. D. E. will find a recipe for waterproof blacking on p. 155, vol. 26.

(1) F. D. D. asks: Why is it that oscillating engines are not used on steamboats or by manufacturers? A. They are, to some extent.

(2) H. C asks: What degree of angularity can be given to a wedge of cast iron, finished smooth and thoroughly lubricated, without its being forced back by the compression of wood into which it is driven? A. It must not exceed twice the angle of friction between the wedge and the surface. An average value of the angle of friction is 5¾°, so that, for such a case, the angle of the wedge should not be greater than 11½°.

(3) T. J. A. & Co. ask: What is the process of cupellation? A. The principle depends upon the property which lead possesses of absorbing oxygen at a high temperature, and of forming with it an easily fusible oxide, which imparts oxygen with facility to all those metals which yield oxides which are not reducible by heat alone. Most of the oxides thus formed unite with the oxide of lead, and produce a fusible glass, which is easily absorbed by a porous crucible made of burnt bone, termed a cupel; while any silver that the mixture contains is left behind in a bright globule, which admits of being accurately weighed. The cupels are prepared from bone ash (burnt to whiteness, and ground to a fine powder), by moistening it with water; a suitable quantity of the mixture is placed in a mold, and the required form and coherence is given to it by the blow of a mallet or of a press; the cupels are allowed to dry thoroughly before they are used. The method of cupellation you can find described in any good book on chemistry.

(4) J. & D. N. say: You mention a large magnet, weighing half a tun, that can raise twenty times its weight. At what distance would a magnet of that strength, being stationary, draw another magnet of the same strength not stationary? A. We can give you no general rule for determining magnetic attraction of this description. Much depends upon the quantity of current flowing through the helices.

(5) G. W. S. says: I am running an engine, 12x24 inches stroke, with a common slide valve set to cut off ⅝ stroke, making, with throttle wide open, about 63 revolutions. If I shut my throttle to reduce the speed to about 55 or 56 revolutions, with no load on, I have no back lash, neither have I back lash when load is on; but as soon as load comes off, I have back lash, and in consequence I must slow down my engine. Why have I back lash without load, and none with? A. It appears probable, from your statement, that the governor does not control the engine properly; so that when the work is removed, the speed of the engine is changed. It would be impossible, however, for us to give a definite opinion without further knowledge of the situation.

(6) S. H. M. says: I have a small steam chest which is cracked near one of the bolt holes. What will make a perfect steam joint? The chest is of cast iron. A. If it cannot be brazed, you might apply a patch with tap bolts, either driving a rust joint or using a piece of sheet rubber for packing.

(7) H. F. R. asks: 1. What should be the thickness of shell for boiler of one horse power, to bear 135 lbs. with perfect safety? A. We have no idea of the size of a one horse power boiler. 2. What power would each of two engines give, the one 1¼x4 and the other 2x6 inches, with 100 lbs. boiler pressure? A. The power would depend upon the piston speed, which you have not stated: but you will find numerous rules in back numbers by which you can make the necessary calculations. 3. What are the addresses of the Cooper Institute and Cornell University? A. Cooper Institute, New York city; Cornell University, Ithaca, N. Y. The tuition is free at the Cooper Institute. By addressing the presidents of the institutions named, you can doubtless obtain full information in regard to their relative advantages. 4. Has there been any contrivance patented to light the gas in any part of a residence by electricity, each jet to light independently of all others, but all getting the spark from one battery? A. We think that something of this kind has been introduced. 5. Is there a portable forge made of boiler iron, arranged to use all the extra or lost heat to generate steam to run a small blower, or the steam from several such forges to drive a light steam hammer? A. We have never seen anything of the kind.

(8) B. asks: Will pine wood ignite by coming in contact with a pipe through which live steam is passing? A. Not unless the steam is greatly superheated.

(9) M. E. C. says: 1. I have a small boat with upright boiler two feet in diameter. I have 4 or 5 feet of common one inch iron dipe in the firebox, connected to the crown sheet and side of firebox, and of course there is a good circulation. A friend says that these pipes will burn out very quickly if I use the boat in salt water. Is this so? A. The pipes would soon burn out if scale were formed in them, which would be very likely to occur by the use of salt water. 2. If I wish to take this boat to Florida by inland navigation, would the boat have to be inspected? A. Yes. Apply to the inspector in your district.

(10) W. R. J. asks: Are there any Barker's centrifugal mills now in use? A. We believe there are some turbines constructed in such a manner that they are virtually Barker mills. They do not meet with much favor, however, since the Barker mill is by no means an efficient machine.

(11) A. H. C. asks: 1. At what power would you rate an engine that is 8 inches bore by 15 inches stroke, running at 120 revolutions a minute and using steam at 80 lbs.? A. About 12 horse power. 2. Do you think steam-riveted boilers are as good as hand-riveted? A. Yes, if a good machine is used. 3. Do you think double rivets along the side seams of a boiler make it any stronger? A. Yes.

(12) O'B. & D. asks: 1. What size of wire rope will be strong enough to draw 7,000 lbs. up an inclined plane of one foot rise in three? A. From ⅝ to ¾ of an inch in diameter. 2. Will the wire rope work satisfactorily on a wooden drum 15 inches in diameter? A. No. It would be better to make the diameter of the drum from 24 to 30 inches.

(13) C. D. says: On p. 36 of your current volume, it is stated, that five minutes before a certain explosion occurred, the water stood at 3 inches above the flues. By a long experience with steam boilers, I have become convinced that the water at such times is converted into foam, and entirely fills the boiler. Upon pressing the gage the water has the appearance of being flush, while in reality the boiler was nearly dry. A. We would be glad to receive some facts in corroboration of your statement.

(14) W. S. S. asks: How is burnishing done, with the use of a burnisher? A. By rubbing the tool rapidly over the work.

What kind of briar roots are pipes made of? A. They are made of knotty roots of the common heath, which is found abundantly in Europe, and to some extent in this country.

The cone pulley on my lathe has 3 sizes for change of speed, 2½, 4¼, and 7¾ inches. I want to make a treadle wheel so that one band will suit the three sizes. What rule can I work by? A. We hope soon to publish a simple explanation of the method.

I wish to make some stamps for marking clothing. I have the printer's types, and I wish to make the impression of the types in something that I can run the old types in after being melted. What will answer? A. Plaster of Paris.

(15) W. L. asks: 1. Which will stand the greater pressure, a pipe one inch in diameter or a pipe six inches in diameter, provided both pipes are of the same material and of the same thickness? A. The former. 2. In a boiler with steam up, is the pressure greater or less below the water level than above? A. Greater.

(16) S. says: A train of cars is going round a curve. The outside wheel must go a greater distance than the inside one, yet they are geared together. Please explain it. A. If the wheels are not coned, one must slide. If the wheels are coned, the one on the outer rail will be larger than the other, so that it is possible there may be no slipping. Of course this can only occur when everything is rightly proportioned; and in general there is some slip even with coned wheels, though it is usually reduced by coning.

(17) G. G. C. says: I have a foot lathe on which the belt does not run true, but runs ¼ inch off of both large wheel and pulley wheel. Is this because the shaft and lathe bed are not parallel? A. It is either on that account or because the pulleys are not round or are not centered properly. You can make the adjustments, if required, by measurements.

(18) C. asks: Who first invented the dial steam gage, Eastman, Bourdon, or a German engineer? A. We believe that the Magdeburg gage was the first. Perhaps some of our readers have definite information on the subject.

(19) C. A. C. asks: 1. What can I use to fill up blow holes in some small steam cylinders, subjected to 100 lbs. pressure? A. Braze plugs in the holes. 2. Will a steel boiler be better than an iron one for a two horse engine? A. The steel boiler can be made lighter than an iron one of the same strength. We do not know that it would have any other advantage.

(20) D. E. B. asks: Can a common slide or rock valve be set to work expansively? A. Yes.

What were the seven wonders of the world? A. The pyramids of Egypt, the tomb of Mausolus, the temple of Diana, the walls and hanging gardens of Babylon, the Colossus of Rhodes, the statue of Jupiter, the watch tower built by Ptolemy.

(21) W. H. B. says: L. O. S. says that the same power will do the same work with a 60 inch as with a 30 inch saw. I do not see how it is possible for an equal power to move (through a log) a 60 inch saw. Of course the 60 inch has double the leverage from center to verge, consequently the power to drive such a saw successfully would do twice the work of the smaller saw. But I cannot see how he gets away with the short lever in favor of the small saw. Admitting the verge of each to travel at same speed, of course there must be an increase of speed only at the expense of power. A. In the case of the large saw, the pressure on the engine piston must be doubled, but the piston only moves half as fast.

(22) L. C. W. says: My water pipe, leading from main in street to house, is frozen. Some two or three hundred fellow townsmen are in the same fix. Some few have dug up the street and sidewalk and thawed the pipes out, but this is very expensive and difficult, owing to the frozen condition of the earth. Is there any plan by which they could be thawed out from the inside of the house? A. It can often be done by forcing steam into a pipe from a small boiler.

(23) G. A. McL. asks: What is agate, used for making buttons, etc.? A. It is a variegated chalcedony. It is supposed to have been formed by a deposit of silica from solutions intermittently supplied, and deriving their concentric waving courses from the irregularity in the rocky walls of the cavity in which they were formed. The colors are due to traces of organic matter, or of oxides of iron, manganese, or titanium.

(24) J. C. K. asks: What kind of a locomotive is the Fairlie narrow gage engine, with smoke stack at each end? Is the boiler solid throughout? A. Yes; it is all one boiler, and the two trucks, with the engines, are each pivoted so that they can swing.

(25) W. S. C. says: Can steam power be used in place of horse power in threshing wheat with the same machine? A. Yes.

If two boilers are supplying a third one with steam, will the third one have double the amount of pressure of the other two, or will steam be of equal pressure in all? A. The pressure will be equal in the three boilers.

How should a whiffletree be made so as to hitch 2 horses against one, giving equal advantage to all? My notion is that the middle hitch should be made so as to give the single horse ⅔ of the lever, and the 2 horses just ⅓ of it. Am I right? A. Yes.

Will pewter or lead do to make a cylinder head for a small steam engine 1x2 inches? A. Yes, but it will not be very serviceable.

(26) J. E. R. says: I have an 18 inch circular saw for sawing stove wood. I have it set to double the thickness of saw, and it is perfectly straight. I have run it at different speeds; yet when it is a few inches in the wood it blackens the wood on both sides, though I can see through all the time on either side. A. The bends in the teeth are probably too far from the point. Have the bend in the teeth on a true curve to the extreme cutting point, so that no part of the tooth can touch against the timber except the extreme cutting point, and you will obviate the trouble. The teeth of your saw probably wedge and bind in the kerf, about one third the length of the tooth from the point.—J. E. E., of Pa.

(27) E. F. F. asks: 1. What will be the effect of inserting teeth two gages thicker than the saw? Will not the teeth be likely to expand the saw more than the light teeth? A. If properly fitted, the thick teeth would have no more tendency to expand the saw than those of the same thickness as the saw plate. 2. Would such a saw stand to saw frozen beech, if the blade is properly hammered, using such teeth on ¾ or 1¼ feed? A. Such a saw, if properly made and kept in order, will stand to saw any kind of frozen timber. But in a saw for ordinary use, there is no advantage in having the teeth thicker than the plate of the saw at the rim.—J. E. E., of Pa.

(28) S. A. H. asks: With a column of water of a given hight, and a tube leading out from its base, turning up and opening at a level with the base, and all the proper conditions of free passage secured, to what hight, proportional to the columns, will the jet of water spurt? A. From 50 to 75 per cent.

(29) D. A. R. says: I want to make a magic lantern. I have two lenses 2½ inches in diameter and of 8 inches focus. Will these do? A. Place a reflector and a light in the focus of the fixed condensing lens, then the slide in the focus of the objective, the latter in a sliding tube, both with plane side to light.

(30) T. M. says: I have seen a small battery consisting of two cells, with zincs 2x2 inches and ¼ inch thick. The exciting fluid was sulphate of mercury. The cells were black. Are they made of rubber or carbon? A. They are probably carbon. Such cells and also positive plates are made of carbon deposited in gas retorts by the splitting-up of too highly heated hydrocarbons. In default of this, mix coke or charcoal powder with molasses to a stiff paste, mold, bake, and heat red hot.

Who sells second hand scientific books? A. Scientific books out of date are of but little value.

How can I grind and polish small lenses? I cannot get rid of the scratches in lenses of about 1 inch diameter. A. Repeat the fine grinding with emery that has been suspended in water one hour, then poured off and settled; repolish with rouge or putty powder treated in like manner.

Is there a practical way to transform motion into heat? A. Two flat iron disks rotating in opposite directions were found exceedingly wasteful of power.

(31) E. J. S. asks: What is the distance of Jupiter from the sun? A. Mean distance 475,692,000 miles.

(32) H. C. C. asks: What is the difference in bulk between 1 lb. gold and 1 lb. silver? What is the difference in value? A. These metals in our coinage contain $\frac{9}{10}$ of pure metal, alloyed with copper. It may be profitable for you to work out the answers yourself, from the following data: Value of 1 lb. of pure metal: Gold $301·45, silver $18·85. Weight of a cubic inch in lbs.: Gold 0·697, silver 0·381.

(33) W. B. C. says: On p. 36, vol. 32, you describe a new light invented by MM. Delachanal and Mermet, of Paris. The description is hardly full enough. You say: "The flask is filled with spongy fragments, which imbibe the carbon sulphide." Is the carbon sulphide the liquid bisulphide? 2. Do you understand that only a sufficient quantity of this liquid is applied to saturate the porous substance, or would a surplus in the bottom of the vessel be desirable? 3. Can you give a brief description of the St. Claire Deville apparatus and the Bunsen burner, as you understand them to be adapted in this case? A. In answer to these questions, we cannot do better than refer you to *Science Record* for 1875, p. 208.

1. Can you tell me how to stop the hissing noise made by the oxyhydrogen calcium light, when under heavy pressure? A. Slightly enlarge the opening at the orifice in the jet. 2. Would enlarging the orifice in either of the gas jets be equivalent (in effect of producing greater light) to putting heavier pressure upon the bags? A. It would simply tend to render incandescent a larger surface of the lime, with a corresponding decrease in the intensity of the light from each point of the heated surface.

(34) G. R. asks: How many times is an object increased in size when viewed through a magnifying glass of a power that increases the diameter 1,500 times? I contend that it is increased 2,250,000 times; my adversary says that it is only 1,761,150. A. You are right.

(35) N. R. H. asks: What preparation is used to stick gold leaf or powder to paper or cardboard, for book marks or illumination? A. Use the slightest possible touch of oil on the surface, and apply gold leaf. The powder is best applied by mixing it with size.

(36) C. M. says: I wish to make microscopic objectives of the following foci: 2, 1, ⅝, ¼, ⅛ inch. What should be their respective dimensions? A. Try the following formula for a 1½ inches, and let us know the result: Single front: Plano convex; radius of curvature 0·6 inch, thickness 0·2 inch, diameter 0·3 inch. Triplet: Diameter $\frac{3}{16}$ inch; composed of a plano convex front lens 0·9 inch radius, a double concave flint, radii 0·9 and 1·5 inches, and a double convex, radii 1·5 and 1·7 inches. Back lens: ⅝ inch diameter, plano convex, 2·7 inches radius. Convex lenses to be of a crown glass slide; the double concave to be flint (Chance's heavy glass).

(37) E. A. W. asks: Can a perspective drawing be reduced to a mechanical drawing? A. Not unless the object is represented in all its parts, and the proportion of all the parts given.

(38) E. L. asks: How can I remove the glaze from a cup, to make it porous for battery use? A. Porous cups can be bought for a few cents each from any dealer in telegraph supplies, and it will not be worth your while to make them by such a process as the one you enquire about.

(39) C. C. asks: How is zinc used as a substitute for lithographic stone? A. It is used exactly as the stone is. It is convenient to attach the zinc plate to a slab of stone or slate.

1. How is the wax removed from an electrotype after it is taken out of the battery? My object is to overcome the warping or twisting. A. Lift it off. The plumbago prevents adhesion. 2. What is used for filling or backing, lead or type metal? A. Either will do.

(40) L. W. F. says: I have made three good-looking violins, that sound harshly. I used soft pine for the top. Is this right? A. No. The purity of tone of a violin depends on the hardness and immutability of the wood of which it is made. Hence old violins are the most highly esteemed. Look about for some very old hard wood; it may sometimes be found when an old house is pulled down.

(41) J. W. asks: How can I prevent chickens from eating their own eggs? A. Fill an egg shell with pepper, and give it to them to practise on.

(42) J. C. R. asks: What is the best method of keeping chickens clean and free from vermin? A. Give them plenty of gravel and dry sand to rub themselves in.

(43) J. F. W. asks: How can I make shaving soap? A. Take genuine Naples soap 4 ozs., powdered Castile soap 2 ozs., honey 1 oz., essence of ambergris, oil of cassia, and oil of nutmegs, 5 or 6 drops each. Melt and mix. Smear the slightest portion of this soap on the chin, then use the shaving brush wet with cold water. Do not put water or the brush in the soap dish.

(44) J. B. S. asks: What can I use to polish ivory with? A. Ivory turned in a lathe is readily polished by applying its own dust to it.

(45) R. J. S. asks: What is the correct rule for ascertaining the size of a fly wheel for any given horse power of engine? A. Boulton and Watt give the following: Multiply 44,000 times the length of the stroke in feet by the square of the diameter of the cylinder in inches, and divide the product by the square of the number of revolutions per minute multiplied by the cube of the diameter of the fly wheel in feet. The quotient will be the sectional area of the rim in square inches.

(46) M. M. asks: How is the case-hardening compound mentioned on p. 150, vol. 32, applied? A. Mix the ingredients thoroughly and put the iron articles, red hot, in the powder, and leave till cold.

(47) R. & W. ask: How can we find the number of lbs. pressure obtainable from a wheel weighing 1,000 lbs., diameter 4 feet, velocity 100 revolutions per minute, geared 4 to 1, 5 to 1, 6 to 1, or 7 to 1? A. It would be difficult to obtain an accurate result in any other way than by making a few experiments, to get the necessary data.

(48) G. A. B. asks: From a post a gate is hung which extends horizontally 20 feet. In the center of the gate, or ten feet from the post, the gate has hinges, which allow one half of it to be opened without disturbing the half next to the post. Is the strain as great on the hinges of the post when one half of the gate is folded back so as to lie against the other half as when the whole gate is opened, that is, when the second half is in line with the first? A. The strain is the same in both cases, but the moment of the couple which is acting, and which represents the tendency to break the hinges, is twice as great when the gate is extended.

Can I get a film of copper on a piece of steel without a battery? A. Yes. Clean the steel and immerse it in a solution of sulphate of copper.

(49) J. S. M. asks: If a stick of timber is 20 feet long, 12 inches square at one end and 18 inches square at the other, and of a uniform taper throughout, what are the cubic contents of the stick? A. 31·66+ cubic feet.

(50) E. D. F. says: Given the area and radius of a circular segment to find the hight of the segment. Is there any formula for finding this exactly? A. No.

If two iron balls, one 1 inch in diameter and the other 10 inches, are at the same instant dropped from an elevation of 100 feet above the earth, will both touch the ground at the same instant? A. The difference would not be essential; but the resistance of the air would affect the balls differently because the cross sections of the two balls are as the squares, while the weights are as the cubes, of the diameters.

(51) B. P. G. asks: Which is the best for a water pipe, lead or galvanized iron? A. We can recommend iron pipes, prepared with a coating of pitch.

(52) F. R. M. asks: How many degrees compose the angle $f\ h\ k$, making $f\ h\ k = a$, so that $\cot. a = \cot. 110° + \frac{1}{\sin. 20°}$? This formula is from Fairbairn's "Mills and Mill Work," part 1, p. 160. Are there any numbers, from 100° to 110°, and from 15° to 20°, that will produce, according to formula, 30° or nearly so for the angle $f\ h\ k$? If there be such numbers within these limits, please state them. A. You can readily work it out with a table of natural sines and tangents, by substituting proper values in the equation and solving it. It will be a good problem for some of our readers who are beginning the study of trigonometry.

(53) M. B. L. asks: How can steam be superheated in an ordinary flue boiler? A. You must attach a superheater. 2. What is the piston speed per minute in the fastest passenger locomotives? A. From 700 to 800 feet.

(54) F. M. A. asks: How can I prepare mucilage for office use? A. Make a concentrated solution of gum arabic in hot water, and add to it a little Billter sulphate of quinine, which will effectually prevent it from molding. Only a very small quantity of the last named substance is necessary.

(55) P. McL. asks: How can I make molds with plaster of Paris? I have tried to do it, but they come out full of airholes. A. Use your plaster thinner when constructing the molds; and when ready to cast the metal, heat them nearly to the melting point of the metal; or thoroughly dry the mold and coat it with a solution of shellac in alcohol.

(56) H. & C. ask: 1. How can we make a strong thick paste for pasting sheets of brown paper together in large quantities? A. Melt together in an iron pot equal parts of common pitch and gutta percha. It is kept liquid under water, or solid, to be melted when wanted. 2. Which makes the strongest paste, starch or flour? A. Probably flour. 2. Is alum of any use in paste? A. Yes, to prevent its molding.

(57) H. J. M. says: 1. I find that if fully hydrated oxalic acid be suddenly heated to about 300°, it is resolved into carbonic dioxide, carbonic oxide, and formic acid. How can I separate the formic acid from the other two substances? A. Formic acid ($C_2H_2O_2$) is not known in the free state. Its hydrate, or what is generally known as formic acid, was originally obtained from red ants, and was named from that source. This may be obtained by immersing a glass retort or flask about one third filled with concentrated glycerin, in boiling water, and adding to the glycerin as much dry oxalic acid as it will cover. The mouth of the retort or flask should be connected with a receiver in such a manner that the formic acid distils over into the receiver, while the carbonic acid escapes. When it ceases to come over some fresh oxalic acid is put into the retort, and the process is repeated with the same portion of glycerin until enough acid has been collected. 2. How can I render the oxalic acid fully hydrated? A. What is commonly called oxalic acid is the hydrate required. The anhydrous acid is not known in a free state.

(58) D. C. asks: How can I bore an oblong hole 1x1⅝ inches and 1 inch deep in a block of malleable cast iron (having sides and bottom perfectly smooth) in an ordinary turning lathe? A. The conditions, as stated, are incompatible.

(59) C. W. asks: I have a steam boiler, hight 2 feet, diameter 1 foot, with a 2 inch flue through it. The head is made of cast iron ½ inch thick, the shell being of ¼ iron. What pressure will it stand with safety? A. About 80 lbs. per square inch.

(60) L. A. D. says: A. contends that a man born in 1800, and living now, would have lived in both the eighteenth and nineteenth centuries. B. contends that he would not. They will abide by your decision. A. B. is right.

(61) V. H. N. says: A turbine of about 3 inches diameter proper, purchased by us, behaved strangely. It was first located in the second story of a printing house, and water was conducted to it by a 3 inch pipe connected at a right angle to main in the street, then led 20 feet to cellar, thence at right angle to floor of second story (say 18 feet), thence at right angle to wheel (1 foot). A 3 inch pipe, connected to bottom of wheel, discharged water near point of entrance in cellar, having a siphon end to make it an exhaust tube. Under a few turns of valve (15 or more being required to open it entirely) it drove a ¼ medium and a ½ medium job presses, with power to spare. Now presuming the exhaust pipe to compensate for elevation to second story, the fall was 102 feet. It was removed up street, difference in elevation being 10 feet. A 3 inch supply pipe is connected with main in street at right angle, thence runs 130 feet to wheel in cellar, attachments being made to the pipe on the floor above. It gave scarcely any power, after repeated examination, until 13 out of 16 apertures in wheel were closed with wood; and with valve entirely open, it seems to give less power than the difference in elevation would justify. The water discharges right from the wheel into an open ditch. What is the cause? A. We judge, from your description, that increasing the length of pipe, and diminishing the elevation, cut down the head to a serious extent.

(62) M. U. asks: I have a steam engine 1⅝ inches bore x 3 inches stroke. What size should the feed pump be? A. You can make a plunger pump with same stroke as the engine, and diameter from $\frac{3}{16}$ to ¼ inch.

(63) W. B. says: 1. I have a small boiler 10 inches long with 5 two inch tubes half around a five inch flue. The tubes are connected with it by small pieces of pipe. The water is placed in the tubes and fire passes up between them and out at top. The tubes are ⅛ inch thick, and the ends are secured by a bolt. What would be a safe pressure? A. One of 150 or 175 lbs. per square inch, if the boiler is well constructed. 2. What size of engine ought it to run? A. One developing from ⅓ to ½ a horse power.

(64) S. G. asks: 1. Will an engine of 2 inches bore and 4 inches stroke be powerful enough to run a foot lathe with 10 inch swing? A. Yes. 2. What size of boiler should I use? A. Give it from 8 to 10 square feet of efficient heating surface.

(65) M. E. C. says: Our engine is 16x30 inches, and makes 80 revolutions per minute. It is impossible to keep the journals cool. We have ample power. It would do the work with 20 or 30 lbs. of steam. A. The piston speed is not excessive, if the engine has large bearings and is in good adjustment, with the valves properly set and the parts in line. You may possibly find that the trouble occurs from a neglect of some of these details.

(66) E. R. C. asks: Can you give me some information as to using lead pipe for carrying steam underground? Will the expansion and contraction weaken the pipe? A. We have had no practical experience with the lead pipe for this purpose, but are inclined to think that it will answer very well. We would be glad to hear from any of our readers who have used it.

(67) E. W. P. asks: In an artesian well, 1,200 feet deep with 3½ inch bore, what flow of water per minute might be expected at a depth of 20 feet below the highest point to which water will rise in the pipe, conceding that the supply at the head is inexhaustible? A. We do not know of any method but experiment, applicable to such a case.

(68) J. W. says: I wish to build a small steamboat 35 feet long and 20 feet wide, without any upper work, save a frame and awning. Would a five horse engine do to drive it? A. The engine will answer very well. Use an upright tubular boiler. You will require a license. We could not answer your other question without more data.

(69) J. W. H. asks: What is the effect on air, as regards volume, of increasing the heat from say −20° to 80° Fah.? Does not the heat greatly increase the volume of air? A. If the volume is maintained constant, the pressure increases. If the pressure is maintained constant, the volume increases.

(70) C. S. asks: 1. Will it be safe to use condensed steam to feed the boiler with, and convert it into steam again? A. Yes. 2. Will the condensed steam be soft water? A. Yes.

(71) E. G. P. says: I have seen the bottom of small creeks coated over with ice, in shape corresponding with the shape of the gravel and small rocks on the bottom. I found it much more difficult to walk across the creek, from the unevenness of the bottom, than on clear ice on the surface. During this time there was no ice running on the surface. How is this? A. Very likely the water was frozen solid during the winter.

It is well known that heat and cold are antagonistic. Which of the two predominates? If all heat were annihilated, can the amount of cold be estimated? A. Heat and cold are only relative terms, so that a body could not be cold unless it had some heat. Were heat annihilated, we should reach the absolute zero of our temperature scale, and could take no more account of heat and cold.

(72) L. F. M. and others.—The square of the diameter (expressed in inches) is the number of square inches in a square which has the diameter for a side. It is also the number of circular inches in the circle (a circular inch being the area of a circle whose diameter is one inch). Hence, as a circular inch is about 0·7854 of a square inch, the square of the diameter multiplied by 0·7854 gives the number of square inches in the circle.

(73) W. S. C. asks: What is meant by a steam boiler priming? A. The boiler is said to prime when water is mingled with the steam.

An artesian well is said to be one bored to a stratum of water that will force itself up out of the well, and that the water will rise as high as the source of supply. How then can an artesian well deliver water higher than its source? A. It cannot, but the source of the water may be very distant. There are some artesian wells which are estimated to be more than 200 miles from the source of supply.

There is a kind of powder claimed to keep coal oil from exploding. Can that be done? A. No. The thing is a fraud.

Where does the supply of oxygen come from that we breathe? A. Animals exhale carbonic acid, which the plants require. The plants take the carbon and set free the oxygen.

(74) R. M. asks: I am building a small steam engine with a square cylinder, of $\frac{3}{16}$ wrought iron, to be bolted together. The bolts are to be 2 inches apart; the cylinder is 4 inches in the clear by 8 inches long. Would such a cylinder be as good as a round one? A. You will have difficulty in keeping the piston tight without excessive friction. You do not send enough data for the determination of the other points.

What will cut off the attraction of a lodestone from steel? A. It can sometimes be done by striking the bar, or bringing it under the influence of a more powerful magnet, and reversing the poles.

Is there a rule for telling how much lumber there is in a log? A. We do not know of any that is applicable in all cases.

(75) R. L. asks: What sized boiler, engine, and propeller would it take to run a boat 20 feet long by 4 feet beam, and 3 feet depth of hold at 15 miles an hour, with steam at 60 lbs. pressure? A. The boat is too small to carry the machinery required for such a speed.

(76) J. V. asks: How can the area of a circle be equalized to that of an equilateral triangle? A. A side of the triangle is equal to 2·6042 times the radius of the circle.

Would a locomotive be able to run through a drift of wet snow 6 feet high and about 25 feet wide? A. Some engines are powerful enough.

What is an easy process of testing gold and silver? A. They can be treated in solution by various substances, when they will give characteristic precipitates. Consult a good work on chemistry.

(77) H. A. J. asks: What will remove a kerosene stain from a carpet without injuring the colors? A. Try benzine.

(78) G. W. H. says: 1. I am making a small oscillating engine, cylinder of 3 inches diameter and 6 inches stroke. Would it do to run an ordinary rowboat? A. Yes. 2. What kind of propeller wheel should I use? A. One of 2 feet diameter and 3 feet pitch. 3. Would a boiler 2 feet in diameter by 3 feet high be large enough to run it at 7 miles an hour? A. No.

(79) D. H. asks: 1. In testing a boiler with cold water through a rubber hose, does the hose sustain the same pressure per square inch as the boiler? A. Yes. 2. If the entrance to the boiler is smaller than the hose, will the hose have to stand the same pressure as the boiler? A. Yes.

(80) D. H. M. asks: What is the process of oil tempering tools for cutting wood, such as planer knives, chisels, etc.? A. Heat them red hot, and quench them right out in oil.

(81) J. H. F. asks: 1. What kind of clay do artists use for modeling? A. The material used in modeling is common potter's clay of the best quality, made so wet that a mass of it will not stand an inch higher than its own width without support. 2. Is modeling done by the hand or trowel? A. Modeling tools are either loops of wire of different sizes fixed in wooden handles, or various shaped pieces of ebony or boxwood. Both are to be considered merely as occasional aids to the fingers, or to be used in portions of the work which cannot be reached by the fingers.

(82) J. M. asks: 1. How can I give paraffin a fine red color? A. By the application of magenta and stearic acid, to the purified paraffin, a most beautiful rose color is obtained. 2. How can I perfume paraffin? A. We can give you no recipe for the purpose.

(83) J. G. asks: How are red and green lights made for use in tableaux? A. Red fire is made by using 61 per cent chlorate of potash, 16 of sulphur, and 23 of carbonate of strontia. Green fire, 61 per cent nitrate of baryta, 22 sulphur, and 18 chlorate of potassa.

(84) M. M. & Co. say: There is a person here who proposes to sell a recipe for causing 50 gallons of water to mix with 50 gallons of lard oil, thereby doubling the quantity and not deteriorating the value of the oil for lubricating purposes. Is this a fraud? A. Yes. We know of no chemical which will impart such properties to water.

(85) H. J. asks: 1. Are green paper hangings, that have been on the wall four or five years poisonous? A. Very probably. 2. Is the gas arising from coals taken from a stove as poisonous as that arising from burning charcoal in a room? A. Yes, if the gas given off is of equal amount. 3. In a recent article in your paper, you stated that kerosene oil barrels were poisonous. Is refined kerosene poisonous? A. It is injurious if taken in large quantities.

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

M. A. P.—The brilliant metallic particles are copper pyrites; they are imbedded in an impure quartzose rock.—T. A. H.—It is a rock, composed of quartz and mica.—E. W. S.—The sand is made up mostly of pure white quartz sand, and the bright shining appearance is due to little scales of mica. It can be employed where a fine white sand is needed.—O. H. P.—It is sulphuret of iron.—A box, directed to Rev. L. S. Bacon, contained red argillaceous (clay) shale, containing sufficient red oxide of iron to make it appear like an iron ore, but not enough to make it fit for working. When shale of this character gives a good color on grinding, it is sometimes used as a coarse paint.

A. B. asks: What is the material used in the manufacture of corduroy, which gives that fabric so disagreeable an odor whenever it is wet?—H. S. asks: Is there a good and speedy dryer for lithographic ink?—C. H. U. asks: How is the black stain and finish, similar to that used on lead pencils, made?—W. asks: How can I make rice paper?—L. K. Y. asks: In what way can I plug up screw holes in finished work, so the plugs will not show?—J. E. M. asks: What will keep sumac or bark liquor from souring in warm weather?—J. W. B. asks: How can I bleach yellow paraffin?—E. L. asks: How can I make a preparation for coloring eggs blue, red, and yellow?—J. W. asks: Is there a cheap mode of soldering or otherwise making a tight joint on black sheet iron pails?—J. N. P. says: I have some books that got very badly smoked from being in a burning house; the insides are not burnt, but the backs and edges of the leaves are very black. What can I do to take it off?

COMMUNICATIONS RECEIVED.

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

On a Ride on a Locomotive. By G. M. G.
On the Patrons of Husbandry. By W. R. S.
On Chemical Telegraphy. By G. L.
On Rubber Ligatures. By R. B. M.
On Telegraph Alphabets. By J. M.
On Boiler Explosions. By T. F. T.
On Squaring Numbers. By F. C.
On Cleansing Dirt from the Hands. By B. F. R.
On Steam Climbers. By W. E. S.
On Frozen Water Mains. By A. C., by W. T. F., and by F. T.
On Polarity of Water. By J. T.
On Flies. By C. T.
On Kaolin. By G. B.
On Talking Ants. By R. A. H.
On Flying Moths. By J. S.
On Finding the Meridian. By J. A. M., and by C.

Also enquiries and answers from the following:

E. E.—F. F. A.—J. T.—J. M. S.—A. G.—B.—T. L.—A. A. P.—J. D. M.—W. L. S.—D. L. B.—W. P.—A. S.—T. A. B.—O. G. S.—W. H.—W. W. H.—S. N. M.—J. H. P.—A. S. G.—S. B.—E. R. H.—J. L. B.—A. G.—R.—H. C. W.—H. O. T.—E. J. E.—T. H. N.—J. C. G.—A. R. L.—G.—J. C. B.—H. T. B.—A. Y.—R. E. M.—S. & S.—J. M.—L. D.—A. F.—S. A. T.—W. M.

HINTS TO CORRESPONDENTS.

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

Enquiries 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 enquiries analogous to the following are sent: "Who makes firemen's respirators, invented and described by Professor Tyndall? Who makes the best ten horse engine for a sawmill? Who makes a lathe for turning wooden bowls? What is the price of galvanized iron water pipe? Who sells machines for sandpapering wooden rollers? Who sells sash holders that are efficient substitutes for sash weights? Who makes the best dynamometers? Who sells dentist's diamond drills? Whose is the best mode of drying lumber? Who sells an icebox constructed on scientific principles? Where can seeds of *arundo arenaria* be obtained? Who sells machines for turning croquet balls? Is there a glass bead factory in the United States? Who sells diamond drills? Who sells the most economical steam boiler? How small are hydraulic motors made? Who can give particulars as to drying lumber by steam? Who makes a spiral spring that will sustain 500 lbs.?" 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 March 16, 1875,

AND EACH BEARING THAT DATE.

(Those marked (r) are reissued patents.)

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Vehicle chafing iron, G. Smith 160,793
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DESIGNS PATENTED.

8,206.—AQUARIUMS.—J. W. Fiske, New York city.
8,207.—MUSTARD BOTTLE.—J. Gulden, New York city.
8,208.—CARPET.—A. Heald, Philadelphia, Pa.
8,209.—GAUNTLET.—B. G. Shults, Johnstown, N. Y.
8,210.—PERFUME BOTTLE.—G. Storm, Philadelphia, Pa.

TRADE MARKS REGISTERED.

2,287.—PERFUMERY.—W. B. Dorman, Georgetown, Mass.
2,288.—COOK STOVE.—M. L. Filley, Lansingburg N. Y.
2,289.—MEDICINE.—B. Gorrell, Hopewell, Md.
2,290.—CIGARS.—Harned & Co., Brooklyn, N. Y.
2,291.—MEDICINE.—Henry & Co., New York city.
2,292.—FLOUR.—T. C. Jenkins, Pittsburgh, Pa.
2,293.—PRONG HOES.—Reisig *et al.*, New Castle, N. Y.
2,294.—CIGARS.—A. Schuneman & Co., Detroit, Mich.
2,295.—OILS.—W. C. Stiles, Jr., Volcano, W. Va.
2,296.—SOAP.—Kendall M'f'g Co., Providence, R. I.
2,297.—ESTREMETS.—Underwood & Co., Boston, Mass.
2,298.—BURNING FLUID.—B. A. Rose, Urbana, Ohio.
2,299.—LINIMENT.—E. Mastman, St. Louis, Mo.
2,300.—FERTILIZERS.—Patapsco Guano Co., Baltimore, Md.
2,301.—DYEING CHEMICAL.—Weeks *et al.*, Boston, Mass.

APPLICATION FOR EXTENSION.

14,285.—WATER WHEEL.—J. Haseltine, Boston, Mass.

SCHEDULE OF PATENT FEES.

On each Caveat $10
On each Trade mark $25
On filing each application for a Patent (17 years) $15
On issuing each original Patent $20
On appeal to Examiners-in-Chief $10
On appeal to Commissioner of Patents $20
On application for Reissue $30
On filing a Disclaimer $10
On an application for Design (3½ years) $10
On application for Design (7 years) $15
On application for Design (14 years) $30

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA, MARCH 12 to 19, 1875.

4,487.—P. Mayrand, Gentilly, P. Q. Wood splitting machine. March 12, 1875.
4,488.—G. R. Edwards, Galena, Ill., U. S., *et al.* Safety whiffletree. March 12, 1875.
4,489.—J. B. Hava, New Orleans, La., U. S. Treatment of cod liver oil. March 12, 1875.
4,490.—J. S. Garner, Galena, Ill., U. S. Wash boards. March 12, 1875.
4,491.—J. A. Lakin, Westfield, Mass., U. S. Overdraw bar check. March 12, 1875.
4,492.—H. B. and E. W. Rathbun, Mill Point, Ont., *et al.* Barrel heading cutter. March 12, 1875.
4,493.—C. C. Roe, Hamilton, Ont. Machine belt buckle. March 15, 1875.
4,494.—C. I. Corbin, East Oxford, Ont. Extension of 287. Rake. March 15, 1875.
4,495.—M. Pettingill, Minneapolis, Minn., U. S. Car coupling. March 15, 1875.
4,496.—E. L. Howard, Boston, Mass., U. S. Fagotting attachment to sewing machines. March 15, 1875.
4,497.—C. F. Ritchel, Corry, Pa., U. S. Brush block boring machine. March 15, 1875.
4,498.—L. Cotó, St. Hyacinthe, P. Q. Forming stiffeners for boots. March 15, 1875.
4,499.—J. S. Anderson, Flintville, Wis., U. S. Wash boiler. March 15, 1875.
4,500.—R. Paradis, St. Hyacinthe, P. Q. Shingle machine. March 15, 1875.
4,501.—T. Richardson *et al.*, Fergus, Ont. Gang plow. March 15, 1875.
4,502.—J. K. Feick, Berlin, Ont. Felt boot tree. March 16, 1875.
4,503.—G. Houlton, St. Andrews, N. B., *et al.* Car axle boxes. March 16, 1875.
4,504.—W. R. Close, Bangor, Me., U. S. Friction catch wheel. March 16, 1875.
4,505.—J. Collins, Montreal, P. Q. Bag tie and fastener. March 16, 1875.
4,506.—J. C. Peacock, Finsbury, London, England. Non-conductor of heat. March 16, 1875.
4,507.—J. F. Williams, Niagara, Ont. Extension of 289. Lever buckle. March 17, 1875.
4,508.—L. J. House *et al.*, Stanstead, P. Q. Stump extractor and stone puller. March 18, 1875.
4,509.—C. C. Jones, Fredericton, N. B. Combination barrel pump. March 18, 1875.
4,510.—S. E. Foster, Minneapolis, Minn., U. S. Vehicle spring. March 18, 1875.
4,511.—F. G. White, Ottawa, Ont. Artificial honey. March 19, 1875.
4,512.—J. M. Mehag, Montreal, P. Q. Wedge valve. March 19, 1875.

Advertisements.

Back Page - - - - - - $1.00 a line.
Inside Page - - - - - - 75 cents a line.

Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Friday morning to appear in next issue.

FOR SALE—PATENT IRON HEATER AND OVEN.—State Rights. J. H. McCARTNEY, Olathe, Kansas.

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FOR SALE OR LET ON ROYALTY—A Valuable Patent in Key Seat Cutter and Hand Planer. Send for Descriptive Circular to ROBERT HARPER, Glen Mills, Delaware County, Pa.

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TO FOUNDRYMEN—A middle-aged man, who has had a thorough business experience, and who owns a valuable patent that will consume three hundred thousand pounds of *fine* iron castings per year, would like to associate himself with a maker of fine castings. Those having special goods to place upon the market preferred, as the only object is to reduce office and selling expenses. Address C. J. H., Station D, New York Post Office. Replies to be called for.

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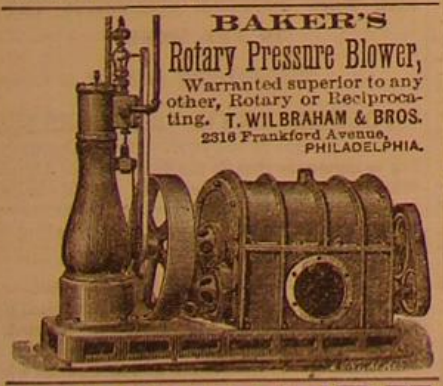
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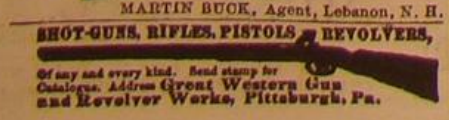
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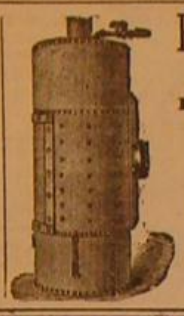
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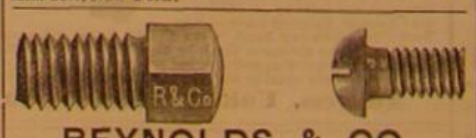


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