

SCIENTIFIC AMERICAN

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

Vol. XXXIII.—No. 24.
(NEW SERIES.)

NEW YORK, DECEMBER 11, 1875.

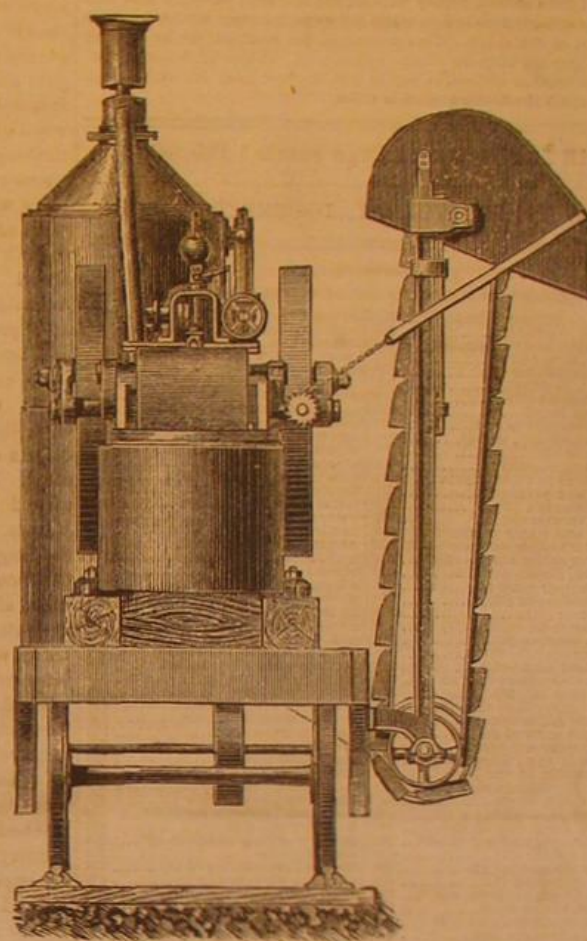
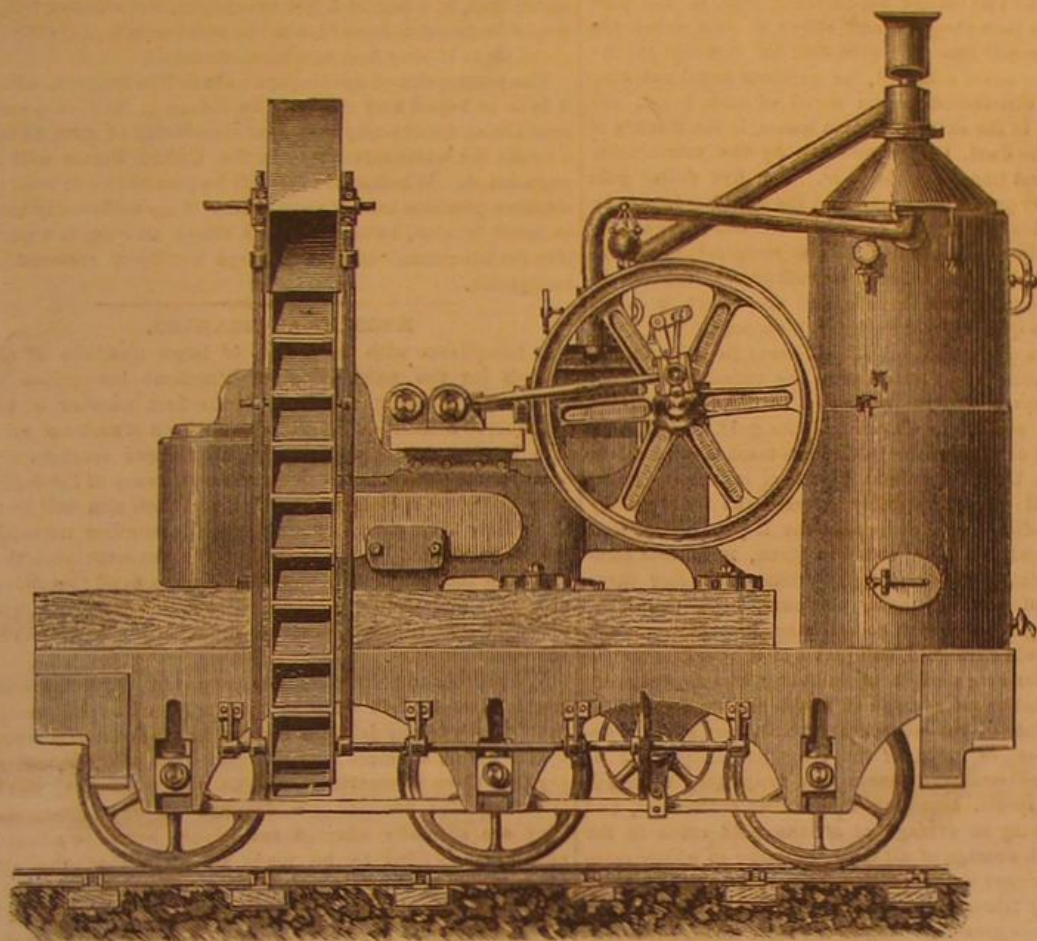
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BALLASTING MACHINERY.

Our illustration shows a very useful form of machine for breaking stone and ballasting railroads, and for macadam-

buckets are of wrought iron, and mounted on 4-ply India rubber belting 13 inches wide. A hood is placed over the top to shade the delivery from the wind. The ladder deliv-

the illustration. It was exhibited at the recent exhibition of the Society for the Promotion of Scientific Industry at Manchester. This machine is remarkable for the high speed



RAILWAY BALLASTING AND STONE BREAKING MACHINE.

izing common roads. It is the design of Mr. Marsden, of Leeds, England, and the stone-breaking arrangement is the familiar American machine known as Blake's stone crusher. The machine is designed especially for ballasting railroads; and it has long been known that stone or slag properly broken and screened, is a most excellent material for such purpose, giving a close road free from dust, while the material is left in the best possible form for binding together. The machine is used on the London and Northwestern Railway, and is capable of breaking down for ballasting about 120 tons of slag per day. The total weight of the apparatus is about 26 tons.

The working jaw is operated by a vertical rocking bar, having a front and back toggle plate taking into recesses on each side of the bar, the other end resting on the jaw and in the adjustable toggle block. When the jaw is forward these plates are placed in a straight line, when it is back they assume an angular position, one up, the other down; and as the rocking bar passes its vertical center twice for each revolution of the crank, two distinct vibrations of the jaw are made. A horizontal cylinder, 14 inches in diameter by 14 inches stroke, is placed between the arms at the rear of the machine. These arms carry plunger blocks, in which runs the crank shaft in adjustable gun metal; two massive fly wheels, each weighing one ton, are fitted at each end of the shaft. These carry crank pins, and two connecting rods pass to a stout crosshead bar. Slipper guides are bolted to each side of the frame, and the piston is coupled by a stout link direct on to the rocking bar. An efficient governor is supplied to regulate the speed of the engine to 125 revolutions per minute. There is a screw-down starting valve, and the motion of the slide valve is effected by an eccentric working on to a weigh bar or rocking shaft, which has an L lever link to the valve spindle. The cut-off is arranged at five eighths of the stroke; but by a slot in the L lever, the stroke can be lengthened or shortened to cut off sooner or later.

The boiler is of the vertical type. The elevators radiate round the bottom shaft, and the angle of delivery can be altered by the windlass attached to the side of the machine. The

ers the material into trucks on the opposite rails. The boiler is fed by an injector

WOOD-BORING MACHINERY.

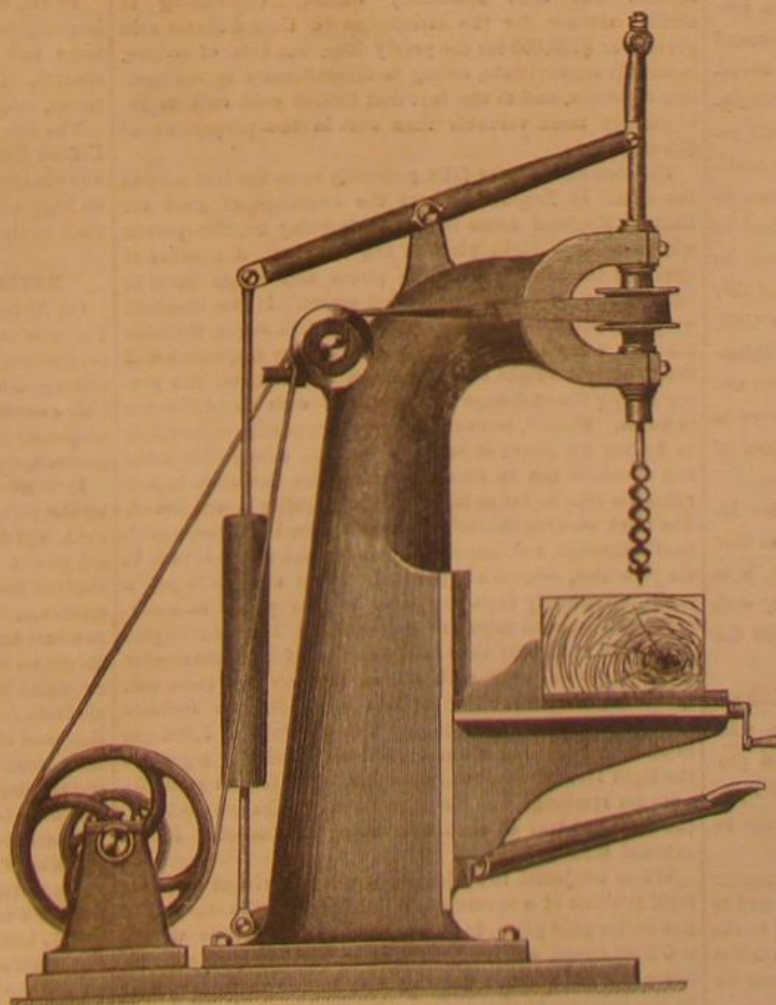
We publish herewith an engraving of a very simple boring machine, the whole construction of which is obvious from

at which it can be driven without noise, bevel wheels being entirely dispensed with, motion being imparted by straps. The upright frame is in one casting, the table moving up and down in slides, and worked by a rack and pinion, worm and wheel. It will bore holes from $\frac{1}{4}$ inch to 3 inches diameter, and 12 inches deep, and can be fitted with plug cutters and recess cutters.

The machine illustrated herewith does not necessarily possess advantages over the same class of machines made in this country, but it may interest our mechanics to see an engraving of one of the best of its kind used in England.

The Monopolies of Inventors.

A large fortune made from valuable patents was that of the late I. M. Singer, who left property valued at \$9,000,000 in the United States and \$4,000,000 in Europe. It has often been observed that inventors are not apt to amass wealth. This statement, however, is wide of the truth if it means that inventors are more apt to die poor men than those who engage in other branches of business. We are very confident, says the *Artisan*, that, if a comparison were instituted between inventors and all those in this country who have engaged in mercantile business, stock speculation, or banking, it would be found that as many inventors have acquired wealth in proportion to their whole number as those engaged in any other branch of business. We might enumerate instance after instance where very large fortunes have been made, as in the case of Mr. Singer. Should we do this, however, we might supply an argument to those who believe that patents create oppressive monopolies. We are willing to grant that, when wealthy rings and cliques are enabled to control legislation, so as to obtain the renewal of patents, through the aid of bribes, which they could not obtain under the regular working of the patent laws, oppressive monopolies may be created and fostered, but this is to be attributed to the general corruption of officials, and it is not peculiar to the working of the patent system. Designing individuals who combine to control legislation require monopolies of privileges in other departments of business more oppressive than any monopoly which has for its basis a patented invention.



FURNESS & CO'S VERTICAL BORING MACHINE.

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 63

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 the paper will be sent from the receipt of the order. When requested, the numbers can be supplied from January 1st, when the volume commenced. 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 XXXIII, No. 24. [NEW SERIES.] Thirtieth Year.

NEW YORK, SATURDAY, DECEMBER 11, 1875.

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PUBLISHERS' CARD.

The present volume of the SCIENTIFIC AMERICAN is drawing rapidly to a close. Three numbers (including the present) and the year will be ended. Some eighteen thousand of our subscribers will find, printed on their wrappers covering this week's papers, the announcement that their subscriptions are about to expire, and the request that they will remit for the new volume. To prevent any break in the continuity of their subscriptions, and to enable the publishers to know how large an edition to print at the commencement of the year, subscribers are invited to remit for a renewal as early as possible. Simultaneously with the mailing of this week's paper, an envelope, containing Prospectus for 1876, a beautiful chromo Name List, a Catalogue of our Publications, and an Illustrated Hand Book, useful for inventors and others, will be mailed to all our subscribers; and we hope to receive all the lists back again filled with the names of those who wish in the future to take our paper.

To save our friends all the trouble possible, we also inclose an envelope with our address printed thereon, so that all the subscriber and getter-up of a club has to do, is to place his name or list of subscribers in the envelope, with the postal order, draft, or money, put a 3 cent stamp on the former, and drop it into his post office.

The terms of subscription remain as heretofore—\$3.20 per annum, postage prepaid by us, for single subscribers, with discount for a number. See terms for clubs in special prospectus. All news dealers throughout the country will, as usual, receive subscriptions and have our publications on sale.

THE railway to the Hot Springs, Ark., has been opened to within seven miles of the locality, and will be finished to the Springs by January 1. This will open, to the convenient access of the public, one of the most remarkable places on the globe.

WHAT IS HARD MONEY?

The Director of the United States Mint has recently made his report to the Secretary of the Treasury, in which he shows the amount of metallic currency in existence at the expiration of the fiscal year ending June, 1875: Gold, \$33,553,965; silver, \$10,070,368, and minor pieces, \$230,375. This is a small supply of currency for so great a country, and doubtless statisticians find little difficulty in tracing its course during the period of its circulation. Small as the amount is, however, it will serve to illustrate a curious fact. Leaving the nickels and pennies out of consideration, suppose that the aggregate sums mentioned of gold and silver could be thrown into circulation on some given day—say June 1, 1875—instead of at divers times, as of course was the case. Suppose, further, that on June 1, 1876, the total could again be collected and delivered at the mint. It might naturally be inferred that, the mint having regained exactly, to all appearances, the sum it sent forth, it would be financially as it was prior to emitting said sum—no poorer, no richer. The fact would be, however, that, if the mint should receive back the gold and silver at face value, the government would lose over \$100,000; for it would pay for gold and silver never returned, for precious metal not non-existent but distributed in the metal of cash boxes, the wood of tills, in the skin of human hands, in the threads of clothing, in the dust, in the air—lost by the unavoidable waste of almost imperceptible wear. The five dollar gold piece which we put in our pockets in the morning is not the same as the five dollar gold piece we take out at night, although the coin may never have left its receptacle in the interval. Probably no balance is sufficiently delicate to indicate the loss; but loss there is, and one which becomes an appreciable quantity after a month's carriage.

A better idea of the amount of deficiency in coins due to wear, can be obtained by considering the currency of England: Gold sovereigns are composed of one twelfth alloy of silver and copper to eleven twelfths gold. American dollars consist of nine tenths gold to one tenth similar silver alloy. It has been determined by actual experiment, conducted several years ago under government auspices by Messrs. Cavendish and Hatchett, of the Royal Society, that the English gold standard, as above given, is the best combination in point of power to resist friction. During these tests, alloys of silver, copper, platinum, iron, tin, lead, bismuth, manganese, nickel, cobalt, zinc, arsenic, and antimony were made with gold, and plates of the various metals were rotated for long periods in tumbling barrels, and were rubbed together on an average of half a million times each. Toward the close of the last century, trials were made to determine the loss of metal of the coins, more especially of gold, and these tests have since been frequently repeated. The average result, according to the best authorities, and reached by taking an average of all the gold coins in the country and an average of all the hard usage to which coins are exposed, shows that each coin bears an annual loss of about 1-900 by friction. In silver the loss is supposed to be five or six times greater, owing to the more unceasing circulation of silver than gold, and the less degree of fitness of the metal to bear friction. At the close of 1872, a careful estimate of the coin in circulation in Great Britain and Ireland placed the gold at £84,551,000 and silver at £15,000,000, from which it will be seen that, in the three years which have passed on the amounts above noted, there has been on the gold an annual loss of £93,945.5, and on the silver £99,996, or, for the entire period, the sum of nearly \$2,900,000 has been absolutely wasted. Calculating in similar manner for the circulation in United States coin gives over \$100,000 for the yearly loss, but this, of course, is merely approximate, owing to the difference in composition of alloys, and to the fact that British gold coin is intrinsically more valuable than ours in the proportion of \$55 to \$54.

The loss due to wear falls generally upon the last user of the coin. In England, where the exchange of gold for Bank of England notes is constantly going on, the person who presents a light piece is the sufferer. A number of clerks of the bank examine the pieces and weigh them in bulk with very carefully adjusted scales. If the standard weight is lifted, notes are given. Should, however, the scale not turn, a few light coins are picked out by inspection and others of full weight added to make the balance, the person asking the exchange being charged with the difference in value. Should, however, a person presenting light coins, on finding the pieces to be below weight, change his mind and conclude not to take the notes, the law steps in and ruins his coin so far as its circulating utility is concerned. The clerk unceremoniously clips each piece by cutting a gash nearly through and across its diameter, and hands it back to the presenter, despite his protests. If he chooses to pay a small tax, usually from two pence to four pence on a sovereign, the spoiled coins are redeemed by new sovereigns. While the bank may thus in the course of business receive light pieces in bulk with others, it never pays them out. Quantities of coin are thrown into a wonderfully delicate machine, which weighs the pieces at the rate of 3,000 per hour with unerring accuracy, and automatically separates the light from the full weight coins. The former go to the mint for recoinage, and the government reimburses the bank, the wear and tear of such coin being compensated for by national taxation.

When subjected to such tests it will be evident that the legal lifetime of a sovereign, which is nearly the size of our five dollar gold piece, is quite short. The average weight is 0.2562 ounce, and one year's wear, as already shown, reduces it 0.023 ounce, a quantity very readily distinguishable by the balance, so that indeed the continuous circulation of

the piece for a much briefer period is sufficient to render it open to rejection as light. Mr. Palmer, the Deputy Governor of the Bank of England, recently informed a Committee of the House of Commons that last year the Bank weighed coin to the amount of £23,100,000 and rejected £840,000, or about 3.6 per cent, as being light gold. For this amount the Bank paid the value, making a deduction for the deficiency in weight, which, at the rate of three pence per pound sterling, would show a loss of some \$250,000 in our money on the above amount. It was also stated, says the London Times, referring to Mr. Palmer's report, that boxes of correctly weighed gold, sent by the Bank of England to Scotland, frequently came back without having been opened, and Mr. Palmer stated that there is then some reduction for light weight. He explained this by adding that the mere shaking of the sovereigns on the journey will make a slight difference. There is a point at which every sovereign becomes light, and many sovereigns turn that point on the journey. Mr. Hodgson, M. P., a bank director, stated that, in a box of 5,000 sovereigns, the number which would be found to have turned the point would generally be about eight if they had not been disturbed.

The resumption of specie payments in this country, which it is to be hoped may not long be deferred, will of course result in an enormously increased circulation of coin, and as a result the waste referred to in the United States will be augmented. Whether it ever will be possible so to treat or combine precious metals as to render them sufficiently hard to resist friction, better than the alloys now do, is a question for inventors, and one perhaps worthy of renewed investigation.

MECHANICAL DRAWING.

In compliance with the desires of large numbers of our readers for the publication of Practical Instruction in Mechanical Drawing, we shall, in the first number of the SCIENTIFIC AMERICAN SUPPLEMENT, begin a series of valuable lessons on the subject, by experienced teachers and draftsmen. These instructions will commence at the beginning, at the most elementary point, and their aim will be to show how any person, young or old, whether naturally skilled or not, may learn to draw. We are convinced that there are thousands who would be glad to avail themselves of simple and plain directions, periodically continued, with plentiful examples for practice, provided such practice involves no expense.

We propose to point out, in these papers, by precept and ocular example, how wide is the range of useful practice that is open to any faithful learner in mechanical drawing by the use of a simple rule and pencil or pen. When we say that these instructions will be such that they can be taken up for practice or dropped at any time; that they are specially adapted for leisure hours or minutes, and are intended to be made so plain that the simplest minds may easily follow them, we think that those who neglect so excellent an opportunity for learning will be without excuse. We suggest to the heads of families that they cannot do a better thing for their boys than to make them a present of a year's subscription to the SCIENTIFIC AMERICAN SUPPLEMENT, and encourage them to follow these lessons in drawing. See prospectus elsewhere.

We also suggest to young men the propriety of devoting their leisure time to the practice of drawing, instead of wasting their evenings in useless loafing at the country store.

To all, whether young or old, we suggest the propriety of learning to draw. Its practice quickens the mental perceptions and insensibly promotes a taste for other useful studies, of which many, suggested from time to time in our paper, may be readily acquired.

The life of the late Henry Wilson, Vice President of the United States, is a striking example of the progress in knowledge that any faithful learner may make, even when he begins late in life, and under toilsome discouragements, such as those encountered by a poor shoemaker.

EXPLOSION AT THE PULLMAN CAR WORKS.

On November 10, a strange explosion took place in the Pullman car works in Detroit, which dangerously injured several workmen. We give some details about it, as the event conveys a useful lesson to establishments where similar arrangements are in operation, and because it is a verification of the scientific theory concerning the nature of explosive gaseous mixtures.

In this establishment, the furnace under the boilers is fed by the refuse matter of the workshops (shavings, sawdust, etc.), which is swept into openings in the floors of the different rooms. These openings communicate with a large brick shaft or flue, reaching from the top to the bottom of the building; inside this flue is an iron pipe through which the sawdust and small shavings, from several woodworking machines on the different floors, are blown. This material is collected by means of a fan blower, which, exhausting the air from funnels over the machines, carries it along by suction, and then sends it by pressure down the iron pipe into the furnace below, performing the double function of blowing the fire and furnishing fuel in the form of dust. When this dust fuel is not needed, the connection of this pipe with the furnace is closed, and the blast sent up through the surrounding flue, while the exit of the dust and shavings out through the roof is prevented by a wire grating or screen in a cupola on the roof, wherein this dust is retained. This cupola has to be cleaned out from time to time, the dust being thrown down the large brick flue. Workmen thus employed discovered that the material on the bottom was on fire, having been ignited through a defect in the closing of

the communication with the furnace, from which the upward air current in the flue had drawn sparks. As water thrown in from below did not extinguish it, a hose was applied to the top; and at the moment of injecting a stream of water, a most violent explosion took place in the flue, blowing the wire grate, cupola, and belfry into fragments, and high into the air, and wounding 13 men. Then a fire broke out in the roof, but this was speedily under control after the firemen arrived.

The local papers, commenting on this event, say that the water was changed into steam, oxygen liberated, and the gas ignited; this of course is erroneous, and the cause of the explosion ought to be attributed, like all similar explosions, to a mixture of air with a combustible vapor or dust. Just as ordinary illuminating gas is liable to explode when mixed with air in the right proportion, so will the dust of inflammable material. There are already numerous examples on record of the same nature. Last August an explosion took place at the works of the Milburn Wagon Company at Toledo (see SCIENTIFIC AMERICAN, October 9, page 228, current volume), which was also caused by the fine wood dust in a shaft through which the shavings, etc., were conducted to the furnaces; it was so violent that the boiler room and magazine were completely wrecked, the roof blown off, the walls thrown down, etc.; and we then called attention to the dangerous nature of the dust of combustible materials.

In the *Science Record* for 1874, published at our office, it is stated (on page 395) that at the town hall at Friedek four persons were injured by such an explosion; and not wood dust only, but flour dust, will cause similar disasters. In the Ofen-Pesth steam mill, an explosion, which destroyed the windows and roof, was caused by a cloud of dust of some very fine varieties of flour being ignited by a candle. A great explosion also occurred at Glasgow, where the stones grinding the flour struck sparks during an accidental cessation of the feeding. Of the latter accident a detailed account was given in the SCIENTIFIC AMERICAN of October 5, 1872 (page 209, volume XXVII.), where it is also mentioned that Professors Rankine and MacAdam made experiments to ascertain the inflammability of such mixtures, and verified the result of the calculation of the right proportions to produce the accidents in question. It has been found that the rapid combustion of the finely divided flour, as well as the ignition of a mixture of air with the gases furnished by the decomposition of flour and of wood, may produce explosions. Flour and bran mixed gave off, at 450° Fah., a gas which, mixed with nine times its volume of air, ignites; and such a temperature is often obtained by the friction in the grinding process, and it has undoubtedly been a cause of many unexplained fires in flour mills.

Other materials than wood dust and flour have given rise to like accidents. About 10 years ago, a similar explosion took place in the Grahamsite mines in Western Virginia, where the dry, resinous, and brittle material had filled the mining shaft in the form of an impalpable dust, which it was afterward found could not be entered with impunity without safety lamps.

It is therefore probable that the dry sawdust, with which the flues in the Detroit establishment were filled, required to be intermingled with air in the right proportion to form an explosive mixture, and that the intermingling was effected by the stream of water entering from above, while fire was set to the mixture from below; or inflammable gas may have been produced by the decomposition of the wood shavings at the bottom of the flue, or by imperfect combustion, evolving carbonic oxide gas, favored by insufficient access of air; this gas may also have entered from the furnace, by the acknowledged imperfection in the arrangements for closing the communication. This combustible gas may have mixed with the air and combustible dust, to such an extent as to form the explosive mixture. There is no doubt that the limits of such dangerous mixtures are often reached in many localities; and the actual explosion is only avoided by some disturbing influence, which prevents the attainment of the required proportions, persons of the vicinity remaining unaware of the dangerous crisis through which they have passed.

THE PRESERVATION OF HOPS.

As the brewing of beer is making such tremendous strides at the present day, owing to its enormously increasing consumption, the production of and trade in one of the most important ingredients, the hop, have become a correspondingly gigantic branch of commerce. The active constituent in the hop is volatile; but a worse feature is that it is powerfully acted upon by the atmospheric oxygen, which in time renders useless hops that have long been preserved. Hence attempts have been made to keep them in their normal condition, and the manufacture of an extract of hops has been attempted in this country with apparent success. The brewers, however, found that they could not use it, or rather that if they used it it made the beer less palatable, and therefore less salable; hence they have all adhered to the use of the original hops, and the great problem has been how to preserve the hops themselves. It is now announced in the German papers that C. B. Jung, a merchant in Fürth, has succeeded in doing this by removing the atmospheric air. As it was not practicable to do this by exhaustion by an air pump, he attempted to do it by displacing the air with a gas that did not contain any oxygen, or at least no free oxygen, and he tried nitrogen, hydrogen, carbonic oxide, carbonic acid, etc.; and he patented his process in several countries. At last he selected carbonic acid as the most effective and the cheapest gas, as it can be made by mixing limestone or chalk and sulphuric acid. He operated thus: He loosely filled a box (lined with tin) with hops; he brought a tube to the bot-

tom of the box, and by it conveyed under the hops the carbonic acid, which, being heavier than air, remained below, and drove the air out upwards. He then compressed the hops, filled the box up again with more hops, and admitted more gas; and he continued in this way until the box was full, then put on the cover, and admitted more gas, to prevent the penetration of air by possible diffusion, and after a while he closed the box hermetically. For the performance of this generation on a large scale, he proposes to have the gas ready in a large gas holder, similar to those used for illuminating gas, and to introduce it by a moderate pressure. The hops prepared by him in this way have thus far been found by the brewers to have remained in perfect condition, and fully equal to the fresh article.

THE SCIENTIFIC AMERICAN SUPPLEMENT.

The first number of this new addition to our publications will be ready next week. We issue it considerably in advance of its actual date (January 1) for the convenience of those who desire to procure copies for examination prior to subscribing. Single copies 10 cents. For sale at all the principal news stores throughout the country. Single copies also sent from this office to any address on receipt of the price. The first number of the SCIENTIFIC AMERICAN SUPPLEMENT will contain a large amount of interesting matter.

Among other things it will contain a paper relating to the Construction of Ice Boats, illustrated with working drawings and specifications for the making of the best and fastest boats now used on the Hudson River. These articles will be of great utility to young mechanics in all parts of the country, furnishing them the measurements, proportions, and all the details of construction. The ice boat is a simple machine, but its use involves some skill and is productive of great enjoyment.

For a more detailed statement of what the subscriber to our SUPPLEMENT may expect during the year we refer to the prospectus in another column.

A HINT FOR THE HOLIDAYS.

As the season for gift-giving draws nigh, the annually recurring problem, what to give, presents itself. What will afford the most pleasure or yield the largest benefit for the money to be expended?

We do not propose to answer or attempt to answer a question so delicate and important; but would merely suggest a few instances in which a very useful, pleasure-giving, and appropriate gift would be a year's subscription to the SCIENTIFIC AMERICAN.

Employers often find it advantageous to manifest their appreciation of the fidelity and painstaking care of the better sort of workmen by a holiday gift; and for such a gift, a year's subscription to the SCIENTIFIC AMERICAN is sometimes chosen. In some cases as many as fifty workmen in a single establishment are reminded, in this way, that their personal character and skillful services are favorably regarded by the proprietors. And we have been assured, by those who have tried the experiment, that gifts of this kind are as profitable to the giver as acceptable to the receiver. By its timely suggestions, hints, items of information, and general influence, the SCIENTIFIC AMERICAN makes the recipient more careful and intelligent as a workman, more fertile in resources, less likely to waste his time in idleness or unprofitable associations; and the giver reaps a benefit perhaps many times above the cost of the gift. This, leaving out of sight the pleasant effect which such attentions from employers have upon the employed.

Equally happy will be the effect of such a gift upon any young mechanic from any interested friend. It cannot but be instructive and improving; and many successful machinists, artisans, and others have gratified us with the voluntary assurance that their progress in their chosen trade or profession has been very largely owing to the habitual study of the SCIENTIFIC AMERICAN.

But it is not to the mechanic only that a subscription to the SCIENTIFIC AMERICAN will be acceptable and useful. To the farmer—young or old—its pages are full of suggestions and instruction; and no better or more pleasing present for its cost could be made to a wide-awake son of the soil. This not only for the wide range of entertaining and instructive scientific matter it presents, but also for the information it furnishes in regard to improvements in farming machines and implements, and still more in regard to the handling and care of them. To be a successful farmer to-day, a man needs almost to be a machinist as well.

Not less appropriate is the SCIENTIFIC AMERICAN as a holiday gift to the doctor, lawyer, minister, or other professional man. Each and all of these have to do mainly with the great army of producers, of whose thoughts, labors, interests, etc., this paper is an exponent; and their success in their profession cannot but be furthered by such a knowledge of the world their clients live in, as our paper is calculated to furnish.

Do you contemplate a holiday gift to your pastor? Consider whether a present which will break the routine of his professional reading, which will show him, from week to week, what the men who deal with the physical are attempting and achieving, how they regard the great question of force and life, and what is doing in the world of Science and scientific speculation: whether such a gift will not prove at once useful and suggestive to him, a help in social intercourse, a means of diversion and of instructive recreation.

Is it a gift for the village schoolmaster that you are seeking? A copy of the SCIENTIFIC AMERICAN will give him a weekly respite from the domination of text books, tell him much that the intelligent patrons of the school are interested

in, and furnish an abundant store of information with regard to the world's activities, the discoveries of Science, the masterpieces of inventive genius, and a thousand things, not only available for breaking the monotony of school studies and brightening the wits of the children, but directly useful to him in increasing his range of knowledge and widening his views of man and nature.

Is it a bright student you think of favoring? The annual volumes of the SCIENTIFIC AMERICAN furnish instructive matter equal to several books of corresponding cost, besides a multitude of engravings, illustrating not only the best inventions, but the more important feats of engineering and construction, new discoveries in chemistry, electricity, and physical science, figures of many new and remarkable plants and animals, portraits of eminent men, views of the world's great workshops, and scores of other interesting scenes and objects. The subjects discussed and described, unlike those of his text book, are subjects of current interest and significance. They open to him an inviting entrance to the living world of human thought and action, enliven his interest in what is useful and instructive, and tend to create in him a becoming respect for the dignity and honor of labor. And its influence is cumulative. The pleasure and profit of the gift do not pass with the holiday season, but abide throughout the year, bringing, at the least, fifty-two reminders of the giver's thoughtfulness and kindly consideration.

What is true in regard to the fitness of the SCIENTIFIC AMERICAN (and of the SCIENTIFIC AMERICAN SUPPLEMENT as well) as a cheap, appropriate, and useful holiday gift to the classes we have named, is equally true with respect to many others. Is there no Association, Society, Reading Room, Library, Lyceum, Lodge, Club, or Institution, in your vicinity, whose prosperity you desire to promote? Probably nothing that you could do would be so highly appreciated by the members as the gift of a year's numbers of THE SCIENTIFIC AMERICAN and SCIENTIFIC AMERICAN SUPPLEMENT. These two publications, costing only \$7.00, will furnish fresh and useful reading matter throughout the year, equal in amount to eight thousand ordinary book pages.

SCIENTIFIC AND PRACTICAL INFORMATION.

RUSSIA AND THE CENTENNIAL.

A curious misunderstanding, it now appears, has existed throughout the country relative to the attitude of Russia regarding the Centennial. Her neglect to apply for space, and to accept the official invitation of our government to contribute to the Exposition, has been a matter both of surprise and regret, since the friendship existing between the two countries has never been impaired, and the non-participation of the empire has been construed in the light of an intended slight. The news, therefore, that Russia has not only recently officially applied for space through her representative in Washington, but has asked for double the area allowed her, will be received with general satisfaction. The Russian journals promise a magnificent display of national productions, which will far exceed anything hitherto contributed by Russia to any of the great expositions heretofore held in Europe.

REMARKABLE FEAT IN SAW MAKING.

At the works of Messrs. Emerson, Ford & Co., Beaver Falls, Pa., on November 11, a solid toothed circular saw, with 40 teeth, of No. 5 gage at the center, and No. 6 at the rim, was finished complete, ready for market, in the short period of 7 hours and 45 minutes. The saw was on the anvil (being flattened, smithed, hammered, and blocked) 4 hours and 55 minutes. The hammer strokes were counted, and aggregated 12,764. The balance of the time, 2 hours and 50 minutes, was occupied in drilling, toothing, grinding, hardening, tempering, and cooling after it was tempered. The teeth were ground into shape after they were cut, and the saw was ground after smithing, then again after being hammered and before it was polished and stamped. Total amount of labor expended, including that of helpers, was 12 hours and 40 minutes. The saw was of high temper, and required rather more than an average amount of smithing, as 8,523 blows were expended in this laborious operation alone.

AN IMPROVED METHOD OF ETCHING COPPER AND STEEL.

In overlooking the recent handbooks, encyclopedias, technological dictionaries, and journals, many directions for etching metals, especially steel and copper, are found. It is a pity, however, that most of these prescriptions only very imperfectly fulfill the purpose intended, while some of them are even utterly impracticable. Some modern industrial establishments in Germany, especially the Metallurgical Museum of Nuremberg, have undertaken the task of submitting the processes proposed by the books to practical tests, in order to abolish many of them, which, like a chronic disease, are carried from generation to generation, by being copied in good faith in the handbooks and encyclopedias; and it is expected that only very few of them will stand this severe ordeal.

Rudolf Wagner, editor of the "Annual Chemical Technological Report" (*Jahrbuch des chemischen Technologie*), mentions in a recent German industrial journal that he found that solutions of bromine and bromine compounds were most excellent for the etching of steel. He uses 1 part of bromine to 100 of water; and in case he wished to avoid the vapor of this volatile material, which may injure delicate objects around, he prefers a solution of 1 part of bromide of mercury in 30 parts of water. For etching copper, he recommended a solution of bromine in hydrochloric acid, as preferable above all other agents known.

IMPROVED FLOODWAY FOR WAREHOUSES.

In the accompanying engravings we illustrate still another of the useful inventions of Mr. John H. Morrell, several of which, of similar nature to that below described, have already appeared in our recent issues. The present device is intended to supply a means of quick discharge from the sinks or reservoirs of a building to the drain pipe, and is so provided with valves that no foul air from the sewer can rise back into the house. In case of fire breaking out in the lower stories, the smoke ascending the main sewer pipe will be prevented by the invention from escaping into the upper rooms through the reservoirs. All draft through said pipe is also checked at the reservoir at each floor. We also represent a modification of the device, showing its adaptation to street sewers, both for preventing the entrance of solid material which would choke the drains, and the reflux of foul gases to poison the air in the vicinity.

The bottom of the sink or floodway reservoir, as shown in Fig. 1, is set inclined so as to cause the hinged valve, A, to rest in a closed position until such time as water may enter in sufficient quantity to lift the valve from its seat. The water then escapes, after which the valve instantly falls back to its former position, thus effectually preventing the return of foul gas. B is a wire netting or grating set across the pan so as to keep floating debris from choking the valves or pipes.

In case where it is desirable to carry the drain pipes through the walls of a building or underground, a valve of similar construction is used, inclosed in a box as represented in Fig. 2.

The sewer floodway is shown in section in Fig. 3, and is applied to a sewer opening, such as is ordinarily made at street corners. Just beneath the opening the box connecting with a pipe, C, leading to the sewer, is set. This box is divided into two compartments by an inclined partition, in which the valve, connected similarly to that before described, is hinged. In front of the valve aperture is a movable grating, E, which serves as a strainer. There is also a movable pan, F, surmounted by another grating, G. The pan, which can easily be taken out, allows of the removal of collected obstructions, which are stopped by the inner gratings, and thus admits of the quick cleansing of the floodway. The invention is simple, and could probably be cheaply constructed. Its use might prove an important sanitary precaution in localities where the sewer arrangements are defective in means for preventing escape of gas.

Patented through the Scientific American Patent Agency, October 5, 1875. For further information address the inventor, at Morrell's Storage and Safe Deposit Buildings, corner of Fourth avenue and 32d street, New York city.

The Death of the Vice President.

Vice President Henry Wilson died on the morning of the 22d of November, of a third and fatal attack of apoplexy. The first stroke of the disease occurred some two years ago, and a second attack quite recently had prostrated him and aroused serious fears for his life. From the last, however, he appeared to be recovering when the fatal visitation came and resulted in almost instant and painless death.

Like many of the men whose names have become famous, and who have occupied the most exalted positions in the nation during the last decade, Mr. Wilson arose from the humblest position in life. His origin was not only in utter poverty but almost in vagrancy, and at barely ten years of age he was sent forth from the mere hut in which his parents dwelt to become a farm drudge. For eleven years he labored at his apprenticeship, employing every spare hour at hard study from such books as he could borrow in the vicinity, or at his tasks during the winter months of district schooling. When his apprenticeship had concluded, he obtained small wages, and the money he scrupulously saved; and as was common with Massachusetts boys in those days, he looked forward to emigration to another part of the State, where a trade might be learned, from which a better income could be gained.

In course of time he journeyed to Natick and there engaged as a shoemaker. In three years, he made seven thousand pairs of shoes and saved seven hundred dollars, which sum he determined to devote to the acquisition of a good education. He had already entered an academy when the failure

of the person in whose hands his earnings were deposited swept all away. Nothing daunted, young Wilson relinquished his long cherished plans and went back to his trade, working on his own account. He prospered so well that in 1840, after six years labor, he owned his shop and the land on which it stood, besides a handsome residence in the main street of the town. It was during the year above mentioned that he made his first appearance in politics, by warmly advocating the election of General Harrison for the Presidency,

Fig. 1

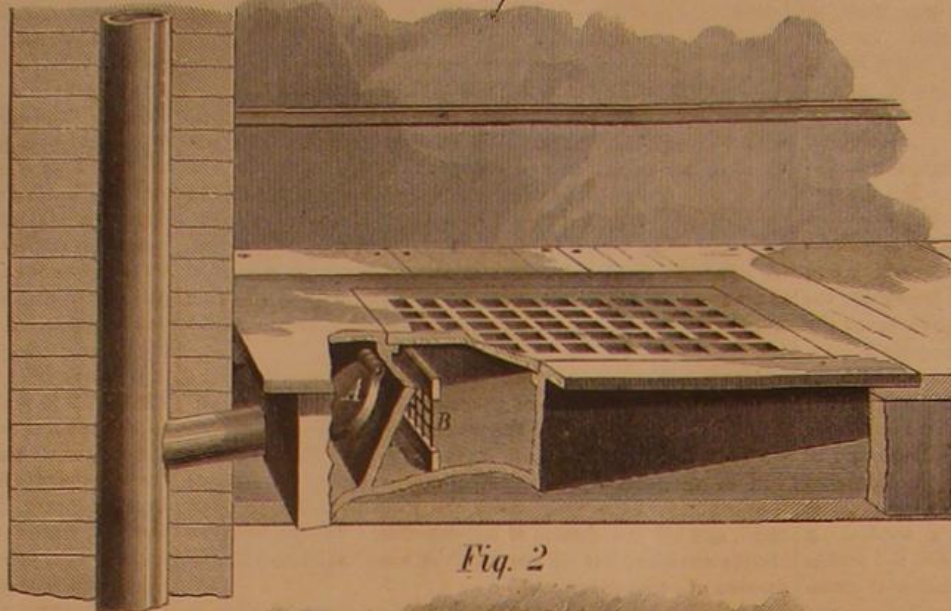
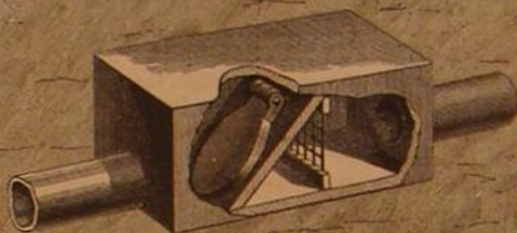


Fig. 2



MORRELL'S FLOODWAY FOR WAREHOUSES.

a course which resulted in his being chosen to the Legislature of Massachusetts from Natick. Detailed reference to his political career, which extended from the cobbler's bench to the second position in the gift of the nation, is without our province. After repeatedly holding office in his native State, he was elected to the senate in 1855 and continued

Railway Tunnel under the London Docks.

The works on the East London Railway, by which the line will be extended from the present terminus at Wapping to the Liverpool street station of the Great Eastern Company, are now rapidly approaching completion, and it is expected that the extension line will shortly be opened for traffic, when there will be through communication between Liverpool street and New Cross, where the line forms a junction with the London and Brighton and the Southeastern lines. The most formidable engineering portion of the works is the tunnel under the eastern basin of the London Docks, which has just been completed. The water communication between one side of the basin is restored, and vessels of large tonnage may now be seen berthed in the basin immediately over the submarine railway which has been formed. Operations were carried on by means of coffer dams and dredging trenches in the bottom of the dock until the London clay was reached. The driving of the piles and the construction of the walls of the coffer dams was one of the most formidable portions of the work. The arches of the tunnel are of the ordinary horseshoe shape, built with seven rings of brick, and are surrounded with three feet of puddled clay. About two thirds of the Shadwell station are already completed, and the covered way northwards, in continuation, is also nearly all finished to about 50 feet north of Commercial Road. The retaining walls for the Whitechapel station are also nearly finished, and the station itself will soon be completed. The line continues from Whitechapel station to its junction with the Great Eastern line at Brick Lane, and the works at this point, which are comparatively light, are actively proceeding. The whole of the works have been designed by Sir John Hawkshaw, and are being carried out by Mr. Hunt, the resident engineer. The estimated cost of the works is set down at \$2,500,000 per mile.

Education of the Flea.

Mr. Bertolotto, the well known educator of the flea, is now in New York exhibiting his curious success in this line. The insects he employs appear to be the species of flea common to dogs. The first lesson, he says, is to put the insects in a small circular glass box, where, by jumping and knocking their heads against the glass for a day or two, the idea is finally beaten into them that it is useless to jump; and during the remainder of their natural lives, to wit, about eight months, they are content to crawl.

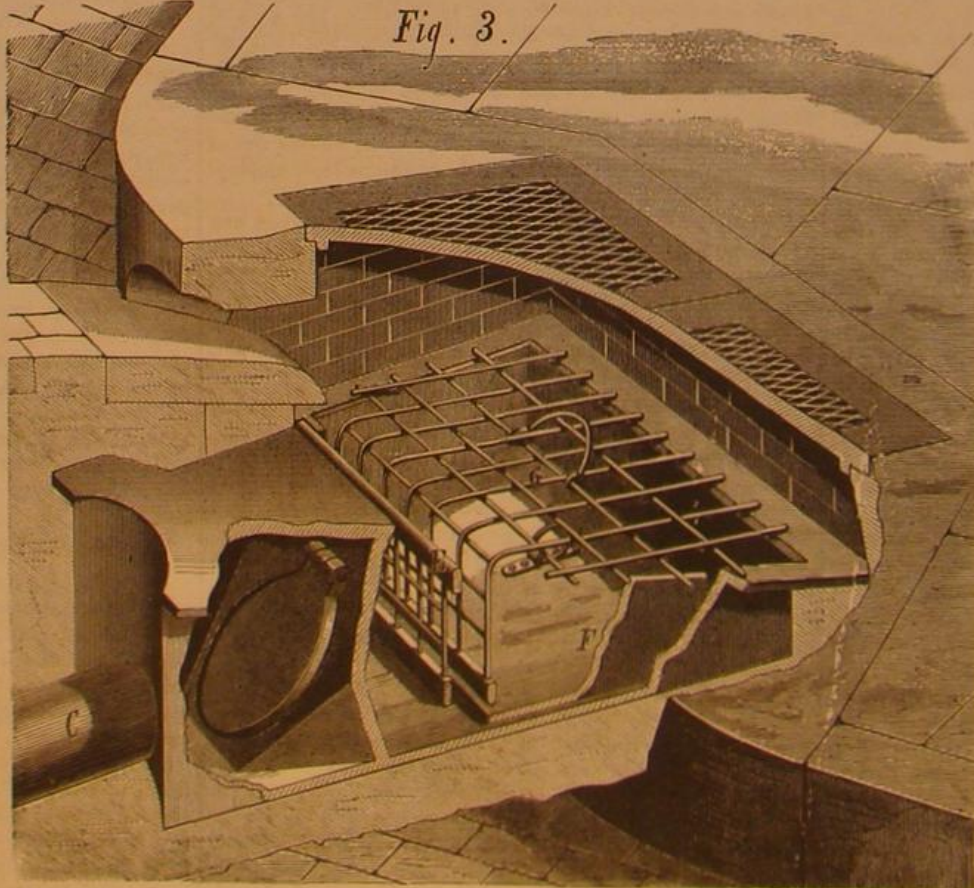
Having corrected their intellects in regard to jumping, the instructor now fastens a delicate pair of wire nippers to the middle part of the flea's body; to the nippers any desired form of miniature vehicle, such as a wheelbarrow, a car, a wagon, etc., is attached, and the flea thus harnessed trots away with the load, to the great amusement of the looker-on. The professor harnesses his insect pupils into a great variety of other positions, and makes them perform many curious duties, such as the operation of a fortune-telling wheel, orchestra playing, racing, etc. They are allowed to feed twice daily upon the instructor's arm. It remains for Mr. Darwin and his compeers to determine what effect this system of insect education is likely to have upon the habits and development of future broods.

Cold Bands in the Obscure Portion of the Spectrum.

When a thermo-electric battery is moved along in front of the part of the screen where is shown the ultra-red portion of the solar spectrum, a succession of thermic minima are noticeable, which may be called cold lines or bands, by analogy with the black rays of the luminous spectrum. The spectra from artificial sources, such as from incandescent lime, do not exhibit this phenomenon; but M. Desains has lately succeeded in developing it by causing the radiations to traverse a thickness of 0.4 inch of water.

M. Desains, from his investigations, logically concludes that the cold lines are due to atmospheric vapor of water. The position of the principal ones, measured from the extreme end, is found to be so near the position of the solar lines that the difference is almost imperceptible. For four of the former lines in an artificial spectrum, the angular distances 19° 8', 30° 6', 39° 5', and 52° 8' are given, while the solar spectrum gives cold lines at 19° 1', 29° 41', and 50°. We look for further information as to the results of M. Desains' experiments.

Fig. 3.



MORRELL'S SEWER FLOODWAY.

therein until he was elected to the Vice Presidency. His record in the cause of emancipation is a most noble one, and the mere history of the great reforms to which he gave undeviating toil would fill a volume.

Mr. Wilson was born in February 16, 1812. The autopsy of his remains shows, in addition to the effects of the malady which resulted in his death, a diseased condition of many vital portions, which probably would materially have shortened his life had the apoplectic stroke not terminated fatally.

THE LITTLE GIANT STEAM ENGINE.

Another motor, designed especially to meet the requirements of those who need light power for manufacturing of other purposes, is illustrated in the engravings given herewith. It is curious to remark that a few years ago there was almost a dearth of motors of this description, and calls for them arose from scores of trades and from amateur workshops all over the country. At the present time, the mechanic finds the lack well filled, and he may take his choice among motors driven by steam, by water, by hot air, by oil, by gas, and by electricity, from any one of which he may obtain power, generally under 5 horse, or just sufficient for his particular want, from the driving of a sewing machine up to the running of the machine tools of a moderate-sized workshop.

The engine described below is a simple horizontal machine, presenting nothing intrinsically novel in its construction, connected, however, with a boiler especially adapted for it, and well suited for the economical supply of the small amount of steam required. The feature which will, above others, commend the apparatus, in its entirety, to steam users, will be its very low cost, as we know of no other efficient engine and boiler of one horse power sold at the price of one hundred and fifty dollars.

The shape of the boiler, which occupies about as much floor space as a small stove, will be understood from Fig. 1, and from the external casing removed in Fig. 2. The body, B, is made of lap-welded tubing, 10 inches in diameter, and is closed below with a cast iron cap, D, and surmounted above by the head, A. Twenty-nine water tubes, C, projecting into the fire space, are expanded into the portion, B. These are each 15 inches in length and extend upward to a point just below the water line. The couplings, E and F, are for connecting the feed pipes and the three smaller couplings, at the upper part of the boiler, serve for the attachment of the gage cocks. The outside dimensions of the one horse boiler are: Height 3 feet 4 inches, and diameter 18 inches. The diameter of the engine cylinder is 2½ inches, stroke 4½ inches, and about 300 revolutions per minute are made. Two larger sizes of engine, of two and three horse power respectively, are constructed, with boilers suitably increased in dimensions.

The D of the engine valve is worked by a single eccentric, and the valve rod is flattened so as to spring, thus avoiding the necessity of a joint. The pump is of the locomotive pattern and is driven from the crosshead. The governor is driven by a belt from a pulley beside the eccentric. All the parts are neatly finished and fitted, and the machine, as a whole, is very far from being the mere toy which, at first sight, would seem probable.

In point of safety, the boiler appears to be well constructed. The manufacturer claims that the bursting pressure is some 1,200 lbs. per square inch, and tests every boiler to 300 lbs. before sale. The working pressure runs from 70 to 300 lbs. The consumption of fuel is a scuttle or two of coal per day—no more than that of a small stove. The boiler, in fact, is a stove in itself, and might well serve to warm a shop besides driving the engine.

The manufacturer is Mr. Ward B. Snyder, of 84 Fulton street, New York city, who may be addressed for further particulars.

A MECHANICAL PHOENIX.

The bird of the old mythology which not only endured roasting with complacency, but sprung up fresh, and vigorous, from its ashes immediately after it had suffered cremation, was tame, torpid, and quiescent compared to the idea the latest form of which we herewith illustrate. Searching once in Ewbank's "Hydraulics" for a particular design for

a rotary pump, we found accidentally an engraving of a cylindrical pump, which "consists of two concentric cylinders and drums, the annular space between them forming the pump chamber; but the inner one, instead of revolving, is immovable, being fixed to the sides of the outer one or case. The piston is a rectangular and loose piece of brass or other metal, accurately fitted to occupy and move in the space between the two cylinders. To drive the piston, and at the same time to form a butment between the orifices of the induction and eduction pipes, a third cylinder is employed, to which a revolving motion is imparted by a crank and axle in the usual way. This cylinder is eccentric to the

illustrated by exactly similar drawings, as are set forth in the Belgian patent of A. J. Works, now resident in this city. (This is an admirable comment on the value of the enormously expensive system of examination as to novelty, in which our Patent Office indulges at the expense of the inventor, and which results in delaying the issue of his patent.) But referring to *The Repertory of Arts* for the description of John Trotter's invention, we stumble across an engraving of a rotary engine invented in 1843, by Thomas Cochrane, Earl of Dandonald, which is almost line for line identical with the pump of Trotter (1805), and that of the other mechanic mentioned by Ewbank, and with the engine patented by Works, and afterwards by Myers. Thus up to a recent date the machine had been invented five times and patented four.

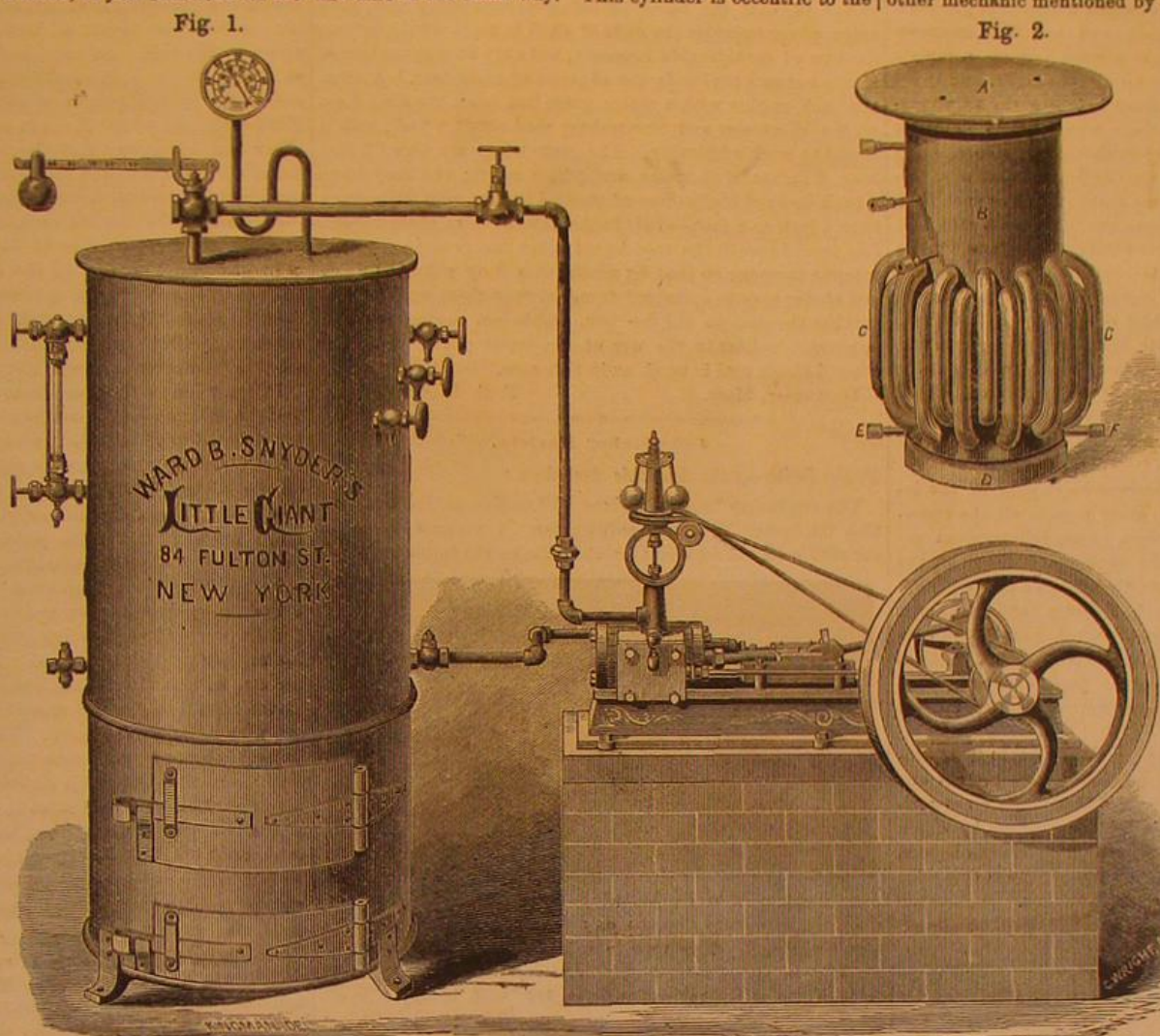
A very little search lays open a new field bristling with rotary engines and pumps of the same design. Our contemporary, the *English Mechanic*, republished our engraving of the Myers engine, and immediately Mr. E. L. Voice writes to point out that it is identical with an English patent issued to a Mr. Newton, in 1864, and Mr. Andrew Leighton shortly afterwards claims that it was an original production of Mr. A. Higginson, of Liverpool.

Mr. Charles E. Moss, of Dublin, Ireland, a correspondent of the *Engineer*, sends a drawing of the same device, which is published in that journal, page 118, August 13, 1875. Mr. Moss does not appear to have heard of any other inventor of the engine or pump, but merely says: "It is superior to anything yet produced. I invented and made a model of it in 1868." Total to date, eight inventors of the same device, six of which (and perhaps more) have received letters patent.

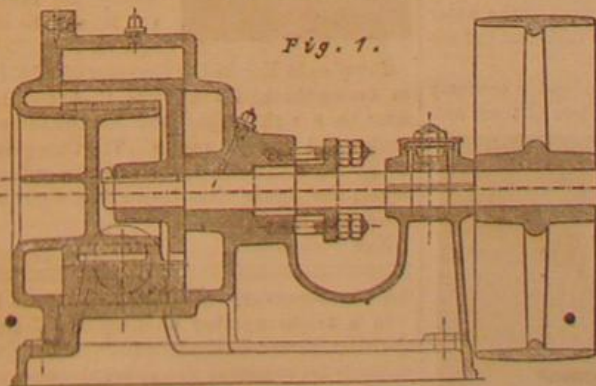
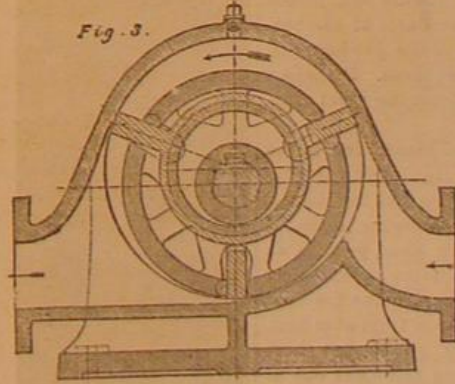
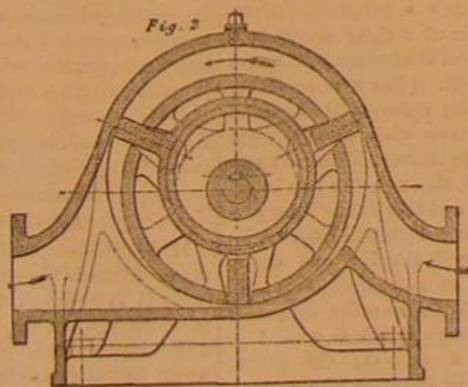
The McFarland rotary pump is substantially the same device, as will be seen on comparing our engraving herewith with the Myers engine alluded to above. It is only fair to Messrs. McFarland, however, to say that, while the other patents are dead, their machine appears to be doing good work and giving general satisfaction. But the comparison of the following description (selected from *Engineering*) with the details of the Trotter engine, given above, will be sufficient to establish its identity.

In our engravings, Figs. 1 and 2 are respectively a longitudinal and transverse section of one of these pumps adapted for lifts up to about 60 feet, while Fig. 3 shows the slightly modified construction adapted for higher lifts. Referring to Figs. 1 and 2, it will be seen that the pump consists of an outer casing, into one side of which a shaft enters eccentrically, this shaft having keyed upon it a drum of such diameter that it just touches the interior of the casing on one side, as shown in the engravings. On the cover which closes the outer casing, on the side opposite to that on which the shaft enters it, is formed a long boss which is concentric with the casing, and which passes into the driving drum already mentioned as being keyed to the shaft. On this boss are mounted three arms which are capable of revolving freely, and which pass out through three slots formed to receive them in the driving drum. The outer extremities of these arms fit against the interior of the casing, as shown in Fig. 2.

It will be seen from the engravings that, as the shaft revolves in the direction of the arrows, the driving drum carries round with it the arms turning on the boss of the cover, and each arm as it passes through the upper third of its revolution sweeps before it a charge of water, filling the upper part of the pump. In the earlier pumps two chambers were used, each being fitted with two arms; as now made, however, but one chamber is employed, this being fitted with three arms as we have explained. It will be seen on reference to Fig. 2 that, owing to these arms only acting through the upper third of their



SNYDER'S LITTLE GIANT STEAM ENGINE



THE McFARLAND ROTARY PUMP.

repertory of Arts, volume IX., second series." Ewbank further states that it was re-invented afterwards by a mechanic who was greatly distressed on finding that he had been anticipated.

A glance at the engraving in Ewbank's work shows that the invention is almost identical with the Myers rotary engine, illustrated on page 308 of our volume XXXI; and Myers obtained an American patent for exactly the same claims,

arms turning on the boss of the cover, and each arm as it passes through the upper third of its revolution sweeps before it a charge of water, filling the upper part of the pump. In the earlier pumps two chambers were used, each being fitted with two arms; as now made, however, but one chamber is employed, this being fitted with three arms as we have explained. It will be seen on reference to Fig. 2 that, owing to these arms only acting through the upper third of their

revolution, the amount of their sliding movement through the driving drum when exposed to the pressure of the water is very small, the chief sliding movement taking place during the remainder of the revolution, when the arms are in equilibrium. The pump thus works with but very little friction, and the flow is very regular.

Correspondence.

The Locomotive.

To the Editor of the Scientific American:

The locomotive has probably attained a degree of simplicity and efficiency which is susceptible of but little improvement. It is true that it does not always possess complete symmetry and just proportion in all of its details, and it yet remains for some fortunate inventor to do for the valve mechanism of the locomotive precisely what Corliss has done for that of the stationary engine: with this difference, however, that the complexity of the Corliss device must be avoided in that of the locomotive, for the reason that the peculiarly rough nature of railroad work demands the utmost simplicity in everything pertaining to its prosecution. The Corliss device (leaving off the "dash pots") would doubtless effect as great a saving of steam in the locomotive as it has done in the stationary engine; but the idea of having eight valves, valve seats, and valve stems (with their connecting rods and studs) to keep in repair, instead of two, is hardly compatible with the present prevailing ideas of railroad men. Such complication will not be admissible in railroad practice (however great the possible saving) until fuel shall have become much more costly than it now is.

Anything differing from the present valve gear of the locomotive, to meet with approval, must possess all the economic qualities of the Corliss device, name, independent exhaust of at least three times the capacity of the inlet, the least possible steam space between the valves and the piston, not more than two valves to each cylinder (and these flat ones, and as accessible as the present single valve), and two valve stems, operated by the present reverse link without diminishing the size of exhaust ports. Such a device would probably find ready acceptance among locomotive makers and railroad men.

The greatest source of waste in locomotives is in their consumption of fuel. Probably not one half (some say not one quarter) of the fuel used is utilized; and inventors are zealously at work upon the problem of devising means by which the gas and sparks may be appropriated. A device has been in use sometime in this vicinity for the purpose; it was first used on the Worcester and Nashua Road, I believe. It consists of a cast iron pan, similar in form to a bed pan, but much larger; it is placed bottom up in the top of the chimney, directly above the exhaust pipe, the inner smoke pipe being so formed as to deflect the smoke and sparks into this pan by the power of the exhaust steam. A large conduit from the opposite sides of the pan conveys the sparks, etc., down the chimney, and thus around the boiler back to the fire box; and a powerful draft is kept up through these conduits while the engine is at work, by the partial vacuum in the fire box caused by the exhaust steam. This apparatus serves an excellent purpose, not only as an economizer of fuel but as a preventer of fires along the line in dry weather. Another device has been applied with considerable success; it was first used, I think, on the Boston and Providence road. It consists of an arch or partial partition in the fire box, placed so as to give an inward direction to the products of combustion, and keep them as long as possible in the fire box, and thus cause a more perfect consumption of them. Perhaps a combination of these two devices would form the great economizer sought.

An important source of waste in the locomotive is the clogging-up of the bottom of the water legs around the fire box and around the lower flues in the barrel of the boiler. Engineers can have no valid excuse for allowing sediment to collect at these points, as it frequently does, to such an extent as not only to render utterly inoperative as generators the lower flues and much valuable surface in the fire box, but to expose these parts to rapid destruction from over heat. Screw plugs and hand holes are usually provided at these points; and one hour devoted to getting sediment out of each engine once a month, or, if the conditions of the water are favorable, once in two months, would be sufficient to keep the boiler free from sediment.

It would doubtless be productive of considerable economy to use three cylinders of equal capacity, C, two of them out-

that direct steam could be used in all three in case of emergency. Such an engine would be extremely steady upon the track, however rapid its motion. This plan would, owing to the central crank, A, bring the center of gravity of an engine rather high. This could, however, be easily remedied by making the boiler with two barrels, B, so that the sweep of the crank would come partially between them. By filling these barrels nearly full of the usual flues, the generating power would be fully as great as that of the single barrel.

I wish that such engineers as have experience with the water grate would give us their opinion of it, as to its economic value, etc. It has always seemed to me that, if properly put in, with the tubes inclining considerably and with screw plugs opposite the ends of each tube, it would be productive of considerable economy, not only as a generator of steam but as a saving in the expense of grate bars. A nine-ton tank engine with a water grate has been running here on the Worcester and Shrewsbury road about a year, and it seems to work admirably. The grate tubes are about 3 feet long, 2 inches in diameter, and $\frac{1}{2}$ inch apart; and they have a back upward inclination of about 4 inches, or a little more than 1 inch to a foot. This inclination renders them accessible from beneath the foot board when the rear door of the ash pan is open; so that by means of a long poker, the ash and cinder may be dislodged from between them without disturbing the coal in the fire box. This last seems to be an important matter in the use of the water grate, especially when Lehigh coal is used, as in this case.

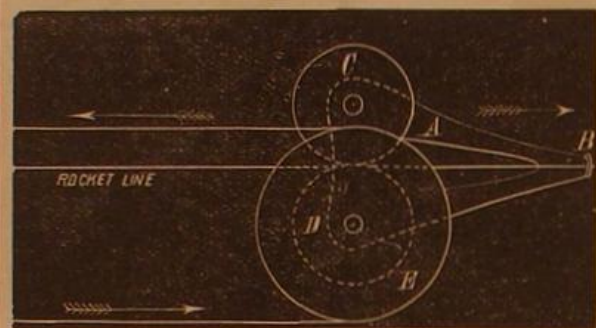
Worcester, Mass.

F. G. WOODWARD.

Life-Saving Devices.

To the Editor of the Scientific American:

The engraving herewith given will suffice to illustrate an idea for saving life from shipwrecks. I propose to run a sheaved rope out on a small rocket line in the following man-



ner: The line is to be placed between two gripping rollers, C and D, which are pivoted on a frame, A, and passed into a guide hole, B. The rope to establish permanent communication is passed over a gripping sheave, E, which is made fast to one of the rollers, and revolves with it on the same pivot, and is of a larger diameter than the rollers. On revolving the sheave by means of the rope, the whole can be made to travel in either direction.

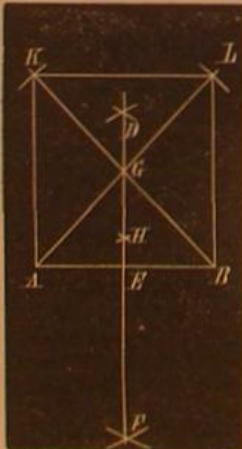
B. FRESE.

Chicago, Ill.

Laying Out a Square.

To the Editor of the Scientific American:

The following is a simpler, quicker, and just as correct a way of laying out a square as that given on page 325 of your current volume.



Proof.—As K B is the diameter of a half circle which may be drawn through the points, B, A, and K, the angle at A must be a right angle, and for the same reason the other angles will be right angles. The triangles, A G B, A G K, etc., being made equal, their corresponding sides must be equal; the figure thus drawn has right angles and equal sides, and is a square.

New York city.

On the Recovery of Silver from Cast Iron Crucibles.

In a recent number of Dingle's *Journal*, two Vienna chemists, named Tavorosky and Priwoznik, describe the new methods for obtaining the silver absorbed by cast iron crucibles used in some mints and other establishments for fusing silver and its alloys. A cast iron crucible can be used 10 to 15 times for fusing silver; then the cracks are so considerable that it must be thrown aside. These crucibles were formerly broken up, and the bottoms and other portions which contain much silver thrown into the very impure mother liquor from the crystallization of sulphate of copper. This liquor is not easily utilized in any other manner; but on putting in the iron, the copper is precipitated, while the iron goes into solution. The cement copper thus prepared, and containing all the silver, along with the graphite, silica, and other insoluble con-

stituents of the cast iron, is treated in the usual manner for the separation of the silver. This process, however, is tedious, and the amount of material to be worked is increased instead of being diminished, for 100 lbs. of cast iron yields about 113 lbs. of cement copper.

The late director of the mint at Vienna, Von Schrötter, proposed a method for overcoming this difficulty. The crucibles are first broken up and then dissolved in dilute sulphuric acid without heat. To avoid the trouble of evaporating a large quantity of water, in order to crystallize the green vitriol, in the first experiment the sulphuric acid was only moderately diluted, and consequently large quantities of anhydrous protosulphate of iron separated, and enveloped the undissolved pieces of iron, protecting them from the action of the acid. As soon, however, as the acid was diluted to 20° B., the iron dissolved rapidly. Where chamber acid can be easily obtained, it would doubtless be the cheapest. Even with acid of 60° B., it is not expensive, and the latter offers the advantage that the heat generated in diluting it helps the reaction and hastens the solution. The iron is dissolved in wooden vessels lined with lead, 12 to 15 feet long, 6 feet wide, and 20 inches deep, with a grating made of laths, about 8 inches from the bottom, on which the pieces of crucible are placed. As the solution becomes more concentrated, it sinks to the bottom, and the iron is continually brought in contact with fresh acid. If the precaution be taken to cover the vessel tightly, the extremely disagreeable smelling gases evolved will not prove a serious disturbance.

In from ten to fourteen days, the acid becomes saturated, and the solution settles and has a concentration of 20° B. By evaporation to 66° B., the green vitriol crystallizes out. The insoluble residue amounts to about 20 per cent. It contains all the silver, silica, graphite, sesquioxide of iron, copper, and small quantities of sulphur and phosphorus. The larger pieces of silver are picked out, and the smaller are obtained by sifting and amalgamating the residue. Only the old slick and the amalgamation residue, which still contains 1.4 per cent silver, are worked over in the silver works.

This process of recovering silver is much more rapid than the method previously in use. It has the advantage that 80 per cent of iron is removed before proceeding to the recovery of the silver, so that the argentiferous material is reduced to one fifth its original weight. The experience of those who have employed it in Vienna show that it is thoroughly practicable, and that the green vitriol produced pays for the labor.

In the Royal-Imperial mint at Vienna, 315 old cast iron crucibles, weighing 115,192 lbs., have been treated in this way producing 405,574 lbs. of commercial sulphate of iron. The weight of the residue was 23,038 lbs. The poorer portion, and the residue from amalgamation, weighing 13,429 lbs., was smelted. Nearly 737 lbs. of silver was obtained, worth 30,143 gulden (about \$15,000), from which the percentage of silver in the cast iron is calculated at 0.64 per cent. The amount of silver in a cast iron crucible depends on the richness of the alloy melted in it; those used for rich alloys of course contain more silver than those in which poor ones are melted. Most of the crucibles worked up so far had been used for the alloy from which the Austrian small change is made, and which contains only 45 to 50 per cent silver. The results obtained with those in which alloys containing 83.5 per cent are fused will, no doubt, be more favorable.

A New Form of Leclanché's Cell.

A new form of Leclanché's cell has been constructed by Dr. Muirhead, in which the carbon and black oxide of manganese are packed in the outer case around a glazed porcelain jar perforated with holes about $\frac{1}{2}$ inch in diameter, the jar containing a zinc plate bent into the form of a cylinder.

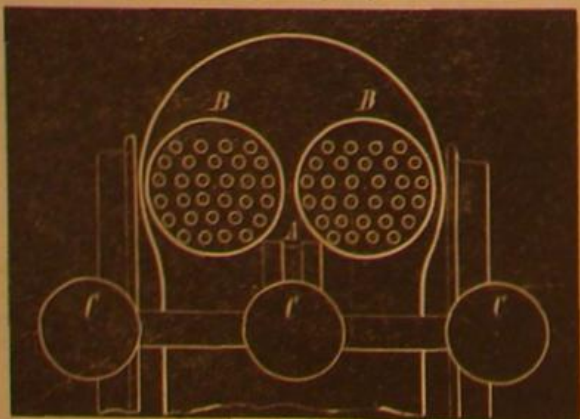
The advantages gained are that a much larger surface of zinc is exposed, and the perforations of the jar are in no danger of being choked up by deposition of chloride of zinc.

A New Theory of the Nebulae.

M. Planté has recently communicated to the French Academy of Sciences the results of some experiments which may lead, it is believed, to a new theory for the circumstances to which are due the spiral forms of many of the nebulae. The experiments consist in the exact reproduction of these forms by the combined action of electricity and magnetism. Two copper electrodes of a battery of 15 elements, being plunged in water acidulated to 1-10 with sulphuric acid, the end of the positive electrode is brought to one pole of the magnet. The cloud of metallic matter carried from the electrode by the current at once assumes in the liquid a gyratory spiral movement, of which the general disposition strongly recalls that of the nebulae. The investigator is proceeding with further experiments in the light of this idea.

"Healthy body, healthy appetite, healthy feelings, though accompanied with mediocrity of talent, unadorned with wit and imagination, and unpolished by learning and science, will outstrip in the race for happiness the splendid irregularities of genius, and the most dazzling success of ambition."—Greville's *Memoirs of George IV.*

MARKET STREET Bridge in Philadelphia was recently totally destroyed by fire. The loss peculiarly amounted to but \$115,000; but a large section of the city was temporarily greatly inconvenienced, owing to the breakage of the gas connections. The Pennsylvania Railroad will shortly erect a temporary bridge for their traffic, which will be replaced by a very costly and handsome structure, probably equal or superior to the Girard avenue bridge which has been illustrated in these columns.



side, connected in the usual way but acting simultaneously and a central one acting with a crank at a right angle to the outside cranks, and exhausting its steam into them through a superheater; but the engine should be so arranged

PRACTICAL MECHANISM.

BY JOSHUA ROSS.

NUMBER XXXVII.

LINING OUT WORK.

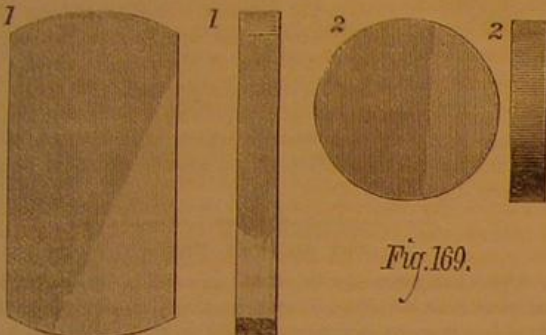
For measuring purposes, the usual inside and outside callipers are employed, in conjunction with a pair of compass callipers, namely, a tool composed of one inside caliper leg and one compass leg, the use of which is to find the true center of either inside or outside work.

For making parallel lines upon shafts or other round work, we have the angle piece, shown in Fig. 168. It is



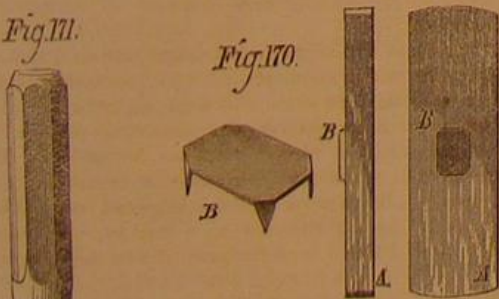
apparent that, if it is placed (as shown) upon a piece of round work, in such position that the edges, A and B (C being the work), will contact with the work, those edges will stand true and parallel with the work, and may therefore be used as a guide whereby to draw the lines.

Our next requisites are termed centers or center pieces, their uses being to stand in holes or between jaws, and to receive center marks or lines. For use on small work, especially in holes that are rough, that is, those which have not yet been cut true, pieces of lead, such as are shown in Fig. 169, are the best, because they may be stretched larger or



compressed smaller, to suit any required size of hole, by a few blows with the hammer, and because the lead will conform itself to the uneven shape of the hole, and will therefore hold fast and not be liable to move; and furthermore, because a few blows will deface any lines which may have been made upon the face of the lead in service upon a previous piece of work. Again, it may be necessary to first mark a center line, and subsequently other lines; and then drawing a wet finger across the old lines on the lead will dull them, while the newly made ones will be bright, and thus remain distinct. For holes that have been trued out, similarly shaped pieces of sheet brass may be used, the form shown in No. 1 being for the larger, and that shown in No. 2 for the smaller sized holes; these brass pieces may be filed up very true, and have a centerpunch mark in their exact center, thus obviating the necessity of finding the center at each time of using.

For use on holes of comparatively large dimensions, that is to say, above 4 inches in diameter, the center piece shown in Fig. 170 is very convenient. A represents a piece of wood, and B, a small piece of tin or sheet iron, having its corners bent up so that they may be driven into the wood and thus made fast in position to receive the center. Such a center is very easily and readily made, and may be used on rough or finished work. If the surface of the work upon which either of these centers is used is flat, the ends of the centers must of course be also flat; and in the case of the last described, a piece of paper, leather, or other material may be inserted in one end to make up any small deficiency in the size. The center punch used for marking out should be as shown in Fig. 171, the object of making its diameter so small toward



the point being that it shall not obstruct a clear view of the line. A heavier centerpunch may of course be employed to increase the size of the centerpunch marks when the same is necessary. The hammer should also be a small one, weighing about $\frac{1}{2}$ of a lb., and having a ball face to efface any centerpunch marks erroneously marked or to be dispensed with, an ordinary hammer being employed to perform any necessary operation other than the simple marking out.

Straight edges and a pair of parallel strips, or winding strips as they are sometimes called, together with a few parallel pieces, will complete the tools necessary for any ordinary marking out. A straight edge about an inch wide and a foot long, made out of saw blade, is an excellent tool, since

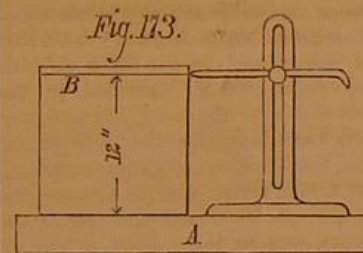
it may, by a little pressure of the fingers, be bent hollow or round to conform to the surface of the work, as is sometimes highly advantageous. Parallel strips are pieces of metal of equal thickness, intended to lift a piece of work from the surface of the table, so that any projecting piece or part will clear and not tilt the work to one side. They need not be made square, but are preferable if the thickness one way is two thirds that of the other way, so that they may be turned on either side as the case may require. Pieces of old piston rings form very good parallel pieces, and are in many instances very easily obtained.

Before proceeding to mark out a piece of work, it should be roughly measured so as to ascertain, before having any work done to it, that it will clean up. The square should also be applied to see if it is out of square, and thus to find out if it is necessary to accommodate the marking out to any particular part that may be scant of material (or stock, as it is often termed). The surface of the work should also be examined; so that, if any part of it is defective, the marking off can be performed with a view to remedying the error, whether of excess or defect. Now let us mark off a block, say of 12 inches cube, and we shall find that we must not mark it out all over until one of the faces has been planed up. Suppose, for instance, we mark it out as shown in Fig. 172. The inside lines on faces A and B are the marking-off



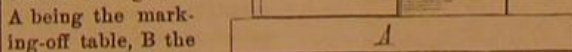
lines: If, then, we cut off the metal to the lines on A, we shall have removed the lines on B, and vice versa; and there is no manner or means of avoiding the difficulty, save as follows: We may mark off one face and let the block be cut down to the lines, before marking the other face; or we may have a surfacing cut taken off one face, and then perform the whole of the marking off at one operation. The latter plan is preferable, because it gives us one true face to work from in marking off, and obviates the necessity of having to prevent the rocking of the work upon the marking-off table, by the insertion of wedges, which is otherwise very commonly requisite. It is preferable, then, upon all work easily handled and chucked, and in which the lining off must be performed on more than one face, to surface one face before performing the marking out; and supposing our block to have one face so surfaced, we will proceed.

We first well chalk the surface of the work all round about where we expect the lines to come, which is done to make the lines show plainly; we then place the work upon the table with the surfaced face downward; and placing a

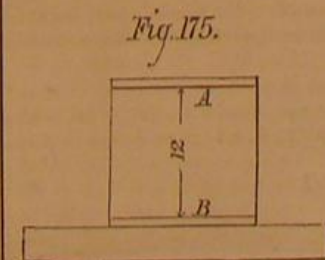


rule alongside of it, we set the scriber so as to take off the necessary amount from the top, as shown in Fig. 173 (A being the plate), and mark the line, B, around all four faces of the work. We then turn the work on the plate

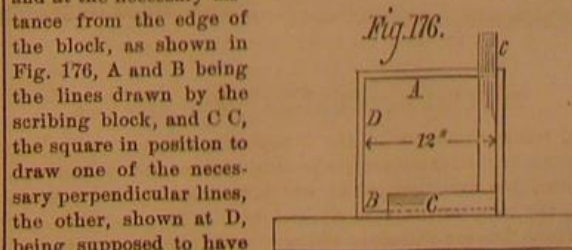
so that the true face stands perpendicularly, setting it true by wedging it, so that, a square being placed with the back to the face of the table and the blade against the surfaced face of the work, the latter will stand true with the square blade, as shown in Fig. 174. A being the marking-off table, B the square, and C the surfaced face of the work. We then (with the scribing block)



mark, across the surfaced face of the work, two lines, 12 inches apart and of equal distance from the top and bottom faces of the work, as shown in Fig. 175, at A and B. Our next operation is to mark off, on the surfaced face of the work, two more lines, standing at right angles to the lines, A and B, in the above figure; so that the surfaced face



will have four lines upon it. These last two lines we mark without moving the work, by placing a square with its back resting upon the table, the square blade standing vertically and at the necessary distance from the edge of the block, as shown in Fig. 176, A and B being the lines drawn by the scribing block, and C C, the square in position to draw one of the necessary perpendicular lines, the other, shown at D, being supposed to have been marked from the square while it was turned around. Here, then, we have the lines for four of the faces, marked upon a face already sur-



faced to the size, thus disposing of five out of the six faces; and since the line for the sixth face stands diametrically opposite to the surfaced face, the latter has only to be kept down evenly upon the table of the planer to ensure the sixth face being cut true: after which, and when each of the remaining four sides is chucked to be operated on, we have a true face to place next to the angle plate, and a true one against which to apply the square to test if the work is held true. Thus we find that the surfaced face of the work, when used with the face of the marking-off table and the face of the planer table, becomes a gage by which (with the aid of the square) all the other faces may be marked and cut true.

It is obvious that, had either one of the faces of the work been faulty, we might have taken off it as much metal as possible, leaving only sufficient to clean up the face diametrically opposite. It often happens that an apparently faulty face shows to more advantage by having a cut taken off it; especially is this the case in iron castings, in which there may be more air holes beneath than upon the surface, which defect may be sufficiently serious to spoil the work. It is therefore preferable to take the surfacing cut off the defective face, so that the degree of defect may be discovered before even the marking out is performed.

The lines being marked, our next procedure is to make light centerpunch marks at short intervals along them, so that, if the lines become obliterated through handling the work, the centerpunch dots will serve instead. These dots should be marked very true with the lines, otherwise they destroy the truth of the marking; because the machine operator, in setting the work in the machine, is usually guided by the dots.

By this method, we may mark off any body whose outline is composed of straight lines, and whose diametrically opposite faces are parallel, no matter what the length, breadth, and thickness of the body may be. It is not, however, at all times desirable to perform all the marking out at one operation. Suppose, for example, our work had been a piece of metal 1 foot square and $\frac{1}{2}$ of an inch thick: were we to face off one of the broad faces before marking off, we should find it very difficult to set our work upon the rough edge, and set it true to the square, as shown in Fig. 174; whereas, were we to face off one of the edges first, we have $\frac{1}{2}$ of an inch only against which to try the square when setting the planed edge perpendicular. In such a case, therefore, it is best not to mark off the edges until the body of the work is cut to the required thickness.

Locomotive Steam Saver.

Mr. James Metcalfe, locomotive foreman at the Manchester and Milford workshops, Aberystwyth, some time ago conceived the idea of being able to utilize the exhaust steam, not by condensation as in some classes of engines, but by carrying a portion of it along a duct direct from the blast pipe to the injector, and so forcing it into the boiler again. The question was not, of course, as to the advisability of accomplishing this desirable end, but as to the possibility of doing so. After a careful investigation, Mr. Hamer, the manager, gave Mr. Metcalfe permission to try the experiment, and an engine was fitted with the new apparatus, which we will now attempt to describe in general terms. The two parts of the engine brought into requisition are the blast pipe, whence the exhausted steam now escapes after it has done its work, and the injector which, by the aid of steam forces cold water into the boiler. A duct inserted at the base of the blast pipe catches a portion of the steam and conveys it to the injector, where it is introduced below the point where the steam at present catches the cold water. The water and the exhaust steam are forced together into the boiler at the same time. When the boiler is filled, the exhaust steam is conveyed through an extended overflow pipe into a hot water tank, and thence it is reconveyed at boiling point through the same tube back into the boiler along with the exhaust steam and cold water. The invention has been at work for three months on the Manchester and Milford Railway with most satisfactory results. The saving per annum on each engine is estimated at no less than \$500, which represents an annual possible gain to some of the largest companies of more than \$500,000 a year.

Removal of Stains with Magnesia.

Carbonate of magnesia—magnesia that has been previously calcined is best—is dried in an oven and mixed with sufficient benzine to form a soft friable mass. In this state it is put into a wide-mouthed glass bottle, well stoppered, and kept for use. It is spread pretty thickly over the stains, and rubbed well to and fro with the tip of the finger. The small rolls of earthy matter so formed are brushed off, and more magnesia is laid on and left until the benzine has evaporated entirely. Materials that will bear washing are then cleaned with water; on silks, alcohol or benzine should be used instead. The process may be applied to textile fabrics of every description, except those containing very much wool, to which the magnesia adheres very tenaciously. It may also be used for stains, old or new, on all sorts of woods, ivory, parchment, etc., without risk or injury. Ordinary writing ink is not affected by it, but letterpress ink quickly dissolves, owing to the absorption of the fatty matter in the ink.

The Allied Attack upon Sebastopol.

Mr. E. J. Reed says: "A faint idea may be formed, perhaps, of the extent to which the place was fired upon when I say that from a tax of 6d. per cwt., which the government levied upon the proceeds of the sales of old iron, shot, and shell, picked up and sold by the people a sum of nearly \$75,000 was realized."

IMPROVED LEVER POWER.

Farmers and others who contemplate clearing land during the coming spring, or before the cold weather permanently sets in, will find in the apparatus here illustrated a simple lever power well adapted for pulling stumps. It is also well suited for raising heavy weights of any description, and is easily operated by one person.

A is the main lever which is attached to the stump or weight as shown. Beneath it is placed the adjustable fulcrum, B, and one end is provided with a link in which the hook, C, Fig. 2 of a hand lever, D, is inserted. The front end of said hand lever is provided with recesses, which are strengthened by side shoulders to rest and turn easily on the cross pin adjusted in the upright standard or post. The hand lever may be placed at different heights, as desired, by inserting the cross pin through higher or lower holes in the standard. The latter is made of two posts that are connected at top and bottom, and braced by side braces, as shown. By bearing down on the hand lever, the main lever is caused to raise the weight. The hook, it will be observed, is pivoted to the hand lever below the recesses for the pins, so that effective work may be accomplished whether the standard is in an inclined or upright position. When used as a lifting machine, single or compound power may be used at option. We are informed that the apparatus has been practically tested with success.

Patented through the Scientific American Patent Agency, September 28, 1875. Further information may be obtained by addressing the inventor, Mr. William F. Hale, Jamestown, N. Y.

of wood, a tip formed of a metal socket with a steel diaphragm and wood filling is added. The ends of shafts are very frequently broken without any injury to the remaining portion, in which case a tip, made as described and shown in Fig. 4, could easily be attached. The iron socket as seen embraces the stump for some distance, and then the latter is dovetailed into the filling of the socket, rendering the shaft complete and strong.

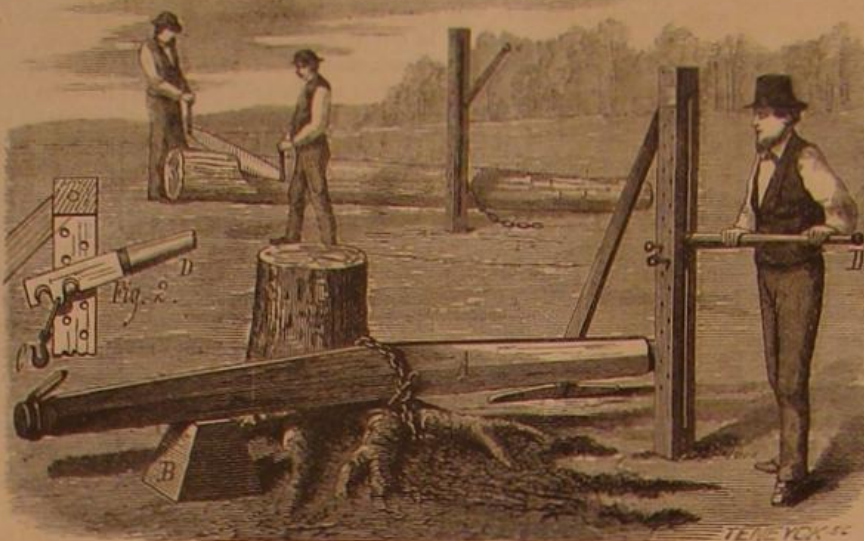
The invention is one of much practical utility; and it has already, we are informed, been adopted by many of the first carriage makers in the country, among them Messrs. Brew-

ster & Co., of Broome street, in this city.

It is the subject of several patents, which cover the various improvements as the same have suggested themselves and been added by the inventor.

For further information address the manufacturers, Messrs. Topliff & Ely, Elyria, Ohio.

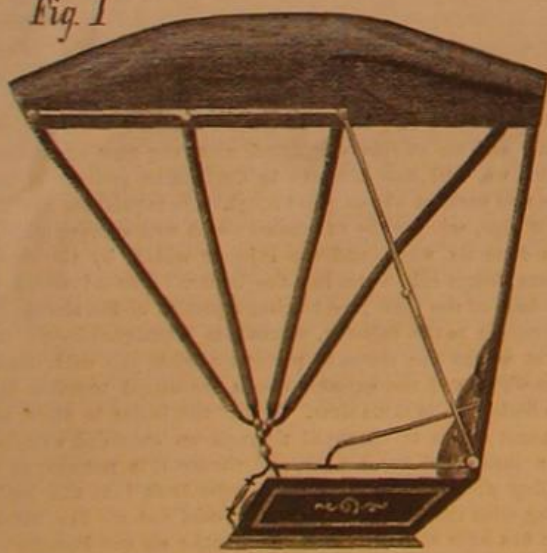
HALE'S IMPROVED LEVER POWER.



IMPROVED TUBULAR BOW SOCKET.

We illustrate in the engravings given herewith two buggy tops—one (Fig. 1) supported by old-fashioned wooden bows covered with leather; the other (Fig. 2) sustained by the new metallic tubular bow sockets, which are illustrated in detail in Fig. 3. The contrast, showing as it does the superiority of the new invention in point of lightness and grace of appearance, is striking. The artist has depicted the rear bow in Fig. 1, as bent or sprung rearward, a condition which often occurs and terminates in a break, owing to such bow being forced to sustain a large portion of the strain due to the weight, etc., of the top, when the wood of which it is composed is inadequate to resist the same. That this difficulty cannot well occur with the new bow will be clearly understood from the description of its construction.

Fig. 1



WOODEN BOW SOCKET.

The sockets consist of long tubes made of a tough quality of sheet iron which extend up on the side of the top, a little higher than the side curtains. In the lower ends of these tubes are welded pieces of the best Norway iron fitted in a neat and workmanlike manner. In the back tube there is also welded a thin strip of steel, A, in the section, Fig. 3, which is tapered similar to the bow and extends upward for about twenty-four inches. The object of this is to strengthen the bow and prevent it becoming marred, bent, or deformed when it strikes the rest or prop when turned down, the edge of the steel receiving the full force of a blow.

The tubes are then nicely japanned and finished so as to resemble the finest patent leather. This work is done with great care so that the japan will not crack off. The sockets are then filled with hard wood, B, Fig. 3, turned to fit and continued to within 8 inches of the top, leaving room enough to make a strong finish.

Mr. J. N. Topliff, the inventor, has exhibited several of these bows to us, which he quite severely tested in our presence. They stood the test of a man exerting his full strength on a single bow across his knee, without breaking; nor does a sharp hammering on the exterior of the material appear to have any injurious effect. The bows are lighter in weight than the old leather-covered devices.

In our fourth figure is represented the application of the same invention to shafts. In lieu of a shaft made entirely

of water, as shown in the illustration. Twenty pounds of steam will thus convert 80 pounds of water into a cloud-like mist, the actual weight of which, issuing from a jet of the above size, amounts to about $\frac{1}{4}$ ton in twenty-four hours. These jets are placed in the sides of the chambers about 40 feet apart. They are supplied with water from the tank above, while the steam is taken from the steam pipes already existing between the chambers, or, better, from smaller ones

put in their places.

At the works of the Lawes Chemical Manure Company, the saving in coal amounts to about two thirds of the quantity formerly burned. It is generally believed that a moderate temperature favors the formation of sulphuric acid, but Mr. Sprengel has found that, the stronger the frost, the better was the condition and the yield of the chambers.

The spray acid has been produced with 6 $\frac{1}{2}$ per cent less pyrites and with 14 $\frac{1}{2}$ per cent less niter than the steam acid which was made from the same material during the two years preceding the application of the spray. These numbers, moreover, refer to the yield of chambers, without Gay-Lussac and Glover towers.

In factories where these towers are in use the saving will be probably one third less, at least as far as steam is concerned. But as it is believed that a large proportion of nitrous acid becomes destroyed in the Glover tower by the heat of the acid from the kilns (that is, broken up into oxygen and nitrogen), Mr. Sprengel thinks that, for the sake of coolness, this acid is better distributed in the chambers as spray. The Glover tower, of course, will still serve as an admirable instrument for concentrating chamber acid.

At the works of the Lawes Company the construction of the apparatus came to about \$50 per chamber, while the saving in steam, acid, niter, and labor during three months amounted to \$1 25 per ton of acid of 1.6 specific gravity, made from pyrites.

No doubt different localities, different care, and different prices will lead to different results. But even if the savings should elsewhere be considerably less, the result will still appear acceptable, considering the simple and inexpensive means by which it has been attained, and the large consumption of the article which it helps to cheapen.—*Chemical News.*

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Fig. 4



TOPLIFF'S TUBULAR BOW SHAFTS.

of water, as shown in the illustration. Twenty pounds of steam will thus convert 80 pounds of water into a cloud-like mist, the actual weight of which, issuing from a jet of the above size, amounts to about $\frac{1}{4}$ ton in twenty-four hours. These jets are placed in the sides of the chambers about 40 feet apart. They are supplied with water from the tank above, while the steam is taken from the steam pipes already existing between the chambers, or, better, from smaller ones

put in their places.

At the works of the Lawes Chemical Manure Company, the saving in coal amounts to about two thirds of the quantity formerly burned. It is generally believed that a moderate temperature favors the formation of sulphuric acid, but Mr. Sprengel has found that, the stronger the frost, the better was the condition and the yield of the chambers.

The spray acid has been produced with 6 $\frac{1}{2}$ per cent less pyrites and with 14 $\frac{1}{2}$ per cent less niter than the steam acid which was made from the same material during the two years preceding the application of the spray. These numbers, moreover, refer to the yield of chambers, without Gay-Lussac and Glover towers.

In factories where these towers are in use the saving will be probably one third less, at least as far as steam is concerned. But as it is believed that a large proportion of nitrous acid becomes destroyed in the Glover tower by the heat of the acid from the kilns (that is, broken up into oxygen and nitrogen), Mr. Sprengel thinks that, for the sake of coolness, this acid is better distributed in the chambers as spray. The Glover tower, of course, will still serve as an admirable instrument for concentrating chamber acid.

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The Siege of Paris.

About two years ago there was erected in this city a large circular iron building, known as the Colosseum, one hundred feet or more in diameter, and nearly the same in height, for the special exhibition of panoramic pictures. At the

Fig. 2

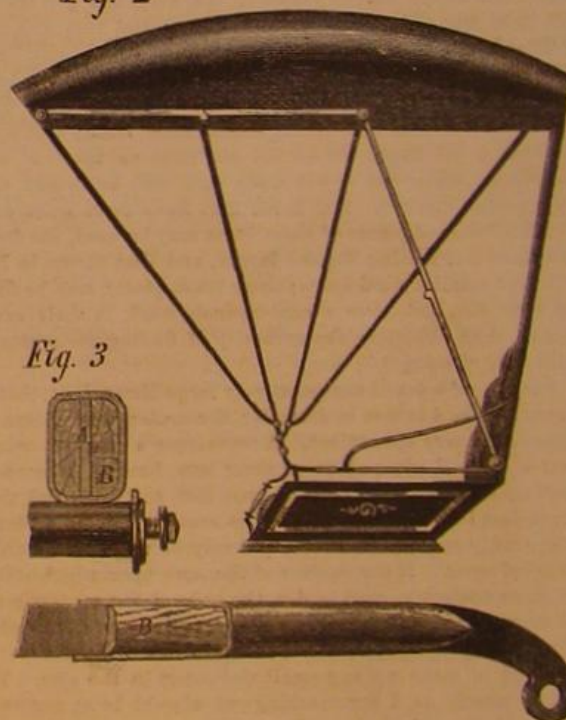
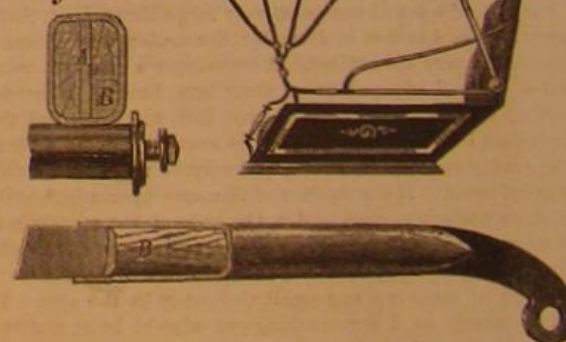


Fig. 3



TOPLIFF'S BOW SOCKET.

center or hub, of the building is a spiral stairway, and also an elevator, by which visitors find access to a lofty balcony whence they look down upon the pictures, which are arranged upon the inner walls of the structure. As the balcony is circular, the visitor only has to walk a short distance round to inspect the entire panorama. At the

present time the art work on exhibition is a panoramic view entitled the Siege of Paris. It represents the Prussian army in their entrenchments around the great city, which is beheld in the distance. Some of the scenes are quite spirited. A view showing the working and firing of a battery of great siege guns, by the Prussians, is particularly noticeable. Standing upon the elevated balcony before mentioned, the visitor experiences the pleasing illusion of looking down, as it were, from a balloon, over a very widely extended area. The painting is, we believe, some three hundred feet in length by fifty feet in height.

A New Mucilage.

The *Journal de Pharmacie* states that if, to a strong solution of gum arabic, measuring 8 $\frac{1}{2}$ fluid ounces, a solution of 30 grains of sulphate of aluminum dissolved in $\frac{1}{2}$ of an ounce of water be added, a very strong mucilage is formed, capable of fastening wood together, or of mending porcelain or glass

HAMPTON COURT PALACE AND GARDENS.

Hampton Court, a grand royal residence, with gardens and park of great extent and beauty, is well known to students of history, and to many American travelers who have visited it. It was a favorite domicile of Henry the Eighth, whose fine collection of Holbein's paintings still adorns the walls; the great Protector, Oliver Cromwell, imprisoned Charles the First here, and afterwards occupied it as his country seat; William the Third laid out the magnificent gardens, and imparted much of Batavian primness to the designs; and Queen Anne was never at home so much as under the trees of the splendid Bushey Park, which forms part of the domain. It is now almost entirely devoted to public recreation; park, gardens, and palace are daily thronged by hundreds, and on Sundays by hundreds of thousands, of pleasure seekers; and with the exception of a few apartments, the whole edifice is open to the investigation of the tourist. It was in a small villa on this estate that Faraday spent his last few years, the residence being the only favor that he ever accepted from any one. Devoting his whole life to original investigation, and living cheerfully and serenely on the very moderate stipend of about \$1,000 a year allowed him by the Royal Institution, after many years of closest application, resulting in services to mankind which no money value can adequately estimate, he retired to the beautiful shades of Hampton, and added another, and that not the least one, to the many grand memories that surround the ancient palace.

In the gardens, the Maze is a never-failing source of amusement to the young. Once inside it, hours may be spent in trying to find the way out, the paths being alley ways between high hedges, and there being no indications of a short cut to an exit. Another feature of interest is the ancient vine, which covers an enormous space, and frequently in autumn has 2,000 lbs. of ripe grapes hanging on it.

The gardens are kept up with great care, and important additions are made from time to time. Recently a conservatory, 70 feet long, 30 feet wide, and 34 feet high was constructed; it is now filled with specimens of rare beauty, especially of tropical vegetation and arborescent ferns. We give herewith a well executed engraving of the building. "Of conservatories recently erected in the neighborhood of London," says the *London Garden*, "this is one of the most remarkable, as regards its superior design and finish and the elegant character of the vegetation which adorns it. This is mainly composed of a number of tree ferns, many of which are distinguished by the slenderness of their stems—these, indeed, looking more like tall antelope's legs than the tree fern stems with which we are familiar. Among the different plants generally employed for conservatory decoration, none, except palms, can compare with tree ferns, and

even palms themselves lack that freshness of aspect and exquisite feathery beauty which are characteristic features of these ferns when well grown. Many tree ferns, now in cultivation, are Australasian species, belonging to the genera *Dicksonia*, *Cyathea*, and *Alsophila*; but even these are surpassed in lightness and graceful contour by some of the less known but certainly more delicately beautiful South American kinds, of which some striking examples may be seen here. These slender-stemmed and exquisitely beautiful American species are so distinct from the ordinary kinds as to be well worthy the attention of all interested in new and rare forms of tropical vegetation. Their distinctive features, too, are all the more apparent, inasmuch as they are growing side by side with well developed specimens of other kinds, among which we remarked *Dicksonia squarrosa*, *Cyathea dealbata*, and other equally well known forms. Beneath the rich South American vegetation just referred to are dwarf ferns, such as *Adiantum*, *Pteris*, and *Asplenium*, together with an abundant undergrowth of other well arranged foliage plants, such as *Dracaenas*, variegated *Yuccas*, *Caladiums*, fine specimens of the velvety-purple silver marbled *Cissus discolor*, noble crotons and alamanas; the girders of the dome above being nearly hidden in wreaths of variegated *Cobaea*, the yellow-margined leaves of which, enlivened here and there with great purple flowers, had a fine effect. On one side is a tastefully arranged piece of rockwork, half hidden among creepers, and draped with feathery ferns, selaginellas, *Tradescantia variegata*, grasses, and brilliant orange yellow, dark-eyed thunbergias, the latter flowering freely, and, when backed up by cool green banks of selaginellas, having a very pretty effect. At the base of this rockery is a small strip of water, replenished by a dripping cascade from the rocks above, and ornamented with aquatics. The larger ferns, and other permanent vegetation, are planted out; but flowering plants, such as *Achimenes*, *Begonias*, *Pelargoniums*, etc., are grown in pots, so as to be replaced, when out of flower, by others as occasion may require. As will be seen in the engraving, however, the pots are judiciously concealed from view by means of a deep curb—an important point, and one that might be carried out in all conservatories in which the object is to show the grace and beauty of tropical vegetation to the best advantage."

Belting versus Gearing.

The largest leather belt ever made in England has just been supplied to a large cotton-spinning mill in Bolton, by W. J. Edwards, 20 Market place, Manchester. The belt is one of Messrs. Sampson and Co.'s patent, manufactured from the best English leathers, and is 38 inches wide and 90 feet long, double (or two thicknesses), and without a single cross joint from end to end, and of equal thickness throughout. The belt is for driving direct from the fly wheel of engine,

and to transmit 350 indicated horse power. The same firm have also two double belts of the same make, each 29 inches wide, driving direct from the fly wheel of engine. The driving pulley is 28 feet in diameter and 5 feet on the face, crowned or turned up for the two belts, and the belts travel through 4,500 feet per minute, transmitting 600 indicated horse power. It is claimed for this belting that it is specially adapted for main driving, and has the advantage of running perfectly straight. A prize medal for their specialties has just been awarded by the Society for the Promotion of Scientific Industry, Cheetham Hill Exhibition, Manchester (this is the sixth medal awarded at various exhibitions). This system of driving direct from the fly wheel is becoming more general in this country every day. The patentees have lately fitted up a large spinning mill, where they are transmitting 2,000 indicated horse power through this class of belting.

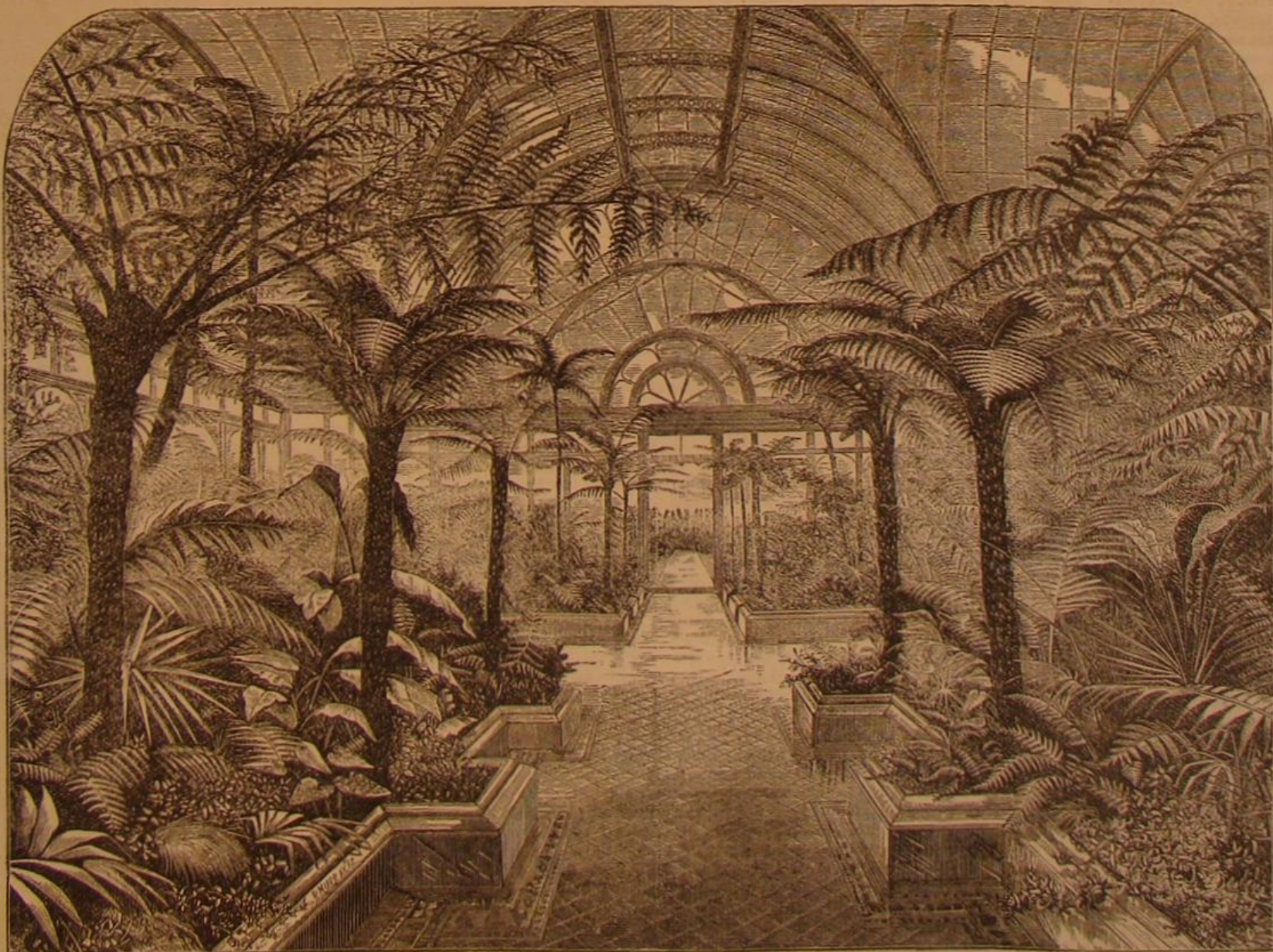
The belt system having been in general use in the United States for the past thirty years, it is gratifying to observe that our British cousins are at last beginning to appreciate its advantages.

Influence of Season on the Skin.

Donhoff calls attention to the fact that the obvious difference between the fur of animals in summer and in winter is associated with an equally striking difference in the texture and thickness of their skins. Thus, for example, the average weight of an ox hide in winter is 70 lbs., in summer 55 lbs.; the hair in winter weighs about 2 lbs., in summer 1 lb., leaving about 14 lbs. to be accounted for by the proper substance of the skin. These differences are quite as decided in foetal animals as in adults. Calves born in winter have a longer and thicker coat than those born in summer; moreover, there is a difference of more than a pound in the average weight of their skins after the hair has been removed. Similar fact may be observed in the case of goats and lambs. That these differences are not to be ascribed to any corresponding change in the diet and regimen of the parent animals is proved by the fact that they are equally manifest in the young of individuals kept under cover and on the same food all the year round.

Utilization of Plaster Rubbish.

Gaudin, Paris, patents a method of treating plaster rubbish with carbonate of soda, by which it is rendered fit for use over again. Old plaster, even after it has been re-burned, sets too quickly for use. By calcining the rubbish and mixing it with some saline solutions instead of pure water, this is prevented. Alkaline solutions are best, and of these a solution of carbonate of soda in water is the cheapest. Plaster from old walls and ceilings when thus treated sets at the end of two or three hours, and has all the properties of fresh plaster.



NEW CONSERVATORY AT HAMPTON COURT ENGLAND.

THE OLDEST MEDICAL WORK IN THE WORLD.

Fifteen hundred years before the birth of Christ, at a period when the Israelites were still in bondage in Egypt, Hermes, a king of that country, and surnamed "Trismegistus," or thrice great, translated, from engraved tables of stone long before buried in the earth, certain sacred characters said to have been written thereon by the first Hermes, the Egyptian god Thoth or Thuti. The books thus produced were deposited in the temples; and the reputation of the king as a restorer of learning lived in history up to the time of the alchemists of the middle ages, who looked upon him as the "father of chemistry," while his name still exists in our word "hermetical," commonly applied to a seal through which nothing, however subtle, can pass. Hermes' writings, according to Clemens Alexandrinus, who described them in chronicles written 200 years after Christ, consisted of forty-two books, all of which were held by the Egyptians in the highest veneration. They treated of rules by which the king was to govern, of astronomy, cosmogony, and geography, of religion and of priesthood, and of medicine. On the last mentioned subject, six books are known to have existed. Though many scrolls have been found treating on all of the above topics, the Hermetic writings have remained undiscovered; and hence their very existence has repeatedly been denied, and the tradition considered as one of the many curious myths which overhang the ancient history of mysterious Egypt.

During the winter of 1872-3, Ebers, the German archaeologist, while residing in the vicinity of Thebes, learned from an Arab of the existence of a papyrus scroll, found between the bones of a mummy, some fourteen years previously, by a person since dead. By dint of a large offer, Ebers obtained the scroll from the Arab. It consisted of a single sheet of yellow brown papyrus, of the finest quality, over sixty feet in length and about eleven inches broad. The writing was clearly executed in red and black inks; the paper was in perfect condition; and the entire work was in a state of remarkable preservation. Hurrying to Leipzig, Ebers at once began the deciphering of his treasure; and the results of his studies are now given to the world, with the announcement that the work is, beyond question, one of the long lost six Hermetic books of medicine.

The age of the manuscript was determined by the study of the forms of the characters, by a calendar which is found in the book, and by the occurrence of the names of kings, all of which show the period of writing to be the year 1552 B. C., at which time, it is interesting to note, Moses was just 21 years old. A translation of the script also confirms the origin of the work, since (as was the custom of the Egyptians, in order to give greater authority to their writings) it is ascribed to the god Thoth or Thuti, who, as we have already mentioned, was the first Hermes.

By the aid of chromo-lithography, a facsimile of the papyrus has been prepared; and it is now published, together with notes, by Ebers, and a translation of some portions. A copy of this rare and important work has lately been received at the Astor Library, in this city; and from one of its pages we have obtained the drawing from which the annexed engraving is made. The characters are facsimiles except in point of color, those which are lightly shaded being written in red, and therefore of course impossible for us to reproduce. The script is of the hieratic form, which was one of the four distinct graphic systems used by the Egyptians. It was devised as a shorter method of inscribing the hieroglyphics, and bore about the same relation to those symbols as our written letters do to printed characters. In this form the great body of Egyptian literature has reached us; and in order to translate it, it is first necessary to resolve the hieratic contractions into their corresponding hieroglyphics. This is done in the second engraving; and the reader will find it interesting to compare the lines of the hieratic writing with the hieroglyphics, and note the similarity. The hieratic reads from right to left, the hieroglyphic from left to right; so that the lines end at the point, A. Notice the similarity of form between the characters at B, also the ideographic nature of the hieroglyphic, the words "to pour out" being symbolized by a man in the act of throwing objects from one hand into another. Notice also the symbols at C, indicating four days. A portion of the character is similar to that used to mean the sun or god Ra, and the four down strokes indicate the number of suns or days. Another ideographic symbol is the bee, to indicate honey. The mode of writing the weights is also curious. The tenat or unit of volume was about six tenths of a quart, and the drachme is probably the same as the Arabic dirhem, and is equivalent to 48 En-

glish grains. The first page of the scroll opens thus: "The book begins with the preparation of the medicines for all portions of the body of a patient. I came from Heliopolis, with the Great Ones from Het-aat, the Lords of Protection, the Masters of Eternity and Salvation."

The preface continues somewhat in the same strain through the page. On the second leaf is found the extract given above, introduced by a kind of charm, which the physician is to bear in mind while administering the doses. The following translation is literal:

"Chapter treating of the taking of medicine. The medicines approach. The expulsion of everything is accomplished from my heart, from my limbs. Powerful are the charms.

meret is cleansed and purified; he has taken the medicine *sep nef sep*, the medicine has taken effect."

In view of the direction to look at the patient "when lying outstretched," it is curious to note that (according to Darglison) the priestly physicians of Egypt are said by Diodorus to have formed their diagnosis principally on the position which the patient assumed in bed.

The book is one of the most valuable contributions to our knowledge of the arts of the ancient Egyptians that has ever been discovered; and the clear manner in which it is written, and its freedom from the nonsense or gibberish usually accompanying so-called charms, serve still further to enhance its archaeological importance. It will elicit the deepest interest in every civilized country,

and will, we trust, give new life to the science of Egyptology, from the study of which, and from the revelations which yet may be expected from the ancient tombs of Egypt, it may be hoped that a clew will be found to the rediscovery of those arts which died with the wonderful people who practised them.

The Mechanical Age.

The London Times, criticising Lord Derby's Manchester speech, says:

"However quick other countries may have been to develop the great mechanical discoveries of the century, it is to England that those discoveries are mainly due; and our riches have been derived as much from the genius and patient intelligence of men like Stephenson and Faraday, as from our stores of coal and iron. But until recently manufactures and machinery were regarded very much as outlying provinces of human energy, which might be left to take care of themselves. They brought wealth to the country and fortunes to individuals, but they were regarded as no more a matter of general concern than any other trade. They are now recognized as a kind of public care; and even in his capacity of Foreign Secretary, Lord Derby was invited at Manchester to treat them as of primary importance. Without going the length of Dr. Playfair the other day, and treating the natural sci-

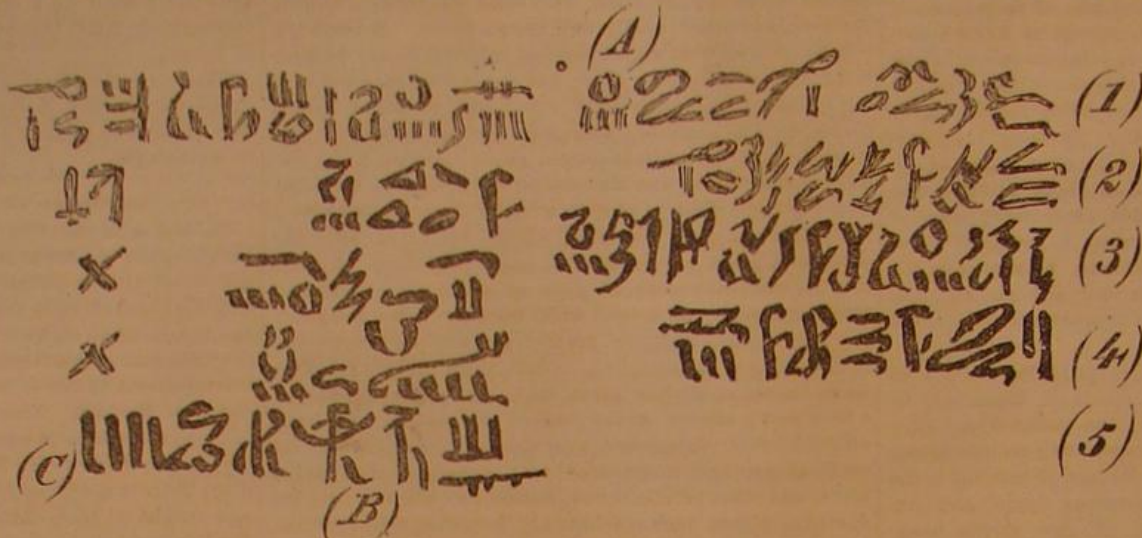
ences as almost a substitute for all human culture, it is evident that, as a matter of fact, all culture is being brought to bear upon them, and that they are absorbing energy and attracting thought in every sphere of life. In view of this remarkable revolution of thought, one is a little provoked by the very matter-of-fact reasons which are usually alleged in explanation of it, and Lord Derby, in the greater part of his Manchester speech, was too true to his habitual caution in contenting himself with reiterating them. Labor, he says, is dear, and is becoming dearer; and it is consequently more and more necessary to invent labor-saving machinery. Similarly, at Leeds, the other day, even the apostles of Science could find little more to tell us than that other nations are threatening to undersell us, and that we need all scientific appliances to hold our own. All this is, no doubt, true, but the reality is too vast and broad to be adequately represented by such statements of the case. To say that we must invent better machinery because labor is dear, however accurate, is nevertheless something of a reversal of the order of facts. What has made labor dear in England? Above all things the invention of machinery. A machine is only matter animated by intelligence; and it is not merely because the wants of men have grown more numerous, but because their intellects have grown more active, that they have at length reached a stage of their development at which they are concentrating their energies on asserting the dominion of intelligence over Nature. It is this which is implied when we call the present a mechanical age."

New Route to Siberia.

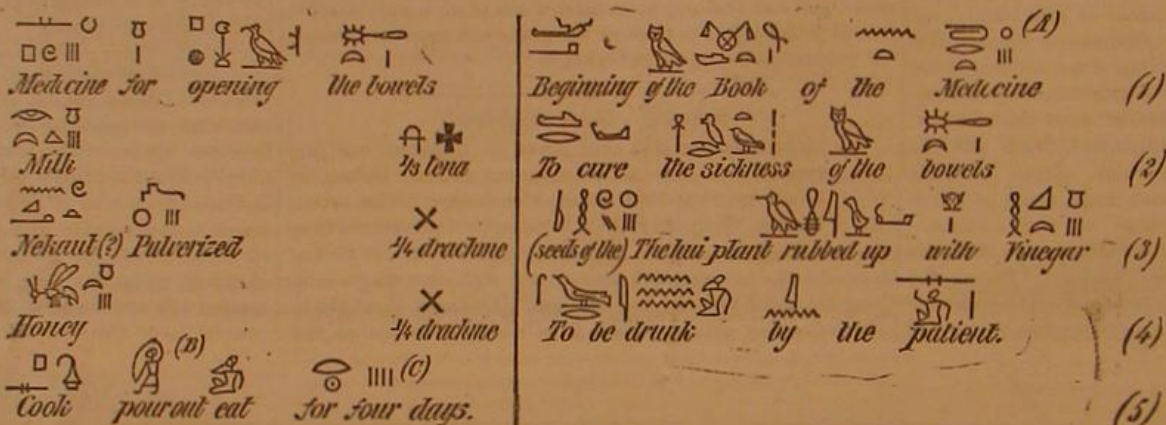
Professor Nordenskjöld's recent journey from Norway to Siberia by way of Pet Straits (Jugorsky Shar) and the Sea of Kara has caused quite a sensation in Russia. At a meeting of the Society for the Encouragement of Commerce and Industry M. Sidorof said that the journey was one to be ranked in importance with the discovery of a new world, as it would in all probability lead to the establishment of a regular line of communication between northern Europe and Siberia, and the vast resources of the latter country would thus at last find an outlet along her great fluvial highways. Captain Wiggins, of Sunderland, who attempted the same feat last year, has signified his intention of being present to welcome Professor Nordenskjöld on his arrival in St. Petersburg.

TALC has been recommended by MM. Vigier and Aragon for the prevention of incrustation in boilers. The quantity of talc introduced into the boiler is about one tenth of the weight of deposit accumulated between two blow-offs.

FACSIMILE OF A PORTION OF HERMES TRISMEGISTUS' BOOK ON MEDICINE.



THE ABOVE TRANSLATED INTO THE HIEROGLYPHIC CHARACTER.



On the medicines. Beginning: I think of the time when Horus and Set were conducted to the great Hall of Heliopolis, so that counsel might be taken on the Hodes of Set and Horus. * * Words which are spoken on the taking of medicines in their regular order, and frequently." Then follow the extracts above, and some more recipes of which the following are specimens: "Caraway seed, $\frac{1}{2}$ drachme; goose fat, $\frac{1}{2}$ drachme; milk, 1 tenat. For sick bowels, the same: Pomegranate seed, $\frac{1}{2}$ drachme; sycamore fruit, $\frac{1}{2}$ drachme; beer, 1 tenat."

Ebers translates but two pages literally, and gives a synopsis of the balance of the book. The chapter headings are peculiar. The initial chapter consists mainly of recipes and the preparation of medicine; then follow chapters on salves for removing the *uhan*; catalogue of the various uses of the *tequem* tree; medicines for alleviating the accumulation of urine and diseases of the abdomen; "the book of the eyes;" medicaments for preventing the hair turning gray, and for the treatment of the hair; on forcing the growth of the hair; salves for strengthening the nerves, and medicines for healing the nerves; medicine for curing diseases of the tongue; medicines for the removal of lice and fleas; medicines for ears hard of hearing; "the secret book of the physician;" "the science of the beating of the heart;" and "the knowledge of the heart, as taught by the priestly physician Nebsecht."

The difficulties in the path of the translator in the shape of technicalities are of course very great; and probably for this reason, he reserves the complete translation of the book for future publication, when it will be issued with notes, etc., obtained by further study. One extract is given, however, to show the general style of directions to the physician. It reads as follows:

"Rules for the *re-het*, that is, suffering in the pit of the stomach. (Pylorus or cardia). When thou findest anybody with a hardening of his *re-het*, and when eating he feels a pressure in his bowels (*chet*), his stomach (*het*) is swollen, and he feels ill while walking, like one who is suffering with heat in the back, *tau nu peht*, then look at him when he is lying outstretched, and if thou findest his bowels hot and a hardening in his *re-het*, then say to thyself: This is a liver complaint, *sepu pu n meret*. Then make thyself a remedy according to the secrets in botanical knowledge from the plant *pa cheset* and from scraps of dates. Mix it and put it in water. The patient may drink it on four mornings to purge his body. If after that thou findest both sides of his bowels (*chet*), namely, the right one hot and the left one cool, then say of it: That is bile. Look at him again, and if you find his bowels entirely cold, then say to thyself: His liver (?)

Recent American and Foreign Patents.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED SCROLL SAWING MACHINE.

Lemuel C. Pratt, New York city.—By a simple and cheap contrivance, this invention gives sufficient forward and back motion to a straight saw working on a pivot to run it in one and the same line at the cutting point, so as to cut more evenly than such saws now do. The invention is specially designed for simple and cheap saws for boys and amateurs.

IMPROVED END GATE.

Edward G. Martin, Kankakee, Ill.—This end gate for vehicle bodies is so constructed that it may be easily released at its lower edge and swung outward to dump the load, and it may be readily attached and detached. Devices are added to prevent the rear ends of the side boards from splitting, and from being forced outward by the pressure of the load.

IMPROVED CHIMNEY COWL.

Theodore C. Nativel, San José, Cal.—The ventilating cowl is formed of two parts or cylinder flues, one inclosed by the other. The inner part, or flue, has vertical exterior ribs which form a bearing or support for the section of the outer flue, leaving air passages between. The flue sections are beveled at their ends to form a close and strong joint, and the ribs act as buttresses for each flue.

IMPROVED WINDOW SCREEN.

Henry B. Walbridge, Brooklyn, N. Y.—This screen is composed of wire netting wound on rollers and held by clamps. It is so constructed that it may be readily applied to windows of different widths, closing the same tightly.

IMPROVED VEHICLE TOP.

Fredrich H. Jury, New York city.—A pair of jointed standards, made each in two parts, are hinged together and to the seat back and back bow. The standards being thus entirely under the back portion of the top, out of sight, make a neater and better arrangement than the projecting folded braces of the common arrangement.

IMPROVED BUNG AND VENT.

Harry B. Cornish, River Falls, Wis.—In this we have an improved bung and vent that closes hermetically the bung hole. At the same time the bung may be easily removed, and air is freely admitted through the bent device without necessitating the unscrewing of the bung. It is a useful device for barrels containing liquors.

NEW HOUSEHOLD ARTICLES.

IMPROVED VENETIAN SHADE.

Charles Widemann, New York city.—The new feature in this invention consists in rods which are attached to the under side of the bottom slat. By placing the end of one rod into a side staple, and that of the other rod into the socket hole nearest to it, an outward and sideways inclined position of the shade is obtained, which protects against the sun, while supplying at the same time the required light and ventilation. The shade is thus capable of being readily adjusted by the different devices into any desired position, and may be cheaply manufactured, as it is formed of a simple connection of slats and bands.

IMPROVED SADDLON.

Oliver Swift, Madison, Wis.—This is principally a new way of attaching the handle of a saddlon, the object being to enable the use of one handle to several irons, thus saving metal and rendering the implement more convenient to use. On the iron are two notched pins. The handle has a wooden hand piece and hollow metal arms, which when in place slip over the pins and hold them by spring catches, which engage with the notches. A wooden ring under the handle allows of the catches being freed or engaged at will. Another new feature is that the body of the iron is made of glass, which the inventor thinks offers a better smoothing surface than metal.

IMPROVED DOOR SPRING.

James M. Hood, Denver, Col. Ter.—This consists of a journaled shaft encircled by a spiral spring, and provided with a laterally projecting arm, whose outer end bears upon the door with a pressure corresponding to the power and tension of the spring. The novel feature consists in devices whereby the tension of the spring may be quickly and conveniently changed, and the action of the apparatus thereby regulated.

IMPROVED WASHING MACHINE.

Timothy Allen, Fort Madison, Iowa.—This machine contains two parallel rollers, the faces of which are grooved transversely in such a way that the projections of the one roller may enter the grooves of the other. They are geared together so that they may rotate in the same direction and with equal velocity, motion being imparted by a longitudinally corrugated roller above. The machine, it is stated, works without becoming clogged, or straining or stretching the clothes, and will allow any part of the clothes to be operated upon separately.

IMPROVED DROP LIGHT GABELIER.

John Fox, New York city.—This invention is so constructed that, as the drop light is drawn down, the unwinding of a cord from a spool will turn a shaft and drum, coiling up a spring, the tension of which is so adjusted as to balance and support the drop light in any position in which it may be placed.

IMPROVED CLOTHES LINE REEL.

Charles L'Hommedieu, Middletown, N. Y.—We have in this an improved clothes line reel which winds up the line automatically as soon as the same is released from the post, protects the same, when applied stationary to the post, against the weather, and allows the ready taking down of the line. The whole forms a labor-saving device for household purposes.

IMPROVED SASH HOLDER.

John E. Frost and Josiah Merrill, Berwick, Me.—This is a simple sash fastener, that binds rigidly on the sash, and holds it securely at any height without injuring it in the least. It consists in a novel combination and arrangement of two rubber-lined rollers at the ends of fulcrumed levers, which are actuated by an intermediate rubber block in the rear. Broadened rear ends serve as handles.

IMPROVED CURTAIN FIXTURE.

Fredrick Backofen, Brooklyn, E. D., assignor to himself and Isaac H. Williams, of same place.—This is a spring end which may be attached to an ordinary wooden roller, so that, in event of changing one's residence, the shade rollers may be altered at a trifling expense to suit the various sized windows.

IMPROVED YEAST COMPOUND.

Jacob Pfeiffer, Brooklyn, N. Y., assignor to himself and Paul Koch, of same place.—Mr. Pfeiffer suggests a new compound which, he states, makes a very good article, which can be kept sweet for four to six weeks in summer, and much longer in winter. It consists of cooked and mashed potatoes, hops, malt, wheaten flour, and corn starch.

IMPROVED LAMP BURNER.

John H. Fouch, Sauk Center, Minn.—In this an inclosing shell is made adjustable on the wick tube. The inner tube has several perforations for gas derived from gasoline or similar substance, and the outer tube or shell has slots made in it. The arrangement of these apertures is such that a portion of them may be closed without shutting off the gas supply of the others.

NEW AGRICULTURAL INVENTIONS.

IMPROVED NECK YOKE.

Charles Shuman, Red Oak, Iowa.—This inventor proposes a new device for connecting the neck yoke with the tongue or pole of a carriage, and which will not weaken the neck yoke, and may be readily applied. Two curved plates fit upon each other, and have eyes formed upon the opposite ends of their upper edges. They have also a tongue hole formed in their lower middle parts, to adapt them to be attached to the neck yoke to support a carriage tongue. Said hole is protected by a rubber bushing, and a bead is added to strengthen the middle part of the yoke, and to keep the device from slipping out of place.

IMPROVED ROTARY GANG PLOW.

John K. Underwood, Sauk Center, Minn.—The construction of this implement includes a kind of diamond-shaped frame having two sets of axles. Dish-shaped rotary plows are mounted on beams with the front edges inclined to the landside, to press into the ground and turn over the furrows as they rise up at the rear and throw them off. The beams swing up and down in the keepers, to be held in place and to vary their height for regulating the depth of furrows. The driver can make any needed adjustment while sitting in his seat; and by suitable means, also, the plows are lifted up and supported above the ground when being moved to or from the field to be plowed. Plows of this description, the inventor claims, will turn wider furrows with a given force than those of other forms, and the width may be raised by inclining a caster wheel right or left, for which it is contrived, and which has a fastening device to hold it in any required position.

IMPROVED FEED BOILER.

Stark Olmstead, Brook, Ind.—The object here is to furnish a simple boiler for agricultural purposes. To this end a tube is conducted through the feed box, and is provided with a furnace at one end, while the other end is led out of the box and has a high chimney attached to it. By the heat of this tube the feed in the box is gradually heated and boiled.

IMPROVED MOWING MACHINE.

Andrew G. Gray, St. John, Can.—The novel features in this mowing machine are ingenious devices whereby the sickle bar may be operated from the driving wheels with a positive motion, and which will enable the cutter bar to be readily thrown into and out of gear with the drive wheels.

IMPROVED CORN PLANTER.

Wilson Gardner and George L. Hays, Piketon, Ohio.—This is a new and useful agricultural implement. The construction of the device is hardly possible to describe without drawings. The novel feature in the operation, however, consists in the adjusting of a dropping device so as to bring the points of rimless wheels in line with the marks left by said wheel during a previous passage, whereby the corn is planted in an accurate check row.

COTTON SCRAPER, CHOPPER, AND CULTIVATOR.

Richard L. McClung, La Fayette, Tex.—In this, cotton planters are provided with an improved machine for scraping or barring off cotton, chopping it to a stand, and cultivating it. The apparatus is constructed so that it may work at any desired closeness to the row of plants, or at any desired depth in the ground, or for use as an ordinary cultivator. It may be made by any ordinary mechanic.

IMPROVED CORN PLANTER.

John Bryer, Wagram, Ohio.—This corn planter can be easily thrown into and out of gear, lowered to and raised from the ground, and adjusted to deposit the seed at any desired depth in the ground. All this is accomplished by new and ingenious mechanism easily operated and controlled.

IMPROVED POTATO DIGGER.

David J. Housh, Syracuse, Ohio.—By the advance of this machine two polygonal wheels carrying radially disposed curved fingers are rotated. Said fingers enter the ground and remove the potatoes, which pass to screens between the rows of fingers, where they are freed from grass, weeds, etc. The potatoes also fall upon a screen, which is vibrated to free them from clinging earth, and then pass to a receiving box, from which they are subsequently removed. Considerable ingenuity has been expended in the mechanical construction of the machine, and a number of entirely new devices have been combined.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED CAR STARTER.

August Dahler, New York city.—The object of this invention is to provide an improved device specially applicable for starting horse cars upon street railways, for the purpose of relieving the horses of the exhausting strain consequent upon the frequent stoppages and startings, the said devices being also adapted to steam railways and all vehicles of a heavy draft. It consists in the particular construction and arrangement of parts wherein a single drawbar extends from one end to the other of the car, and is maintained in a given position by symmetrically arranged springs at each end, whose tension is separately adjustable. Said drawbar is provided with two sets of beveled teeth, which engage with bevel wheels upon the axles of the car, which gear wheels are laterally adjustable thereon, so that, when the traction of the horse in starting is brought to bear on the drawbar, the gear wheels are made to revolve, which wheels, being nearly of the same diameter as the supporting wheels, will start the car so as to overcome the inertia gradually and avoid the sudden strain which is so objectionable.

IMPROVED VISE.

Alexander O. H. P. Schorn, Murfreesborough, Tenn.—In this vise, the use of screw threads is avoided. Instead, spring jaws are arranged, with a cross bar hooking over a cam-shaped flange of a set screw, by which the jaws are instantly and rigidly adjusted.

IMPROVED MILLSTONE DRESSING MACHINE.

Gustav Heydrich, New Ulm, Minn.—This invention is designed for dressing and furrowing the face of a millstone in rapid and even manner. It consists of a series of adjustable and recessed chisels, operated by a revolving shaft, which is hung in vertically-adjustable bearing, and provided with spirally-arranged cams. The chisels are cushioned by rubber blocks that regulate their action.

IMPROVED GATE.

John A. Knepper, Delta, O.—This gate is adapted to farm and other purposes, and may be readily opened and closed and adjusted to any suitable height without taking up space in operating. It is composed of sliding link-connected rails or sections that are raised by a cord and pulley in grooved posts, and are folded into a base box set into the ground to be covered by the top piece or plank of the gate.

IMPROVED BALE BAND STRETCHER.

James Z. Stocker, Charleston, S. C.—This invention relates to hay or cotton presses wherein the follower and platens are grooved to allow the tie band to be secured on the bale after compression but before removal. It consists in the use of a lever having a slotted catch at the end, for the purpose of tightening the bale band, the lever being suspended by a weight and provided with a claw, so that it may be elevated out of the way or drawn down when wanted.

NEW CHEMICAL AND MISCELLANEOUS INVENTIONS.

IMPROVED BALE TIE.

Robert Stewart, Harnesville, New York.—This consists of a hook on one end of a wire band to engage a loop on the other end. The hook has a brace extending from its base along the line of the strain and terminating in an eye, through which the eye that engages the hook passes. The brace is thus supported, and the eye engaging the hook is securely kept on it. Both hook and the eyes are formed by bending the wires and twisting the bent portions, so that the tie is constructed in a simple and cheap way.

IMPROVED POCKET BOOK.

David K. Osbourn, Baltimore, Md.—This wallet or pocket book is made of one continuous blank, of paper or other cheap material, and has a central part with end flap and side extensions, and symmetrical side pieces folded in gussets and pockets, and connected at the edges. The advantages are simplicity, durability, and cheapness.

IMPROVED CIGAR MOLD.

Heinrich Voltz, Cincinnati, Ohio.—This inventor has devised an improved cigar mold that is not liable to shrinkage, warping, and other annoying features of the common glued molds, and that will readily adjust itself to any change or swelling of the sections without interfering with the shape of the cigars. The base and top molds are made of separate detachable fish sections, sliding in metallic guide frames, and are retained by strong binding springs.

IMPROVED SHIRT.

Clinton M. Ball and John C. Ball, Troy, N. Y.—This shirt has the neck band attached to the body only at back of neck opening, and the bosom attached at upper edge only to front of neck band and shirt body. This plan allows of having the shirt open at back or front, and of ironing the bosom independently of the body.

IMPROVED HARNESS BUCKLE.

Joseph C. Smither, Nicholasville, Ky.—A tapering tube is formed upon the upper or forward end of the buckle frame, and has a recess formed in the rear edge of its outer part to receive the end of the tongue of the buckle. The advantage of this is that, when the buckle is applied to the hip strap of the harness, the horse's tail, when switched, cannot catch either upon the upper end of the buckle, or upon the end of the tongue.

IMPROVED CRACKER SHOW CASE.

Casper Kroeger and Werner Kroeger, Milwaukee, Wis.—This is a detachable show or sample box, provided with a glass front, and having hooks for attaching it to the fronts of the box or case containing the bulk of the material on sale. These sample compartments are nicely painted or finished, so that, when forming the fronts of the cracker boxes, they make a handsome appearance.

IMPROVED DENTAL FILLING.

Lyman W. Sutton, Jr., Jersey City, N. J.—Dr. Sutton proposes crystallized metallic tin as a new dental filling. The metal is obtained, by a suitable chemical process, in spongy crystals, which are very plastic and condensable. The completed filling takes a fine polish, and is said to resist both corrosion and abrasion.

IMPROVED PORTABLE VAPOR BATH.

George Washington Brosius, Gallatin, Mo.—This is a box composed of a bottom board, top board, and four sides, consisting of frames covered with oiled silk or cloth; and the sides, top, and bottom are fastened together by hooks and eyes, so as to be readily put together and taken apart. Within are convenient arrangements for a furnace for vaporizing substances, and for a seat for the patient.

IMPROVED MOLD FOR CONCRETE ARTICLES.

Richard B. Lanum, Mount Sterling, Ohio.—This inventor proposes metal linings to concrete molds having loose joints to let the water escape. The object is to use metal for its smoothness and capability to make sharp angles, and at the same time to have the lining so that it will not obstruct the escape of the water, as it would if the lining were completely connected.

IMPROVED MODE OF CURING MOSS.

Peter Unsworth, Algiers, La.—This inventor suggests a new process of curing moss by immersing and boiling the same in a solution of caustic soda to which sumac, fustic, jappaica, burnt amber, and coppers have been added. In this way gray moss that has been deadened can be cured in thirty minutes, but moss fresh from the tree will require about eighteen days.

IMPROVED PICKET PIN.

James D. Field, Blue Rapids, assignor to himself and J. D. Edmond, Leavenworth, Kan.—In order to construct a picket pin which may easily be inserted in the ground without the necessity of hammering, and which shall have a firmer hold when set, this inventor constructs the pin of metal, and bends the shank in spiral form. The upper end of the shank is also bent to form a handle for holding the pin while it is boring into the ground.

IMPROVED PAPER BOX.

Felix Salomon, New York city.—This invention consists in binding the edges of the paper boxes with metal strips, and soldering the top or bottom parts to the side walls. The object is to enable the boxes to resist wear better and to retain their shape longer. The inventor says that the improvement renders pasteboard boxes almost as stiff and as strong as wooden ones.

IMPROVED RECOIL CHECK FOR GUN STOCKS.

William D. Miller, Pittsburgh, Pa.—This inventor proposes to provide the butt ends of gun stocks with a device for diminishing or neutralizing the recoil. The invention consists of a fixed butt plate, in connection with a hinged, guided, and spring-acted plate. The check plate and spring break the recoil, and thus admit of a surer and steadier aim.

IMPROVED CRIMPERS' PINCHERS.

George G. Wright and George Bassett, Spencer, Mass.—Shoemakers are provided in this invention with new pinchers for use in crimping boots, which are so constructed that they may be used for operating the screw clamp for drawing down the corners of the leather, for drawing the edges of the leather into place, for driving the tacks for securing the edges of the leather, and for drawing said tacks.

IMPROVED METALLIC BURIAL CASE.

Henry M. Gray, San Francisco, Cal.—The novel feature in this invention is a handle attachment located under and against the over-shutting flange, in such manner that the lift or strain thereof is mainly sustained by such flange, and the screws relieved of it. The handles are thus made much more secure, and yet require only one or two screws for fastening them.

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Notes & Queries

A. J. W. can harden tallow by using the recipe on p. 202, vol. 24.—J. K. can preserve wood from decay by the process detailed on p. 219, vol. 31.—A. F. will find a description of the hydrogen lamp on p. 242, vol. 31.—R. H. is referred to p. 48, vol. 29, for a formula for calculating the friction of water in pipes.

(1) J. B. asks: Is there any chemical that will cause the hair and fleshings from hides in a tannery to decompose in three months? A. Try caustic ley.

(2) W. M. D. asks: 1. Is the word ohm used to signify a unit of electric force, or is it a term applied to the resistance of electric force or measurement thereof? A. It is a unit of resistance. 2. How long will the Daniell battery work, if freely supplied with sulphate of copper, with a uniform force? A. That depends upon the size of the cell and the amount of current which it gives. For telegraph lines, these batteries generally work for about four months. 3. How long can they be used before the porous cups need to be renewed? A. The porous cup may be used, with care, for years. 4. What is the power of Daniell's compared with Lockwood's battery? A. Precisely the same. The Lockwood is only a modified form of the Daniell. 5. Does not the Daniell require the least care, and is it not the most reliable and simple for all practical purposes? A. No. There are other forms more suitable for some purposes.

(3) W. B. W. asks: What chemicals possess the property of destroying and disintegrating vegetable substances without corroding and destroying metals, as acids do? A. We think that strong potash lye in contact with steam at a high pressure will probably accomplish the desired result.

(4) G. B. R. says: I am experimenting with electricity, and I have made an electro-magnet; but passing the current through it makes both poles north or both south, according to the direction of the current. Has such a thing been done before? A. Nothing of the kind has ever been produced before to our knowledge.

(5) A. K. asks: What kind and number of wire ought I to use for a house electric telegraph, laying the wire between the bricks and plaster of the wall? A. No. 16 copper wire covered with gutta percha and enclosed in lead.

(6) W. B. B. asks: 1. Does carbonic acid gas, compressed in liquid form in a tube $\frac{3}{4}$ inch in diameter, create any damage, such as a dangerous explosion, if suddenly liberated? A. Yes. At the moment of liberation from pressure (about 600 lbs. to the square inch) one portion of the liquid rushes into the gaseous state, and, in the effort of so doing, abstracts so much heat from the remaining portion of the liquid that the temperature of the latter is reduced to such a degree as to convert it into the solid snowlike form. This sudden and extreme reduction of temperature causes a corresponding contraction of the glass tube, a contraction so nearly instantaneous, and of course unequal, that the tube is, in many cases, shattered into fragments. 2. What is the effect of heating the above tube to 300° F. Does it increase the pressure in the tube? A. It would enormously increase the pressure. 3. What is the effect if the tube be placed in a cold mixture, say one of 6° F. A. It would reduce the pressure. 4. What effect has carbonic acid on iron? A. Little or none if the metal be dry. 5. Will it keep its pressure in tubes for a number of years, provided they are tight? A. Yes. 6. Does it remain heated after it is compressed in tubes, or only during compression? A. Only during compression. It rapidly gains the temperature of the surrounding air.

(7) H. S. asks: What will take grease out of sheepskins after they are tanned with the wool on? A. Try digesting for a short time in bisulphide of carbon, and dry in the air. The sulphide is very volatile, and in a short time will completely evaporate, leaving no unpleasant odor behind.

(8) W. E. G. asks: 1. In a line of telegraph of about 12 miles long, worked in duplex, how much resistance will be required in resistance coils? A. About 300 ohms. 2. How many cups of battery will be required if the wire is No. 8 and has two relays, each measuring 125 ohms? A. About 24 of Daniell's cells. Four telegraph, according to your description, ought to work.

(9) H. H. asks: What produces the brilliant coloring of the autumn foliage? A. The action of organic acids upon the coloring matter of the leaves.

(10) F. asks: 1. Do the Chinese know the secret of welding copper? A. Yes. 2. Do they make copper edge tools? A. We are not informed on this point.

After kalsomining, is there any known chemical (combinable with the kalsomine) that will not wash off when water is applied? A. We do not know of anything that can be applied that would not, in some way, be objectionable.

(11) H. G. asks: What will remove grease from a tortoiseshell hair comb? A. Try steeping it in benzine or chloroform.

(12) W. H. G. asks: Can the aroma of Havana tobacco be taken from the stems? A. Yes. Crush them and digest for some time in hot water. Then decant the liquid and digest a second time with a little diluted alcohol, and finally remove the residue and carefully dry it. If it is desired to extract the nicotine, evaporate the decanted liquid to a syrupy consistence, and then agitate with twice its volume of alcohol, and allow to stand for a short time. The alcohol, under these conditions, will extract all of the nicotine salts from the aqueous solution, and rise to the top, forming a distinct layer, of a dark color. Decant this upper layer, concentrate by evaporation, mix with a small quantity of solution of potash, and briskly agitate with ether. The ether dissolves the nicotine and some fatty matter which the potash has liberated, and rises to the top when the mixture is left at rest. In order to separate the nicotine from its solvents, the etheral solution is decanted into a retort provided with means of transmitting dry hydrogen through it. Heat is now applied, and the ether is driven off. When the ether vapor ceases to come over, the temperature is raised to 356°, when the nicotine itself distills over and is collected.

(13) W. J. S. asks: Would it be beneficial to force linseed oil into the pores of the spokes and hubs of buggy wheels, after the spokes are driven, to prevent the natural shrinkage, which even the best seasoned timber is subject to in this climate? A. Your plan is a good one. Try it.

(14) W. M. B. asks: Is there a liquid preparation made that a spring, when heated to a cherry red, may be thrown in, and will come out of a good spring temper? A. We know of no such liquid, nor of any better plan than hardening the spring in water and blazing off in oil in the usual manner.

(15) E. W. H. says: 1. How is the dial of a galvanometer graduated? A. It is usual to graduate the dial into 360 equal parts. 2. What sizes of wire are used for the coils? A. The size of wire should be selected with regard to the currents to be measured. No. 18 or 20 will be found convenient we think. 3. Are there not 2 coils of different sizes of wire? A. Some galvanometers are made with several coils of wire, so that they can be used in a large range of measurements, but each coil should be arranged so that it may be separately included in circuit. The principle shown in your sketch applies to the induction coil, and not at all to the galvanometer.

(16) G. A. B. asks: What is the object of making soldering irons square instead of round? A. To increase the amount of contact.

(17) N. W. asks: What do you consider the most nearly correct theory of the earth's daily revolution on its axis? Whence comes the motive power? A. The earth persists in its motion for the same reason that a stone does after its leaving the hand which throws it, or as a railroad train will run several miles, by the motion acquired, after the steam has been shut off; and even after the engine has been reversed and the brakes applied, the train cannot be stopped in a less distance than half a mile, after running at a high speed. The motion was given to the earth during the period of its creation, and it is simply the momentum of its huge mass, combined with its astounding velocity and the absence of resisting obstructions, which keeps the motion up.

(18) J. B. F. asks: Of what ingredients should a composition be, for the ornaments for stove plate and similar light patterns? A. Use a soft alloy. See p. 91, vol. 30.

(19) J. T. M. asks: Would a small tube made of canvas dipped in hot paraffin answer as a flexible pipe to convey hot and cold water? A. No. 2. What would answer better? A. Leather hose.

(20) J. P. asks: What is the generally accepted explanation of the reflection of a ray of light from the inner surfaces of glass, diamonds, drops of water, and other transparent substances, causing the brilliancy of the diamond, the formation of the rainbow, etc.? A. The reflection from the inner surface of a transparent medium is similar to that from the outer surface. Observation and experiment have proved that it is a universal law that, when light passes from a dense into a rare medium, or vice versa, a part of the light is reflected in such a direction that the angles of reflection and incidence are equal. When, therefore, the surface between the two media is perfectly even, it acts like a mirror, and the smooth surface of still water is as good a reflecting mirror for the fishes under it as for men above, of which fact you may easily satisfy yourself by observing an aquarium. A piece of plate glass will also convince you of this by two reflections, one from the front and one from the back or interior surface, giving you two reflected images, which will coincide when the light falls perpendicularly, but become separated when the light is made to fall obliquely. The colors shown by diamonds or raindrops in the rainbow are not due to this reflection, but to the refraction of the rays when they enter and leave the diamonds or water drops; for the explanation of this we refer you to any modern text book on natural philosophy.

(21) J. H. asks: What difference will it make in the power of an engine to give the valve sufficient throw to allow a full opening of the ports? At present the valve opens the ports exactly one half. A. She will take a larger supply of steam at the beginning of the stroke, and develop a corresponding amount of extra power.

(22) E. P. W. asks: Do you know of any chemical that can be used to permeate or saturate hard or soft wood, to render it impervious to water, and prevent swelling when submerged therein? An exterior coating is not desirable. A. Boil the wood in paraffin.

(23) M. asks: How fast should the edge of a circular sheet iron disk run, for cutting wrought iron? A. Ten or twelve thousand feet per minute. 2. Can cast iron be cut in the same way? A. Yes.

Should the flues of a boiler be caulked when there is water in the boiler? A. No.

(24) W. B. D. says: I have used black oil in boilers, and found it very good to remove scales. Has it any bad effect on the iron? A. No.

(25) W. H. says: In your issue of October 16 are figured several boring tools. These forms would be admirable if used with short shanks and for shallow holes; but as no tool is certain never to be required in a deep and proportionately small hole, I see no excuse for making such tools, save habit and example. The common form of boring tool affords an example, almost unique, of universal perversity and failure to recognize a very simple situation. Those tools, if properly formed, might have eight times the strength of shank and still enter a hole equally small. It is simply necessary to form the tool so that the cutting edge is on a level with the axis or center of the shank or bar. I send three wooden models of boring

tools, one a thread tool. A. Were either of the sample tools sent by our correspondent put to the full amount of duty obtainable from a tool of its size, it would break off at the cutting end. This defect might be obviated by lowering the temper, which would, however, reduce the cutting capability. The fault in the sample in each case is that, in the endeavor to get a large shank, the cutting part is ground away, so that one whose width should be $\frac{3}{4}$ inch is but some $\frac{1}{8}$ inch in thickness, while another whose width should be $\frac{3}{4}$ is but little more than $\frac{1}{8}$ inch thick. The whole subject is explained, with engravings, in No. 3 of "Practical Mechanism."

(26) J. B. L. says: We have a rowboat 38 feet long, made of very light timber. How can we caulk it to make it tight? A. If it is well built, you may be able to make it watertight by filling the joints with white lead.

(27) J. O. B. asks: Why is it that a lifting pump for cold water will not lift hot water, at 400° or 500° F. A. Because when the piston rises, the water boils, and the pump barrel is filled with vapor.

Why is lead given to a valve on the steam engine? A. Generally, in order to make the reciprocating parts move smoothly and without noise, or thumping, as it is usually termed.

(28) N. S. asks: I have a boat 30 feet long and of 6 feet beam, displacing about 100 feet of water. I have 36 two inch steam pipes 30 inches long, connected by a 3 way piece so that the water can have a free circulation. Can I make them into a boiler to propel the boat, the pipes being cased inside of a stove frame with two returns for the heat? Will such a boiler be large enough for two 3x6 engines running on quarters? What speed may be obtained from such a boat? A. The boiler seems to be rather small, but it may answer for a moderate speed.

(29) C. C. says: I have a small boat 19 feet long, 4 feet 4 inches wide, sharp at both ends, and 18 inches deep; and I intend to put another 12 inches on it in depth, making it 30 inches deep. It is a clinker-built boat. I intend to put in an engine and boiler. The engine is 5 inches stroke by $3\frac{1}{4}$ bore, upright, and cuts off at $\frac{3}{4}$ stroke. The boiler is horizontal, 4 feet long (besides the bonnets); it is of $\frac{3}{4}$ inch iron, with a dome 22 inches high and 1 foot in diameter. It has one flue 12 inches in diameter, in which the fire is built; and there are 6 return tubes varying from 2 inches to 3 inches in diameter. If I use coal, I intend to make the grate $2\frac{1}{2}$ feet long and as wide as the flue will allow. 1. How large a screw wheel do I want, and what should the pitch and number of blades be? A. Use a propeller 24 inches in diameter, of 3 feet pitch, with either 3 or 4 blades. 2. What speed would it make with steam at 80 lbs. pressure? A. We think you may realize a speed of 6 miles an hour.

(30) G. E. P. asks: Will a rubber packing do for a piston head and piston valve rods? A. Yes.

(31) B. L. says: A friend of mine says that in ringing a bell, he has frequently got it into such a position that he cannot move it with his dead weight, and that, by holding the rope and raising his body with his arms, he can bring it down. I say that whatever power he gains beyond the weight of his body is due to the resistance which the inertia of his body gives to being raised. He says that this is not so, as he moves his body too slowly. Will you please settle this question? A. We think you have the right idea, as we understand your statement.

What is the meaning of nominal power of a steam engine? A. It is power rated by an arbitrary standard, not dependent on the actual conditions.

(32) F. B. says: I intend making a four-oar rowing boat of canvas, to fold together, and to be about 30 feet long, with extended rowlocks. How narrow can I make it to be safe from tipping? A. To be perfectly safe from tipping, it will require to be very broad. If you want to make it as narrow as convenient, you will find good examples in racing shells. 2. What must I use to make it waterproof? The canvas must not crack when the boat is folded up. A. Probably the experience of some of our readers will furnish the information you require; and if so, we would be glad to hear from them.

(33) J. C. G. asks: 1. Which engine will consume the most steam in doing the same amount of work, one with a long stroke or one with a short stroke? A. This is a contested point, and must be settled by taking into account the nature of the work. 2. Which is the best, a short cylinder with a long diameter, or a long cylinder with a short diameter? A. The reply to your first question answers this also.

(34) F. K. says: Our main water pipes are $2\frac{3}{4}$ inches inside, and our fire plug 2 inches. What size of hose should I have to throw a stream of water to best advantage? Would you advise me to have gum or leather hose? A. Use $2\frac{3}{4}$ inch hose. We think you will find rubber satisfactory.

(35) E. J. asks: 1. How many cups and of what size of Bunsen's battery will it require to put the first slight coating of nickel on 1 square foot of surface on cast iron? A. Two or three ordinary Bunsen cells. 2. What size of Smee's cell will it require to finish the plating on the same surface? A. One large Smee. 3. How long does it take to get a good deposit? A. Possibly 4 or 5 hours.

(36) R. F. B. asks: 1. How many cables touch Canadian territory? A. Five. 2. What cables are they and where do they touch? A. See p. 120, vol. 32. Four of them land at North Sydney, and one at Tor Bay, Nova Scotia. 3. Where can I get information in reference to the depths of the seas and oceans? A. See the United States coast survey charts.

(37) G. K. says: 1. A brother engineer and myself are discussing the relative elasticity of steam and compressed air, one maintaining that, when used in an engine expansively, air will not give the same results as steam, as, for want of elasticity, the pressure will fall off much more rapidly after the cut-off than would be the case with steam. The other claims that there is little, if any, difference. In any event too little to be taken into account in practical working. As we have no means of making anything like a respectable test, please enlighten us upon the subject. A. If the temperature is sensibly constant during the expansion, there will be little difference in the two cases. You will find formulae for the expansion and compression of air without gain or loss of heat in answer No. 14, August 21, 1871.

(38) P. & K. ask: 1. Are bored wells from 6 to 18 inches in diameter not a failure, as a rule, on account of having too little reservoir? Does not the cost of boring wells nearly equal that of the ordinary method of digging? Is drilling a six inch hole in hard rock impracticable for wells, inasmuch as it costs too much? A. We think that some of our readers, who have had experience in these matters, can answer our correspondent more fully than we feel able to do. We hope to hear from them.

(39) J. T. W. asks: 1. What strain or pressure will a boiler 7 inches in diameter and 13 inches long, made of copper No. 18 stand? A. Fifty lbs. per square inch. 2. How large a safety valve should I use? A. Half an inch in diameter. 3. Would the boiler be large enough to run an engine with a cylinder of 14 inches bore and 3 inches stroke? A. It would run the engine, but would not do much work.

(40) L. W. F. asks: 1. Are vernier calipers fastened together before or after being hardened? A. Before. 2. Are they secured by rivets or tapering pins? A. Rivets.

(41) M. H. F. asks: What is meant by cushioning as applied to steam in an engine? A. Cushioning takes place when the exhaust port is closed before the piston reaches the end of the stroke, which leaves some steam in the cylinder, which the piston compresses like a cushion.

(42) W. K. B. asks: How can I make paste, such as is used by stereotypers? A. Common flour paste is sometimes used for this; but some stereotypers put white lead in the composition.

(43) G. H. M. asks: How can I attach canvas to the leather side of tanned lamb skins? A. Try a mixture of gutta percha and pitch, applied hot.

(44) J. F. asks: 1. Which is the best non-conductor of heat, wood or plaster of Paris? A. Wood. 2. Will heat crumble plaster of Paris after it has been dried? A. No, unless it is great.

(45) McC. T. & Co. ask: Is exhaust steam beneficial or injurious if allowed to escape under grate bars? A. Sufficient steam to keep the grate bars from burning is good. It also increases the draft in the furnace.

(46) A. S. asks: Please give me a recipe to prevent cracking of rubber boots. A. The cracking of the rubber is due to the oxidation of the sulphur which it contains. As a preventive, coat the rubber with a thin covering of varnish made by dissolving pure gum rubber in hot naphtha or bisulphide of carbon.

(47) J. R. Y. Jr. asks: Can you give me a recipe for a waterproof muckage, suitable for pasting labels on wood, something that will stand the weather? In your issue for October 16 I found a recipe for this purpose; but after several trials I have been compelled to abandon it, being unable to combine the glue and alcohol. I tried to combine the two by first dissolving the glue in water, and adding alcohol afterwards; but the glue thickened up and would not combine with the alcohol. A. Melt together equal parts of common pitch and gutta percha. It may be kept liquid under water, and it has been highly recommended both for its superior adhesiveness and waterproof quality after once being applied.

(48) G. W. L. asks: What cement will make the insides of paper barrels tasteless and odorless, and be sufficiently elastic and proof against vinegar, wine, and other liquids? A. Try coating the interior with hot paraffin.

(49) O. S. asks: I stamp embroidery patterns in this way: I lay a sheet of paper under the pattern which I wish to copy, and then trace the outlines on the paper underneath by pricking through the pattern with a fine needle. I then remove the paper, and place it on the cloth which I wish to stamp. I then take rosin and Prussian blue (or any other coloring substance), finely powdered, which I rub through the holes in the paper by means of a small pad, and the pattern shows well on the cloth. This paper is removed and replaced by a clean piece, after which a hot iron is run over to melt the rosin into the cloth. So far I have not been successful, as the pattern rubs off before I can get it worked. Will you tell what to put in the powder to make it stick? A. As a substitute for the Prussian blue and rosin, use first a little very finely ground aniline red, and then rub over this a cloth or sponge moistened with a little dilute alcohol. Dry, as before, with a hot iron. The paper should be removed immediately after applying the alcohol.

(50) N. F. H. asks: Can you inform me of any acid that will operate on ruby or other colored glass, so as to leave it in a rough state, like ground glass? I want to lay out sign work and leave the letters the same color as the glass. I have seen work of this kind done by acids, and it is much cheaper than if done by the sand blast. A. Hydrofluoric acid is used for this purpose. It is made by acting on powdered fluor spar with strong, hot oil of vitriol; and the gas that comes over is passed into water, which absorbs it. The hydrofluoric

acid is often used in the gaseous state. A leaden tray is partially filled with the powdered fluor spar, and over this is poured the hot oil of vitriol. The plate of glass, previously prepared, is then secured over the dish tightly, and the gas, as it is liberated, exerts its peculiar corrosive action on the uncovered portions of the plate to its fullest extent.

(51) W. C. J. asks: Do you know of any street car, in this country or in Europe, in which wind is applied as a motor? A. No.

(52) J. V. R. says: I have a quantity of homemade wine, that has fermented in too warm a place, and has consequently become somewhat acid. How can I correct it without injury to its flavor? A. The free acid may be neutralized by addition to the wine of the proper quantity of bicarbonate of soda.

(53) C. A. W. says: 1. I have some bits of gold which I wish to melt up and cast into different shapes. Can I melt it on a common forge or stove fire in a black lead crucible? A. Place the gold in a small black lead crucible with a little borax, and subject it to a very bright red heat for some time, or until complete fusion ensues. 2. Can I pour it best into a charcoal mold? A. No. Molds made of iron slightly waxed or greased are used for this purpose. 3. Do I need a flux? A. Yes. 4. Will silver admit of the same treatment? A. Small beads of both gold and silver may be fused in charcoal, when mixed with a small quantity of borax and heated strongly by means of a blowpipe or blast lamp.

(54) W. D. says: What is the percentage of salt of the water of the Dead Sea? A. The solid matter is 21-22 parts in 100, nearly all of the solids being salts of sodium, magnesium, lime, etc.

(55) J. B. S. asks: Why was it that, in establishing a uniform gage for railroads, 4 feet 8 1/2 inches was chosen instead of 4 feet 8 or some other even number of inches? A. The first railroads were constructed for coal traffic, and were of the same gage as the colliery tramways, 4 feet 8 1/2 inches; and the latter are so old that no one can now tell why this width was chosen.

(56) E. D. P. asks: 1. What are the melting points of gold and silver? A. Gold melts at 2010° Fah., and silver at 1873°.

(57) R. P. G. asks: By what process is cocoa nut oil obtained? A. It is obtained from the cocoa nut, either by expression or decoction. It is of a fine white color, liquid at 80° Fah., and of the consistence of lard below that point, becoming solid at about 40°. It is used for making toilet soaps, and is sometimes employed medicinally in cases of consumption. It must not be confounded with cacao oil or butter, which is obtained from the cacao or chocolate nut.

(58) C. A. K. asks: 1. Am I right in believing that coal is formed by the decomposition of vegetable matter? A. Yes. 2. What proof have you of this? A. The cleavage of blocks of coal frequently shows the forms of the leaves of the vegetable matter from which the coal was made. Fern leaves, especially, are often seen singularly perfect.

(59) W. J. H. says: We have lately put up a large band saw for re-sawing lumber. After running a few days, the saw cracked along the front edge of the blade. What is the cause? A. Either the saw was brittle, or the wheels were of too small a diameter for the thickness, or too great a strain was put upon the saw. A band saw of No. 16 gage should be run on a wheel 6 feet, No. 17 on a wheel 5 feet, and No. 18 on a wheel 4 feet in diameter. This is a good rule to act upon, but an extra tough saw of No. 16 gage may run successfully on a 4 foot wheel, and No. 17 very well on the same size. Parties using band saws should bear in mind that they must not file or sharpen to acute angles, but leave all angles round.—J. E. E., of Pa.

(60) A. S. T. asks: 1. Please tell me the best way to temper tooth chisels for cutting marble. A. Harden at a bright cherry red in a mixture of 1 gallon whale oil (pure), 2 lbs. rosin, and 1 lb. beeswax. Warm the oil, melt the rosin and wax, and stir together while hot; as the mixture loses its hardening properties, add more rosin and beeswax, then draw to the proper color. The above mixture will harden without fire-cracking. 2. Does filing the tooth hurt the steel? A. No.—J. E. E., of Pa.

(61) J. B. J. says, in answer to D. A. R.'s query as to the weight necessary to break an iron bar: If the iron bar is firmly fixed at one end, and the load applied at the other, then $W = \frac{D^3}{l} \times k$, in which D =depth of bar in inches, l =horizontal breadth in inches, l =length in feet from support to center of weight, k =536 for cast iron, 508 for wrought iron (mean of 4 authorities, varying somewhat with quality of metal and manufacture), W =breaking weight in lbs. In the given case $\frac{4^3}{36} \times 536 = 3,732$ cast and 4,186 wrought iron, when the flat side is vertical. If the longer side is placed horizontally, then $\frac{(3\frac{1}{2})^3}{36} \times 536 = 612\frac{1}{4}$ for cast or 684 lbs. for wrought iron. For safety, one fourth of the above should be used.

(62) J. G. says, in answer to F. B.'s query as to dropping a ball in a railroad car: Your friend is correct if the motion of the train is uniform, since the directions of the force or gravity, while the ball is falling, are sensibly parallel. If the train had moved (which is an impossible case) such a distance in a straight line during the fall of the ball that the direction of the earth's attraction could no longer be considered parallel during this time, the ball will not strike the same point of the floor as when the train is at rest, neither will it do so if, during the fall, the train changes its motion either in direction or velocity.

COMMUNICATIONS RECEIVED.

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

On an Air Locomotive. By F. G. W.
On Diphtheria. By J. W. H.
On Imaginative Arithmetic. By S. S.
On Iron. By J. D.
On Specific Gravity, etc. By J. B. M.
On the Mechanical Equivalent of Zinc. By H. M. P.
On Experiments in Geometry. By A. B.
Also inquiries and answers from the following:
J. L. C. P.—H. S.—M.—J. C. G.—R. H. B.—H. W.—G. W. B.—M. H. S.—J. S. R.

HINTS TO CORRESPONDENTS.

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

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

Hundreds of inquiries analogous to the following are sent: "What is the value of dry extract of oak bark for tanning? What is the price of soluble glass? Who has a steam process for drying lumber, and will furnish particulars? Who makes a picture frame mitering machine, working two knives? Who sells self-rocking cradles? Who makes the best air pump, and what is its capacity? Who makes cotton spinning and weaving machinery? Who sells steam pumps, suitable for irrigation? Whose is the best ice-making machine? Who sells tools for making stencil plates?" 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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DESIGNS PATENTED.

8,779.—CARPETS.—J. Barrett, New York city.	
8,771.—SASH PULLEYS.—G. A. Blake, New Haven, Ct.	
8,772.—DOOR KNOBS.—B. Mallory, New Haven, Ct.	
8,773 to 8,775.—OIL CLOTH.—C. T. Meyer et al., Bergen, N. J.	
8,776.—HANDLE TIP.—G. O. Monroe, Newark, N. J.	
8,777.—TOBACCO PIPE.—L. Nax et al., Philadelphia, Pa.	
8,778, 8,779.—SODA WATER APPARATUS.—F. H. Shepherd, Boston, Mass.	
8,780.—CARPETS.—T. J. Stearns, Boston, Mass.	
8,781.—CROCHET.—W. Steinhilber, New York city.	
8,782.—PIANO FRAME.—C. F. Steinway, New York city.	
8,783.—FLOWER STAND.—H. P. Roberts, De Ruyter, N. Y.	
8,784.—METAL TRUNK COVERING.—A. V. Romadka, Milwaukee, Wis.	
8,785.—WATCH CHAIN.—E. Bartow, Attleborough, Mass.	
8,786.—CHAIN LINK.—D. A. Beem, Newark, N. J.	
8,787.—SHOW CASE.—W. H. Grove, Philadelphia, Pa.	
8,788.—SATCHEL HANDLE.—G. O. Monroe, Newark, N. J.	
8,789.—CLOCK CASES.—H. J. Miller, New York city.	
8,790.—LIFTER HANDLE.—J. M. Read, Everett, Mass.	
8,791.—HANDLE BARS.—W. M. Smith, West Meriden, Ct.	
8,792.—RADIATOR PIPES.—G. W. Walker, Malden, Mass.	

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On application for Design (14 years).....	\$30

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA,
November 8 to 13, 1875.

5,347.—S. T. Draper, Clarence, Ont. Lamp chimney.	Nov. 8, 1875.
5,348.—E. Bradley, St. Leonard, Nicolet, P. Q. Extract of hemlock bark.	Nov. 8, 1875.
5,349.—J. O. Byrns, Detroit, Mich., U. S. Advertising indices.	Nov. 8, 1875.
5,350.—J. Fairburn, Upton Station, P. Q. Vacuum pan.	Nov. 9, 1875.
5,351.—C. W. Baldwin, Chicago, Ill., U. S. Duplex hydraulic elevator.	Nov. 9, 1875.
5,352.—J. Blakeley, Toronto, Ont. Car axle bearing.	Nov. 9, 1875.
5,353.—E. V. De Guison, Jersey City, N. J., U. S. Supplying oil to lamps, etc.	Nov. 9, 1875.
5,354.—F. A. Glanz et al., Buffalo, N. Y., U. S. Rope-molding machine.	Nov. 9, 1875.
5,355.—H. Wilson, Ithaca, N. Y., U. S. Horse rake.	Nov. 9, 1875.
5,356.—L. D. Green, Waterdown, N. Y., U. S. Rotary pump.	Nov. 9, 1875.
5,357.—H. F. McKevey et al., Cheboygan, Mich., U. S. Car coupler.	Nov. 9, 1875.
5,358.—J. W. Brooks, Boston, Mass., U. S. et al. Machine for trimming heels.	Nov. 11, 1875.
5,359.—J. W. Brooks, Boston, Mass., U. S. Heeling machine.	Nov. 11, 1875.
5,360.—J. W. Brooks, Boston, Mass., U. S. Machine for attaching and trimming heels.	Nov. 11, 1875.
5,361.—A. Holmes, Hamilton, Ont. Churn dash.	Nov. 11, 1875.

5,362.—A. J. R. Phillips et al., Philadelphia, Pa., U. S. Ice creper.	Nov. 11, 1875.
5,363.—M. K. Bortree, Jackson, Mich., U. S. Corsets.	Nov. 11, 1875.
5,364.—E. W. Johnson, Foreston, Ill., U. S. Grain cleaner.	Nov. 11, 1875.
5,365.—Rosamond Woolen Co., Almonte, Ont. Process of finishing cloth.	Nov. 11, 1875.
5,366.—J. W. Brown, London, Eng. Mode of transmitting telegraphic signals, etc.	Nov. 11, 1875.
5,367.—G. H. Ames, Adrian, Mich., U. S. Car coupling.	Nov. 11, 1875.
5,368.—L. W. Pond, Eau Claire, Wis., U. S. Sawmill head block.	Nov. 11, 1875.
5,369.—F. Beaumont et al., Dallas, Tex., U. S. Stilts.	Nov. 11, 1875.
5,370.—A. Payette, Montreal, P. Q. Axle box.	Nov. 11, 1875.
5,371.—O. Holden, Chicago, Ill., U. S. Separating substances from liquids.	Nov. 11, 1875.
5,372.—A. Poppenhusen, College Point, N. Y., U. S. Combs.	Nov. 11, 1875.
5,373.—E. C. Ibbotson, Montreal, P. Q. Passenger car ventilator.	Nov. 12, 1875.
5,374.—J. W. Dixon, West Manayunk, Pa., U. S. Wood, straw, etc., paper pulp.	Nov. 12, 1875.
5,375.—E. Bazin, Paris, France. Extracting slime, etc., from fouled vessels, etc.	Nov. 12, 1875.
5,376.—A. Riddell, Guelph, Ont. Suction and force pump.	Nov. 12, 1875.
5,377.—J. D. Gould, Boston, Mass., U. S. Lamp burner.	Nov. 12, 1875.
5,378.—D. Kearney, Montreal, P. Q. Automatic fire alarm and extinguisher.	Nov. 12, 1875.
5,379.—J. H. Morrell, New York city, U. S. Floodways for warehouses and other buildings.	Nov. 12, 1875.
5,380.—J. D. Hobbs, Northfield, Iowa, U. S. Tire-shrinking machine.	Nov. 12, 1875.
5,381.—J. Sims, Boston, N. Y., U. S. Cider mill.	Nov. 12, 1875.
5,382.—A. Chavasse et al., Montreal, P. Q. Composition for removing boiler scale.	Nov. 12, 1875.

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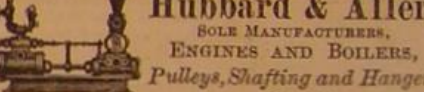
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30 July

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

Vol. XXXIII.—No. 25.
[NEW SERIES.]

NEW YORK, DECEMBER 18, 1875.

[\$3.20 per Annum.
[POSTAGE PREPAID.]]

A NEW GRAIN ELEVATOR.

A new grain elevator in New York city is now in process of construction by the New York Central and Hudson River Railroad Company, which is designed as the beginning of arrangements for the accommodation of a great grain trade which ultimately will tend to direct a large trade, to New York city in this line.

The magnitude of the future facilities for cheaply handling grain in New York can be inferred both from the requirements of the large traffic of the Central and Hudson River Railroad and from the fact that, with that line, other lines will necessarily be brought into active competition, and so led to provide adequate terminal accommodations for their own benefit. The Pennsylvania road has already recognized this, and, it is reported, contemplates the erection of an elevator as large as that of the New York Central Company, and subsequently of building one of double the size, capable of holding 3,000,000 bushels of grain; while the Erie, we learn, proposes to construct a small transfer elevator of 100,000 bushels capacity, and probably in the future a building of much greater size.

At the present time New York suffers from no lack of storage capacity for grain taken from vessels. There is an abundance of floating elevators, and the stationary edifices will, together, accommodate some 12,000,000 bushels. The absence of railroad elevators has, however, rendered the handling of the enormous quantity of grain arriving by rail both costly and difficult, in a degree which may be estimated from the fact that the same has now to be shoveled by hand from the cars of the New York Central and Hudson River road into canal boats, and by the latter transported to storage houses to the lower part of the city.

The opposition to building elevators on the part of the railroad managers has been based on economical motives. The grain-grading system now existing, through the agreement between the Produce Exchange and the roads, has hitherto not been favored; and as a result, under the old plan (it being necessary to deliver the identical grain received for storage) such grain would have to be stored in a separate bin even if it did not nearly fill the latter, so that it was

practically impossible to utilize even half the capacity of the accommodations provided. The present system obviates this trouble, and admits of the employment of nearly the full capacity, through proper weighing and inspection, by which the exact amount of the same quality, etc., of grain is returned to the storer: though such is not the identical material, as several consignments may be mingled in one or more bins, in order that the latter may be completely filled. Another obstacle has been found in the fact that the buildings must be erected on the Hudson River, and suitable bottom for laying foundations has hitherto not been reached. This difficulty has, by dint of persevering search, been overcome, and now the Central, Erie, and Pennsylvania roads have, on their respective properties, found solid bottom at a depth of some 75 feet.

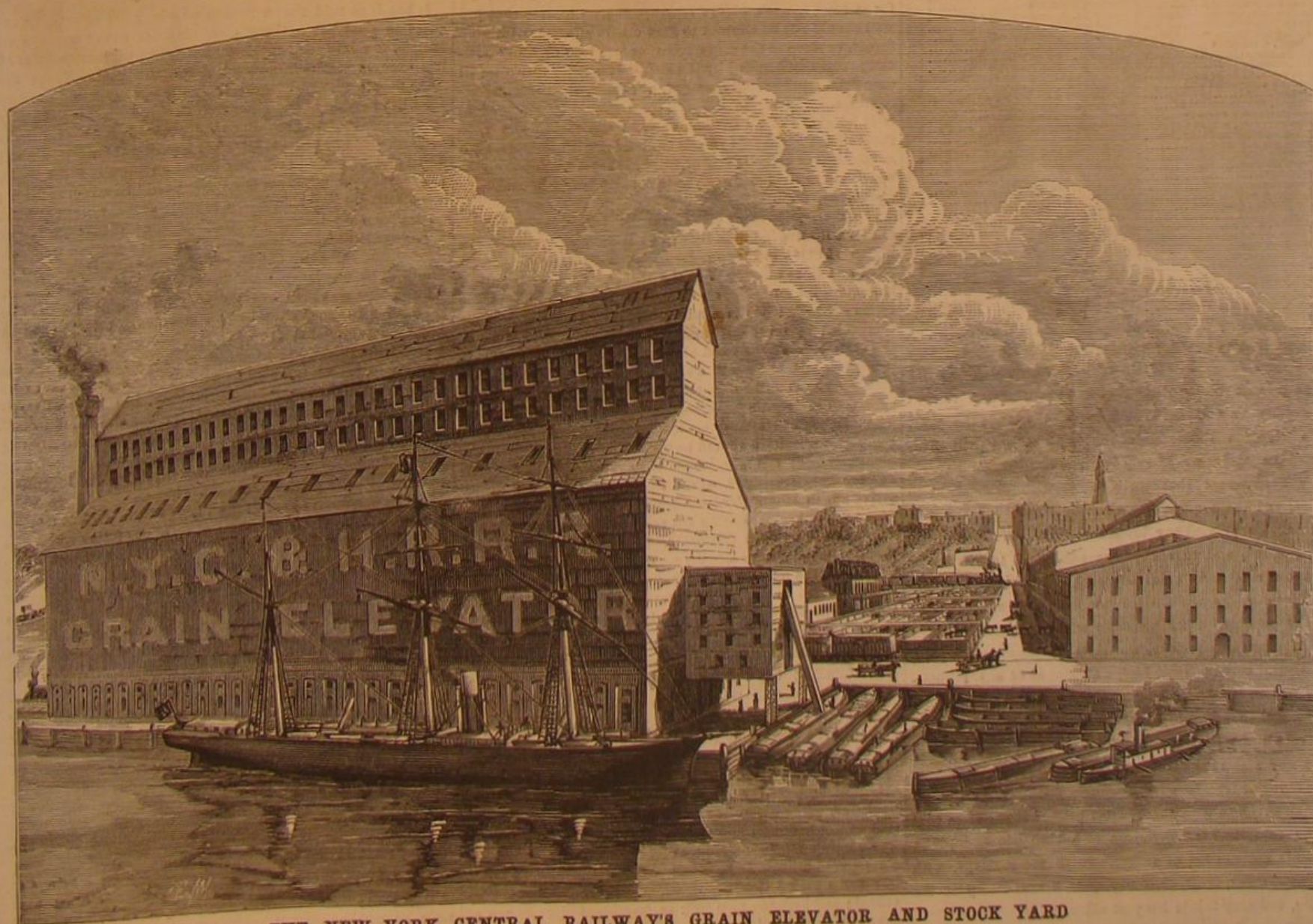
The New York Central and Hudson River Railroad Company's elevator, at the time of writing, exists partially in the shape of foundations and partially on paper, in the form of plans. Mr. Charles Hilton is engineer in charge, and through the courtesy of Mr. C. B. Gerard, the assistant engineer, we have obtained the following facts in regard to the edifice, and from the drawings our artist has prepared the accompanying accurate representation of the structure as it will appear when completed one year hence. The building is located between 60th and 62d streets, and on a line with Twelfth avenue. It is 354 feet in length by 100 feet in width, and 160 feet in height, and contains 264 bins, each 65 feet high, having a capacity of 6,000 bushels each, or an aggregate capacity of over 1,500,000 bushels of grain. The foundation is composed of some seven thousand piles driven into the river bed at intervals of 2 feet 9 inches between centers. These are cut off below low water level, filled in with sand, and transversely capped with heavy timbers. Two diagonal cappings follow above, and a series of granite piers, pyramidal in shape, finally support the ponderous timbers which sustain the bins. The superstructure is of brick outside to the top of the bins, and slate above.

At the north end, four tracks enter, and between the outside pairs twenty-two receiving pits are made, each pit holding one car load of grain, and so located as to come just

abreast the car doors. Steam shovels are to be used to remove the grain from the cars; and the grain is then carried by the elevator leg, which enters each pit, to a receiving hopper above the bins. The power for elevating is furnished by a 500 horse power double engine. As soon as the receiving hopper is filled, an attendant on the ground floor opens a valve and allows its contents to run into a weighing hopper placed beneath. The scale rod is also in the lower story, though connected with the hopper far above by suitable devices, so that the weight is easily read off. The weighing hopper may be rotated on a vertical axis, and is provided with an inclined spout. This spout traverses the interior periphery of a ring, into which opens a series of conduits, leading to twenty-four adjacent bins. By means of a wheel and index hand, the attendant can adjust the hopper spout against any desired bin chute, and it only remains to open a valve to deliver the grain into the bin. Meanwhile the receiving hopper valve has been closed, and the hopper is being refilled, so that the raising of the grain is continuously carried on. At the bottom of each bin is a spout, and under every fourth row of bins there is an endless moving belt. Bags, after being filled at the spouts, are thrown upon the belt, and thus transported to the vehicles at the delivery door.

In order to accommodate shipping, a separate hopper is provided, and a spout therefrom leads outside the building to the hold of the vessel. Arrangements are also provided for removing grain from boats, the elevator leg for this purpose being 60 feet in length and capable of vertical adjustment over a distance of 20 feet, to suit varying conditions of tide, etc.

Our engraving represents the new elevator, and also affords an idea of another edifice, probably the largest of its kind in the world, and of the extensive yards owned by the New York Central and Hudson River Railroad Company and let to the Union Stock and Market Company as a receiving station for the immense droves of live stock received from the West over the Hudson River road. The sheep and hog house, which very recently has been completed, is shown in the distance. It is a brick structure 370 feet long by 200 feet wide, and is



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divided into one section 100 feet in length and three stories high, for the reception of hogs, and another occupying the remaining space, but four stories in height, for bees, calves, and sheep. The ground floor is utilized for cattle and the upper stories for the sheep, broad inclined planes being the means of ascent. The interior is thoroughly illuminated by a large skylight and innumerable windows, and the ventilation, obtained by flues and hundreds of apertures in the walls, is thorough; 20,000 hogs, 30,000 sheep, and 2,000 calves can be accommodated at once on the various floors, which aggregate in area nearly seven acres. The yards outside offer quarters for 4,500 head of cattle. The land included in these new improvements, for conducting freighting business by this company, is some 20 acres, nearly all of which is made or filled-in ground, which has heretofore been useless.

Scientific American.

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VOLUME XXXIII, No. 25. [NEW SERIES.] Thirtieth Year.

NEW YORK, SATURDAY, DECEMBER 18, 1875.

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PUBLISHERS' CARD.

The present volume of the SCIENTIFIC AMERICAN is drawing rapidly to a close. The next number ends the year. Some eighteen thousand of our subscribers will find, printed on their wrappers covering this week's papers, the announcement that their subscriptions are about to expire, and the request that they will remit for the new volume. To prevent any break in the continuity of their subscriptions, and to enable the publishers to know how large an edition to print at the commencement of the year, subscribers are invited to remit for a renewal as early as possible. Simultaneously with the mailing of this week's paper, an envelope, containing Prospectus for 1876, a beautiful chromo Name List, a Catalogue of our Publications, and an Illustrated Hand Book, useful for inventors and others, will be mailed to all our subscribers; and we hope to receive all the lists back again filled with the names of those who wish in the future to take our paper.

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DIPHTHERIA.

There has been recently in this city, and throughout the country, quite an alarming spread of diphtheria, amounting almost to an epidemic. The disease is one which fastens on children most readily, although it attacks adults with often fatal effect. Its chief causes are neglect of proper sanitary precautions and the inhalation of foul sewer gas and of the emanations from damp and badly drained ground. We believe that it is not realized, by dwellers in and owners of our city houses, how imminent the danger of such disease is, or else we should see more efforts directed by private individuals toward the closing up of any possible avenue of entrance for mephitic gases into dwellings. It may be laid down, as a general rule, that the merest whiff of sewer gas pervading a hall or room should be considered as a signal of impending peril, and not a moment's delay should intervene before measures are taken to discover its origin. If the drain pipes in a house are properly constructed, there should be no smell whatever; and the first points to look to are whether there is a good trap in the sewer pipe in the cellar, and whether there is a ventilating tube leading from the soil pipe into a chimney, or to a height at least two feet above the roof. If not, these additions should at once be made. If a tenant be the sufferer by foul odors, and the proprietor neglect the proper safeguards, in this city, the former has only to apply to the Health Board, when an inspector will examine the premises, and the result will be a peremptory summons to the recreant landlord to make the necessary alterations within three days or thereabouts, or in default pay a fine, and also the cost of the work which the Health Board will proceed to perform for him. It is well for tenants to remember this, as we happen to know of cases where many people have all but risked their lives, perhaps through inability to take the precautions themselves, and supposed inability to force their landlords to do so.

About a year ago, Dr. Stephen Smith, of the New York Health Department, published some useful suggestions relative to diphtheria which are well worth remembering. Under the heading of precautions, in addition to the removing of sources of sewer gas escape as mentioned above, he advises the removal of every kind of filth from around the house, the cleaning and white washing of dirty walls, and the disinfection of cellars and ventilation of all apartments, especially those which have been occupied by people suffering with the disease. It is well, in such rooms, not only to lime-wash the ceilings but to paint the woodwork, boil or subject to a high degree of heat every article that can be so treated, and expose the room and its contents to currents of fresh air for at least a week before reoccupation. Children that are well should not be allowed to kiss others affected with sore throat, or sleep in the same room, or use toys or other articles previously handled by the sick. It is safer to isolate ill ones from all the family, except, of course, the necessary attendants. The air in the sick room should be changed at least hourly, and all discharges from the mouth and nose should be received into vessels containing disinfectants, such as solutions of carbolic acid or sulphate of zinc, or upon cloths which are to be immediately burnt or else boiled or soaked in disinfecting fluid.

Diphtheria, like many other serious maladies, is not difficult to check if attended to in time; but it frequently baffles the highest skill if allowed to run. Its distinctive feature is the formation of a false membrane in the throat, which shows itself in grayish brown patches. Sometimes the whole membrane forms suddenly; but as a rule, the patches first appear accompanied by fever and prostration. The first symptoms of the disease, sore throat and abnormal heat, are too often considered as premonitory of a simple cold; but there is no necessity of such error if parents will carefully examine the throats of their children as soon as soreness is complained of. The patches can almost always be well recognized, and a competent physician should be instantly summoned. Home-made remedies and gargles should not be depended upon; and the only treatment worth practicing before the doctor arrives is to administer pounded ice, the use of which was found very effectual during the ravages of the disease in the Oneida community in this State. The prevailing dampness peculiar to the winter months may lead to increased numbers of cases of the malady. It is well therefore to keep in mind that there are but three safeguards: first, cut off the foul air; second, watch all sore throats in the family; and thirdly, summon the doctor immediately.

A VALUABLE GIFT BY CHEMISTRY TO THE WORLD.

A celebrated physician, the late Dr. Valentine Mott, used to say that iodine was the greatest gift which medicine had ever received from chemistry; and it may now be said that one of the most remarkable and important services rendered by chemical investigators to the arts and sciences is the discovery of bromine, by Balard in France, just 50 years ago. Berzelius, while describing it in his "Chemistry," mentions that no use had been found for it, but he cautiously adds the words "thus far," showing that he confidently expected that a use would ultimately be found. The discovery was fruitless for a period of 15 years, when daguerreotypy was invented; and bromine soon took an important place as one of the most valuable ingredients in the necessary materials, and now bromine compounds are indispensable to the photo-

grapher. Another 15 years elapsed; and then physicians commenced to experiment with the new element, and they soon ascertained its great value as a remedial agent, and the salts of bromine now form a series of the most important substances in the materia medica. Lately it has been found that bromine and some of its compounds are the very best etching materials for engraving metals, surpassing all acids and other agents, as described on page 369 of our current volume. But there is no reason to believe that this will close the list of the uses of this remarkable elementary substance, which is found in sufficient abundance in the waters of the sea and of many saline springs to make it comparatively cheap. A short account of the manner in which it is produced will undoubtedly interest many readers.

Bromine is commonly obtained from the mother liquor or bitters of salt works, which is rich in bromine compounds, the latter being retained in the liquor, as they do not crystallize out as easily as the chlorine compounds, of which common salt is the principal. The old method is to pass chlorine gas through the liquor, which, as the chlorine has greater affinity to the bases than bromine, sets the bromine free. The latter is then absorbed by shaking portions of the thus chlorinated liquid with ether, which dissolves out the bromine, and is darkly colored by it. Then the ether is shaken with caustic potash or soda, which combines with the bromine, and so a bromide of potassium or sodium is obtained, out of which the bromine may be set free again in the same way as chlorine is disengaged from common salt, namely, by mixing it with sulphuric acid and black oxide of manganese, and heating, when the bromine distils over.

According to an improved method, the bromine is obtained directly from the mother lye or bitters, by heating the latter with the sulphuric acid and black oxide of manganese, which decomposes the chlorides and yields chlorine gas; this in its turn sets the bromine free from the bromides, and the vapors, with that of water, pass over to a cool receiver, where they condense; while the pure bromine at last floats over a layer of saturated solution, containing 1 part bromine to 40 of water. We ought to add that pure bromine is a virulent corrosive poison. When a small piece of phosphorus is thrown on a few drops of bromine in a tall beaker glass, it is at once violently projected upward with an explosive noise, and in an ignited condition; this forms a striking lecture room experiment, illustrating the effects of very active chemical affinity.

Bromine is a very disagreeably smelling brown liquid, freezing at -8° Fah., and boiling at 150° , when it changes into a deep red vapor, nearly 6 times heavier than the air. According to Wagner's last *Jahresbericht des chemischen Technologie*, the total production of bromine at present equals 245,000 lbs., of which the United States and Germany produce the greatest part, namely, 100,000 lbs. each. Scotland produces 30,000 lbs., and France 10,000 lbs.

MAKING EXCUSES.

It has been said that a person who is good at making excuses is good for nothing else. Nature never accepts an excuse, the law seldom does, and yet in ordinary affairs of life excuses play a large and pernicious part. There are some people who spend half their time in inventing excuses for what they do in the other half of the time. What a pity this inventive power could not be directed into a useful channel, and made to benefit instead of injuring their fellow men! The habit of making excuses grows on what it feeds upon. If excuses were never accepted they would be seldom offered; but on the contrary, our whole primary school system is built on a plan that fosters the fabrication of excuses, many of which are little better than lies. There is a story of a school-master who called up one of his favorite scholars and asked him why he was late. "Oh," said the little excuse maker, "I dreamt I was going to California, and when I heard the school bell I thought it was the steamboat bell." Glad to avoid punishing his favorite, this absurd excuse was accepted and the delinquent pardoned. We fear there are too many parents and teachers so willing to accept excuses that they greatly encourage excuse making, and indirectly encourage lying. As these pupils grow older and begin to feel a personal responsibility for their actions, they naturally fall into the habit of making excuses to their own consciences and of deceiving themselves. How quickly an ingenious excuse heals the prick of conscience!

We do not mean to assert that, frail and imperfect mortals as we are, we should require perfection of our fellows, nor, like Shylock, demand that the letter of the bond be fulfilled. Justice must be tempered with mercy, but sometimes we must be cruel in order to be kind. Nature's laws are inflexible; there is no escape from the severities of her just penalties. If we breathe infected air through ignorance, we suffer as much as if we had entered it with full knowledge; ignorance of the law does not relieve us from its penalties. Our statute and other laws distinguish between murder committed with premeditation and malice from that committed without forethought. The insane escape punishment for their crimes, however heinous. The man who shoots his alister by accident is at once acquitted. But does the bullet discharged by accident, or by a lunatic, or by any one in the heat of passion, prove less fatal than it would had murder been intended? The severed artery, the pierced lung, the congested brain listen to no excuses. To him that is murdered it is all one whether it was premeditated or not.

The infraction of any and all of Nature's laws brings as certain punishment as does Recorder Hackett's court, nay, more certain, if less speedy. The tight shoe, whether of satin or cowhide, worn voluntarily or involuntarily, by a city belle or a rustic clown, is sure to produce the well known corn. Undue exposure leads to consumption; over study and

excitement produce brain diseases as frequently in the pulpit as in Wall street. How often are people engaged in charitable work stricken down by disease incurred in the fulfillment of a holy mission! Most undeserving of such a fate, we are inclined to exclaim; but Nature accepts no excuses. Violate her laws, and ye die!

But what is the great harm in excuses? we think our reader begins to inquire. First, it encourages story telling, untruth, prevarication, and white lies. Second, it makes people careless. Railway trains are our best examples of punctuality; if you reach the depot but 15 seconds too late, you are left and must wait, perhaps for hours. It is of no avail to tell the doorkeeper that your delay was unavoidable, that the omnibus broke down, or the street was blockaded, or the car ran off the track. People know that the rule is as inflexible as the law of the Medes; they do not flatter themselves, as does the tardy school boy, that their excuse is a good one, and thus loiter along at a convenient gait. One of the blessings of railway travel is that it makes people more prompt and more diligent. The banks are another class of institutions that will not accept excuses; if your note is not paid by three o'clock, it goes to protest. It matters not that the money promised you fails to come to hand in time, the train bringing your draft was delayed by snow drifts, or the telegraphic remittance was stopped by a broken wire, or the messenger on his way to the bank fell into an open coal hole and is maimed for life: the bank asks none of these questions, it listens to none of these excuses; the law is carried out.

The publishers of the SCIENTIFIC AMERICAN discontinue sending it to a subscriber as soon as he stops paying. The forgetful subscriber, who would continue forgetful if his paper kept on coming, arouses from his lethargy, and the next year he does not forget to renew it in time to avoid any loss.

The poorest of all excuses is forgetfulness, and the best method of cultivating the memory is to resolve never to accept this excuse from yourself nor make it to others. "I forgot" and "I didn't think" have caused untold misery, and should be stricken from the vocabulary of every ambitious youth. Conductors and switchmen sometimes forget that a certain train is due, and the next morning we read in heavy head lines: "Fearful Railroad Accident! Dreadful Loss of Life." The innocent (?) conductor is acquitted of the murder because he renders an acceptable excuse, and history goes on repeating itself. In some eastern countries, it is said, when a house burns down, the owner, instead of getting paid for it, loses his head. Fires are not of frequent occurrence there.

The old saw, that where there is a will there is a way, is true more frequently than is generally supposed. Let a man know that no excuse will avail for the omission of duty, and nine times out of ten he will contrive to accomplish what he had supposed to be impossible.

WEAK SPARKS.

Poggendorff's *Annalen* for February, 1875, contains an interesting account of many experiments by the celebrated German electrician, Professor Reiss, concerning a new form of electric spark, which he discovered several years ago, and which he denominates "weak sparks." He states that they differ from the ordinary strong electric sparks, not only in form, light, and sound, but in other and very various properties. For example, the length of the conductor makes no difference in the production of the weak sparks; in reference to length, light, and sound, they are independent of the composition of the circuit in which they occur; they produce no marked indication of heating in the circuit, and no magnetization. So far as we have examined the accounts of M. Reiss's results, he appears to have experimented chiefly with the Holtz frictional machine; but doubtless he has tried other apparatus. We however do not observe that he anywhere suggests any form of apparatus for telegraphy or other practical uses of the weak sparks.

It would naturally follow, from what we know of electricity and from the extensive series of experiments and the careful investigations of the nature of the weak sparks by the author, that they might be produced by any of the various known forms of electrical apparatus; and this would appear to be confirmed by certain recent experiments of Mr. T. A. Edison, the well known telegraph engineer and inventor, of Newark, N. J. Mr. Edison has recently ascertained that the weak sparks may be produced by means of an ordinary electro-magnet, and has also put the new sparks into working harness in the form of a telegraph apparatus. As before intimated, we have not carried our examination of Professor Reiss's experiments far enough back to determine whether he describes any method of obtaining them from magnets, and will therefore leave that branch of the subject for further consideration, giving briefly an account of Mr. Edison's new experiments, and what he supposes he has discovered.

The method by which Mr. Edison generates the weak sparks is so simple that any telegrapher or electrician can test it. A bar of metal (cadmium seems to be best) is placed on or over an electro-magnet in an electric circuit; attached to the metal is a wire (of iron or copper, possibly any other metal) which conveys the current of newly discovered force. On breaking the electric circuit with an ordinary telegraphic key, sparks are observed when the free end of the wire is brought in contact with any metallic substance. When the wire from the cadmium is attached to a gas pipe, sparks may be drawn from any part of the entire system of gas pipes simply by touching it with a piece of metal. By this simple means signals have been sent for long distances, as from Mr. Edison's laboratory to his dwelling house, in another part of the city, the only connection being the common system of gas

pipes. Mr. Edison states that signals have also been sent the distance of seventy-five miles on an open circuit, by attaching a conducting wire to the Western Union telegraph line.

For some time Mr. Edison has been industriously studying the weak sparks, and the developments, he thinks, are unceasingly novel and surprising.

Thus far his examination has resulted chiefly in determining the fact that the weak sparks, first supposed to be a phase of inductive electricity, have really no further likeness to electricity than similarity of origin, the power of furnishing sparks, and the ability to transverse electric conductors. On the other hand, the sparks seem to travel over electric non-conductors with equal facility, a glass rod or a strip of hard rubber conveying them as well as a bar of metal. They require no closed circuit. They cannot be grounded, and seem to be incapable of insulation. They are retroactive, sparks appearing when the conducting wire is turned back upon itself, just the same as when the free end of the wire is brought in contact with any other metallic substance. They have no polarity, and apparently no mechanical power. With carbon points and points of several metals, the spark is highly actinic; yet the current seems to have no physiological effect, and does not influence in any way the most sensitive of electroscopes or galvanometers.

Such, in brief, are the leading points of Mr. Edison's observations concerning weak sparks from magnetism, and they closely correspond with the long prior observations of Professor Reiss.

We shall recur to the subject in our next.

WORKING MEN'S READING ROOMS.

We are very much in favor of the plan, which some contemporaries are just now discussing, of free evening reading rooms for workmen; and if such resorts could be started and maintained in every manufacturing village, we believe that an immense amount of good would be done, both in educating the men and checking the spread of intemperance. The average workman gets very little time to read except during the evenings; and if he be single and live in a boarding house, the lack of light, fire, and other necessities for comfort effectually precludes his doing so there. The tavern is, however, open to him, well lighted and well warmed; and there, perforce almost, he spends his evenings in idleness and in the acquisition of habits which are the reverse of beneficial. The trouble with most reading rooms which we have seen in country villages is the fact that they are generally the work of excellent and pious people who unfortunately imagine that a selection of religious literature and a pious cast over the general surroundings of the place are beneficial. However good the motive, this often fails to induce workmen to visit the places. The effect is indeed ordinarily the reverse; for working men are but human beings, and prefer the joviality and lack of restraint at the tavern to the perusal of tracts or the mental digestion of Sunday school books, be the morals and precepts of the last never so good.

The true way of making a reading room both successful and useful is first to render its advantages absolutely free, and secondly to make the room both comfortable and attractive so that every man of average intelligence may avail himself of its privileges. The literary fare may consist at the beginning of periodicals alone, leaving the formation of a library to the future, when a membership becomes established and the members feel like subscribing to enlarge its scope of usefulness by adding a library. Publishers will generally send their journals to such reading rooms at reduced prices; or the charitable in the town or village may often be successfully appealed to for contributions of papers, magazines, and sometimes books which they have read. If there be a local journal, and few towns in this country exist where one is not published, the editor will gladly contribute such of his exchanges as he does not need. In this way, it will be found, plenty of good reading matter can, with a little energy, be collected, and it will prove serviceable in benefiting the community without much expense.

Our plan for a working men's reading room is a plain apartment, as easily accessible to everybody as the tavern. There is no need of costly appointments of any kind; but plenty of good light and a warm fire are indispensable. A table and sufficient chairs, some files for newspapers, and a few shelves for books, include all the furniture absolutely necessary. If the philanthropic projectors can afford a few pictures, a tasteful paper for the walls, or any other ornamentation, so much the better; money thus laid out will not be lost, as such articles lend a home-like air which, to most people, is attractive beyond all else.

A few weekly papers and three or four monthly magazines will be enough for a start; and then, as it becomes apparent that the people of the town are growing more interested in the work, plans can be matured for a wider selection of reading matter; and perhaps, as we before intimated, a subscription among the readers can be taken towards putting the establishment on a broader basis. This is the season of church and similar fairs, for raising money for various benevolent purposes. Perhaps we may venture the suggestion that a small amount may be raised in this way, thus enlisting the cooperation of the young people in the good work. Certainly a free reading room would be a noble Christmas gift from the churches of a village to the working men residing in its limits, or from the proprietors of factories to their employees.

A PIECE of rubber belting fastened around the belt pulley of an engine will keep the belt from slipping.

THAT OBNOXIOUS POSTAL LAW.

Postmaster General Jewell, in recommending in his recent report the repeal of the Act of Congress passed last January which doubled the postage on transient newspapers, books, and similar third class mail matter, raising the same from one cent for every two ounces or fraction to one cent for every ounce or fraction, simply reflects public sentiment relative to that illconsidered and obnoxious law. It was a stupid blunder, on the part of those who framed the bill, that, contrary to their intent, by their own admission, language open to construction as affecting anything but the miscellaneous merchandise which the mails are allowed to carry should ever have entered into it; and the passage of the act shows even more reprehensible negligence on the part of those members who voted for it, in not subjecting the measure to proper examination. Except in the opinion of the express companies, who have been greatly benefited, and by whose influence the act was adopted, there was no necessity for increasing rates even on the miscellaneous matter, as the cheap postage on similar parcels, like seeds, bulbs, samples of merchandise, etc., was a great convenience to the public, and especially such to people living in out-of-the-way localities.

The Postmaster General excepts this mixed material from his recommendation to return to the old rate on printed matter, but fails to show a good reason therefore, based on a possible benefit to the Department. In fact in this respect the report logically contradicts itself flatly, for it may be justly inferred that: if, as the writer paradoxically asserts, "the sending of public documents through the mails has not delayed the delivery of ordinary mails or perceptibly increased their cost," some 200 to 300 tons being the estimated amount sent; the sending of small parcels, not exceeding, if altogether aggregating, in weight the hundreds of tons of documents which the members of Congress heretofore sent free through the mails, would, if the matter were paid for at any price, result in positive gain. It may be remarked in passing, that the sentence above quoted is unfortunate from another point of view, as it apparently offers an argument to those who are seeking the return of the franking privilege; for it is easy to predicate the assumption thereon that, if several scores of tons of matter is imperceptible in point of cost or trouble, then as many hundred tons would be practically inconsiderable.

There are rumors that Congress will act upon this subject early in the session. We trust that the same are well founded, and that our representatives will use no delay in restoring the old and popular rates, including all articles coming under what is "third class matter."

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VI. Subscribers who preserve their numbers have, at the end of the year, two handsome volumes of 416 pages each, containing several hundred engravings, worth, as a work of reference, many times the price of subscription.

A Gas Shadow.

A striking and curious experiment, showing the superior weight of carbonic acid gas over air, may be made by projecting the shadow of the gas, as it is poured from its containing vessel, upon a screen. The latter should be of white paper and bright sunlight should fall on the stream of gas, which should be poured from the spout of a pitcher held within 10 inches of the screen. The curious result, of a shadow produced by apparently nothing, will be seen, the former resembling descending smoke, quite black at the spout of the vessel, but brightly illuminated whenever the sunlight is concentrated by passing through the gas.

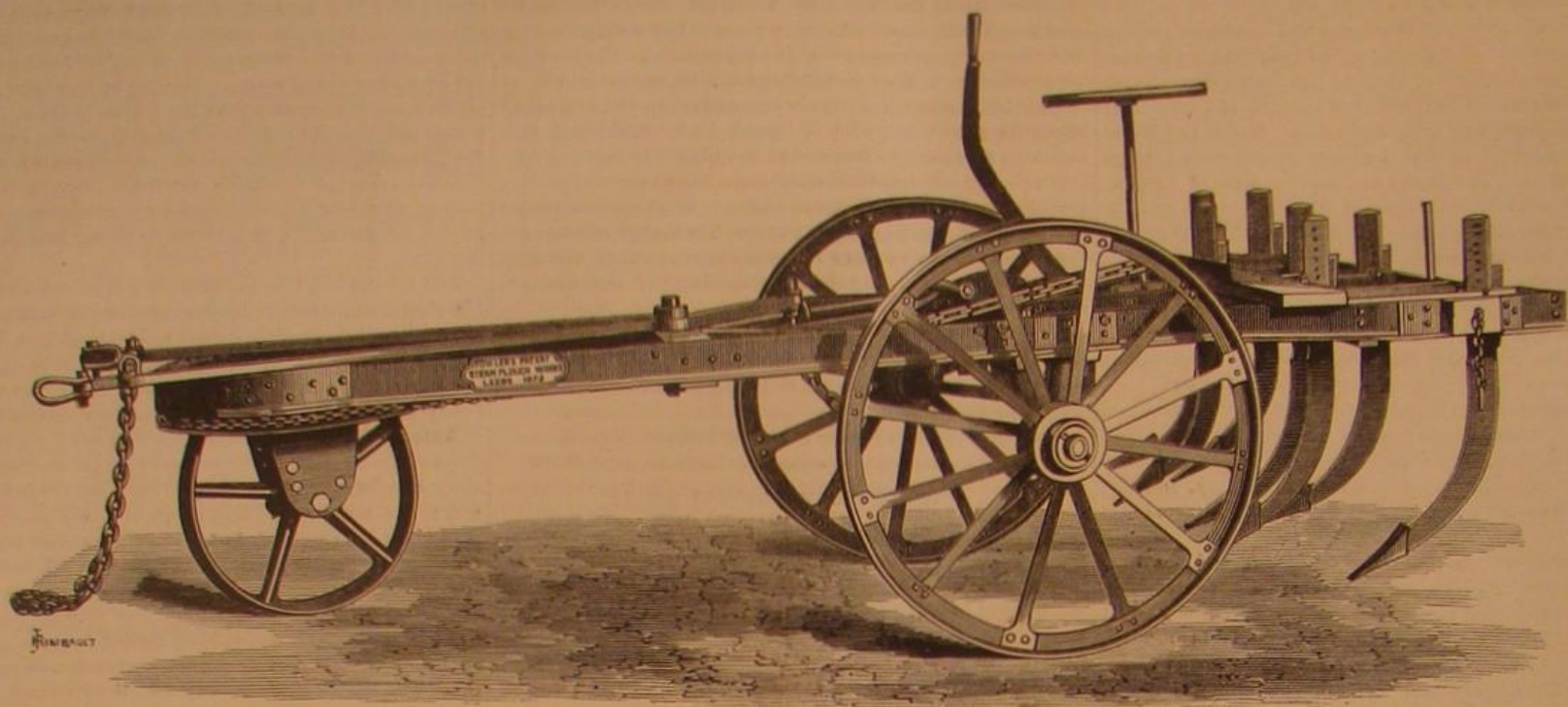
To prepare tin for tinning brass, copper, and iron. Melt the metal in a crucible which has previously been slightly warmed; and at the moment the metal begins to set, and when it is very brittle, pound it up rapidly, and sift when cold to remove any large particles.

STEAM CULTIVATION.

The Fowler system of steam plowing has been frequently mentioned in these columns as being the most successful of many attempts to solve a problem of some difficulty and of great importance to the future of agriculture. We illustrate herewith a cultivator, intended by the makers for use where the double machine would be unnecessarily large and expensive; it is constructed so as to be readily turned and operated in the reverse direction after one set of furrows has been cut. Messrs. Fowler have made some improvements in this apparatus, one of which deserves special comment. This consists merely in making the lever, to which

the screw working in the water of replacement was to take away some of the pressure which drives the ship. But with reference to the advantage of housing in a tunnel if the screw were driven at excessive speed, he thought it not unlikely that the housing would produce a beneficial effect by preventing the scattering of the water, and whatever reaction the water supplied would be more effectively directed into the line of motion; nevertheless he considered it would involve the drawback of adding largely to the surface friction of the vessel, and he expected that nearly the same advantage, but less encumbered by surface friction, would be obtained with any kind of shrouding given to the tips of

water, which, being sucked in by the action of the screw frequently break some, if not all, of its blades. Mr. Griffiths also considers that the effects of racing will be much decreased, on account of the water being taken in from below, and therefore he thinks that the whole of the after part of the vessel will have to be lifted out of the water before any racing will take place. There can be no doubt, however, that for ships of war it is a matter of no small importance that the screw should be protected from shot and shell, and, if possible, completely cased with armor plates. It is well known that at present the helm has to be put over to port or starboard, according as the screw is left or right handed, and



FOWLER'S STEAM CULTIVATOR.

the ropes are attached, of a forked shape, as shown. In use that arm of the fork to which the hauling rope happens to be attached is of course brought into a direct line with the strain; while the other arm is thereby caused to project laterally, thus bringing the tail rope clear of the wheels, and causing it to be in a favorable position for turning the implement when the headland is reached. The tail of the draft lever is coupled to a short chain; and when, on arriving at a headland, the strain is transferred to what was previously the tail rope, and the draft is thus brought at right angles to the implement, this chain is tightened and, by acting on a segment, turns the main axle, which is cranked, and this, by depressing the supporting wheels, lifts up the main frame, and raises the tines clear of the ground. The tines being maintained in this position by a lever and catch, the turn is readily made; and on its being accomplished, the steersman allows the frame and tines to fall again, and the implement starts on a fresh journey. The action of this turning arrangement is admirable. The turns are made with great promptitude, and within a very limited space, while the implement is altogether thoroughly manageable, and there is nothing about it liable to get out of order.

RECENT IMPROVEMENTS IN THE SCREW PROPELLER.

It would be by no means an easy task to enumerate the many inventions which have been made, since the introduction of steam navigation, to improve the form of the screw. The modification of the screw propeller devised by Mr. Griffiths has been generally admitted to be one of the best. Mr. Griffiths, however, has since arrived at the opinion that we have hitherto been neglecting the true principles in screw propulsion; and after a series of experiments he concludes that the difference, between the amount of power exerted to propel a ship by a screw and that required to tow her, which in one case Mr. Froude found to amount to a loss of 58 per cent of the power supplied, is due to the screw not being sufficiently supplied with water. With a full-sterned ship this is greater than in one having a fine run, as the water runs into the space left by the stern, and deprives the screw of its full supply.

To remedy this, Mr. Griffiths' plan is to put the screw into a casing of 50 to 75 per cent larger area than that of the screw's disk, and provided with an opening underneath, so that the screw is not supplied with the water which would otherwise flow into the space left by the ship, nor does the ship rob it of any of the water which it requires to force back in order to give the thrust to the screw shaft for propelling the ship. This view of the case was not, however, assented to by Mr. Froude, who thought that the effect of

the screw blades. Since then Mr. Griffiths has had H.M.S. Bruiser placed at his disposal to experiment with, and the results certainly appear to bear out the experiments with models previously made by that gentleman. The Bruiser was first tried, on February 26, with her propeller fitted in the ordinary way, her course being over the measured distance within the breakwater at Plymouth. The force of the wind was 2 to 3, and its direction E.S.E., and the sea smooth. The draft of the ship was 8 feet, both fore and aft, and she was fully equipped and ready for sea. The screw fitted was one of Griffiths', with two blades, having a diameter of 6 feet and 8 feet pitch, with 60 nominal horse power, and a mean pressure in the cylinders of 35.79 lbs. her mean number of revolutions, after six runs, was 881 per mile, and her true mean speed 8.016 knots. Having been docked, and the casing fitted to her, as shown in the accompanying illustration, she was again tried on July 2, under almost similar circumstances to those of the first trial. The force of the wind and the state of the sea were the same, though the direction of the former was S.W. instead of E.S.E. She carried one more ton of coals, and her trim was a little different, being 7 feet 10 inches forward, and 8 feet 1 inch aft. With the same nominal horse power, and only 0.4 more horse power indicated, the mean number of revolutions was only 836, whereas the speed gained was 8.274 knots, or rather more than a quarter of a knot beyond what was realized without

that some loss of speed is thereby occasioned; but with the screw in a casing this is not necessary, and perhaps a good deal of the quarter to half knot increased speed obtained with the Bruiser may be due to this cause. Mr. Griffiths' system, however, is not all included in placing the screw in a casing, for he also proposes to divide his power into two parts, by using two small screws instead of one large one, and putting one at the bow and the other at the stern of a ship. The engines and shafts, also, would be placed lower down in the ship, and therefore, in men-of-war, be more protected against shot. But perhaps the most important improvement claimed for this system consists in having two separate sets of engines, boilers, and propellers, so that if one were placed *hors de combat* the other would still be available to keep the ship off a lee shore, or from getting into the trough of the sea. The experiments with the casing round the screw having proved so far successful, the British Government have now placed a small screw launch at Mr. Griffiths' disposal with which to try still further experiments.

Three Curious Discoveries.

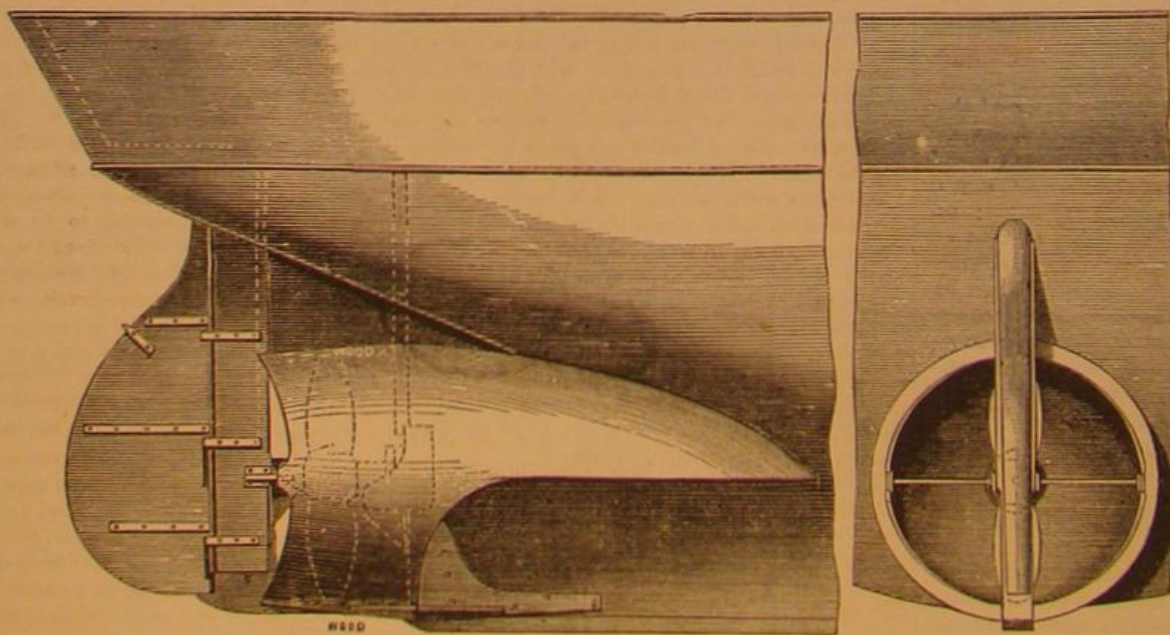
A recent examination of the bottom of an old Roman well, located near the hot springs of Bourbonne les Bains, in France, has resulted in three remarkable discoveries, two of an archaeological nature, and one of some importance from a geological point of view.

After the excavation had been thoroughly drained, and a thick layer of refuse penetrated, the first discovery was made in the bringing to light of thousands of small metallic objects of art. These included ornaments, statuettes, and coins, the last of silver, gold, and copper, dating back to the times of Nero and Hadrian.

Beneath the layer of ornaments, etc., a second layer was found, composed entirely of fragments of sandstone, which, together with the metallic objects, were completely covered and held in masses by metallic crystals, evidently deposited by the water above. These crystals were subjected to careful investigation; and as a result they have been pronounced to be of such a nature that geologists would unhesitatingly describe their formation to natural causes, working

through ages. That such is not the case is plainly evidenced by the known eras of the coins above which they have formed. It will be seen that the circumstance, which constitutes the second discovery, may throw serious doubt over a large quantity of important geological deductions as to lapses of time, when the same, as is the fact in many instances, are wholly based on supposed slowness of formation of similar deposits.

The third discovery relates to the fragments of sandstone



THE GRIFFITHS SCREW PROPELLER.

the casing. It being thus evident that Mr. Griffiths was correct in his conclusions, that greater speed would be obtained with a screw in a casing than with one fitted in the ordinary manner, it may be as well to inquire into the other advantages which he claims for his system. No small value is attached by him to the fact that a complete protection will be afforded to the propeller by the casing, as a safeguard against the dangers a screw usually is liable to from pieces of wreck, ice, etc., floating on or near the surface of the

By comparing these with other pieces, already found in similar localities, the investigators have concluded that such fragments were thrown into the wells as votive offerings to local divinities by the ancient inhabitants of the country, and that the same custom, continued through centuries, accounts for the presence of the much more recent Roman money. A chain of proof, mainly circumstantial, has been elaborated, which refers the stone fragments to the neolithic epoch, in prehistoric ages, and further shows that the pieces probably represent the earliest money used by man.

Self-Acting Car Couplings.

At a recent meeting of the Master Car Builders' Association, the subject for discussion was "Freight Car Couplings, Draw Bars, and Buffers," upon which Mr. Partridge made an address.

Mr. Adams was called upon for information on what is required by railroad companies, and said that he had no specific facts to present in relation to the repair of drawbars throughout the country. It was very difficult to get very specific data. The habits and customs of our car men have not been of the character to present these data accurately. The committee appointed on this subject, in looking over the matter, had made up their minds as to some important points to arrive at in the way of improvements. "We have been shown by Mr. Partridge some of the defects in the present arrangement, which had been considered by the committee. But there were some other things that presented themselves to their minds, and one of the most startling of the whole of them was the expense of links and pins. Upon some roads this expense was enormous, amounting to anywhere from \$10,000 to \$60,000 or \$70,000 a year, according to the size of the road. The ordinary roads perhaps would average \$30,000 to \$40,000 a year. We need something to couple our freight trains which will enable us to dispense entirely with pins and links. This was one of the points to be striven for. Another point in which we thought there was an absolute necessity for improvement was a greater power of resistance in our buffer springs, and a greater range of motion. Our resistance is altogether below the line of connection. If the springs were made stronger, given more motion, and placed in the direct line of resistance, the difficulty would be materially obviated. Various devices have been presented to us during the past year; a good many models have been brought out, and some of them have approximated somewhat to the accomplishment of the idea, but we have not seen any yet that meet our wants, in the opinion of the committee. The thing, after all, is progressing, but yet there is room for improvement. We have got to have a device that will couple freight cars without a link and pin, and, in addition to that, a separate ebuffer placed directly in the line of the frame or bottom of the car, and we have got at the same time to use our present stock; that device must be made to connect itself with our manner of coupling. We have got to use our present stock until it is worn out. But the committee is not as yet prepared to recommend anything. They have not found anything that will entirely accomplish the purpose. A buffer must be so built that it won't couple when you don't want it to. Many inventors seem to think that you must get something that will couple every time it strikes. There have been but few models that seemed to embody the idea to dispense with links and pins, but I think we shall have to make it in two parts, a separate buffer and separate hook, because we want our connections to be in the floor of the car. Mr. Stone in his model has accomplished considerably towards it, and I have no doubt he may be able to bring it perhaps to something near what we want."

Mr. L. Garey said that it was easy to find fault, and difficult to apply the remedy. "The necessity for improvement in the attachment by which cars are coupled together has been felt for a great number of years, and it was still evident that the improvement had not been got. The necessity of these improvements was shown by the immense number of patents granted year after year. The real necessity is an automatic coupler with buffing attachments, either connected or with another device placed on the line of resistance. The buffing requires from one half to double the resistance of the drawing to make it substantially strong. Now if some of our inventors will dispense with the use of the links and pins entirely, provide us with a coupling, automatic or not, which can be uncoupled from cars from the top or side, and give us a buffing attachment which is sufficient for the work, that ought to make a dozen fortunes for him and secure him the blessings of all the people, not only those that travel, but especially of the men employed on railroads. He thought that the railroads would say that, out of the cars which were side-tracked for repairs, eight tenths were owing to some defect in the drawing or attachment. If this could be reduced to three tenths, it would be a great deal. There was more difficulty from the failures of the attachments than in the drawbars themselves."

Don't Leave a Legitimate Business for Financiering.

It is an evil of the intense competition in great mercantile communities that it drives many from the walks of legitimate business into schemes of speculation with reference to sudden and extravagant gains. The history of frauds teaches that they originate chiefly in the attempt to grow rich rapidly by financiering rather than by diligence in business. Financiering has its place in legitimate business. Some men have a talent for this, which is as true a mark of genius as is poetry or art. But it is not a talent that every man can acquire, and it is fortunate that this is so; for if all the world should turn financiers, the earth itself would soon go

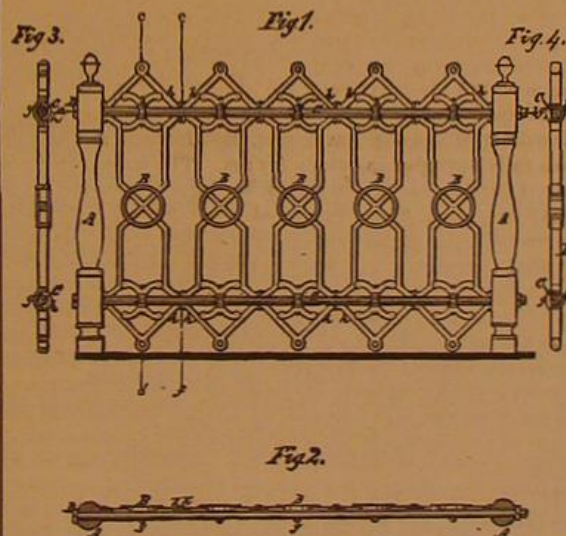
into bankruptcy. Now, the calamity of a great city is that every one who gains a little money takes to financiering as a readier mode of increasing it than regular business. Wall street, the focus of financiering, gives a tone to the whole business community.

But financiering is a deep game; and he who leaves an honest toil in a business that he does understand, for calculations of chance in matters where he has no skill, is very apt to become the loser, and, as in all lotteries, to grow desperate in the attempt to make up his losses. We do not speak of investments in stock as property, but of the spirit of speculation; and we have no doubt that a just verdict upon many cases of fraud would be: "This man lost his capital and his character by speculation in stocks." Keep, therefore, to honest toil in a legitimate business, and do not aspire to become a financier. "Be content with such things as ye have."

ROBERTSON'S IRON FENCE

The use of ornamental iron fences is no longer confined to expensive city residences, but is gradually extending to the more humble suburban or village houses; and they would be used much more but for their great cost; to lessen this is the object of an invention lately patented by Mr. T. J. W. Robertson, which is illustrated in the accompanying engraving, Fig. 1 representing an elevation, and Figs. 2, 3, and 4 showing sections through the lines, *a b*, *c d*, and *e f*, respectively.

This fence is made up of castings having the metal so disposed as to allow rods to be passed through the ornamental openings in the sections or pickets, whereby the latter are so effectually secured to the former that they cannot be removed when the panel is in place between the posts by which it is supported; and this is done without fitting, riveting, or other fastening, except that necessary to secure the rods in the posts. To accomplish this, the sections or pickets are made with three vertical bars, *h g h*, where the tie rods are to be connected to them; and these bars are so formed as to admit the tie rods between them, in the same manner as the weft thread passes through the warp in weaving cloth. That the tie rods may readily pass through the sections, the two side bars, *h h*, have recesses on one side, and the central one, *g*, on the other, so that an edge view of the castings would show holes through it about the size of the rods, *C C*, through which the latter are passed.



With sections thus cast, all that is required to make a panel of fence is to pass rods or gas pipes through a sufficient number of sections and the posts, and then bind the whole together by screwing nuts on the ends of the tie rods, when the panel is ready to be erected. Where large hollow posts are used the nuts may be concealed in their interiors.

From this it will be seen that the cost of a fence of this character may be reduced to that of the castings, rods, etc., as no time is spent in fitting, boring, riveting, etc.; and although thus cheaply built, it is one of the strongest fences made, as the whole strength of the materials employed is utilized in fastening the parts together.

For further particulars, or the purchase of State or county rights, application should be made to the patentee at 818 O street (N.W.), Washington, D. C.

A NON-RETREATING BUNSEN BURNER.

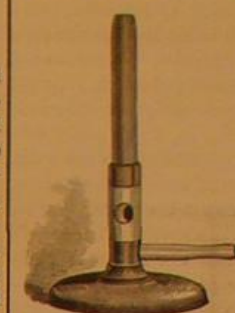
BY PRESIDENT HENRY MORTON, PH. D., STEVENS INSTITUTE OF TECHNOLOGY, HOBOKEN, N. J.

In consequence of the low pressure of gas during the day time, in this place, we have long experienced trouble from the retreating of Bunsen burners of the usual construction. This having repeatedly proved a source of annoyance and loss, I was led to a series of experiments with the view of removing the difficulty, if possible, by some modification in the form of the burner. After various trials with burners, in which the relation of height to diameter in the main tube and the size of the gas jet were varied, I was led to the following consideration of the subject:

The retreat of a burner will evidently occur whenever any part of the ascending column of mixed gas and air is moving at the orifice with a velocity less than that at which the same will burn. Now, in an ordinary burner, with its main tube of regular cylindrical bore, it is evident that the friction of the surface of the ascending column of mixed gases will cause that portion to move at a less velocity than the central part, and that even currents of the nature of eddies will be developed. It will thus happen that, while the central portion of the ascending column of gaseous mixture issues at a velocity much greater than that at which the ma-

terial can burn downwards, and thus is quite free from any danger of retreating, the marginal portions of the column or jet of gas will be escaping at a rate so much less than the velocity of their combustion downwards will exceed that of their upward motion, and retreat of the flame will ensue.

It is well known that, to secure a jet of water or of any other fluid whose particles shall move with equal velocities in all parts, and thus avoid currents and eddies, it is only necessary to make the orifice of efflux an aperture in a thin wall. In following out this idea, I made a burner of a bore rather large compared with its height, and then drew in its upper edge into the form of an open-ended thimble, so contracting the orifice of escape to about two thirds of the area of the tube, and rendering this orifice practically an opening in a thin horizontal wall or plate. The results of this modification far surpassed my anticipations.



A burner thus constructed, as shown in the engraving, gives a perfectly non-luminous flame with gas pressures varying between $1\frac{1}{2}$ inches and $\frac{1}{8}$ of an inch of water, and with the lowest of these pressures cannot be made to retreat by the most violent handling in the way of sudden movement or waving about in the air, even when this violence is carried to the extent of extinguishing the flame altogether. Under like conditions of pressure, a burner of the ordinary construction is made to retreat by a slight draft of air or a very moderate amount of motion.

These burners are being manufactured, for our own use and for other colleges, by George Wale & Co.

Correspondence.

The Purification of Water.

To the Editor of the Scientific American:

In 1869 I took occasion through the columns of your valuable journal to call attention to the beneficial action of air for purifying water which had become foul with decomposing organic matter, and to offer my patent air treatment for the purpose, for domestic uses, free of charge. At that time the subject was new to the public; and few perhaps attached to it the importance which more recent developments have shown it to possess, especially for dwellers in cities. Recent articles by various writers on the subject tend not only to fully support my statements, but to show that bad water invariably suffers for want of oxygen, the degree of foulness indicating the diminished proportion or the absence of free oxygen.

The putrid water of a river can be reclaimed by absorption of oxygen, and it will arrive at sweetness and wholesomeness as soon as it possesses $\frac{1}{2}$ of 1 per cent of free oxygen; this amount is necessary for fishes to thrive in water. But such water would not necessarily be suitable as a beverage for man.

Great apprehensions are now entertained that the horridly putrid condition of the ponds in Central Park will spread disease over the neighborhood, and these fears will be too fully justified if the present state of things continues. But there is no necessity for pond water to be putrid, or to become unwholesome, at any time. By the moderate annual expenditure incurred in running an air force pump or pressure blower, requiring about 20 horse power, in a place conveniently central, conveying the air by light but durable mains of about 12 inches bore to pipes of smaller bore near the bottom of the ponds, with perforated branch pipes through which the air issues, all apprehension of the re-occurrence of foulness in ponds can be entirely removed. Sufficient oxygen can be supplied by thoroughly agitating the water for about one hour daily, by pumping in air, to keep the ponds sweet. To purify them in their present state, the most rigorous air treatment for several days is needed; it may take a week to do it. The Croton water has suffered with this malady for years, and if it be not speedily provided against, it will fill our cemeteries at a still higher rate than 27 in 1,000 per annum, a death rate only exceeded by Bombay with 29.

R. D'HEUREUSE.

New York city.

The Treatment of Diphtheria.

To the Editor of the Scientific American:

I wish to make known to the public a method of treatment for diphtheria, which has been uniformly successful, in the practice of the writer, during a number of years, which included two epidemics; and in a large number of cases, not a case has been lost since this treatment was adopted. I feel confident that, by its general use, the mortality may be reduced to one per cent, or even less. I have heretofore delayed publishing the results in order to make sure that the treatment was really what it promised to be, and I now wish to use the columns of your journal, in order that the public generally may have the knowledge in their own possession.

An attack of diphtheria is usually ushered in with a high fever and headache, and, in children, with nausea and vomiting. There is great prostration. Upon the tonsils and surrounding parts are seen white, snow-flaky patches. In malignant cases, the patches are often yellow or brownish, and a terrible odor is perceived.

The remedy found successful by the writer is permanganate of potash, in conjunction (not combination) with the tincture of belladonna. The method of administration is as

follows: From 2 to 3 grains (not more) of the permanganate are dissolved in from 2 to 4 ozs. of water in a goblet. Five drops of the official tincture of belladonna, or, better, from 10 to 20 drops of the 1st decimal homoeopathic tincture of the same drug, are put into another goblet with an equal quantity (2 to 4 ozs.) of water. A teaspoonful is to be taken from each goblet alternately at intervals of a half or one hour. It is, perhaps, needless to say that separate spoons should be used, and the goblets kept covered.

In twenty-four hours, frequently, a favorable change will be seen, but quite as often the disease seems to go on unchecked, save that the fever may seem a little more moderate; but I can assure my readers that, during the second day of the treatment, a most marked change will take place. The fever will entirely subside, the mind will brighten, the tongue will begin to grow clean, and the deposits upon the fauces will peel off at their edges or gradually break away. The patient will be upon the highway to recovery, and a day or two more of the treatment will bring back the normal hue of health, and an appetite to correspond. In rare cases, however, when the constitution is bad (cachectic), a longer time, five, six, seven days, may be required; but even here the treatment has not failed.

I think that, under this treatment, diphtheria is not a disease to be dreaded by the profession. The belladonna may, in special cases, find a substitute, but not the permanganate of potash. The only case in which the above treatment will promise unsatisfactory results is when the disease rapidly invades the larynx and bronchial air passages (diphtheritic croup), when suffocation threatens to supervene before the remedy can act, or when the mere presence of large detached deposits in the air tubes imperils the success of the case. Such an instance recently occurred, which was successfully treated with inhalation of the vapor (not the spray) of a dilute aqueous solution of bromine.

I know that the permanganate has been used as a disinfectant, locally applied, in putrid diphtheria heretofore, in dilute form (as a gargle), and upon general principles as an antiseptic; but I am not aware that the persistent use throughout the disease has heretofore been made known to the public or profession. That it does not act as an antiseptic is shown by the fact that the other antiseptics have no analogous effect; that it does not act locally may be inferred, because its marked curative effects appear in the system before they are seen in the fauces. The theory of the writer is that diphtheria finds its nutriment in partly devitalized organic matter in the blood, which the permanganate, rapidly absorbed, attacks and destroys by oxidation (being the most powerful non-poisonous oxidizer we have): thus cutting away the pabulum of the disease, when the deposits die a natural death and disappear. The process certainly sometimes appears magical in its action. I trust that, if others employ this treatment, they will not attempt to modify it till they have first given it a fair trial in the manner above proposed.

I have also found the permanganate of potash very successful in the treatment of certain slow forms of putrid and typhoid fevers, with loaded tongue, foul breath, etc., and in recurring boils. This lends additional force to the theory of its action above indicated. I am sure that this drug, so rich in oxygen the life-giver, so harmless in its action upon the human system, will well repay study by the profession generally, which it has heretofore only received, and that in a very inadequate degree, from the homoeopathic branch.

Philadelphia, Pa.

L. W. HEYSINGER.

What Flies Do.

To the Editor of the Scientific American:

An article on this subject, in a recent issue of your paper, by Mr. Emerson, an English chemist, has induced me to send you the result of some careful observations made upon the parasites that infest flies. It is not my purpose to dispute the theory, advanced by Mr. Emerson, that flies are scavengers of the atmosphere, and that, while flying through foul places, they collect on their bodies various organisms, which they feed upon at leisure. My desire is only to draw attention to the fact that the common house fly (*Musca domestica*) is at certain seasons possessed of parasites. In examinations made during the summer months, I have failed to detect the parasites; but in the autumn, as a rule, they can be discovered in large numbers around the *coxa* (the joint of the leg that is attached to the thorax); and when disturbed, they become very active, running up and down the spines or hairs of the fly. They somewhat resemble in form the *acarina tellurium*, the little red mites of our hot-houses. They differ from them in having but six legs; and in fact, they possess every quality, excepting wings, necessary to constitute perfect insects. They are half a line long, and, by the unaided eye, can be seen as mere specks, and therefore do not belong to the animalcules which represent the smallest and imperfect forms of life. By placing a fly possessed of these parasites upon a piece of clean glass, and then killing the fly, the parasites will immediately leave the dead body and wander away upon the glass. By holding the glass up to the light, the parasites can be seen as atoms, moving. Under frequent careful microscopic examinations, I have never observed that these parasites were eaten by the fly. On the other hand, I am very much of the opinion that the fly is consumed by the parasite. In every case of my observation, the fly possessed of these parasites was in a sickly condition.

F. C.

Prizes for Designs for a Concrete Villa.

In pursuance of past promises, and in compliance with numerous requests, we invite competition designs for a class of structure which commends itself to notice. Of the various kinds of building open to selection, not one seemed to us more suitable, in calling into exercise the skill and ingenuity of architects and the younger members of the profession, than the one we have chosen. We have thought of dwellings for the poor and middle classes, hospitals and asylums, churches and schools, all deserving subjects, but they have been more or less used up, and there appeared to us little in them to provoke inventiveness or to afford so ready a response as a villa designed in a material comparatively new, and affording ample scope for an independent architectural solution.

CONDITIONS OF COMPETITION.

1. The design to be adapted for a villa of the ordinary suburban class, suitable for a corner site.
2. The accommodation provided is to comprise a porch, hall, morning room, library, dining room, kitchen, and necessary domestic offices on the ground floor; two principal bedrooms, dressing room, bath room, and three other bedrooms on the first and second floors. Coal, wine, and beer cellars to be arranged in the basement. A servants' staircase to be provided. The sizes of the rooms are left to the discretion of the designer.
3. The cost of the villa not to exceed \$9,000, calculated at 14 cents per foot cube of the whole building, the contents being measured from the foundation level to half way up the roof. Preference will be given to a design that exhibits economy of plan combined with a suitable architectural treatment of concrete.
4. The general drawings to be to a scale of one sixth of an inch to a foot, and to comprise the following: Cellar plan showing drainage, ground plan, first floor plan, three elevations, one section taken through principal staircase. A sheet of details, illustrating any important part of the construction or decoration, drawn to an inch scale, on a sheet of paper 22 by 14 inches, may accompany the drawings. The whole of the general drawing to be arranged on a sheet of double elephant paper (hotpressed), 37½ inches by 27½ inches, and to be sent in unmounted. The designer to be at liberty to send in a perspective view with the general drawings, in lieu of one elevation, but no account will be taken of this in selecting the design.
5. All the drawings to be drawn in black (Indian ink) lines, and to be suitable for photo-lithography. No wash of any kind to be used. The shadows, if any, should be hatched in line.
6. The drawings to be accompanied by a general specification of the method of construction proposed to be adopted, the scantlings of timbers, etc., with a general statement of the reasons that have influenced the designer, and the dimensions of the several rooms.
7. Particular regard will be paid to the constructive and sanitary merits of the designs submitted.
8. The drawings to be sent in under motto, accompanied by a sealed envelope containing the name and address of the designer, to the editor of the *Building News*, London, on or before the 25th day of January, 1876, carriage paid.
9. The decision will be published in the columns of the *Building News*, with a report of the judges.
10. The editor reserves the right of publishing any or all the designs.
11. The sum of \$50 is offered for the best design; \$35 for the second; and \$15 for the third, all in gold.—*The Building News*.

Tania and Raw Meat.

"Seventy years ago tania (tapeworm) was such a rare affection in France that many physicians of large experience had not met with it; or if they had, the cases were extremely few. To-day tania has become so common that every practitioner meets several or many cases yearly. To what is due this sudden multiplication of tania? It is twenty or twenty-five years since Trousseau first, and many physicians after him, and more recently Professor Fuster, began to employ raw meat as a remedial agent; and it was at first received with distrust, but at present it has become of general use. This coincidence alone permits us to suppose that raw meat may have something to do with the production of tania, and most physicians have adopted this etiology, which appears absolutely certain. Beef frequently contains the germ of tania, which germ, transported into the stomach of man, develops, taking the form of the tapeworm. In Abyssinia, where the use of raw meat is general, every one has tania. At St. Petersburg, Dr. Weiss observed, according to Cauvet, that children fed upon raw meat were frequently attacked by tania.

"For my part, I have observed a great number of cases of tania during the past few years, and in every case the individual had made use of raw meat or was at the time under that regimen. In a convent I recently administered raw meat to four nuns, three of whom were seized with tania afterward.

"M. Laborde (*Tribune Médicale*, page 472) does not believe that raw meat is the cause of the increased production of the worm. 'Each of the three varieties of tania which are found in man,' says he, 'argues its origin in an absolute manner. The *tania solium* results from the transformation of the *cysticercus cellulose* of pork. The *bothriocephalus tania* is produced by fish. The *tania mediocanella* is the only one that can be communicated by beef or mutton, and we all know how rare the *tania mediocanella* is.' There is precisely where the error lies. The *tania mediocanella* is not rare;

on the contrary, it is at least as frequent in our time as the *tania solium*; and it is readily recognized by a simple magnifying glass. If M. Laborde were to examine the tania that follows the ingestion of raw meat, he would see that the *tania mediocanella* has become very common in France from our new therapeutical habits, while the frequency of the occurrence of *tania solium* has not increased, for pork meat slightly cooked or raw remains exceptional. Thus we see that it is beef or mutton which furnishes these frequent cases of tania. Have we any means of doing away with this terrible inconvenience?

"It is at least probable, if not certain, that the addition of alcohol to raw meat, following the method of Fuster, of Montpellier, suffices to kill the germ. For that, the alcohol employed must needs be strong, and the meat should be well mixed with that liquid and allowed to macerate for some time. Thanks to heaven, the moment tania becomes frequent, the *materia medica* enriches itself with the knowledge of a new tenifuge, at least as efficacious as any other, and superior, inasmuch as it is absolutely innocuous, and that its abundance and low price place it within the reach of every purse. Freely administered pumpkin seeds constitute a sure and inoffensive tenifuge, that seldom misses its effect. Some precautions are necessary in the employment of this medicine.

1st. The intestine is previously emptied by recommending the patient to abstain from eating on the eve of the day on which he proposes to take the remedy.

2d. Early in the morning we administer on an empty stomach 60 grammes (1 oz., 7 drachms) of pumpkin seeds, deprived of the skins and ground with sugar, then mixed with water, forming a sort of milk of almonds.

3d. When the patient feels the worm detaching itself, we administer 70 grammes (2 oz., 125 grains) of castor oil in a cup of hot broth or black coffee, and the worm, in all probability, will come away during the day.

If the head of the worm is not found, the same treatment is repeated in eight or ten days, or the day following the first treatment, if desirable. To recapitulate: It is certain that raw meat as prescribed to-day exposes the patient to tapeworm. The species observed in such cases is the *tania mediocanella*. Mixing the meat with alcohol lessens the danger. The tania, once developed, is easily removed by pumpkin seeds properly administered.—G. Régnault.

Punctuality in all Things.

It is astonishing how many people there are who neglect punctuality. Thousands have failed in life from this cause alone. It is not only a serious vice in itself, but it is the fruitful parent of numerous other vices, so that he who becomes the victim of it gets involved in toils from which it is almost impossible to escape. It makes the merchant wasteful of time; it saps the business reputation of the lawyer, and it injures the prospects of mechanics who might otherwise rise to fortune; in a word, there is not a profession, nor a station in life, which is not liable to the canker of this destructive habit.

In mercantile affairs, punctuality is as important as in military. Many are the instances in which the neglect to renew an insurance punctually has led to a serious loss. Hundreds of city merchants are now suffering in consequence of the want of punctuality among their Western customers in paying up accounts. With sound policy do the banks insist, under the penalty of a protest, on the punctual payment of notes; for were they to do otherwise, commercial transactions would fall into inextricable confusion. Many and many a time has the failure of one man to meet his obligations brought on the ruin of a score of others, just as the toppling down, in a line of bricks, of the master brick causes the fall of all the rest.

Perhaps there is no class of men less punctual than mechanics. Do you want an upholsterer? He rarely comes when he agrees. So with carpenters, painters, and nearly all others. Tailors and shoemakers often do not have their articles home in time. The consequence is that thousands remain poor all their lives, who, if they were more faithful to their word, would secure a large run of custom, and so make their fortunes. What would become of the SCIENTIFIC AMERICAN if it were not punctual in going to press? or if our paper makers were not punctual in delivering paper? or if our compositors were not punctual in coming to work? Be punctual, if you would succeed.

RAILWAY IRONCLADS.—Cologne is to be surrounded by a chain of forts in the same manner as are Metz and Strasbourg. The works, which are now in course of construction, are connected with each other by a protected circular railway, which, now used for transporting material, is designed as an additional means of defence, as it will convey portable ironclad batteries from point to point. Within the outer fortifications there is to be a second line, and a series of revolving iron turrets.

PROFESSOR JAMES ORTON, of Vassar College, proposes at an early day to make an exploration of the Madeira and Beni rivers, which are branches of the Amazons, with the view of opening to science and commerce that portion of South America which is watered by those rivers. The Chamber of Commerce of New York city heartily seconds Professor Orton's project, and has addressed a memorial to the Secretary of the Navy, urging the importance to the United States of a knowledge of that district, and asking his co-operation in the enterprise. Professor Orton has had much experience on the Amazons.

"WRINKLES AND RECIPES" is for sale at all book stores.

By a recent fire in the arsenal at Rendsburg, Holstein, forty thousand new Mauser rifles, an equal number of rifles of older construction, and much other war material were destroyed.

Milk Preserving.—How an American Invention is Worked in England.

The Anglo-Swiss Milk Condensing Company has three establishments in England, one at Middlewich, one at Aylesbury, and the other at Chippenham. Perhaps a better situation for a milk-preserving depot could not be found than at Chippenham, a town long famous for the excellence and the large quantity of its dairy produce, and in the heart of one of the richest milk counties in England. By the kindness of the company's manager, Mr. Bosworth, we were lately allowed the privilege of going over the works in that town; and thinking that what gave us great pleasure might also interest our readers, we give a short account of what we saw and heard there.

Close by the side of the Avon (not the Swan's Avon), on the right hand side as you walk from the railway station to the ancient town of Chippenham, a nice, clean, white stone building attracts the eye. A tall brick chimney suggests a factory of some description, but the general appearance of the building is so clean, and there is so little noise or bustle, that at first one is inclined to think that, whatever work it is dedicated to, business has not yet been commenced. This, however, is not the case, for a busy and successful summer has just been concluded. Entering the large double doors we went upstairs to the office; and on making our desires known, a gentleman, Mr. Page, kindly undertook to show us round. Like Alice in Wonderland we wished to "begin at the beginning and go right on to the end"; and so we went to the other end of the building, where the farm carts bring in the milk every morning. At present this yard is open, but preparations are being made for roofing it in, so that the horses may stand there in comfort while the unloading is proceeded with. In the first room, into which the milk is taken from the carts, we noticed a number of tin saucers with brass plates on them, all numbered, and about half filled with milk. These, we were informed, were used for testing the cream-producing qualities of the different lots of milk; a small equal quantity from each farmer's consignment being poured into one of these neat little saucers, and allowed to stand until the cream was thrown up. It struck us that testing cream must be a most agreeable occupation. Here the milk is carefully weighed (measures are not used) and tested. It is then poured out of the farmers' cans into those of the company, and taken into the next room, where the cans containing the milk are placed into large tanks full of hot water. In the first room the milk cans used by the farmers are washed, the company prudently preferring to have this important duty performed in a thorough, systematic manner by its own servants rather than to trust to the tender mercies of the farmers' servants, and risk the loss of milk in hot weather. The way the cans are washed is at once simple and effective. First, they are roughly rinsed in a large tank nearly full of water; then the can is taken to a table, on the top of which a round hole is cut, the exact size of the can's mouth. In this hole are two pipes, pointing upwards, on a level with the table. The can is placed mouth downwards over this hole; and a handle being turned, a jet of spring water rushes with great force up one of the pipes into the can, thoroughly cleansing it. After this another handle is turned, when a jet of steam acts in exactly the same manner. Another turn of the first handle, and the cold spring water finishes the washing. Thus a very large number of cans are thoroughly washed in a marvelously short time, with very little labor. Leaving this room, we went into the next, where, as we said, the milk cans are placed in tanks containing hot water. From these the cans are lifted, and the milk poured into large open round copper tanks, and boiled by the action of steam. After remaining here for some time it is pumped up into the condensers in the room overhead. These condensers, of which there are three in this room, are also worked by steam, and in them the milk remains for from three to seven hours, according to the quantity. In these condensers a vacuum is created of about 20 lbs. to the square inch, and thus the vapors are drawn off from the milk, which we understand to be one of the most important details in the process, and that on which the future keeping properties of the milk chiefly depend. When the milk has remained in these condensers sufficiently long, it passes into another room, when it is cooled by being put in cans and placed in cold water. The final process is unknown to us, being the one secret of the establishment, but we have a shrewd suspicion that, like many other secrets, there is no great mystery connected with it. Be that as it may, when next we saw the milk it was in exactly the condition we see it in when the little cans are opened for table use. The filling room is a large airy apartment; and as the little cans are filled, they are closed up and sent to the room above to be packed away ready for the market.

Everything is made, and all the work is done, on the premises, upwards of 100 people being employed, of which about forty are boys and girls. One engine of four horse power is sufficient to do all the work, but the boiler requires to be much larger in proportion, in consequence of the amount of steam used for other purposes. Owing to this the boiler is large enough to supply working steam for a forty horse power engine. Not the least interesting part of the establishment is the portion devoted to the making of the tins, in which the milk is put when ready for sale. Here nearly all the work is done by boys and girls; and as each has only one part of the tin to make, the work proceeds rapidly. Thus, one boy cuts the sheets of tin into the proper sizes for the sides or barrel of the tin; the next boy passes three pieces between two little rollers, which curl them up ready for joining. From here they go to another little fellow, who sits and solders the two edges together, and so quickly is this done that a boy can turn out 2,000 a day. After this, the

ends, which are punched out by machinery, are fitted on, and milled, or squeezed tightly to the top and bottom of the little cylinders which form the tins, when they are soldered and the tin is labeled. The milk is then run in through a small round hole left in the top, and then this hole is covered; the tin is rolled in paper and packed, which work is entirely performed by girls. The chief characteristic in their milk-condensing is cleanliness, and the quantity of water used for this purpose is enormous. Ventilation is another necessity, and thus the employment is pleasant and healthy. With foot and mouth disease increasing, it is satisfactory to be able to get a pure article of food for children, and as the milk from diseased cows cannot possibly be used by the Preserving Company, it is particularly suitable for young or delicate persons. It has also the great advantage of being always at hand, ready at a moment's notice, and in any kind of weather, which is a matter of some importance. Condensed milk has long been largely used on board ship and in yachts, but it is only lately that it has begun to come into general use in families; so that, with increased consumption, it is probable that other establishments will have to be formed by the energetic Anglo-Swiss Condensing Company, and if so we wish it the same success which has hitherto attended it.

[The above from *Land and Water*, describes the valuable process invented by the late Gail Borden of Texas, and by him first put in operation in this country about fifteen years ago. Since that time it has spread to all parts of the world, and his condensed milk has become a staple article of commerce and manufacture. The adoption of Mr. Borden's invention in England is only one of many examples of American improvements there worked.—EDS. SCI. AM.]

Uncertainty of Wealth.

"The absence of the law of primogeniture causes a frequent change of ownership in the private residences which contribute so much to the adornment of our cities. While the head of the family lives, the home may be retained—though very often a reverse of fortune compels him to seek humbler quarters—but when he dies the heirs are obliged to get rid of the too expensive luxury. How many of the houses built in St. Louis twenty years ago are now owned by the men who erected them, or their descendants? How many of later date, now occupied by their builders, will be in possession of their present tenants, or their descendants, twenty years hence? Other influences beside the lack of primogeniture contribute to this, in some respects, unfortunate result. There are more ups and downs in life in the new world than in the old. Fortunes are made much more quickly, and disappear much more rapidly. Wealth is seldom transmitted beyond the second generation, and in many instances does not last through the first. The boy born with a silver spoon in his mouth frequently has to taste pewter before his pilgrimage is over, and he may have the pleasure of being splashed with mud from the carriage wheels of the man who was once his father's porter. This is a free country, very free indeed, and among the consequences of that freedom is the exceeding uncertainty of financial matters. Yet in no country is less provision made for the evil day so far as our children are concerned. The wealthy parent brings up his sons and daughters as though there were not the remotest possibility that they could ever be poor. If a rich father should insist upon his boy learning a trade he would be set down as a mild-mannered lunatic. If a rich mother should instill into her daughter rigid ideas of economy and industry, she would be looked upon as either very mean or very foolish—probably both. Yet every day we are taught the necessity of this preliminary discipline; every day we see men and women falling from affluence to poverty, who, if properly trained, might not have fallen at all, or, if they did fall, could have risen again. It is a shame and disgrace that, in a land where labor is supposed to be honorable, and where the law recognizes no distinction of caste, so small a proportion of the sons of the wealthier classes learn trades. No young man has a right to consider himself thoroughly independent unless he has some avocation by which, health permitting, he can always make a living. And the best and surest avocations are those for which there is always a demand. Lawyers, doctors, preachers, professors, clerks—all these and their kindred are frequently a drag in the market; but how seldom is it that a good carpenter, blacksmith, machinist, wagon maker, shoemaker, tinsmith, book binder, or printer has to travel far in search of remunerative employment! We shall never be thoroughly republican until there are fewer genteel drones in the national hive."

There is probably no subject on which more has been written than the above. Almost everybody has seen evidences of the fact about them; and how many who will read this article (from the *St. Louis Republican*) can realize its truthfulness!

Gas for Heating Purposes.

We confidently look forward to the time—and we hope it is not far distant—when, in all large cities, at least, a heating gas will take the place of solid fuel for culinary and general heating purposes. What the consumption for that use would be, were the price sufficiently low, can scarcely be calculated; but if the consumption of illuminating gas on the island of Manhattan alone may be roughly estimated at fifteen million feet per day, the consumption of heating gas would, probably, amount to one hundred million feet; and since it must be made on an enormous scale, at a very low cost, and sold with a narrow margin for profit, there is reason to hope that the efforts to solve the question of an economical heating gas will solve also the problem of cheap illuminating gas; for though the essential properties, and even the

composition, of these two will differ greatly, yet any process that will enable us to make a heating gas, at, say, 20 cents per thousand feet, can, probably, be adapted to the manufacture of a cheap illuminating gas. In the interests of metallurgy, of manufacturing, and of general needs of civilization, we welcome every step toward the attainment of this great desideratum; and it seems, indeed, that no more inviting field for the application of science, skill, and economy exists than that of gas-making. This art has stood almost stationary for nearly half a century, while every other branch of productive industry has made enormous progress; and if the signs of the times are not deceptive, the day is approaching when the demands of consumers will force gas-making out of the rut of conservatism into the path of progress that is characteristic of our time and people.—*Engineering and Mining Journal*.

How to Reach the North Pole.

C. S. says: "I propose to reach the north pole by the construction of an overground tubular railroad, under the auspices of several governments, which should pay sufficient money to construct suitable shops for the making of a wooden tube, 5 or 6 feet in diameter, to be made in light sections for transportation. After some suitable landing place has been chosen, the road could be commenced at the dock. The sections of the tube could be placed on a car which would run inside of the tube and be propelled by hand, and furnished with a light, strong, convenient dummy engine and boiler, to be used when required. Theoretically this idea has many points of great benefit to the explorers. A car can be made and furnished with nearly all the comforts of a home; and the tube, getting covered with snow in the winter, would be quite warm. With properly constructed stoves, plenty of provisions, and fuel, a scientific party could pass a winter in the tubes quite comfortably. I have no doubt but that there are plenty of civil engineers who would jump at the chance of constructing a road of this nature if solid government support was guaranteed. If this idea proved feasible, and the barrier of 120 miles that is supposed to exist could be overcome, and the unexplored supposed open sea found, this road could be made the means of carrying material for the construction of suitable fishing vessels. If the open sea does exist, there is no doubt but whales are to be found there in immense numbers, so as to make the road profitable, and furnish oil for the people when the products of the oil region commence to give out. Shelter in nearly all emergencies would be found in a road of this description. Who can tell of the benefits that might come to the nations if the mysteries of the vast unknown region could be brought to light? The outlay on a road of this character would be a mere bagatelle to the results that would accrue from it."

A New Fumigator.

A new and excellent fumigator has recently been devised by Mr. Thomas Shaw, of Danville, Pa. (P. O. Box 612). We are indebted to the inventor for one of the machines, which we have practically tested to our satisfaction. It consists in a hopper in which the tobacco, sulphur, or other fumigating material is placed, resting on a perforated bottom. A pipe from the hopper enters a miniature fan blower, above the casing of which the hopper is placed. There is a hand wheel which is belted to the fan shaft, so that the latter is very rapidly revolved, causing a down draft through the material ignited in the hopper, and a strong current of smoke to be delivered through the outlet tube of the blower. The device is made large enough for use in large greenhouses or of a size convenient to be carried in the hand. It will also be found admirably adapted for smoking plant lice from window gardens, and for burning coffee or other disinfectants in hospitals and ships.

TO PREVENT GLUE FROM CRACKING.—Glue frequently cracks because of the dryness of the air in rooms warmed by stoves. An Austrian contemporary recommends the addition of a little chloride of calcium to glue to prevent this disagreeable property of cracking. Chloride of calcium is such a deliquescent salt that it attracts enough moisture to prevent the glue from cracking. Glue thus prepared will adhere to glass, metal, etc., and can be used for putting on labels without danger of their dropping off.

ENGINEERS and shipbuilders on the northern rivers in England feel the effects of the general depression. At some of the engineering shops and shipyards there is scarcely sufficient work to employ foremen and apprentices. Nothing better is expected till the spring of 1876, when it is hoped that the trade will vie with the promising season of the year.

A GERMAN astronomer has discovered two new small planets, not visible with the naked eye, in the constellation *Aries*. This makes the number of the lesser planets one hundred and fifty-three.

At Bonn, Germany, headaches, dyspepsia, etc., affecting several patients, have been traced to evening studies pursued under the baleful influence of a green lamp shade, from which arsenic was set free by the heat of the flame.

EUGENE SCHNEIDER, the French statesman and mechanical engineer, died recently, at Paris, at the age of 70 years. He was called to the Paris Cabinet in 1821.

RECENTLY there was a lifting match at Eureka, Nevada, between two men, for a prize of \$200, the winner lifting a 15 lbs. dumbbell at arm's length the greatest number of times. The loser lifted it 1,120, the winner 1,144, times.

PLATE SHEARING MACHINERY.

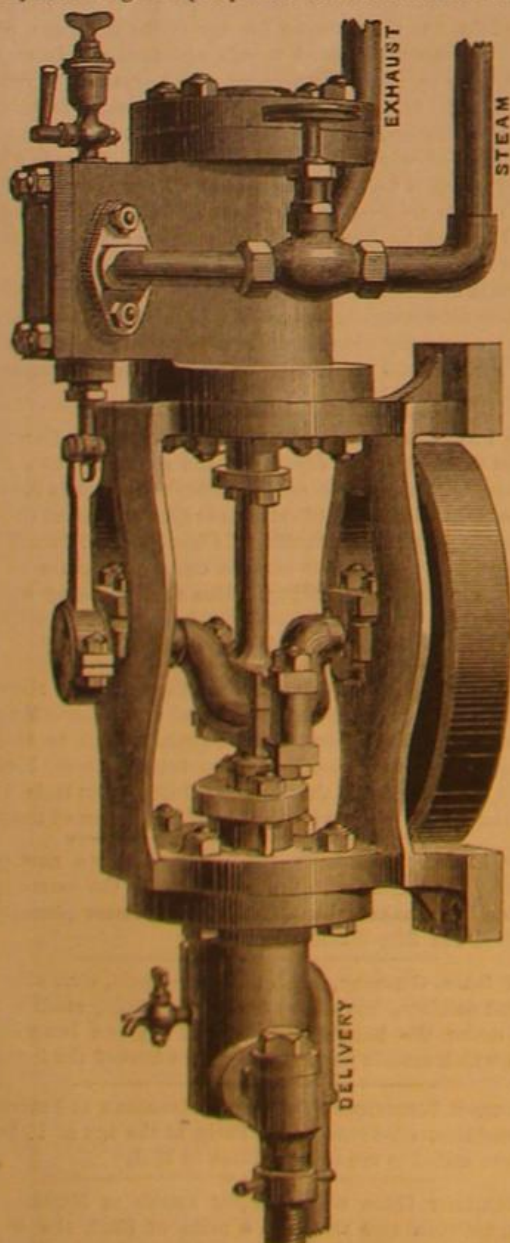
A plate-shearing machine, with revolving cutters, of which we give an engraving herewith, was recently exhibited at Manchester, England. It is provided with an adjustable grooved table and sliding bar, with a stud on the latter, for shearing plates to different radii. A special feature in the machine is that the top cutter shaft is mounted in eccentric bushes, so that by turning these bushes it can be brought nearer the bottom shaft, so as to take up the wear of the cutters. The eccentric bushes are graduated on the edges, so that the two may be turned equally, and the two shafts be thus maintained parallel. The machine will shear plates up to three sixteenths of an inch thick, and it is altogether of a neat and good design.

Natural Gas Fuel.

A few weeks ago a line of pipe was laid from wells in Butler county, Pa., to the mills of Graff, Bennett & Co. on the West Pennsylvania Railroad, in Sharpsburg and Etna, a distance of eighteen miles. It was not known before the connections were made whether there would be a sufficient pressure of gas to make the scheme a practicable one. At a fixed time, however, the connections were made at the well; and the air having been exhausted from the eighteen miles of pipe, the gas rushed through, and in twenty minutes was pouring in great quantities out of the pipe at the furnaces [The velocity maintained is doubtless a mistake.—EDS. SCI. AM.] When the gas was lighted the flames flared up 40 feet high, with a volume sufficient to supply double the quantity of heat required. It is expected that in these two furnaces a saving in fuel of from \$40,000 to \$50,000 a year will be made. In Rogers & Burchfield's rolling mill, the gas has been used for more than a year, and the saving in fuel is estimated at \$60,000 per annum, although only 125 men are employed there. The gas has been flowing with apparently undiminished force for ten or twelve years, and there is no known limit to the supply. Some enthusiasts in Pittsburgh prophesy that within a few years the majority of the furnaces and mills in that great manufacturing city, as well as the parlor grates and kitchen cooking stoves and ranges, will be heated by this new fuel.

DONKEY PUMP.

Subjoined we give a perspective view of a form of donkey



pump which is now being made by Messrs. Hayward, Tyler & Co., and which was exhibited by them at the recent show

of the Royal Agricultural Society at Taunton, England. As will be seen from the view given, the pump is adapted for being bolted up against a wall or boiler, and it is of a neat and compact form, while the pump valves are very readily accessible. The arrangement is so clearly shown by our engraving that no further description will be necessary.

Hygiene for Smokers.

The following are Dr. Berthand's precepts and advice to smokers. Never smoke more than three or four pipes or

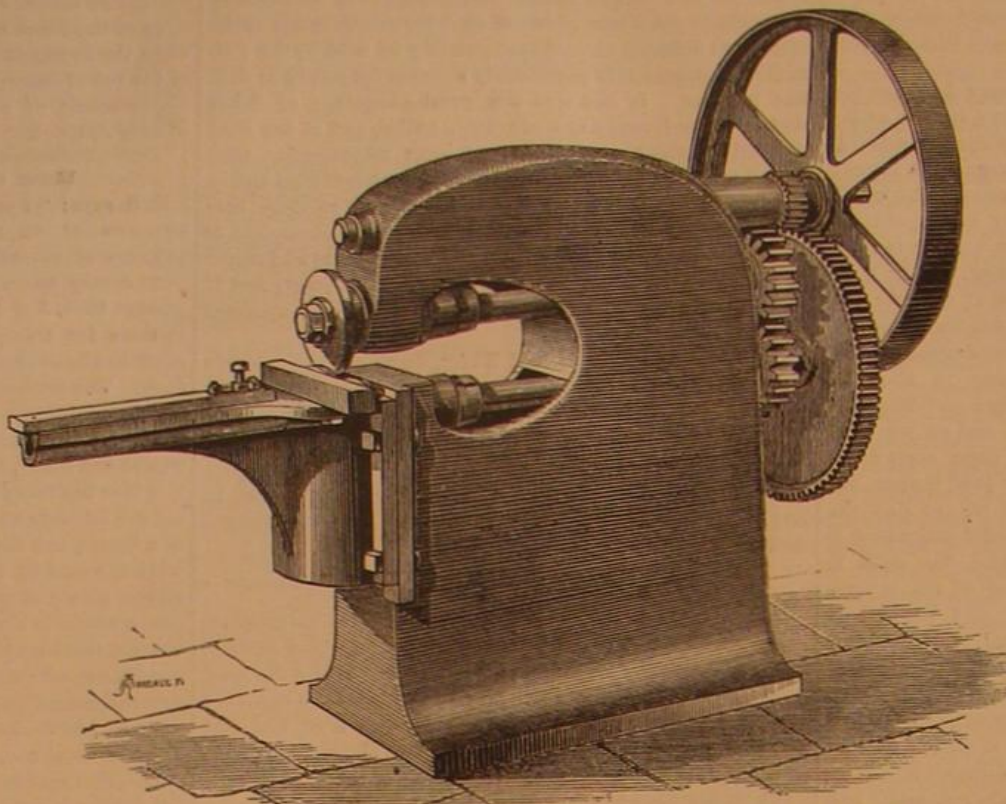


PLATE SHEARING MACHINE WITH REVOLVING CUTTERS.

cigars a day, and, if it is possible, limit yourself to two. It is unwholesome to smoke on an empty stomach or immediately before or after a meal. Whatever be the mode of smoking, direct contact of the tobacco with the *mucosa buccalis* (mucous lining of the cheeks) and the teeth must be avoided. Cigars should be smoked in an amber, ivory, or enameled porcelain mouthpiece. To smoke, by relighting them, portions of cigars that have been extinguished, together with the system of blackened and juicy pipes, constitute the surest way of being affected by nicotine. Every smoker would do well, if he could, to rinse his mouth after smoking. *A fortiori* is the same precaution applicable to chewers. For the same reason it would be well to subject pipes and bowls, in which tobacco has been burnt, to frequent washings either with ether or with water mixed with alcohol or vinegar. It is difficult to choose between the different ways of smoking. I give preference to the cigarette, by reason of its slight quantitative importance and the paper which interferes with the contact of its contents with the buccal mucous membrane. But to realize all the desiderata, it would be necessary to have the *papillito* made of flax thread and to abstain from the practice which has become the *ne plus ultra* method of its kind, retaining the aspiration at the back of the mouth, so as to pour it out of the nostrils afterward. The premature habit of smoking is certainly hurtful to childhood and during the adolescent period of organic evolution. The economy cannot but suffer, at this period, from the narcotic influence, be it never so slight, and from the salivation which is inseparable from this act. All persons cannot smoke with impunity. There are pathological counter-indications or idiosyncrasies to this habit that it would be imprudent and culpable to infringe. Diseases of the lungs, of the heart, chronic affections of the mouth, nose, eyes, throat, and stomach, are the results of the principal incompatibilities. The airing of apartments where smoking has taken place should be well attended to. To sleep in rooms where tobacco smoke exists, slowly constitutes a grave infraction on the elementary laws of hygiene."—*Tribune Médicale*.

Chloride of Silver Battery of 3,240 Elements.

Messrs. Warren de la Rue and H. W. Müller have constructed a battery composed on the one part of 1,080 elements, each consisting of a tube of glass 6 inches in length, and of 2,160 elements formed of glass tubes of 5 inches in length only. All the tubes are 0.75 inch in diameter, and are closed with stoppers of vulcanized india-rubber, perforated with a hole near the edge to permit the introduction of a rod of amalgamated zinc, 0.2 inch in diameter and 4 inches in length for the first 1,080 elements, and 3 inches for the remainder. At the bottom of each tube, powdered chloride of silver is placed, 220 grains in weight, compressed strongly with wooden rods, a flattened silver wire having been first introduced to the bottom of the tube. The silver wires are covered in their upper part, above the chloride of silver and up to the point where they emerge from the vulcanized stoppers, with leaf gutta percha, to isolate them and preserve them from the action of the sulphur in the stoppers. The electromotor force of this battery is to that of a Daniell's battery as 1.03 to 1.

A SPLENDID HOLIDAY GIFT.—"Wrinkles and Recipes." See advertisement on another page.

God's First Temples.

Bayard Taylor, in his interesting work entitled "Home and Abroad," in a graphic account of the mammoth trees of California, thus describes the felling of one of the largest specimens of the Sierra Nevada: "After a steady labor of six weeks the thing was done, but the tree stood unmoved, so straight and symmetrical was its growth, so immense was its weight, and so broad its base, that it seemed unconscious of its own annihilation, tossing its outer branches derisively against the mountain winds that strove to overthrow it. A neighboring pine of giant size was then selected, and felled in such a way as to fall with full force against it. The top shook a little, but the shaft stood as before; finally the spoilers succeeded in driving their wedge into the cut. Gradually, and with great labor, one side of the tree was lifted; the line of equilibrium was driven nearer and nearer to the edge of the base; the mighty mass poised for a moment, and then, with a great rushing sigh in all its boughs, thundered down. The forest was ground to dust beneath it, and for a mile around the earth shook with the concussion." The work was performed by two sets of hands with the aid of long pump augers. The tree was a mass of solid wood ninety feet in circumference, containing some two hundred and fifty thousand feet of timber; and according to the annual rings, its age was three thousand one hundred years. The stump is now used for a ball room, and the trunk for a bowling alley. Dr. Bigelow said of this specimen: "It requires thirty-one of my paces, of three feet each, to measure its circumference at the stump; and the mere felling of it cost, at Californian prices for wages, the sum of five hundred and fifty dollars. An idea of the sublime proportions of these wonderful fathers of the forests can be formed after seeing a man on horseback riding a distance of seventy-five feet through a hollow trunk, and emerging from a knot hole in the side."

IMPROVED SCREW CUTTING DIE AND HOLDER.

We illustrate in the annexed engraving a new adaptation of an improved screw cutting die, made so as to be conveniently held in a bit stock instead of in the ordinary plate. The construction will readily be understood from Fig. 1, and also from the representation of the die taken apart in Fig. 2. The screws shown at A, in Fig. 1, serve to close the parts of the die together from the sides, and the taper screws, B, Fig. 2, spread the die when driven in, thus regulating the size of the cut. By operating either screws, A or B, the portions of the die may be adjusted and held with great nicety, while wear, at the same time, is compensated for in a very simple and effective manner.

The die does its work in a single cut, thus forming the



Fig. 1



Fig. 2

screw thread at once, neatly and sharply, and without raising the thread above the normal surface of the material operated upon. The die also allows of nuts and bolts for different purposes being made to fit together tightly or loosely, as desired.

For further particulars, address the manufacturers, the Wiley and Russell Manufacturing Company, Greenfield, Mass.

THE KRUPP TWELVE HUNDRED POUNDER GUN.

In a recent issue we published an engraving showing the most important types of the armored vessels which have been built during late years. These floating forts represent the theories of one party, of the two which are contesting the question whether the victories in future naval conflicts will be gained by the thickest armor or the heaviest guns. The result of this competition is a constant transition in the prevalent system of warfare; and hence upon what strength, whether of shield or of gun, combatants will rely in conflicts yet to come, neither opinion nor prophecy can be predicated. The naval engineers construct vessels with solid iron walls, some 24 inches thick; but hardly are the ships launched before a gun is produced by the artillerists, capable of penetrating the armor at long range; then follows a new vessel, succeeded by a yet more powerful gun; and so the duel continues, each side gaining the advantage in turn until one can see no definite end unless he venture into the realms of theory, and vainly endeavor to imagine the impossible conditions of that time-honored mechanical puzzle, "the irresistible force meeting the immovable body."

The majority of the experiments, and very costly ones they are, are carried on in England. New ironclads are almost entirely of English construction, the exceptions being a few built by Russia. In the making of heavy guns, however, England is not alone, as Germany, through the great steel works of Krupp, enters the field as a rival—the German policy apparently being first to allow England to vanquish the armor of her own engineers, by the heavy guns of her own artillerists, and then to produce German cannon superior to the English gun. A very recent instance of this has occurred in the construction of the 81-ton gun by England, the tests of which are hardly concluded before Krupp announces the undertaking of a 124-ton cannon, capable of throwing bolts which will pierce 23.8 inch armor at seven and a half miles range. The distinctive features of the English guns we have already described. In the present article we give an excellent engraving of one of the large Krupp guns (which we take from the pages of Knight's "New Mechanical Dictionary"), from which the general characteristics of the German breech-loading system will be understood.

The gun itself is made of crucible cast steel, of a quality especially adapted for the purpose, and is constructed on the built-up system. It consists of an inner tube weighing 20 tons, upon which are shrunk cast steel rings, forming at the breech a three-fold, and at the muzzle a two-fold, layer of metal. Both tube and rings are formed from massive ingots without welding. The caliber of the gun is 14 inches, weight 50 tons, total length 17½ feet; weight of solid shot 1,212 lbs.; weight of shell 1,080 lbs.; charge of powder from 110 to 130 lbs. The breech-loading is on Krupp's patent plan. The shot or shell is raised by a tackle and is rolled into the side of the breech through an aperture closed by a slide. The gun is mounted on a steel carriage weighing some 15 tons, supported on a center pintle chassis weighing 25 tons.

Postal and Telegraph Service.

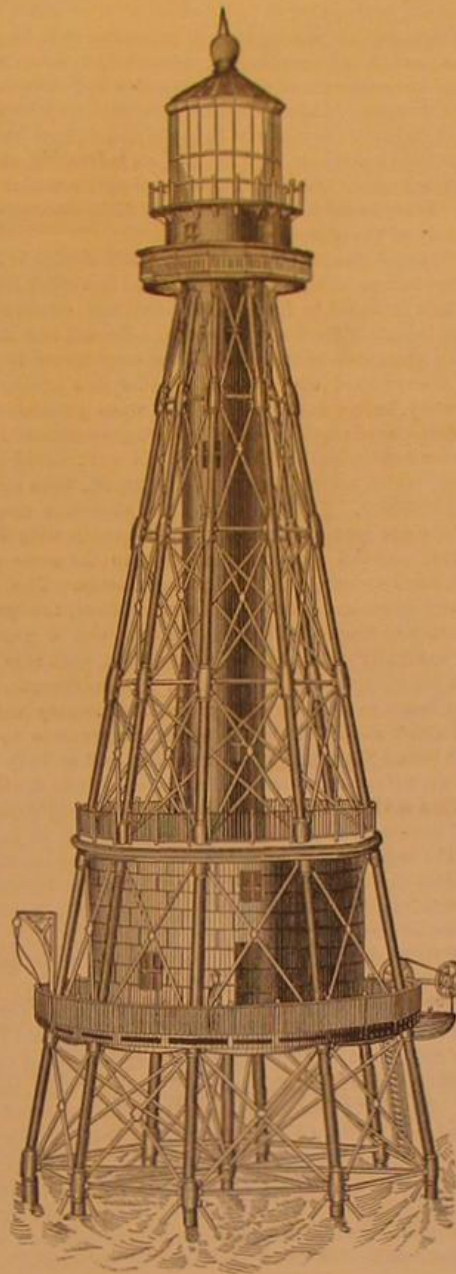
The twenty-first annual report of the British Post Office has just been issued, giving the postal and telegraphic statistics for 1874. It appears that the estimated number of letters sent through the post during the year was 967,000,000, besides about 79,000,000 post cards, and 259,000,000 newspapers and book packets. On an average there were 30 letters to each head of the population in the United Kingdom,

*Published in numbers by Messrs. Hurd & Houghton, New York City.

but the national average was 33 per head for England, 25 for Scotland, and 14 for Ireland, showing some interesting facts in regard to the comparative educational, social, and commercial relationship of each division. The return letters amounted to about 4½ millions, giving an average of about one on each 220.

THE TRINITY SHOALS LIGHTHOUSE.

An interesting application of iron to the construction of



a building requiring exceptional strength and stability is represented in the annexed engraving of one of the two similar lighthouses erected at Trinity Shoals and at Timbalier, in the Gulf of Mexico. The structure is supported upon nine screw piles—a central one surrounded by eight others,

at distances of somewhat less than fifteen feet four inches | each being twenty feet distant from the central one and secured together at the ground by adjustable wrought iron links, and above by diagonal braces and by radial struts to the central pile. The summit of each pile is incased in a cast iron socket for receiving the column and the radial and diagonal braces. The jointed columns which support the lantern have a similar provision for their diagonal braces, the arrangement for which will be understood from the illustration, which we take from Knight's "New Mechanical Dictionary." The different series of columns are joined together by sleeves. The first series above the foundation is 20 feet long, the second 15 feet, the next two 18 feet. The fourth, fifth, and sixth are respectively 15 feet 6 inches, 14 feet, and 12 feet 6 inches. The columns of the first series are of wrought iron, forged tapering; those above are of hollow cast iron, each series successively decreasing in diameter. The lantern is supported on a cylinder of boiler iron, resting on a platform at the top of the columns.

Anthracite Coke.

The high calorific power of anthracite, consisting as it does of nearly pure carbon, and the low percentage of sulphur and ash contained in most varieties, naturally render it of great value as a fuel in the cupola and the blast furnace; while from its abundance in many districts, and the cheapness with which it may generally be worked, it should at once be the best and the cheapest fuel that could be used. The practical drawbacks to its use, which diminish its value and to a great extent restrict its employment, are the difficulty of utilizing the slack or small anthracite, of which a good deal is made in mining and handling, and in breaking the large pieces, and the tendency of many anthracites to split up into small particles if suddenly heated. In the blast furnace this decrepitation is especially injurious, as the fine dust is apt to form, together with the cinder, pasty masses that can neither be melted nor burnt away, and may choke the furnace up or seriously derange its working.

These difficulties in the way of using anthracite generally in its natural or raw state, have led to many attempts to make it into a serviceable coke, by coking it in admixture with a greater or less proportion of binding coal, pitch, or other bituminous substances. None of these attempts, until very recently, appear however to have been commercially successful; none, at least of those made in South Wales, have been carried out largely or continuously; as, though coherent coke was made, it was friable and of inferior quality.

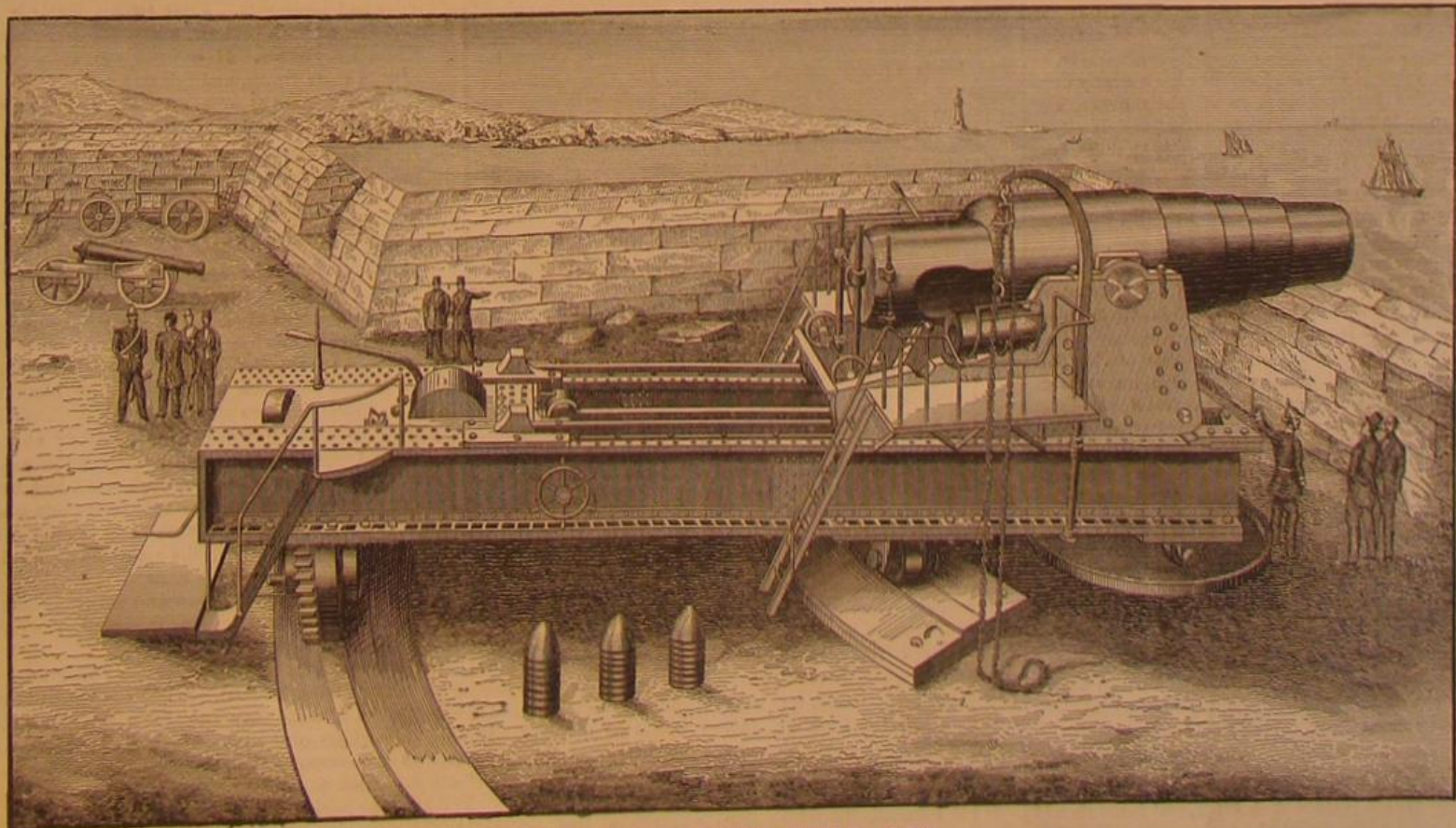
Some samples exhibited would appear, however, to show that the production, on a working scale, of a hard and sound anthracite coke is not at all impossible.

They are fair specimens of the coke now being made by the process of Messrs. Penrose and Richards, of Swansea, to whom the writer is indebted for them, as well as for the information as to the mode of manufacture, and the characters of the coke obtained, on which the present note is based.

The materials used are any quality of anthracite or semi-anthracite, if free from shale or stones, good bituminous or binding coal, and pitch, in the following proportions:

Anthracite, 60; bituminous coal, 35; pitch, 5.

Specimens have been shown of coke made of Messrs. Brock and Sons' anthracite, from Cwmlllynfell Colliery, near Cwm Amman; of a mixture of this with Ynisdwyn anthracite; and of culm or semi-anthracite from Birch Rock Colliery, near Pontardylais. The bituminous coal used in making all the samples exhibited was that from Tyrissa Colliery, near Swansea.



KRUPP'S MONSTER FIELD GUN.

The materials are passed, together, through a Carr's disintegrator, to crush and mix them: the proportions in which they are mixed being regulated by supplying the feeding hopper of the disintegrator by three elevators, one carrying up each constituent, and each provided with buckets of such size and number as to bring up the relative quantity required. Samples are shown of the anthracite, bituminous coal, and pitch, in the condition in which they are supplied to the disintegrator, and of the crushed mixture produced.

The ovens used are of the oblong shape generally employed in South Wales: 15 feet long, by 5 feet 7 inches wide at the back and 6 feet 2 inches in front, and 4 feet 4 inches high to the under side of the arch. Each oven is charged, through a hole in the roof, with about four tons of the crushed mixture; this is leveled by a rabble put in through the door at the end; and a small quantity of bituminous coal, sufficient to form a layer about 2 inches thick, is thrown in and spread uniformly over the surface. The oven is then lighted, by throwing a few shovelfuls of hot embers on the top of the charge, immediately inside of the door, and the coking is managed as in working an ordinary charge of bituminous coal. The object of covering the charge with a layer of bituminous coal is to prevent the burning away of the pitch, and its use appears to be essential for the production of a hard and strong coke. Ordinary slack, of the same quality as that in the mixture, is used for the covering; this is mostly very small, but is not specially crushed.

Rather more than two charges per week are made in each oven; the coke is watered in the oven, and is then drawn out in one mass, by a chain and hand winch.

The yield of coke is 80 per cent of the weight of the charge. The coke is steel gray in color, and very much harder than the anthracite from which it is made: so hard, indeed, that it scratches glass with comparative ease. In a common fire, or under the action of a blast, it burns away without showing any tendency to crumble or decrepitate. It is about 23 per cent heavier than the best coke made from Welsh bituminous coal; so that in sending a cargo abroad recently, a vessel that could not carry more than 240 tons of ordinary coke was able to take in as much as 310 tons of anthracite coke. Another valuable consequence of the dense compact character of the coke, in addition to the saving in cost of carriage, is that, even if soaked in water, it takes up very little, only from 1.5 to 2 per cent of its weight; while many kinds of ordinary coke absorb readily 10 per cent or more. The coke is harder and more dense, the finer the materials are crushed, and the more intimately they are mixed.

In practical use, both in the cupola and in the blast furnace, the coke, so far as it has been tried, has given remarkably good results. These are probably due in part to its hardness and density, or rather to the high temperature required to set it on fire, which brings the zone of combustion closer to the tweers, and diminishes the waste of fuel in the upper part of the furnace caused by the transformation of CO_2 into CO ; and in part to its freedom from water, and the small amount of ash that it contains.

In a small foundry cupola, in which 1 lb. of good Welsh coke, that from Bryndu, near Bridgend, melts 10 lbs. of iron, 1 lb. of anthracite coke melts 16 lbs. and the metal is hotter when tapped out; and in a trial carried out at Messrs. Tangy's Works, near Birmingham, anthracite coke melted well with 25 per cent more burden than that placed on ordinary coke, and would probably have done more, but the managers were unwilling to run any risk of deranging the working of the cupola, and did not push the experiment further.

In a trial made in one of the blast furnaces at Landore, working on spiegelisen, the burden, in using anthracite coke, was increased 28½ per cent; and the economy might probably have been raised to 30 per cent or more, but the stock of coke in hand was not sufficient to admit of carrying on the experiment. The Landore company are, however, so satisfied of the value of the coke that they have nearly completed preparations for making it in all their ovens, and using nothing else in their two blast furnaces.

The cost of anthracite coke is about the same as that of the best ordinary coke made in the district. Anthracite, in Wales, is about 48 cents a ton cheaper than bituminous coal—an economy in one constituent that balances the extra cost of the pitch; and in making best ordinary coke, the coal used is ground, at a cost of about 12 cents a ton, just as in the case of coke from anthracite. The yield of 80 per cent in coking anthracite, against 70 per cent or less in coking bituminous coal, is again in favor of the former.

The cost of the crushing and mixing arrangements, to grind 1000 tons a day, is estimated by the inventors at from \$10,000 to \$12,500. This would include a 6 feet 3 inch disintegrator, with driving power, elevators, and shed.

The process has been carried on near Swansea for about nine months; and though it was suspended for some time during last winter, on account of the colliers' strike, between 2,000 and 3,000 tons have in all been made.

The field for the application of any practical method of utilizing small anthracite is very great; the quantity available in Wales and in America is almost unlimited, and very much of that raised is now unsaleable, merely because it is too small to be used. In Pennsylvania, according to Mr. Bell, from one fifth to one half of the material brought to the surface in the anthracite collieries, is thus thrown aside: partly shale and stones, but chiefly small and dust coal, perfectly clean and bright.

AN engine cylinder piston will not wear the packing in the stuffing box if it is incased with brass, and brass should always be put on the plunger of the feed pump.

The British Channel Tunnel.

The proposition to unite England and France by means of a railway tunnel beneath the waters of the English Channel, which has, during the past few years, figured largely among the items and comments of the engineering press and in the discussions of various learned bodies abroad, has at length assumed such definite shape that the actual undertaking of the enterprise in the near future is rendered highly probable.

To cut a tunnel of the enormous length of twenty miles, beneath the waters of the ocean, is an undertaking which, to most minds, will appear to be attended with so much hazard and uncertainty—as to say nothing of expense—as to be practically impossible of completion; nevertheless, after a most thorough investigation of the subject, and full consideration of the difficulties, dangers, and uncertainties surrounding it, the most eminent engineers of England and France have pronounced their conviction that the project is feasible, and that the building of the Channel Tunnel is simply a matter of expense. We present herewith the main facts connected with the history of the projected enterprise.

The Channel Tunnel Company was established in 1872, and comprises two societies—one French and the other English. It was first intended to form an international company; but owing to certain differences between the French and English laws, the promoters of the undertaking were forced to resort to the abovenamed combination. Under this arrangement each society, before expending money upon preliminary investigations, made application to its own government for the legislative concessions needed before the work could be undertaken, which concessions, it is announced, were obtained without difficulty. The first society will therefore open the door of France beneath the sea in conformity with French legislation, and the second society will do the same on the English coast according to English legislation. The assent of the two governments having been obtained, the preliminary work was begun. The first inquiry was a geological one, by carefully measuring to ascertain on each side of the channel the outcrops of the beds that lay underneath, accurately as could be done by that process. The gray chalk—a mass of strata about 500 feet thick and impervious to water—which forms the principal mass of the cliff at both Dover and Calais, strikes across the channel so with little divergence from horizontality that a tunnel could be pierced within the vertical bounds of its thickness, presuming it to be continuous all the way across. From the geological map constructed on the data thus obtained, it appeared that a line between St. Margaret's Bay (a depression in the chalk cliffs about four miles east of Dover) and a point on the French side, about midway between Calais and Sangatte, would be suitable to carry the tunnel through the lower chalk.

To verify this presumption, an examination across the channel was made by dropping from a steamer a weighted instrument in 500 places, the apparatus running with great velocity to the bottom, and bringing up chalk wherever it was expected. The device employed in this work consisted of an iron tube, over which a hollow shot, fitting loosely, was raised and let fall upon a flange attached to the tube, the end of which is in this way driven into the substance of the sea bottom, the core thus obtained giving the required sample of the rock perforated. The results obtained afforded a complete confirmation of the correctness of inferences drawn from the maps previously made, and were sufficiently satisfactory to establish the feasibility of the project on purely geological grounds.

The line of the main tunnel as proposed, which is to be large enough for a double line of railway, is drawn straight between the proposed termini on both sides. In longitudinal section it presents a slight fall of 1 in 2,640 from the center towards either extremity, and the vertical depth of the highest point of the floor is 436 feet from Trinity high water mark and 200 feet below the sea bottom. From the land levels of the existing railways, the two approaches make long descents of over four miles, each with gradients of 1 in 89 into the tunnel ends, over two miles being under the sea, the total of the whole amount of tunneling amounting to over thirty miles. The maximum depth of water on the line of the proposed tunnel nowhere exceeds 180 feet below high water mark, the water being deepest in the center, and gradually diminishing in depths towards the sides. Below the railway approaches, and continuous with the floor of the submarine tunnel, there will be at each end a driftway leading to vertical shafts ashore for ventilation and drainage. These terminal shafts and driftings comprise the preliminary work which it is intended to make as a test of the general practicability of the undertaking, and of which they will, when completed, form essential portions. On the French side the work of sinking the shaft has just been commenced, while that on the English side is nearly or quite completed. It is proposed to execute the work with the aid of the tunneling machinery recently invented by Mr. Dickinson Brunton. This machine works after the fashion of an auger, and the debris excavated falls upon an endless band which carries it to the wagons in the rear. By this means a driftway, seven feet in diameter, can be advanced at the rate of about a yard and a quarter per hour, at which rate it would only require two years to pierce the channel through, a machine being worked from both sides. For this preliminary work, the engineer's estimates of time and cost are four years and \$8,000,000 respectively, but experienced contractors declare that only half the time and money would be required. It has also been computed that, after the driftway is finished, four years' time and \$20,000,000 will complete the entire work.

It has been ascertained by actual experiment that, provided the chalk be solid, the water will not permeate it, in

proof of which, the Brighton tunnel (5½ miles in length, in close proximity to the seashore, and from 12 to 20 feet below the sea level, and excavated in the comparatively compact upper chalk) is offered in illustration. In this case comparatively little water was met with. Taking everything into consideration, therefore, it is reasonable to infer that the only natural obstacle that could hinder the completion of the work would be the existence of open, unfilled fissures in the bed rock, reaching from the sea bottom to the depth of 200 feet through the rock. The probability of the existence of such fissures and the chances of striking them on the line of the proposed tunnel are extremely small.

The preliminary work abovenamed is being steadily advanced; and should the results obtained continue to verify the anticipations formed by the engineers in charge, the actual undertaking of the tunnel proper will not be long delayed. The funds for the preliminary work are guaranteed by several prominent corporations and the Rothschilds, and there is every reason to believe that the two governments interested will come to the aid of the projectors of the work, at the proper time, by the grant of a liberal subsidy.—Dr. W. H. Wahl.

The Mass Copper of Lake Superior Mines, and the Method of Mining It.

BY PROFESSOR WILLIAM F. BLAKE, OF NEW HAVEN, CONN.

The occurrence of enormous masses of pure copper has given the mining districts of Lake Superior worldwide reputation. The first masses brought from there excited great attention, and directed the notice of the mining world to the few particular mines from which they were taken. It may not now be generally known that nearly all the veins which are worked, and which cut across the trap ridge, contain mass copper, and that large masses are continually being raised from them.

The largest continuous mass which has been taken out was probably that from the Minnesota in 1857, which is variously stated as weighing 420 tons and 470 tons. Its length was about 45 feet, its breadth or height 22 feet, and its greatest thickness 8 feet. All such masses are very irregular and ragged in their form and thickness, thinning out gradually from a foot to a few inches, and struggling through the vein until they connect with other large masses. This was the character of a mass found in the Phoenix mine, one of the oldest on the Lake, which mass altogether weighed some 600 tons. But this was really a series of masses more or less connected by strings of metal, yet no one large part of it weighed, singly, over 200 tons. A similar series of masses, weighing about 600 tons, was extracted from the Minnesota. Some of the Phoenix masses were four or five feet thick of solid copper. The Cliff mine has yielded masses weighing from 100 to 150 tons in one piece. One of 40 tons was taken out this year, besides numerous blocks weighing from 1 to 8 tons. This mine and the Central are now yielding mass copper in abundance.

It is of course impossible to pick, or to drill, or to break out such huge masses of solid metal, when they are found by drifting upon the course of the vein. The method is as follows: The miner picks out, or excavates, a narrow passage or chamber upon one side of the mass, laying it bare as far as possible over its whole surface. It is usually firmly held by its close union with the vein stuff, or by its irregular projections, above, below, and at the end. If it then cannot be dislodged by levers, the excavation of a chamber is commenced behind the mass, and this excavation is made large enough to receive from five to twenty or more kegs of powder. In one instance, in the Cliff mine, a charge of 21 kegs of powder threw down 200 tons of copper. Bags of sand are used for tamping, and the drift is closed up by a barricade of refuse and loose dirt. After such a blast the drift is, of course, charged with foul air, and it cannot safely be entered for hours afterwards. If entered too soon, men lose all strength in their limbs, and fall down.

The huge masses of copper dislodged in this way are too large to be handled and got to the surface. They have to be cut up. The copper cutters are called in, and the mass is marked off in squares or blocks of suitable size. Copper cutting is a distinct art, and requires considerable skill and experience. Ordinary miners, however skillful they may be, cannot cut up copper without long training.

The tools are simply narrow chisels and striking hammers. The chisels are shaped like the parting tools of turners. They are made of flat bars of half inch steel, about 3 inches wide and 18 inches long. They are chamfered each way like a cold chisel, to form the cutting edge. This edge is made a little longer than the thickness of the bar. The cutter holds the chisel and two men strike it. A thin slice or chip of copper is in this way cut out in a narrow channel across the mass of copper. The operation is repeated until the narrow cut, but little over half an inch wide, has been carried through the mass. The chips cut out in this way are long narrow strips of copper only about half as long as the groove from which they are taken, the metal being condensed and thickened by the force of the blow.

This work is necessarily slow and tedious, and it costs \$12 per square foot by contract. At this price, the cutters make \$2 per day.

It is inconvenient to handle masses weighing over 6 tons. Such masses, when hoisted, are landed upon very strong platform trucks, and are then dumped in the rock house upon a large pile of dry pine logs. When a considerable number of masses has accumulated, the logs are fired and the whole pile is heated to redness, for the purpose of loosening the very considerable quantities of vein stone which are enclosed in the ragged cavities. This vein stone consists chiefly of calcite; and after cooling off, it is so much softened that the

greater portion can be knocked out by pounding upon the copper.

The masses are then marked, numbered, and recorded, and are shipped to the smelting works, where they are melted down in reverberatories.

Knight's Mechanical Dictionary.

This excellent publication, from which we often give extracts and select engravings, has lately been purchased by the firms of Messrs. Hurd & Houghton, New York city, and Messrs. H. O. Houghton & Co., Riverside Press, Cambridge, Mass., from Messrs. J. B. Ford & Co., the former publishers. The well known reputation of the new publishers is abundant assurance that the work will lose nothing, in point of superiority, in the manner in which the few parts yet to be issued will be brought before the public. We learn from Mr. Knight that the Dictionary will be rapidly pushed forward to completion, and will probably be finished within four months. Some twenty-seven numbers have already been published.

NEW BOOKS AND PUBLICATIONS.

CAMP LIFE IN FLORIDA, a Handbook for Sportsman and Settlers. Compiled by Charles Hallock. New York city: Published by the "Forest & Stream" Publishing Company. American News Company, Agents.

We have heard so much of the Adirondacks, during late years, as the "sportsman's paradise" *par excellence*, that it is altogether refreshing to take up a book which suggests the advantages of one of the most beautiful and, save a small part of Florida visited by invalids, least frequented portions of the country. The compiler has embodied, in a handy volume, some excellent papers published in *Forest and Stream*, which were the result of the labors of an exploring expedition sent out by the enterprising publishers of that journal during the last two winters. We can commend it as something very much better than the hybrid productions, half fact, half fiction, in which modern writers, describing the scenes of past sporting adventure, are very prone to indulge.

ORNAMENTAL DESIGNS FOR FRET-WORK, FANCY CARVING, AND HOME DECORATIONS. Part 1, price 75 cents; Parts 2 and 3, \$1 each. Edited and Published by Henry T. Williams, 46 Beekman street, New York city.

Since the introduction of the ingenious machine saws for amateurs, with some of which the readers of the *SCIENTIFIC AMERICAN* are already familiar through the illustrations and descriptions published from time to time, there has been a growing taste for this most fascinating and artistic branch of woodworking. So many beautiful home adornments can be cut out of various colored woods that an endless fund of amusement is found in the manufacture, and in many instances considerable profit beside. The work (published in numbers), the title to which we give above, is one which will be an invaluable aid in the designing of objects to be carved, embracing artistic designs for picture frames, wall pockets, brackets, book racks, book stands, baskets, easels, platters; in fact, a great variety of other fancy articles can be produced by fine saws. The numbers are mailed on receipt of price.

GASFITTER'S AND PLUMBER'S GUIDE. By Joseph D. Galloway, Gas Engineer. Published by the Author. Price, in paper, 75 cents. Philadelphia, Pa.: 1332 Chestnut street.

A handy volume of practical suggestions for the trades to which it is addressed. There are a large number of useful recipes, and a few illustrated descriptions of patented devices invented by the author, together with tables relating to weight of pipes and wire, and other data referred to constantly by workmen. The directions are clear and concise, and comprehensible by any one of average intelligence. The book contains about 100 pages; and its accuracy is vouched for by the long practical experience of its author.

IMPROVED DIARY AND MARGINAL INDEXED BOOK OF DAILY RECORD. Revised and Arranged by M. N. Lovell. Mailed, post paid, for \$2.00. Erie, Pa.: Erie Publishing Company.

This diary is so arranged that, by means of marginal indexes, the user can at once turn to the page on which the events of any day are recorded; and also, through an alphabetical index, he can easily find notes of various days on which similar events have happened. It is available for five years. For inventors desiring to keep proper chronological records of their ideas, it will prove a useful aid. It is especially well suited to be in one's pocket during visits to the Centennial, as it affords excellent facilities for jotting down notes, and grouping and easily finding them at will.

REPORT OF GENERAL CHARLES K. GRAHAM, Engineer-in-Chief of the Department of Docks, for the Year ending April 30, 1875. New York city: M. B. Brown, 201 William street.

Recent American and Foreign Patents.

NEW AGRICULTURAL INVENTIONS.

IMPROVED COMBINED CULTIVATOR AND HARROW.

George Croll, Tontogany, O.—This relates mainly to a new mechanical construction, which is such that the beams which receive the shovel plows may be adjusted to run level, whatever the position of the draft bars, and so that, when the said bars are parallel, the beams may incline toward each other. Braces are added, which may be adjusted to correspond with the draft bars.

IMPROVED ANTI-SUCKING BIT FOR CALVES, ETC.

John H. Bailey, Toledo, Iowa.—This is a novel device to prevent the sucking of calves or colts. It consists in a tubular bit, having open ends in communication with the external air, and an opening located inside of the mouth, so that, when the animal attempts to suck, air only will be drawn in through the bit.

IMPROVED MACHINE FOR BINDING GRAIN.

Argyle W. Tucker, Waxahachie, Tex., assignor to himself and L. J. Stroop, same place.—This machine combines several novel and ingenious devices, which together operate as follows: A band procurer moves forward into a band trough and takes up enough straw for a band. On the latter the gavel is caused to fall and then is compressed between fingers. The free end of the band is next carried over and caught by a forked needle, by which it is twisted around the stationary end. As the needle makes its last half revolution, it draws the stationary end out of the jaws of the band procurer and tucks the free end of the band under the body of the same. The mechanism then leaves the sheaf free, and a fork, moving upward and outward, throws it from the machine.

IMPROVED CORN-SHELLER FEEDER.

William B. Quarten, Fremont, Iowa.—This invention relates to certain improvements in feeders for corn shellers in which the ears of corn are carried up by means of endless belts and delivered to the holes or feeding throats of the machine. The improvement consists in using a single broad apron, or wide endless belt, which moves beneath the channels in the feeder, and is provided with buckets, which receive and carry up the ears. It also consists in dividers of considerable height, which are applicable to machines having four or more throats, and divide the channels into sets of

two, thus causing the ears, which are dumped promiscuously, to assume a longitudinal position in the channels, and thereby increasing the feeding capacity of the device.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED AUTOGRAPHIC TELEGRAPHIC INSTRUMENT.

John C. Ludwig, San Francisco, Cal.—This invention relates to a new telegraphic instrument belonging to the autographic or fac simile class, and designed to produce a record in the same handwriting as the original written message. The invention consists in an oscillating traverser, vibrating in unison with a similar traverser, at another station, which first traverser makes the circuit through the conducting lines of writing upon a slip of paper, and the second traverser effects the record by puncturing the paper through the instrumentality of a spark from an induction coil, so that the message is recorded in facsimile by a series of little holes or punctures. Another important feature of the invention is the method of preparing the paper upon which the message is written, and it consists in treating it with a mixture of ferrocyanide of potassium and coal oil, which renders the paper non-conducting except in the lines of writing made by an ordinary lead pencil. The invention also consists in numerous other details of construction for which reference must be made to the specification.

IMPROVED SEWING MACHINE FRAME.

Harriet Ruth Tracy, New York city.—This invention consists in an improved construction of the end frame for sewing machines, which frame is provided with peculiarly arranged casters or rollers, and with lugs or ears which adapt the frame to receive a hinged folding section of drawers without alteration or injury to the said frame.

IMPROVED CAR LIFTER.

General John D. Imboden, Richmond, Va.—This invention relates to means for transferring loaded cars from a track of one width to that of another without breaking bulk. It consists in using inclines located in a pit under the railroad track, movable truck frames, and a vertical lifter; also in combining with the latter crutches, a pitman and stirrups connected with the crosshead of an engine.

IMPROVED COTTON PRESS.

W. W. Wallace, Neckesville, Tex.—This invention relates to the mode of actuating the follower of a cotton press so as to combine convenience and facility of operation with a maximum of compressing power. It consists in connecting the lever arms and follower by arms that are pivoted to each, while the windlass is arranged under the press follower and connected by cords with a set of levers.

IMPROVED EYELETING MACHINE.

John J. Allred, Charlotte, N. C., assignor to himself and Alson G. Jordan, same place.—In this machine, the magazine containing the eyelets and the chute for conducting them to the inserting tool slide forward to carry the eyelet over the tool by a spring, and are forced back by a cam lever worked by the slide of the tool. In going back they work the feeder, by which the eyelets are delivered from the magazine into the chute. The slide of the inserting tool also works the feed, and the punch is worked by a cam on the driving shaft and a spring. The general arrangement is simple and doubtless effective.

NEW HOUSEHOLD ARTICLES.

IMPROVED CLOTHES HOLDER.

James Lesh, Warren, Pa.—The invention is an improved device for holding bed clothes or coverings properly stretched, and preventing their being thrown or pushed off in consequence of the restive movements of children while asleep. It is also applicable for holding lap robes when riding. The same consists of an elastic band having a sheath or guard hook attached at one end, and tapes or cords attached to the other. The hook is inserted through the clothes or robe, and the strings are tied to the person or to some fixed object. The elasticity of the band enables the clothes or robe to yield and adjust themselves to the movement of the legs or body.

IMPROVED IRONING STAND.

John Finck, Piqua, Ohio.—The invention relates to the manufacture of ironing stands, so that garments can be conveniently manipulated in the process of ironing, and so that they may be readily folded up and packed in a small space. The stand consists of two posts, provided with crossbars at top and connected by a rail jointed at one point, the board being open at the end and provided with a clamp screw.

IMPROVED INVALID BEDSTEAD.

William Huntress, Richmond, Va.—A portion of the mattress is supported on a hinged frame, which, being dropped, allows a vessel and a chute to be adjusted in a portion of the bed convenient for the requirements of the occupant.

IMPROVED PICTURE NAIL.

John P. Stockton, Jr., New York city.—This inventor proposes a nail having a stationary disk upon it which presses close against the wall, and so affords an additional support, and having a knob composed of two parts, the inner portion being loose. The idea is to allow of the ready adjustment of the suspending cord or wire without requiring the raising of the suspended object.

NEW WOODWORK AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED WAGON BRAKE.

Halvord Markrud, Ettrick, Wis.—This inventor proposes an arrangement of brakes in connection with the tongue, which is pivoted to the hounds and has rear branches which act upon the horizontal brake levers. By this, when the wagon presses forward against the tongue, the levers are operated to press shoes forward against the wheels, and the friction of the wheels causes the shoes to rise, bringing their wider part against the wheels and making the pressure greater. When the wagon is backed, suitable devices prevent the shoes from acting upon the wheels.

IMPROVED WAGON BOX.

Timothy Jennings, Moulton, Iowa.—This invention relates mainly to an improved and strong construction of a wagon body which may at any time be used with or without top box, which forms a rigidly attached extension of the same. The different binding straps and stays connect the body in a solid and durable manner, so as to impart to it the required strength and resistance to heavy loads, while they may be readily replaced without difficulty when they get broken or injured by use.

IMPROVED SHIFTING BUGGY TOP.

Henry M. Gillespie and Virgil True, Laclede, Mo.—This invention relates to certain improvements in shifting tops for carriages, buggies, etc.; and it consists in a horizontal bottom rail, to which the top frame is attached, which said rail is slid into grooves around the top edge of the seat and held therein by a locking key. It also consists in a double set of vertical supporting props for the top, whereby the latter is more securely held in an elevated position.

IMPROVED SCHOOL SAW.

Wm. C. Margedant, Hamilton, Ohio.—The object of this invention is to provide a straining device for a scroll saw adapted to a great length of stroke, and of uniform tension or strain through all parts of said stroke. It consists in a spring bent in a circular, elliptical, or oval form, so that the two ends approach each other, in combination with a lever placed between said ends and swiveling upon either an independent or imaginary fulcrum, so that as the lever is depressed the ends of the spring are active upon the same upon opposite sides of the fulcrum, and as the lever approaches its limit of movement the ends of the spring approach an alignment, and the strain of the spring is correspondingly diminished, just in proportion as the leverage of the lever increases, thus rendering the strain uniform throughout its entire movement. The invention also consists in the peculiar construction of a hollow pitman pin, to be filled with lubricating material, and designed to operate as an automatic lubricator.

IMPROVED BAND SAWING MACHINE.

Wm. C. Margedant, Hamilton, Ohio.—This invention relates to ingenious and valuable improvements in band sawing machines; and it consists principally in the construction of the upper band saw wheel, which is made with an independent loosely sliding face, periphery, or rim, upon which the saw blade runs, the object being to obviate the bad effects arising out of the momentum of the said upper wheel when the lower wheel and actuating mechanism are stopped. The invention also consists in a double acting brake, designed to operate upon both sides of the periphery of the driving wheel to prevent strain and uneven wear upon the shaft, and also in the peculiar construction of back thrust guides, which consist in a series of balls or spheres, which are so arranged as to present always a new surface to the back of the saw blade. The invention also further consists in the means for adjusting the upper band saw wheel, and in other details of construction.

IMPROVED WATER SUPPLY AND VENT FOR TRAPS.

John H. Morrell, New York city.—This inventor has recently devised several useful devices of similar nature to the present one, many of which have been illustrated in late issues of this journal. He now suggests certain new improvements in conducting water from the roof of a building to the water closet, or other traps connected with the building, by leading a pipe from the roof, and connecting it at a point below the drop cup or pan of the water closet, either to the bowl or pipe leading therefrom to the trap. The object is to prevent the escape of sewer gas into the house.

IMPROVED MACHINE FOR BORING BLIND-STILES.

Freeland H. Dam, St. Cloud, Minn.—This is a machine for boring blind stiles, fence rails, and other articles with holes of uniform depth at equal space from each other, and for carrying on the boring operation continuously. By suitable mechanism the exact feed of the boring tools, in either direction, is easily and quickly produced; and by the alternate action of the same one stile is bored while the other stile is fed forward, so that a continuous work of the machine is obtained.

NEW CHEMICAL AND MISCELLANEOUS INVENTIONS.

IMPROVED COMBINED CANE AND WHIP.

Oliver H. Saxton, Washington Court House, O.—This inventor has devised an ingenious combination of a cane and a carriage whip. The whip portion proper is flexible and made solid, and is attached to tubular sections, which are telescopic, so that, to extend the whip, they may be drawn out and secured by their screw joints.

IMPROVED BOTTLE STOPPER.

Adolph Luthy, New York city.—In this a curved-wire spring lever, that carries the stopper, is secured on the bottle by a ball pivoted to the neck band of the same, binding on a recessed top rest of the stopper plate. The lever is first pressed tightly on the stopper, and the ball then slid up over the same, holding both stopper and lever firmly in position by the spring action of the stopper and lever. The device is cheap and easily operated.

IMPROVED SCHOOL DESK.

Thomas Redmayne, Sheffield, England, assignor to William Redmayne.—This inventor proposes to make the plane surface which forms the desk capable of being adjusted and fixed either in a horizontal position, to serve as a table, in a slightly inclined position, to serve as a desk, or in a nearly vertical position, to serve as a back to the seat, which is ordinarily arranged in connection with such desks. The invention consists in mechanism for adjusting and altering the angle of the desk, and also of mechanism for locking or fixing the board or desk when it has been adjusted in the required position, so that it cannot be altered, except by releasing the locking mechanism.

IMPROVED TAILOR'S APPARATUS FOR DRAFTING PATTERNS.

John Bellamy, New York city.—This inventor has devised an ingenious chart, which represents, in miniature, the forms of the different parts of the shirt. The points to draw and cut to are numbered on all the parts to correspond with the actual measures on a scale of proper size for laying off the true measures on the cloth to be cut. A different scale is used for each different size or number of shirt.

IMPROVED BELL METAL TOY BALL.

Jonathan C. Clark, Middle Haddam, Conn.—This is a hollow ball, which is made of bell metal, and in one side of which is formed a slot to allow the metal to vibrate, and thus give a sound. In the ball are formed a number of holes to allow the sound to escape freely, and within the cavity of the bell is placed a small ball, to act as a hammer to cause a sound as the said ball is rolled or shaken.

IMPROVED CIGAR PIPE.

Robert L. Weed, New York city.—This inventor proposes to overcome the prejudices of people who object to pipes by a little device which enables a smoker to enjoy his favorite tobacco, and at the same time to appear as if inhaling the fragrance of a cigar. It consists in a hollow sectional tube, resembling a cigar, made of wood or other suitable material. The tobacco may be readily compressed by the finger into both sections, so as to form a filling corresponding to that of a cigar, while the smoker can always secure and know the kind and quality of tobacco which he is about to use.

IMPROVED YARN-PRINTING MACHINE.

James Short, New Brunswick, N. J.—This is a very ingenious machine, devised for printing the yarn used in carpet manufacture. Its mechanism it would be impossible to explain without the aid of detached drawings; but the essential portion consists of new operative mechanism for a thread printing drum, by which the latter is greatly simplified.

IMPROVED GLOBE ATTACHMENT TO CLOCKS.

Henry Fick, New York city.—In order to show the position of the earth at any hour, this inventor arranges a globe so attached to a clock that it turns in unison therewith, and, at the same time, is free to be turned forward or backward by hand at any time in case it may be required to do so. When let go by the hand, the globe will automatically return to its true position, relatively, to the clock.

Business and Personal.

The Charge for Insertion under this head is One Dollar a Line. If the Notices exceed Four Lines, One Dollar and a Half per Line will be charged.

Every Mechanic and Artisan should have a copy of "Wrinkles and Recipes." Price \$1.50 by mail. H. N. Mann, Publisher, 37 Park Row, New York City.

Plumbago.—Dixon's Perfect Plumbago Lubricator. Send for samples and information, furnished free by Joseph Dixon Crucible Co., Jersey City, N. J.

Hearing Restored.—Great invention. Book free. G. J. Wood, Madison, Ind.

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

A Bargain.—A set of Scientific American, from Vol. 3, Old Series, to Vol. 21, New Series—1875 to 1890—33 Vols., well bound, for \$80. Address A. F. R., Box 773, N. Y.

Wanted.—A 2d hand Watchman's Clock, cheap. Address Penfield Block Works, Lockport, N. Y.

Bright tinning Gray Iron Castings.—Instructions or Sale. Samples free. J. M. Simpson, Oakbrook, Wis.

To Engine Builders.—See Advt in this paper.

Centennial Exhibitors, see Advertisement of Blackmer & Co., page 396.

For Sale, Cheap.—1½ inch Schlenker Bolt Cutter (new) complete. E. Gould, Newark, N. J.

Wanted.—A good patented article to introduce in South, one suitable to that locality. Address J. R. McNulty, 107 Clark St., Chicago, Ill.

The cheapest and best portable oil cook stove. Agents wanted by T. B. Jeffery, 333 Canal St., Chicago.

A Great Business Success.—Messrs. Geo. P. Rowell & Co., do one of the largest advertising trades in the world. Their extensive premises embrace nearly all of the entire second floor of the New York Times building, Nos. 40 and 41 Park Row, where thousands of newspapers are received daily, examined and put away, and hundreds of letters read and replied to. The place is a business beehive in fact, and admirably illustrates one of the most remarkable institutions of our time, the Advertising Agency. The offices are well arranged in counting-house fashion, and are among the most pleasantly and advantageously situated in the city. We congratulate our enterprising neighbors upon the success which persistent industry, a keen eye to business, and uprightness in the doing of it, have obtained for them. (Evening Mail, N. Y. City.)

Railroad M. M.—Send for Circulars of Gardner's Pat. Centering and Squaring Attachment for Lathes, R. E. State, Springfield, Ohio.

For the Best Hand or Power Bolt Cutter and Nut Tapper for Railroad use, address R. E. State, Springfield, Ohio.

Fat Iron Polisher and Knife Sharpener.—New thing. Dealers and Agents, send 30 cts. for sample. Circular Free. T. B. Stayner & Co., Providence, R. I.

The Varnishes of the London Mfg Co. have obtained a wide celebrity for their superior finish. They have no equal either in this or foreign markets. 246 Grand Street, New York.

Self-Feeding Bolter, for Sawing Handles, Heading, Splines, Lath, Chair Stuffs, Wagon Stuffs, Bed Posts, Splines and Sticks, Pickets, Siding, etc. Send for circulars. Richard V. Montross, Galien, Mich.

For Sale.—6 ft. Planer, Chucks and Tools, \$275; 15 in. x 7 ft. Lathe, Chuck and Tools, \$175; 17 in. x 6 ft. Lathe, \$175; 20 in. Drill, \$50; 36 in. Drill, \$125. Shearman, 45 Cortlandt St., New York.

Wanted.—Correspondence with parties manufacturing Lawn and Parlor Games. M. C. Burr, Minneapolis, Minn.

Wanted!—\$1,000 to complete arrangements for the m'f'g of a new Pat'd Article in Steel. One half interest in Business and Patent will be given. Address P. O. Box 136, Brooklyn, N. Y.

Williamson's Tannate of Soda removes and prevents Scale in Boilers. 25 lb. boxes, 25 cents per pound. C. O. D. D. D. Williamson, 368 West St., New York.

Some beautiful Electrical Apparatus for Sale, suitable for lecture purposes. T. W. Tobin, 141 E. 15th Street, New York City.

Grotto.—A new Lawn and Parlor Game. Will license to the right party, or sell outright. M. C. Burr, Minneapolis, Minn.

Water, Gas and Steam Goods.—Send eight stamps or Catalogue, containing over 400 illustrations, to Bailey, Farrell & Co., Pittsburgh, Pa.

For automatic Twist Drill Grinding Machines, address C. Van Hagen & Co., Philadelphia, Pa.

Painters and Grainers, send at once for Sample and Catalogue of the Celebrated Metallic Graining Tools; \$5.00 now in use. Address J. J. Callow, Cleveland, O.

Small Engines. N. Twiss, New Haven, Conn.

Patent Scroll and Band Saws, best and cheapest in use. Cordeman, Egan & Co., Cincinnati, Ohio.

Camp Lounge, \$5. C. L. Co., Troy, N. Y., and Newark, Ct. N. Y. City Salesroom, 177 Broadway.

Boul's Paneling, Moulding and Dovetailing Machine is a complete success. Send for pamphlet and sample of work. B. C. Mach'g Co., Battle Creek, Mich.

For best and cheapest Surface Planers and 1 Universal Wood Workers, address Bentel, Margdar & Co., H. Milton, Ohio.

The Original Skinner Portable Engine (Improved), 2 to 8 H.P. L. G. Skinner, Erie, Pa.

Single, Double, and Triple Tensioning Machines of superior construction. Martin Buck, Lebanon, N. H.

Gothic Furnace, for coal and wood, heats houses & churches. Send for book. A. M. Lesley, 226 W. 23d St., N. Y.

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

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

"Pantoc," or Universal Worker.—Best combination of Lathe, Drill, Circular, and Scroll Saw. E. O. Chase, 7 Alling Street, Newark, N. J.

Hotchkiss & Ball, Meriden, Conn., Foundrymen and workers of sheet metal. Fine Gray Iron Castings to order. Job work solicited.

For Sale.—Second Hand Wood Working Machinery. D. J. Lattimore, 21st & Chestnut St., Phila., Pa.

Price only \$150.—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., 246 Canal St., New York.

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

All Fruit-can Tools, Ferracuta Wks, Bridgeton, N. J.

American Metaline Co., 61 Warren St., N. Y. City. Genuine Concord Axes.—Brown, Fisherville, N. H.

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

Faught's Patent Round Braided Belting.—The Best thing out.—Manufactured only by C. W. Army, 128 North 3d St., Philadelphia, Pa. Send for Circular.

Diamond Tools.—J. Dickinson, 64 Nassau St., N. Y.

Magie Lanterns and Stereopticons of all sizes and prices. Views illustrating every subject for Parlor Amusement and Public Exhibitions. Pays well on small investments. 72 Page Catalogue free. McAllister, 49 Nassau St., New York.

Temples and Oilcans. Draper, Hopdale, Mass.

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., 246 Canal St., New York. Makers. Send for free illustrated Catalogue.

For Best Bolt Cutter, at greatly reduced prices, address H. B. Brown & Co., New Haven, Conn.

The Barter Engine.—A 48 Page Pamphlet, containing detail drawings of all parts and full particulars, now ready, and will be mailed gratis. W. D. Russell, 18 Park Place, New York.

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

Spinning Rings of a Superior Quality.—Whitinsville Spinning Ring Co., Whitinsville, Mass.

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

Notes & Queries.

D. L. M. (steam pressure in caldron), does not send sufficient data.—J. S. F. and others are informed that there is no such instrument as a rod that will indicate the locality of coal in the earth.—H. M. T. will find a recipe for cement for leather on p. 119, vol. 23.—A. will find directions for pickling cucumbers on p. 155, vol. 31.—C. A. B. will find a recipe for a white metal on p. 363, vol. 31.—J. W. H. will find a recipe for cement for china and glass on p. 373, vol. 32.—M. will find full descriptions of friction gears on pp. 227, etc., vol. 26.—J. S. S. can polish his gun barrel by following the directions on p. 11, vol. 32.—W. W. S. will find directions for cementing leather to iron on p. 317, vol. 30.—J. C. P. will find directions for calculating the teeth of compound gears on p. 187, vol. 29.—E. H. can fasten emery to a belt with good glue.—G. B. S. will find full directions for constructing friction gears on p. 227, etc., vol. 26.—J. C. W. can calculate the amount of friction of water in a pipe by the formula given on p. 48, vol. 29.—M. G. will find that a treatment of catarrh was described on p. 85, vol. 32.—J. S. W. can cement cloth to wood with marine glue. See p. 43, vol. 32.—J. S. S. can waterproof leather by the method described on p. 155, vol. 26, and paper by that detailed on p. 116, vol. 31.—E. W. C. can put a black enamel on his iron castings by following the directions given on p. 208, vol. 26.—T. D. B. can fasten emery to wood by the method described on p. 233, vol. 32.—G. B. M. can clean fly specks off gilt moldings by the process detailed on p. 27, vol. 31.—J. V. R. will find full directions for making induction coils on p. 213, vol. 32.—J. E. S. can copper cast iron by following the directions on p. 90, vol. 31.—A. McK. will find a description of meerschaum on p. 11, vol. 32.—G. C. U. and others will find an explanation of an iceboat sailing faster than the wind on p. 331, vol. 33.—S. B. will find full directions for polishing magnifying glasses on p. 363, vol. 31.—F. C. will find answers to all his questions on electroplating in No. 34, p. 284, vol. 33.—J. V. B. P. will find directions for hardening files on p. 213, vol. 26.—W. E. and G. W. McK. will find a recipe for liquid glue on p. 90, vol. 32.—J. F. C. and others are informed that the force of a falling blow is discussed on p. 90, vol. 32.—H. G. B. will find a recipe for bronzing on iron on p. 283, vol. 31.—W. W. S. can cut glass bottles by following the directions on p. 399, vol. 24.—H. J. B. can remove fruit stains by the method described on p. 283, vol. 31.—E. J. C. will find a description of a straw-burning engine on p. 214, vol. 30.—W. H. C. will find a detailed account of the sand blast on p. 296, vol. 25.—N. T. H. will find directions for etching on glass on p. 409, vol. 31.—N. will find directions for gliding picture frames on p. 317, vol. 31.—C. W. S. can preserve his skates from rust by the method detailed on p. 283, vol. 31.—E. J. O. will find directions for making artificial stone on p. 350, vol. 25.—H. B. B. will find directions for making rubber printing stamps on p. 156, vol. 31.—W. E. will find directions for crystallizing the surface of tin on p. 394, vol. 31.—P. H. H. will find a good recipe for shoe blacking on p. 283, vol. 31.—J. L. K. can galvanize iron articles by the process described on p. 59, vol. 24.

(1) F. F. asks: Is there any way to prevent lamp chimneys from breaking by heat, or by cold in daytime, when the lamp is not burning? A. If the chimneys be properly annealed, they will not easily break, if ordinary care be taken not to spatter them with cold water when very hot.

(2) S. T. R. asks: Will you please state what is the simplest test for the presence of free carbonic oxide in the atmosphere of rooms in a dwelling? A. There is no simple method of doing this satisfactorily, owing to the solubility of all the combinations into which it enters. A solution of the bichloride of copper in hydrochloric acid, or of a salt of the dioxide of copper in ammonia, gradually absorbs carbonic oxide if agitated with it.

(3) J. A. R. asks: How can I make liquid gold and silver, to be used for writing on paper? A. Procure a book of leaf gold, take out the leaves gently and grind them in a mortar with a piece of honey about the size of a hazelnut, until it is thoroughly intermixed with the gold; then add a little water and rework it; put the whole into a phial and shake well. Let it remain an hour or two, and the gold will deposit at the bottom of

the phial. Pour off the liquor, and add weak prepared gum in its stead, sufficiently to make it flow freely from the pen. When required for use, shake it occasionally.

(4) G. H. asks: Is there any marking ink sold which does not contain silver salts? The laundry washing removes all marking by AgNO₃ ink, probably using KCN. Some kinds of indelible printing ink are not affected. Can you give the ingredients for any such ink, to be used with a pen? A. Make a solution of genuine asphalt in alcohol. This is one of the best indelible inks known. You may find it, already prepared for sale, under the name of indelible carbon ink. Angline black also gives very good results.

(5) W. F. W. says: I have at our works three steam boilers, 26 feet long by 36 inches diameter, with 2 flues in each of 14 inches diameter. Furnace is 11 feet wide and grate bars 4 feet long. Boilers are set 15 inches from surface of bars; smokestack is 42 inches in diameter. We require 80 lbs. of steam to do the work, and it requires skillful firing and constant hard work to make the steam. By this forcing of fires, a waste of fuel occurs. We use river water, and wash out the boilers once a week, and we find a deposit of scale in each, about two quarts in quantity, collected in a circle 8 or 10 inches in diameter, 40 inches from front of boiler. It is in the same place every week. Would the use of grate bars 12 or 15 inches longer overcome the necessity of forcing the fires, and give more heat? A. It is probable that your best plan would be to put in another boiler. Before doing this, however, we advise you to have your boilers tested, so as to ascertain whether they are as efficient as they should be. 2. Is it the intense heat on the front sheets that causes the scale to collect in a circle in the same place? A. The reason suggested for the formation of scale in particular spots is very plausible.

(6) J. S. E. says: We tried preserving eggs by coating them with paraffin, but the warm paraffin was chilled the instant it touched the egg, and it seems impossible to apply it. How can it be done? A. Send us a copy of the directions that you made use of.

(7) J. N. P. says: On a three story house was suspended a scaffold, the weight of which was not over 150 lbs.; the rigging of the scaffold was made of ¾ inch rods, and chains, the links of which were also made from ¾ rods. An accident occurred when there were two men on the scaffold, weighing probably 150 lbs. each. The scaffold was one of a pair which were swung together, with a bridge between. At the time of the accident one man was near one end of the bridge, and the other about the middle of the bridge, which was about 12 or 15 feet long. All at once, without any warning, one of the rods pulled in two, and the scaffold fell; the strain was from end to end (tensile); the end of the broken rod showed no fracture, and it was not splintered, but had more of the appearance of coarse cast iron; the crystals were very distinct. The iron was bought for the best Swedish wrought iron. 1. Do you think the rods were overloaded? The rigging has been in use about four years, and has been used in all kinds of weather. A. From your account, we infer that the accident was caused by a defect in the iron. 2. What do you think would be a safe load for a scaffold fitted with such rods? The total weight of the bridge was not over 75 lbs. A. Each rod, if made of good material, should be capable of sustaining with safety about 1,000 lbs.

(8) C. D. asks: Please give the formula for producing the white finish upon thermometer and barometer tubes. A. The white enamel sometimes seen is made by fusing together hard flint glass and white arsenic, in the proportion of 10 parts of the former to 1 part of the latter. In some cases, calcined bone or ivory is used in place of the arsenic. The proportions in this case are the same as in the former.

(9) T. D. H. asks: How can I make a good barometer? A. Obtain a good strong glass tube, about 34 inches long and having as smooth and even a bore as possible. Close one end by means of a spirit lamp and blowpipe, or Bunsen burner, and fill the tube with pure clean dry mercury, being careful to exclude all bubbles of air. Then place your finger over the open end of the tube and carefully invert it into a small vessel, partially filled with mercury. Be careful not to remove your finger until the end of the tube which it covers is safely below the surface of the mercury in the reservoir. When the tube is thus inverted the contents will fall until the height of the column is about 30 inches above the level of the mercury in the little reservoir below. In the barometer the mercury never rises above 31 inches, and rarely falls below 27. The scale is therefore applied only to that part of the tube which lies between these limits. This scale may be adjusted properly by comparison with some standard instrument.

(10) M. O. asks: Of what metal shall I make an inkstand which will not corrode or spoil the ink? A. You fail to state what kind of ink. Ink varies greatly in composition. As a general rule, the metals (gold, platinum, etc., excepted) could not well be employed for this purpose, as in many cases they would contaminate the ink. Try bone, ivory, horn, or some kind of close-grained, hard wood.

(11) C. W. H. says: Herewith is a rubber band which has the appearance of having been subject to heat sufficient to destroy its elasticity, and almost to char it. In 1870, I placed this band around a bundle of letters, and put the bundle away. From that time it has not been disturbed. I find this band in its present condition, while the letters on the outside of the bundle next to the band, as well as all papers lying next to it, are discolored and have the appearance of being scorched. There was nothing else in the drawer in all that time, except clean bundles of letters. Can you

account for it? A. The specimens forwarded prove to have undergone oxidation, but it would be surprising if the results noted could be traced to this. The degree of heat necessary to have scorched the paper, as stated, would have caused a partial decomposition of the rubber, leaving it in a viscous condition, which is not the case.

(12) J. B. asks: How can I carbonize, decarbonize, and extract phosphorus from iron, when melting it on a small scale? A. Fuse with a small quantity of cubic niter and calcium chloride.

(13) J. S. B. asks: Can you inform me of the process for a detonating compound composed of chlorate of potash and amorphous phosphorus, and the nature of the explosive conditions under which it explodes, etc.? A. Glue, or gum, or any similar substance is first dissolved in a small quantity of water to the consistence of a thin sirup, with which, having been heated to 122° Fah., the phosphorus (amorphous in powder) is incorporated, by gradually adding it and keeping the mixture stirred so as to form an emulsion, to which is next added the chlorate of potassa, having been previously well pulverized. The amount of phosphorus should be in the proportion of 1/10 or 1/12. A drop of this mixture, if allowed to dry, detonates violently on the slightest friction as well as by contact with flame.

(14) A. B. B. asks: How can I remove grease spots from paper? A. Warm the paper and cover it on both sides with dry, finely ground pipe clay, and place it under a slight pressure for a few hours. Then dust off the clay, and remove the fine dust that still adheres by means of a good piece of India rubber.

Can carbonic acid gas be collected and liquefied from tubs of fermenting grain, as in distilleries? A. Yes, but we do not think it would repay you for your trouble.

(15) H. & W. ask: We wish to dissolve some bleached shellac, and have tried alcohol, spirits of turpentine, and potash, but all have failed. Can you tell us what will do it? A. If the substance in question is really shellac, alcohol will dissolve it readily. Shellac is also soluble in a hot solution of borax in water.

(16) E. S. C. says: I am building a side wheel boat, 18 feet long and of 5 feet beam. The engine cylinder is 3 inches by 6 inches. Please give proper dimensions for paddle wheels to run at the rate of 7 miles per hour. How fast should they revolve? Is it best to speed back with cog gear or belt? A. It is not probable that you can realize the speed you mention. We would recommend wheels about 3 feet in diameter, making 30 to 35 revolutions a minute. You can use friction gearing to advantage.

(17) P. asks: What buoyancy in sea water will a globe of glass containing 100 lbs. weight of atmospheric air have when immersed to a given depth? In other words, if a utensil containing 100 lbs. of air is submerged in water, how much weight will it carry or hold up without sinking? How many cubic inches of space contains 100 lbs. of air? What is the weight of air by the gallon? A. You do not send sufficient data; but we will give you what you need to work out the example. The weight of one cubic foot of air, at ordinary temperature and pressure, is 0.076391 lbs.

(18) W. T. A. says: I am using two return flue boilers 28 feet long and 3 feet 4 inches in diameter, and a new high pressure Corliss engine. I burn wood and have plenty of draft. The water is full of lime, which stops my gages up and precipitates in large quantities throughout the boilers and engine. If I use a heater, exhausting from the engine into it and then allowing the steam to escape at the other end of the heater, would it purify the water at all, and help me out of my trouble? A. The use of a good heater would probably prove of advantage in your case. It would be well for you to blow off some of the water in the boiler once or twice a day.

(19) W. B. asks: What sized wheel is proper for a side wheel steamboat 80 feet long, of 15 feet beam, and 4 feet deep? Should the wheel house be perfectly round, or does it want to slant out at the bottom? A. Make the wheel as large as convenient. It will answer very well to use a round wheel house, leaving some clear space below.

(20) W. B. G. says: I am using several water wheels, which I think will be sufficiently described by calling them center vent turbine wheels. If I gear them so that, to do the same work as now, they would have to make more revolutions, do I thereby increase their power? I also use more water. In other words, does the amount of water vented bear any relation to the speed of the wheel, and can a small wheel be made to do the duty of a larger one by simply increasing its speed relative to the work to be done? A. Generally, any particular wheel has a certain velocity at which it gives the greatest efficiency.

(21) C. J. H. asks: How can I insulate copper wire for an induction coil? A. Cover the wire with silk. The longer the wire, the greater the shock. One thousand feet will give a good shock.

(22) N. B. A. asks: Please give me a recipe for an ink which, although it is of a reddish color when first applied to the paper, in a few moments turns black or purplish black. I think it is called chromium ink. A. Dissolve 3 ozs. solid extract of logwood in 3 gallons hot water; to this add ¼ oz. bichromate of potassa, also dissolved in a little hot water. The ink, when cool, is ready for use.

(23) F. O. asks: 1. With what can I fasten leather to wood? The cement must not be soluble. A. Melt together equal parts of pitch and gutta percha. Apply hot. 2. Will kid leather submerged in kerosene be destroyed? A. We think not. 3. Will felt withstand the action of kerosene? A. It will.

(24) J. A. C. asks: Does the electric current used in sending a message to Europe or elsewhere return again to the instrument from which it emanated, either by a wire or by the ground? If the wire is dispensed with, does the current return by way of the earth in a direct line, and, having an affinity for the place from which it came, pass by all other attractions in its passage to that? A. The current does not return through the earth, but is absorbed by it at each end, thus causing a movement in the wire the same as if the ends were joined. It was formerly supposed that the current returned through the wire, but this has been proved to be incorrect.

(25) M. M. M. asks: By what method and under what conditions can the power of a permanent steel magnet be kept exactly the same for any length of time? A. The most effective way is to place a bar of iron across the poles.

(26) W. M. J. asks: 1. Would good varnish or paraffin make a good insulator for wire intended to be used in the helices of a relay? A. Silk or cotton would be better. 2. In what way does insulation act upon the condition of a magnet other than to separate one wire from another in the coils? A. Insulation of the wires is only intended to separate them, and prevent any conduction between the layers.

(27) E. C. G. says: 1. I am about to make an electro-motor. What metal must I use on which to wind the magnetic coils? A. Iron. 2. What kind and size of wire must I use? A. No. 14 copper wire.

(28) N. W. L. says: You state that grease or oil applied to the coils of a telegraph battery will prevent creeping. Having been annoyed by the creeping of our battery, and acting on the hint, we applied butter to it, that being the only grease at hand at the time. Since the application the battery does not creep, but the current is a great deal weaker. Is the butter the cause? A. No. Probably the battery needs fresh water.

(29) W. L. asks: 1. What bright large star is in the northeast, not very high, at about 6 P.M.? A. It is Capella, the principal star in the constellation *Auriga*. 2. What bright bluish star is high overhead to the westward? A. It is Vega, but more frequently called *Lyra*. It is the principal star in the *Harp*. 3. What large star is near *Orion* on the west side? A. It is *Aldebaran*, the largest star in the constellation *Taurus*.

(30) W. P. H. says: 1. I have in my possession two glass disks 2 inches in diameter, made by Chance & Co., of Birmingham, England. One consists of hard crown glass and one of dense flint. With these I wish to make a plano-convex achromatic objective: what should be the radii of curvature for the surfaces of the disks in order to have a focus of 10 inches? A. If the flint is of medium density, the curves of the crown may be 3.4 inches radius. The flint glass should be double concave, one side to fit the crown, the other side of 25 inches radius. If the flint is very dense, the curves may be of 3.5 inches radius for each side of the crown, and 29 inches for the long side of the flint. 2. What would be the negative and positive foci of the disks? A. The focus of the crown will be the radius, that of the flint $\frac{1}{2}$ its radius.

(31) C. M. B. says: I have a soapstone grid-die which, by accident, was thoroughly greased. How can I extract the grease? A. Wash it carefully with hot potash lye, and rinse with clean cold water until all trace of the alkali has been removed.

(32) R. F. S. asks: 1. What are the diameter, focus, and shape (plano convex or double convex) of the eye lens for a good microscope, and is it achromatic? A. The lenses of the eyepiece of a microscope are both plano-convex, made of single pieces of glass. The field lens is usually larger and of longer focus than the eye lens. 2. What is the diameter, focus, and shape of the field lens, and is it achromatic, and what is the proper distance between the eye lens and field lens? A. For medium powers, the field lens may be of 2 inches focus and the eye lens of 1 inch focus, set $\frac{1}{2}$ inches apart, with the convex sides toward the object. As they correct each other, the combination is achromatic. 3. What is the proper shape of an achromatic objective, plano-convex or double convex? A. The best objectives for high powers are made of three separate lenses, each lens of two kinds of glass. The best form for a single lens of one piece of glass is a double convex, whose radii are as one to six.

(33) L. J. asks: How shall I clean the lenses of optical instruments? A. Breathe on the glass, and wipe with chamois skin or the nap side of cotton flannel. Paper of any kind would be very likely to scratch the glass. This also answers A. F. O.

(34) H. S. asks: What is the magnifying power of the home-made compound microscope, described in your issue of October 30, 1875? A. If the tube or body of the home-made compound microscope be 12 inches in length, the magnifying power would be about 100 diameters. The same eyepiece, with an objective of $\frac{1}{4}$ inch focus, would give a power of about 200 diameters; then by lengthening the body, the power may be easily increased to 300 or more. A common and convenient way of determining the power of a microscope is to focus an object of known size, and place a rule on the stage outside, then look with one eye at the object in the microscope and with the other at the rule. It will readily be seen how large the object appears to be on the rule, and this gives the approximate magnifying power.

(35) H. M. says: I am getting up a small engine and boiler to drive a yacht. If my boiler will furnish steam to fill a 3x3 cylinder, and I put in 6 cylinders each 3x3, cut off each at $\frac{1}{2}$ stroke, and use the steam expansively the rest of the way, could you recommend such a course? A. We cannot recommend the plan.

(36) R. J. F. asks: Is it possible to improve an object glass of a telescope by change of figure, if the fringes around objects are equally colored with green and purple? Would the thickness of the glasses make much difference? A. Telescopes are usually made of a double convex crown and a concave flint. In small objectives, of less than 3 inches diameter, the flint is usually double concave, and in large glasses, concavo-convex. The following curves for a $\frac{3}{4}$ inch objective, of 8 feet focus, answer very well: Outside curve of crown 50 inches radius, contact curves $29\frac{1}{2}$ inches, and the back convex side of flint 140 inches. This combination forms an achromatic lens, which will get rid of your trouble.

(37) R. M. asks: How must the lenses be set, and of what size and focus must they be for the home-made microscope, recently described by you? I want it to magnify from 1,000 to 1,500 times. A. The lenses must be set as described in the article. The focal length of the objective should be about $\frac{1}{4}$ of an inch, and of the field lens of the eyepiece $\frac{1}{2}$ inches, and the eye lens $\frac{1}{4}$ inch. Then, by lengthening or shortening the body, a power of 1,000 or 1,500 may be obtained.

(38) J. B. says: I am building a machine showing the earth turning on its axis at an inclination of $23\frac{1}{2}^\circ$, the moon revolving around the earth, and all around the sun. Is there such an apparatus in existence? A. There are very perfect instruments for showing the movements of the solar system. They are called planetaria. 2. Would it be best to make it vertical or horizontal? A. For the sake of convenience they are made vertical. They cannot be made correct, but only approximately so. 3. Do the planets return to the same places in a year? Will they be seen next year in the same place on the same day at the same time? A. The planets never return to the same place on the same day of the year.

(39) W. H. D. L. says: If milk is not properly cooled, or is confined in a tight can before the animal heat has passed off, it soon becomes tainted. Would bacteria or some similar organisms be present in such a case? A. Yes. 2. What must be the magnifying power of a microscope to reveal such organisms? A. A power of 200 diameters shows the animalcules in stagnant water; and no doubt it would be all you would require. A less power, even, might answer your purpose.

(40) S. D. T. says: You could not see anything in a mirror attached to a kite, because of the constant movement of the mirror and the highly magnified condition of the light coming from the mirror to the observer.

(41) E. R. asks: Does any one manufacture cast steel that can be tempered? A. All cast steel can be tempered.

(42) T. G. asks: It is asserted that water, in running out of a basin through a hole in the bottom, takes a rotary motion, and, when unobstructed, the circular motion is always one way, namely, the same as the hands of a watch laid on its back. Is this true? A. We think not.

(43) F. R. B. asks: Can I arrange a small compound microscope so as to throw an enlarged image on a screen, as a stereopticon does? A. You cannot do it, on account of the high magnifying power, small field, and want of sufficient illumination.

(44) C. T. P. says: Please inform me which is the proper way to run a belt, with the grain or the flesh side next to the pulley. A. The grain side.

(45) W. H. P. says: I am running a 50 horse power tubular boiler, but have not got draft enough at times. The main flue is of iron, 2 feet in diameter, and passes up through the roof of the building about 4 feet, and then on a level 17 feet to the chimney. Will a jet of steam help the draft? If so, how large should it be, and where should it enter the flue? A. A jet of steam in the iron flue will help your draft without damaging the chimney. The size of your jet must be determined by experiment.

(46) T. W. C. says: I have a boat, 50 feet long by 18 feet beam by $3\frac{1}{2}$ feet depth. What should be the dimensions of engine, boiler, and feed pump respectively? She is to have a stern wheel, and her engine is to work at high pressure. A. You might use two engines, with cylinders 7 by 12 inches, and a vertical boiler 5 feet in diameter and 8 feet high. Feed pump should be $2\frac{1}{2}$ inches in diameter and of 12 inches stroke.

(47) J. M. says: Please give us the best composition of brass to be polished, so as to give it the nearest resemblance of gold. A. Mix 10 parts copper and 1 part tin. Add 2 lbs. spelter to every 100 lbs. of the brass.

(48) S. M. C. says: Bloxam's "Chemistry" p. 203, Philadelphia edition, says: In the reduction of iron ore, a large sized blast furnace consumes daily 50 tons of ore, 30 tons of coal, 6 tons of limestone, and 100 tons of air. Is not the amount of air exaggerated? The working of a blast furnace is familiar to me; and considering the size of the blowers and number of strokes per minute, I cannot conceive of this amount of air passing through the tweens in the time given. A. The statement is correct. It falls under, rather than over, the truth.

(49) S. H. says: In regard to your article on "Flat Surfaces" (October 23, 1875) I would like to ask how the constants used in the formulae are obtained? You say the factor of safety used is 8, but that seems to me to be indefinite unless we know what modulus of strength is used, and how it comes in. If you could give the formula in such a way as to bring in the ultimate tenacity or some other modulus easily determined for different qualities of metal, you would, it seems to me, make them much more useful to engineers. Perhaps you will inform us what different quanti-

ties are included in the constants of the given formulae, that is to say, what modulus of strength, etc. A. The constants are those for tensile strength. It is assumed in the article that the ultimate strength is as follows: Cast iron, 20,000 lbs. per square inch. Wrought iron, 48,000 lbs. per square inch. Steel, 80,000 lbs. per square inch.

(50) A. J. M. says: I have an electromagnet of 1 inch iron, 1 foot long, having 100 feet of No. 16 copper wire on it. What amount of horse power will I require to make an electro-magnetic machine to cause that magnet to lift 100 lbs.? A. An eighth of a horse power would be ample.

(51) S. W. says: Salt of steel is the *sal martis* of the old chemists. It is common copperas, or green vitriol, or sulphate of iron.

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

A. G. S.—It consists of manganese, with iron, alumina, and silica.—J. M.—It is made of burnt sugar and chicory.—W. A. W.—The paper was covered mostly with a pigment having clay and lime for its basis, and no poisonous matters were detected in the small scrap forwarded.—O. P.—It is bituminous shale rock.—J. E. B.—It is sulphuret of iron.—W. L. W.—It is iron pyrites, and is worth working if the quantity is very large and the cost of mining small.—C. P. C.—It is carbonate of magnesia.—J. M. H.—It is yellow hydrated sesquioxide of iron on mica schist.—E. S. B.—It is galena, with a trace of silver.—A. M. C.—It is gold.—H. J. R.—If the specimen referred to was inclosed in a box (unlabeled) marked "Fine Steel Cutlery," it is iron pyrites.—C. F. H.—No. 1 is pyrites (no gold detected). No. 2 is an inferior kaolin. Use Dana's "Mineralogy."—J. F. F.—They are fragments of quartz and amethyst, with magnetic iron sand.—P. J. M.—We were unable to detect any foreign substance with the gelatin.—W. D. C.—It is calc spar and hornblende.—A. J. H.—Both are oxide of iron.—J. H. P.—Nos. 1 and 2 are quartz rock with small scales of mica. No. 3 is bituminous slate.—E. P. McL.—No. 1 is iron filings. No. 2 is red jasper.

A. C. S. asks: Can you give me a recipe for removing black smoke marks off a brick wall? We do not want to paint the wall.—W. A. K. asks: Can any one inform me of a good way of heating street railway cars.

On page No. 306 of this paper will be found an advertisement of a new recipe book, just published, which will be found a useful companion for reference by every one.

COMMUNICATIONS RECEIVED.

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

On a New Method of Ventilation. By L. B. G. On Instinct. By C. T. On the Formation of Planets. By H. L. On Bankers' Safes. By S. M. L. On the Wagner Free Institute. By W. H. W. and R. G. On Explosive Oils. By J. R. C. On Spectral Lines and Atomic Weights. By A. H. McK.

Also inquiries and answers from the following: A. K.—J. R. T.—J. B. O.—S. W.—N. F. F.—R. M.—J. G.—D. A.—J. G.—G. N. T.—F. G. S.—J. D. H.

HINTS TO CORRESPONDENTS.

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

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 inquiries analogous to the following are sent: "Who makes rubber tires for traction engines? Who sells machines for bending cold iron bars? Who sells carrier pigeons? Who makes screw-cutting dies, made to the Whitworth thread? Whose is the best engine governor?" 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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Wagon, side bar, J. F. Barnecott.....	170,005
Washing machine clamp, Camp & Osterhout.....	169,901
Watch case centers, die for, J. Goldreich.....	170,029
Watch, stem winding, C. D. P. Gibson.....	169,930
Watchman's time check, L. Aldridge.....	6,743
Water raising, electrical, E. Ponvert, Jr.....	169,859
Water, wheel, G. H. Darling.....	170,052
Water wheel, W. C. Groves.....	170,053
Weather strip, W. Sustins.....	170,031
Wells, etc., S. D. Tripp.....	169,956
Windmill, J. K. Babcock (r).....	170,089
Windmill, A. O. Campbell.....	170,121
Windmill, M. Carter.....	
Windmill, M. Crossman.....	
Window screen, H. B. Walbridge.....	
Wire fabric, A. C. Garrett.....	
Wrench, B. F. Joslyn.....	
Wringer, J. Smith.....	

DESIGNS PATENTED.

- 8,793.—STOVES.—J. J. Bonnet, Quincy, Ill.
 8,794.—BETONS.—J. H. Farrell, Boston, Mass.
 8,795.—EMBROIDERY.—E. Crisland, New Haven, Conn.
 8,796 and 8,797.—SODA WATER APPARATUS.—F. H. Shepherd, Boston, Mass.
 8,798.—JAPANESE.—T. J. Stearns, Boston, Mass.

SCHEDULE OF PATENT FEE.

On each caveat.....	\$10
On each Trade mark.....	\$25
On filing each application for a Patent (17 years).....	\$15
On issuing each original Patent.....	\$30
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 (14 years).....	\$10
On application for Design (7 years).....	\$10
On application for Design (4 years).....	\$30

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA,
November 12 to 16, 1875.

5,382.—R. C. Nugent & al., Dayton, O., U. S. Machine for turning flanges on boiler heads. Nov. 12, 1875.	
5,384.—A. Payette, Montreal, P. Q. Axle box. Nov. 12, 1875.	
5,385.—G. W. Copeland, Malden, Mass., U. S. Boot and shoe lasting machine. Nov. 12, 1875.	
5,386.—E. S. Howland, Batavia, Ill., U. S. Dress for metallic grinding rings. Nov. 12, 1875.	
5,387.—F. N. Dailois, New York city. Manufacture of plumbers' traps. Nov. 12, 1875.	
5,388.—W. H. Babbitt, Toronto, Ont. Cooking pot. Nov. 12, 1875.	
5,389.—J. C. Blyth & al., Ottawa, Ont. Milk can. Nov. 12, 1875.	
5,390, 5,391.—E. W. Grant, Ypsilanti, Mich., U. S. Step ladder. Extension of No. 4,705. Nov. 12, 1875.	
5,392.—A. M. Brush, Potsdam, N. Y., U. S. Organ stop action. Nov. 15, 1875.	
5,393.—W. H. Johnson & al. Combined milk pan and water vat. Nov. 15, 1875.	
5,394.—A. Button, East Saginaw, Mich., U. S. Combined tool. Nov. 15, 1875.	
5,395.—A. N. Breneman, Lancaster, Pa., U. S. Boot and shoe holder. Nov. 15, 1875.	
5,396.—H. Whiteside, Jr., Montreal, P. Q. Sectional mattress. Nov. 15, 1875.	
5,397.—M. Glenn, Stratford, Ont. Machine for separating wheat, seeds, etc. Nov. 15, 1875.	
5,398.—F. C. Crean & al., Montreal, P. Q. Propeller wheel. Nov. 15, 1875.	
5,399.—E. Longley, Cincinnati, Ohio, U. S. Addressing machine. Nov. 15, 1875.	
5,400.—J. C. Bassett, Oshawa, Ont. Thrashing machine gearing. Nov. 15, 1875.	
5,401.—C. Appleton, Whitechurch, Ont. Sleigh brake. Nov. 15, 1875.	
5,402, 5,403.—W. N. Whiteley, Springfield, Ohio, U. S. Extension No. 4,863. Mower and reaper. Nov. 16, 1875.	

Advertisements.

Back Page - - - - - \$1.00 a line.
 Inside Page - - - - - 75 cents a line.

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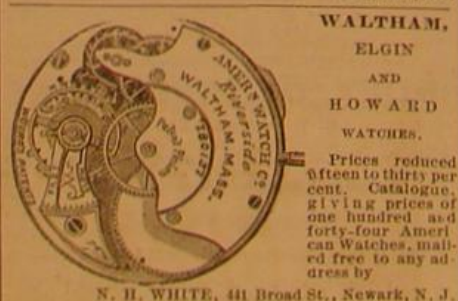
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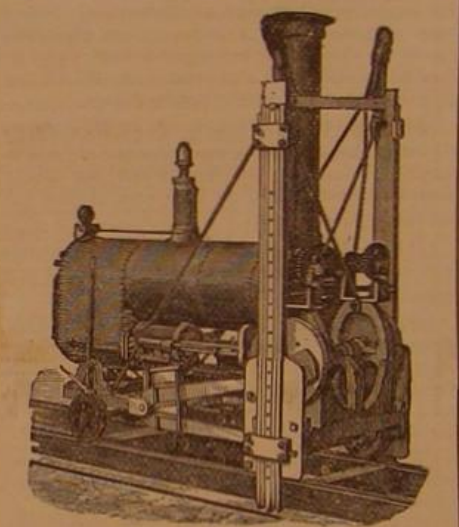
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THE "Scientific American" is printed with CHAS. ENU JOHNSON & CO. 3 INK. Tenth and Lombard Sts. Philadelphia and 99 Gold St., New York

30 July

SCIENTIFIC AMERICAN

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

Vol. XXXIII.—No. 26.
(NEW SERIES.)

NEW YORK, DECEMBER 25, 1875.

\$3.20 per Annum.
(POSTAGE PREPAID.)

GRAND CENTRAL DEPOT SIGNAL SYSTEM.

Three great railroads have their termini in the Grand Central Depot, located on 42d street, in New York city. An illustration and description of this immense structure have already appeared in these columns. With the exception of the interval between 1:10 and 3:40 in the morning, and of fifty minutes at noon, no period of fifteen minutes elapses in which some train does not depart or arrive via the Harlem, the Hudson River, or the New York, Hartford and New Haven road. One hundred and eighteen regular, and from ten to fifteen extra, trains daily pass, in one direction or the other over the tracks on the underground road between 53d street and Harlem bridge, a distance of nearly four and a half miles. Barely two minutes sometimes intervene between the departure of one train and the incoming of another, and three trains often start at intervals of five minutes apart.

It is obvious that, in order to prevent confusion and accident, the movements of each and every one of these trains, while traveling between the points named, must be governed with absolute certainty. Add to this that crowd after crowd of passengers must be admitted from the reception room to the outgoing cars at exactly the proper time, and the checking of their baggage must be stopped in time to insure its despatch by the proper trains; and the reader will have formed some faint idea of the perfect system which must exist for the management of the machinery of the great depot and its approaches. To indicate the salient points of this system is the object of the present article; and in the accompanying illustrations are represented such devices pertaining thereto as are interesting, both in respect to ingenuity of design and mechanical novelty.

The system as a whole may be divided into three really distinct though closely interwoven parts: first, the means whereby trains are received and despatched, and also the internal operations of the depot controlled; second, the electro-magnetic way signals; and third, the novel interlocking apparatus for switches and crossings. For the sake of clearness, we shall begin with the first, mentioning merely results, and leaving the explanation of the same to consideration in connection with the other two topics.

Located far up on the north wall of the depot, the view from its broad window extending over the intricate network of rails into which the various tracks diverge, is a small cabin, the interior appearance of which the reader has before him in the largest of the engravings herewith given, Fig. 1. On the wall hang signal indicators and bells, time tables, and a huge clock. On the table before the single occupant are a telegraph instrument, a record book, and three rows of ivory buttons, twenty in all. This is the dispatcher's office, and here, by pressing the buttons or manipulating the telegraph key, he controls the movement of every train going or coming, the buttons, through simple electric bells, governing everything near and about the depot, the key transmitting instructions to far-off points. By way of illustration, we suppose that one train is to start at 4:30, and that another will arrive at 4:31 o'clock. It is now just 4:10, the passengers are congregated in the waiting room, the cars are in place; and the engine, with steam up, is standing outside, not

yet attached. The dispatcher touches a button, the sound of a bell is heard, the heavy doors of the waiting room fly open, and the passengers crowd upon the cars. Fifteen minutes elapse: the operator presses another button, a gong strikes in the baggage room, and the checking is stopped. Belated individuals who wish to depart by that train must go *minus* their baggage. Now the operator watches the clock closely; three minutes pass, and then a sharp peal rings out from a bell close beside him. The minute hand points to 4:28, and the incoming train has reached 64th street and is signaling its own approach. The sound continues for half a minute, then stops; the train is at 55th street, and the finger of the dispatcher at once presses another button. If we were on the arriving locomotive, we should see a green disk

arriving train now rushes in, its passengers disembark, and at the sound of the bell from the dispatcher, a locomotive kept for the purpose, couples on and drags the empty cars out of the depot.

We have accounted for twenty-one minutes, during which one train has left and one arrived; the reader may imagine the celerity and certainty of the work when we add that, within the fifteen minutes which we recently spent in the dispatcher's cabin, three trains on three different roads were started and three received, all at different times and without the slightest confusion.

The electric bells about the depot being of simple and well known construction, and sounded by the establishing of the current when the buttons are pressed, need no elucidation; and therefore the

points remaining which require explanation are those relative to the movement of the flying switch and danger signals by the dispatcher, and also as regards the indicator which announced the passage of the train over the crossing. This brings us to the second branch of our subject.

The electro-magnetic way signals and their operations are represented in Fig. 3. The signal is a disk made of metal, painted red, and inclosing a circle of red glass. This is supported on a shaft, shown upright (it may be horizontal, or in fact in any position), which, by the gearing and weight shown at A, is rotated through the unwinding of the cord wound about the barrel of the larger gear wheel. The disk may be turned to present its full face or only its edge in any direction, in one case showing its full color and signaling "danger," in the other being almost invisible and allowing the aperture of the frame or box in which it is placed to appear empty, meaning the reverse, or "clear road." It is obvious that, in order to govern the disk so that it must always appear

in one of the two positions—that is, full face or on edge—mechanism is required which will allow it to be rotated by the weight exactly one quarter revolution at a time, and no more nor less. This apparatus is found in the simple electro-magnetic device shown. Just below the disk, and rigidly secured to the shaft, are four arms having downward end projections, B. Also fixed on the shaft and further down is a cam, carrying beneath it two short vertical pins. The latter, as the shaft revolves, strike certain leaf springs, which will be seen on the circular stage, C, which is located just above the frame which carries the electro-magnet, D. The armature, E, of the magnet is hinged at one side, and so placed that, when not attracted by the magnet, and consequently held outward by a suitable spring, the projections, B, strike against it as shown in the engraving, so holding the disk stationary. The construction is such, however, that when the circuit is closed by any means, through one of the springs on the circular stage, C, and the pin on the cam of the disk shaft, then the magnet will become active, the armature be drawn in, and the projection freed, when of course the action of the weight will revolve the disk. But as the latter revolves, the pin on the cam will pass clear of the spring on the stage; the current will then be broken, and the armature will fly back in time to intercept the next projection, B, preventing further movement of the disk, which

(Continued on page 402.)



GRAND CENTRAL DEPOT.—TRAIN DISPATCHER'S OFFICE.

before us, or at night the flash of a green light, meaning that everything is ready for the flying switch just outside the depot, by which the engine is to clear itself from the train, the cars entering the depot by their own momentum. Now it is 4:29; down goes another button; a bell on a post beside the locomotive waiting outside rings for the engineer to back in and couple on. Hardly ten seconds elapse before a sharp "ting" calls the operator's attention to the fact that the pointer arm of the indicator on the wall has swung over from "clear" to "block." The arriving train is on the 53d street crossing. The clock says 4:30; again a button is pressed, the doors of the waiting room are slammed shut, there is a few seconds' delay for the tardy ones on the platforms to board the cars, and then the train moves slowly out of the depot. The indicator pointer still shows "block," and if the outgoing train continues its course a disastrous meeting on the crossing may result. The dispatcher remains passive, however, for he knows that the signal between that train and the crossing is normally at "danger," and that the engineer will certainly come to a stop, and wait until the red disk is turned. The delay is but for a second, for the indicator bell almost instantly sounds again, the arm swings over to "clear," and the proper button is immediately touched. A distant cloud of steam can be seen for a moment, and the outgoing train is off again. Pressing another button, the operator restores the danger signal. The

Scientific American.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
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VOLUME XXXIII, No. 26. [NEW SERIES] Thirtieth Year.

NEW YORK, SATURDAY, DECEMBER 25, 1875.

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THE ORIGIN OF LIFE.

Whether the line of experimental investigation adopted by Bastian and other students of spontaneous generation will ever lead to a convincing demonstration of the origin of life *de novo* is very doubtful. However fine the apparatus employed, however exacting the precautions against the slipping in of germs from without or their escape from destruction within, the ingenuity of the opponents of the theory will always be able to discover a possible broken link in the chain of evidence.

Like many another point of scientific controversy, this, we suspect, will be flanked rather than carried by direct assault. As in the case of magic and witchcraft—belief in which died a natural death in the minds of intelligent people, superseded by more rational views of man and Nature, but never logically demolished—so, we are inclined to think, the mystery of life's beginning will undergo a natural solution.

Those who hold to the dogma of "no life without antecedent life" are compelled to assume, at some point in the history of the Universe, the occurrence of nothing less than a miracle—that is to say, a phenomenon unknown to Science, and logically unsupportable from a truly scientific point of view.

Life must have begun somewhere, once at least. If it was not a natural product of material conditions, its beginning must have marked a positive breach in that causal connection of events without which Science would be impossible. The weight of all experience is against assumption of such a breach of continuity; in other words, against a miraculous origin of life. On the other hand the weight of experience is equally against the assumption of a material condition absolutely unique in character. If life arose once in consequence of material conditions, Science affords no justification for the assertion that such conditions may not be repeated, possibly in our laboratories.

This is substantially the position taken by Mr. Proctor in the latest expressions of his views, and by Professor Tyndall in his latest discussion of matter and life; and such appears to be the growing conviction of those of the present generation of scientists most pervaded by the spirit of scientific progress. Says Professor Tyndall: "The conclusion of Science which recognizes unbroken causal connection between the past and the present would undoubtedly be that the molten earth contained within it elements of life, which

grouped themselves into their present forms as the planet cooled." The context shows that by "elements of life," Professor Tyndall does not mean entities but possibilities of molecular condition by which the phenomena of life were to be evolved in the natural course of events, not by the miraculous addition of a new force but by means of the forces already in play.

"The difficulty and reluctance encountered by this conception," he continues, "arise solely from the fact that the theologic conception obtained a prior footing in the human mind. Did the latter depend upon reasoning alone, it could not hold its ground for an hour against its rival. * * *

Were not man's origin implicated, we should accept without a murmur the derivation of animal and vegetable life from what we call inorganic nature. The conclusion of pure intellect points this way and no other."

Admitting the natural origin of life, the question arises: When did life begin?

One branch of the evolution school delights to trace the existing forms of life back to some primordial germ: through changing conditions, the tendency of living things to vary from generation to generation, the survival of the fittest, etc., the one has become many. But there is from this point of view no satisfactory accounting for the persistence of so many primitive forms, or for the present preponderance of undeveloped forms. Nor is there any sufficient reason given for assuming that life began once, and once only, in the distant past.

A more logical position is occupied by those who favor the hypothesis that the material conditions under which life originates are common conditions; consequently that the low forms of life which swarm in the waters of today are low because of their recentness. If they resemble long past fossil forms, they do so from some natural law of evolution, rather than in consequence of direct descent. From this point of view there may be no closer kinship between humanity and existing brutes than arises from a common relationship to Mother Earth. Man may be cousin to the ape; but that does not necessarily follow from the theory of evolution, as the Science of the future will regard it.

HEAVY LOSS FROM LIGHTNING ROD IGNORANCE.

On the 6th of September last the large woolen mill of Robert Fitton, Esq., at Cavendish, Vt., was struck by lightning and consumed, with a loss of \$100,000; 130 persons were thrown out of employment. The mill was 45 feet wide, 106 feet long, 4 stories high. It had a flat, gravel-covered roof, and around the eaves ran a $\frac{1}{4}$ inch iron lightning rod with vertical points every four feet. From the eaves rod six branch rods extended to the ground, five of which terminated at a depth of three feet below the surface, and the other was carried thirty feet underground to the bank of a pond. These particulars have been mostly furnished to us by the proprietor of the mill. The Boston *Commercial Bulletin* states that the insurance underwriters regarded the mill as particularly well protected against lightning, as there was upon it an unusual array of rods, which had been overhauled and put in good order during the year. Yet the mill was struck, the flames flashing instantaneously through the spinning room. The *Bulletin* thinks that the loss of this mill shows what value there is in lightning rods. The insurance companies had to pay \$84,000 in settlement.

The principal comment we have to offer is that the burning of the Cavendish mill was a glaring example of the results of lightning rod ignorance. It would be difficult to find a more sagacious or enterprising body of business men than are the presidents, directors, secretaries, inspectors, and agents of our fire insurance companies. It would naturally be supposed that, in a matter which so directly affects their pecuniary interests as fire losses from lightning, they would take great pains to acquire knowledge concerning the means of safety, and promulgate the strictest requirements among insurers. But they appear to be lacking in this respect, although year after year the records of annual losses of millions in property, by fire caused by lightning, are forced upon their attention, and large sums of money in damages are drawn from their coffers. By consulting the naval records they may easily satisfy themselves that, while formerly the losses of ships and lives by lightning were enormous, the losses immediately ceased when rods were introduced upon vessels; and at the present day we seldom or never hear of a serious injury to or loss of life from lightning, upon a properly rodged ship. The same appliance that protects a wooden vessel at sea will protect a wooden building on land, and we will here briefly describe this appliance, though in doing so we only repeat what we have oftentimes published.

In general terms, a ship's lightning rod consists of a rope or rod of copper or iron wire, lashed to the rigging and extended from the sky pole down so as to connect at any suitable place with the copper bottom, which is in contact with the sea. The rod thus has for its terminal a very large surface of conducting material, larger in fact than the deck surface of the vessel, and the lightning passes off harmlessly.

The golden rule, of safety for rodged buildings is analogous to the above. The rod must have for its terminal a very large surface of conducting material, placed underground in contact with the earth. Without such a terminal, no rod can be considered safe.

How large should be the conducting surface of the terminal, and of what materials made? The area of conducting surface necessary to ensure safety varies with the nature of the soil. If the ground is always moist, a smaller extent of conducting surface for the bottom of the rod will be safer than if the soil is generally dry.

To meet the contingency of a very dry soil at the driest season of the year, the electrician, Mr. David Brooks, of Philadelphia, recommends that the rod have for its terminal a conducting surface, placed underground, equal in area to that of the roof of the building; if this rule errs, it is probably on the side of safety.

Applying the Brooks rule to the Cavendish mill, the rods should have had for their terminals, underground, 4,770 square feet of conducting material, in contact with the earth, instead of which they only had the beggarly amount of less than thirteen square feet. No wonder that the building was struck.

Of what material should the terminals of lightning rods be composed? Iron or copper plates or pipes are the best material. In all cases where there are underground water pipes, the rods should connect with them. If these are of any considerable extent, nothing more is required. In cases where metal terminals cannot be provided, then good charcoal may be used in quantity sufficient to furnish the required extent of conducting surface. This substance ranks next to the metals in conductivity. It may be placed in a trench leading away from the building, with the rod extended along the center. Full particulars concerning lightning rods, the electrical laws concerning them, the electrician's tests for safety, and the best methods for their construction have been given, many times over, in our back numbers; but we propose to continue the subject from time to time so long as may be necessary. We are confident that, if the insurance companies were each to spend seven dollars and place the SCIENTIFIC AMERICAN and SCIENTIFIC AMERICAN SUPPLEMENT on file in their respective offices during the year 1876, they would derive many most valuable suggestions from our pages, not only concerning the means of safety from lightning, but the prevention of fires of every description: suggestions which, if required to be carried into practice by insurers, would save large sums of money to the companies.

LIGHT IN COAL MINES.

Two or three years ago the SCIENTIFIC AMERICAN suggested a plan of lighting coal mines from without, so as to do away with miners' lamps, and thereby avoid the explosions of fire damp inseparable from their use. The terrible explosion which occurred on December 6 in a Yorkshire colliery, a colliery said to be worked entirely with safety lamps under very rigid discipline, gives fatal emphasis to the demand for a different mode of illuminating such works.

The experiments described in this paper (page 129, volume XXXI.) amply demonstrate the unsafety of safety lamps in places where blasting is practised, the sound wave generated by a blast driving the flame through the wire mesh of the lamp and firing the explosive air without. However perfect the lamp may be, however carefully managed, the protection it affords is only partial; and explosions are liable to occur so long as they are employed. The safety of the miners demands, therefore, the exclusion of all illuminating flames, wherever fire damp is liable to exist, and the lighting of the mines by luminous radiations incapable of exploding fire-damp.

This could be accomplished very easily, we believe, by the generation of the light without the mine (or else at the foot of a ventilating shaft), and its conveyance through tubes to the points requiring illumination. Beams of concentrated light could be sent to any distance through pipes having reflectors suitably placed at bends and angles, or without reflectors, provided the interior of the pipes were smooth and bright. The cost of such lighting would probably be less than the cost of lamps, and the degree of illumination might easily be such as to flood the mine with the brilliancy of daylight.

Another substitute for treacherous safety lamps might be found in electricity, the lanterns being closed so as to make it impossible for explosions to occur. If the insulation of the conducting wires should prove a serious obstacle, it is quite possible that Mr. Edison's "etheric force" would do the work as well without insulation.

THE DISCOVERY OF ANOTHER FORM OF ELECTRICITY.

Several years ago, it was accidentally discovered that, when the contact of an electric current which magnetized a large electro-magnet was broken very near one of the poles of the electro-magnet, the spark was so much increased in intensity as to produce a powerful snap, like that of a small pistol; while the breaking of the contact at a distance from the electro-magnet produced by no means such effect. The next thing observed was the drawing of sparks from the iron electro-magnet, or from its armature; but neither of these phenomena led any investigator to search out their origin, or to try to find what further results of the same class could be obtained.

This appears to have been done at last by Mr. Edison, of Newark, well known among electricians for several valuable inventions relating to electric telegraphy. He investigated the nature of the spark which could be obtained from the iron core of the electro-magnet, which, according to his statement, recently published, does not manifest the ordinary properties of electricity. The galvanometer is unmoved, the delicate gold leaf electrometer exhibits no signs of deflection, a Leyden jar is not charged by it, etc. But we consider the conclusion that this manifestation shows the existence of a new force, to be rather hasty.

It is well known that static electricity, which will produce a shock, will not move the galvanometer, and that the current of a large element of a voltaic battery will neither move a gold leaf electrometer, charge a Leyden jar, nor produce a shock. Therefore to say that the phenomena observed at

test new "principles, until now buried in the depths of human ignorance," as some of the reporters of the daily papers have done, is, to say the least, rather premature.

We will here call attention to the fact that at present three principal forms of electricity are known, and they vary so much in their nature that formerly some investigators inclined to consider them as separate forces or fluids. First we have the so-called static electricity, possessing great tension; it is developed on a small scale by friction, and on a large scale by evaporation and induction, as manifested in thunder storms. For this form of electricity, not only all kinds of metals, but water and the human body are good conductors, even the dry skin of the hands forming no obstacle. Secondly, we have the voltaic or galvanic electricity, originated by chemical action, and developed in our galvanic batteries. For this form of electricity, only some metals are good conductors, others poorer, while water and the human body are bad conductors; its effects on the latter cannot be studied without wetting the skin, as the dry skin is a non-conductor of it. This form of electricity is used for telegraphy, while, as is well known, the static electricity (as obtained by friction) is not so useful for this purpose, its great tension causing it to escape too easily. Thirdly, we have the thermo-electricity, discovered in 1820, by Seebeck in Berlin, which differs as much from the galvanic electricity as the latter does from static electricity. For this thermo-electricity, water or the human body is an absolute non-conductor, and a thin metallic wire is but a poor conductor; so that it can scarcely pass through the whole length of the coil of a common galvanometer, and does not act on this instrument, but is powerfully indicated by one made with very thick and short wire, even if the galvanometer consists of one single, heavy, and uninsulated wire, in a coil of one turn or only half a turn.

Now it appears to us that the form of electricity discovered by Mr. Edison, may be:

1. A fourth kind of electricity, requiring as little or less insulation than the thermo-electricity of Seebeck. It is said to pass over the ordinary gas pipe, and can equally well be drawn from several of the chandeliers in a house, or even in other houses, if one of them is connected with the source of the new electricity.

2. It may consist of a continually reversing current of inductive electricity of a form in quality between the static and galvanic kinds. This appears the more probable as its source is said to be a vibrating armature, in which of course there are continuous interruptions, the induced currents formed by the interruptions running in an opposite direction from those formed at the making of the contacts, as is well known by all electricians. Such continually reversing currents of course cannot act on the galvanometer, gold leaf electroscope, or Leyden jar, as their rapid reversion neutralizes all possible charge, the only manifestation being the sparks, of which, however, the rapidity of the succession causes an abundance, little affected by imperfection or even absence of insulation.

At the same time, this would explain why one end of a long wire, bent over the other end connected with the electric generator, will produce a spark. Electricity is present in such abundance that branch currents are easily supplied; while at the same time the two polarities are continually and so perfectly balanced as to exactly counteract one another, so as to be unable to charge any conductor, or to manifest the results of such charge, as in an electroscope, or to establish a polar current and manifest its results, as with a galvanometer. It is undoubtedly a manifestation of electricity; and being neither positive nor negative, as is the case with all the forms of electricity thus far known, it might be called neutral electricity.

The sparks investigated by Dr. Reiss, the well known German electrician, and called by him weak sparks, have polarity, being either positive or negative; and although they have certain resemblances to the electricity obtained by the method of Mr. Edison, they appear to be of a different nature, having a very different origin.

The most remarkable feature of this new form of electricity, which proves its perfect neutrality, is that it has no apparent effect on the human body, and none on even that most delicate of all electric tests, the properly prepared frog's leg, unless an exceedingly strong galvanic current is used around the magnet.

Two New Street Engines.

A new traction engine for street usage has recently been tested in Brussels, Belgium, with satisfactory results. Externally it resembles an ordinary street car, with the exception of the chimney which projects through the roof. The body is placed quite low, and the wheels, which run on rails, are concealed to within a short distance from the ground. The boiler is tubular and inextinguishable, and is heated by coke. The engine is one of the Brotherhood three-cylinder pattern. The exhaust is condensed in a tubular condenser, and the boiler is fed by a separate steam pump. The machine traveled without smoke or escape of steam, made no more noise than an ordinary horse omnibus, and turned sharp curves very easily. Another engine has been introduced in Paris; but instead of running on a tramway like the above, it is a kind of omnibus or steam carriage. It accommodates 12 passengers and weighs about 5 tons. A vertical engine supplies the motive power and occupies a space in the rear of but 39 inches high by 31 inches broad. A Giffard injector forces in the feed water, which is taken from the gutters or any other convenient source. The machine will travel at the rate of 9 miles per hour. About 3 horse power is utilized, requiring 600 quarts of water, and 110 lbs. of coal per hour.

THE NEW PHASE OF ELECTRIC FORCE.

In our number for last week, we called attention to what we at first supposed to be a similarity between the prior experiments of Professor Reiss and those of Mr. Edison. A further examination of the Reiss reports satisfies us that the results obtained by Mr. Edison are novel, and have little or nothing in common with those of Professor Reiss.

We have had an opportunity of closely examining the apparatus by which Mr. Edison and his assistants obtained the evidences of the supposed new kind of electricity which has lately elicited so much inquiry and speculation, and we present herewith three diagrams of some of the apparatus used by Mr. Edison during his experiments.

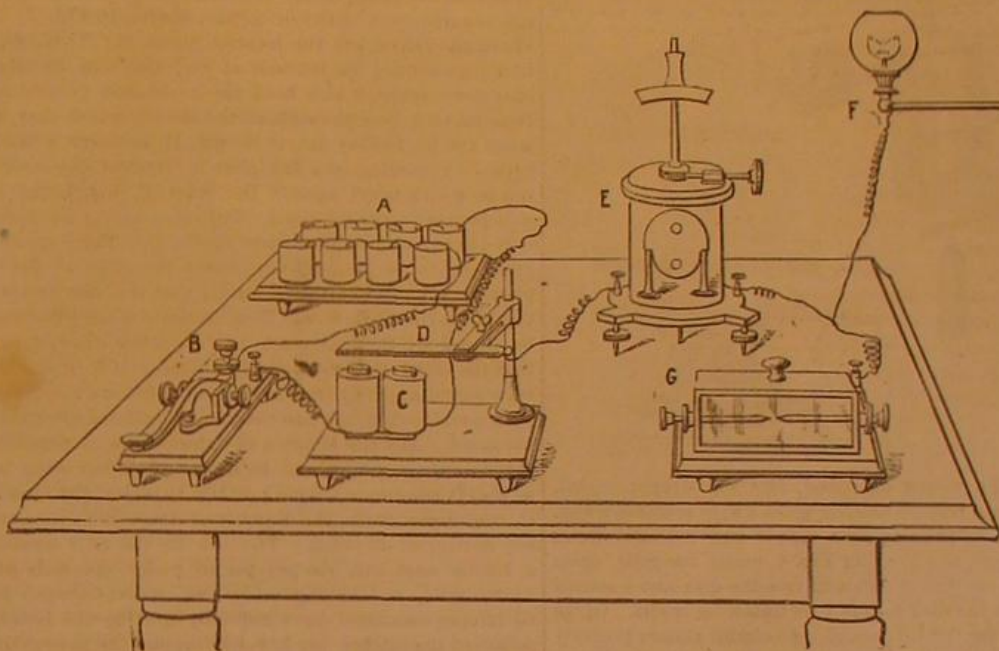
The first recognition of the distinctive character of the spark occurred on the evening of November 23. Mr. Edison and his assistants, as we have already stated, were experimenting with a vibrator magnet, consisting of a bar of Stubb's steel, fastened at one end and made to vibrate by means of a magnet, when they noticed a spark coming from

nection, which would drain the wire of induced electricity, if there were any—bright sparks are visible between the graphite points in response to the motion of the telegraphic key.

Standing on an insulated stool, the experimenters draw sparks from the following arrangement (Fig. 3), in which *x* is the end of the vibrator (which, as well as the battery, is insulated): A, a secondary battery; B, a 200 ohm coil of copper wire; C is a block of iron, and D, a condenser, all well insulated except A, which is of glass, and stands on the table.

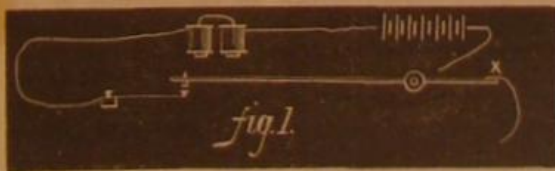
In another experiment a glass rod, four feet long, with a piece of carbon fixed to one end, was well rubbed with a silk handkerchief over a hot stove, and the carbon point presented to the apparatus, the other end of the rod being held in the hand with the handkerchief: sparks were drawn, yet the galvanometer chemical paper, the sense of shock in the tongue, and a delicate gold leaf electroscope were not in the least affected by the mysterious current.

Tested in whatever way the experimenters have been able



MR. EDISON'S APPARATUS, EXHIBITING THE NEW PHASE OF ELECTRIC FORCE.—Fig. 2.

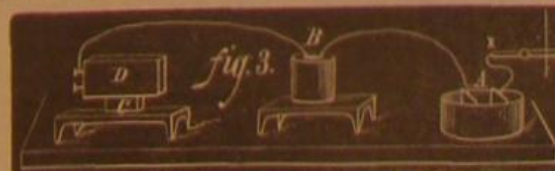
the core of the magnet. They had often noticed the same phenomenon in connection with telegraphic relays, in stock printers when there were iron filings between the armature and the core, and in the new electric pen, and had always supposed it to be due to inductive electricity. On this occasion the spark was so bright that they suspected something more than induction. On testing the apparatus they found that, by touching any portion of the vibrator or magnet with a piece of metal, they got the spark. They then connected a wire to the end of the vibrating rod (the wire leading nowhere), and got a spark by touching the wire with a piece of iron. Still more remarkable, a spark was got on turning the wire back upon itself and touching any part of the wire with its free end. The end of the vibrating rod was then connected by means of the wire to a gas pipe overhead, whereupon a spark could be drawn from any part of the gas pipes in the room, and subsequently it was found that the spark could be drawn from any part of the whole system of city gas pipes. The vibrator and battery were next placed



on insulated stands, and the wire, connected with *x*, Fig. 1, was carried over the stove, about 20 feet distant. On rubbing the end of the wire against the stove, splendid sparks were observed. With the wire permanently connected with the stove, sparks could be drawn from any part of the stove with a piece of metal held in the hand. Again, while the vibrator was in action, a block of iron was placed near *x*, but not touching the bar, nor connected with it in any way except by the wood of the base through the table, and sparks could be drawn from the iron.

These and other experiments which we have had the pleasure of witnessing show conclusively that the new force is not amenable to the laws of voltaic or static electricity.

An experiment made with the apparatus figured in the large engraving (Fig. 2) will satisfy any electrician that the force in action is not induced electricity. All the parts are insulated except the gas fixture. A is the battery; B, a common telegraphic key; C, an electro-magnet; D, a bar of cadmium (or other metal, cadmium being the best) supported by an



insulated stand; E is a mirror galvanometer; F, the gas pipe; G, a dark box enclosing pencils with graphite points (common lead pencils). The unknown current passes from the bar of cadmium through the galvanometer, without causing the slightest deflection, and—withstanding the gas pipe con-

nection, which would drain the wire of induced electricity, if there were any—bright sparks are visible between the graphite points in response to the motion of the telegraphic key.

Mr. Edison has proposed the name "etheric force." Since the above was put in type, Mr. Edison has sent us a variety of additional particulars pertaining to his new and interesting discovery, which we shall give to our readers in our next number.

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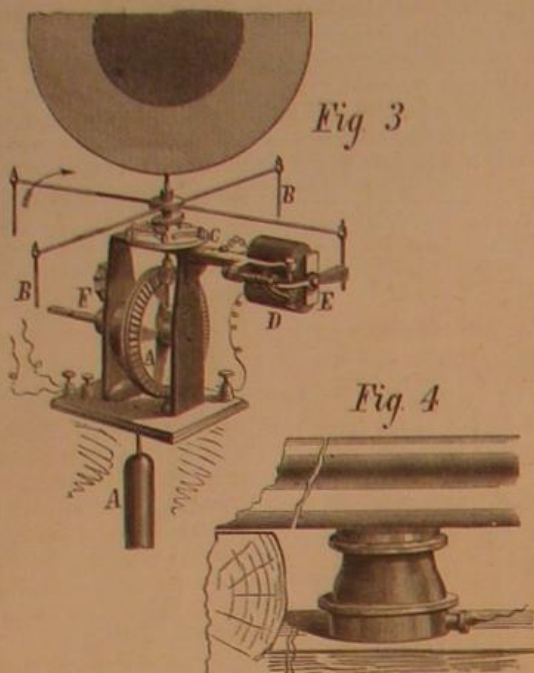
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(Continued from first page.)

will thus have completed exactly one quarter revolution, changing for a given location from an edge view to full face, or *vice versa*. The reader has doubtless ere this divined that the despatcher, in raising a danger signal to release the outgoing train, or in setting the flying switch signal, simply pressed a button which established an electric current, and thus charged the disks as was necessary. From the foregoing also it will be obvious how this signal is worked on the block plan from two different points. As soon, for example, as a train passes a given location, an operator there



posted, by the means described, sets the danger signal. When the train reaches another point a safe distance away, it may itself, by pressing on a simple and delicate circuit closer, arranged, as shown in Fig. 4, under the rails, again establish the current, which will free the disk arm a second time and turn the disk to safety for following trains. Or, as it is easy to see, by the use of two circuit closers properly disposed, the train might set its own danger signal and then reverse it when a suitable distance has been traversed.

But it is not enough that the signals should be set. The people in charge of them must also be infallibly informed of that fact, as well as of any failure in the working. For this purpose the tell-tale shown in Fig. 2 is used. This is the machine which announced that the incoming train, in one example, was coming over the 53d street crossing; or more properly, it first showed that a block signal had there been set and afterwards reversed; for through that signal it was operated, as we now proceed to show.

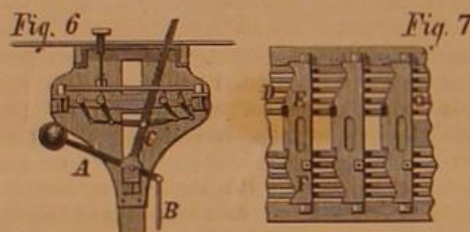
By examining the circular stage, C, in Fig. 3, a pair of springs at the left hand side, placed so as to overlap, will be noticed. There are two pairs of these springs, arranged diametrically opposite to each other on the circle, and hence between the two similarly disposed single springs, through which the circuit, as before explained, is established. The members of each pair of springs overlap without touching, but are brought in contact by one of the pins on the cam on



the disk shaft, during the revolution of the latter. Without entering into further detail, we may state that this contact must necessarily be caused with one or the other pair of springs whenever the disk changes position, and the effect of such contact is to send a current to the electro-magnet in the indicator, Fig. 2. The armature of this magnet is connected with the index clapper, and the general construction is such that, whenever the magnet is excited, the clapper will be thrown over to a position opposite to that in which it happens to be. The relation between indicator and signal is so adjusted that whenever the signal shows "danger," the clapper, which has a weighted extremity to aid its motion and to strike a gong at each end of its course, and so to give warning, swings over to "block;" when the signal is reversed the arm swings back to "clear." During its travel it strikes a suspended ball, and this, vibrating, shows to an operator, who may have several indicators before him, which one has just become reversed. By this arrangement, it will be evident that when the signal moves the indicator must show it, and *vice versa*; so that the operator always has accurate knowledge of the state of the sections of line under his charge, no matter how far distant from him, or how widely separated the same may be. There are many ingenious points about the system, which lack of space forbids our describing. We may mention, however, the device partially shown

at F, in Fig. 3, which consists of the winding stem for the signal weight, and also other mechanism, which compels the turning of the stem and the consequent winding of the cord, before the door of the case in which the signal is contained can be unlocked to admit of the insertion of the lamp at night. Another ingenious device is that used for draw-bridges, which consists of a lock on the crank, which withdraws the locking pin of the bridge. It is impossible to do this until a button is pressed, which sets a danger signal for approaching trains, nor can that signal be reversed or tampered with until the bridge is again securely locked in place.

One of the most important localities where that system is necessary is at the crossing of several tracks, similar to that at 53d street; and here also is used the new switch apparatus, which forms the third and last portion of our subject. Fig. 5 shows the interior of the switch house with the working levers. Each lever is connected to a weighted arm, A, Fig. 6, and also, by suitable interposing connections, through the rod, B, to the locks, the signals, or switches. Attached to the shank of the lever, at C, are jointed rods, which are secured to a series of square shafts, D, Fig. 7. Just above the shafts are the locking plates, E. These are flat iron plates hung in journals at each end. In the edge of each are notches, which hold the levers and prevent them from moving from the ends of the slots in which they work when the latches lay flat, as shown. If, however, a latch be tipped by pressing on a foot piece in front of the lever, the rod of which bears against the point, F, Fig. 7, the lever will be freed from the notch. The interlocking arrangement is found in cams on the square shafts, D. These are so disposed as to be immediately under the edge of the latch plates. When a shaft is so turned that the cam presses on the plate from below up, then, obviously, the plate cannot be tipped by the foot piece, nor the lever disengaged; so that the latter is thus securely locked. It is impossible to set a signal at safety if the switch points are not properly placed and locked, nor can the latter be altered after the signal is set. Any combination of interlocking is possible: in other words, any lever can be made to lock any other lever, so that it becomes a simple problem to adjust the apparatus in conformity with the number of track requirements at any particular situation. The lock for the rails consists of a hollow cast iron sleeper placed under the ends of the switch rails, and having other two crescent-shaped pivoted latches connected by a rod. By moving the latter, the points of the latches are lowered beyond the bottom of the



rails, so that the same can be moved sideways, or raised so as to prevent any similar motion. The construction is such that, unless the rails are properly placed, it is impossible to raise the latch, which thus offers an additional means of safety. Taken as a whole, the ingenuity, simplicity, and utility of this perfect system of communication, and the contrivances invented to accomplish it, are truly wonderful. The mechanical appliances are the joint inventions of Mr. J. M. Toucey, the General Superintendent, and Mr. William Buchanan, Superintendent of Machinery, of the Hudson River Railroad.

The electro-magnetic signals are the invention of Mr. Daniel Rousseau of this city, and are the subjects of several very recent patents. The depot arrangements are the results of the combined skill of Superintendent Toucey and Depot Master Franklin. To all the above named gentlemen we are indebted for much courtesy in facilitating our obtaining the interesting facts here presented.

ACIDIMETRY APPLIED TO THE TESTING OF VINEGAR.

In order to determine the value of a vinegar, it is necessary to discover in what proportion acetic acid is present and to assure oneself that no foreign mineral acids are contained. The chemist executes these various operations with acidimetric liquors, reagents, and apparatus; but there has been for some time needed a simple and practical process available to those who may not have at their command the resources of a laboratory. MM. Revell and Salleron have recently devised an acidimeter, the use of which is illustrated in the annexed engravings (taken from *La Nature*), and which can be readily understood and the directions for its manufacture and employment followed.

The necessary apparatus consists, first, in a tube of glass closed at one end as shown in Fig. 1; near said extremity, at the zero mark, the word "vinegar" is inscribed to indicate the amount of vinegar to be employed. Above the zero, the tube is divided off, and the divisions are marked 1, 2, 3, etc., so as to show the richness in acid, as will be described below. Second, there is a small sponge attached to a whalebone to be used to clean the tube after each experiment. Third, a pipette (Fig. 2), is marked to show a quantity of 0.25 cubic inch of liquid, so that the amount of vinegar for each test can be accurately measured. Lastly a flask of liquor, used as a standard acidimetric reagent, is added.

One fourth of an inch of vinegar is taken into the pipette and retained therein by the finger, as shown in Fig. 2. This is allowed to flow into the graduated tube and the acidimetric liquid, colored blue, is slowly poured in. The fluid soon becomes red when the tube is agitated by being turned over,

the thumb stopping the opening. More of the test liquid is added, the mixture a second time shaken, and so on until the fluid in the tube becomes of the color of the red outer skin of an onion. The graduation on the tube, corresponding to the level of the liquid, is then read off, and this shows the centesimal proportion of acetic acid contained in the vinegar.

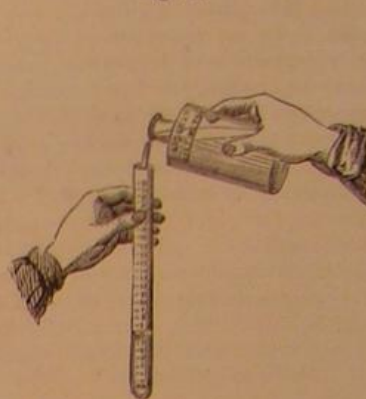
The reaction can easily be followed. The acidimetric liquor, prepared in advance, is a solution of borax and caustic soda. The proportion of these ingredients is calculated to correspond to a certain quantity of crystallizable acetic acid. The liquor is colored blue by litmus, and indicates by its change to violet red the moment when the saturation of the acid by the base is effected.

Vinegars are sometimes adulterated with sulphuric and other mineral acids, which may be detected as follows: The vinegar to be tested is boiled with a few fragments of starch.

Fig. 2.



Fig. 1.



It is then cooled, diluted, and a few drops of iodine tincture dropped in. With pure vinegar, the blue color of iodide of starch should show itself; if no coloration ensues, a foreign mineral acid is present. Wine vinegars are frequently falsified with wood vinegars (pyroligneous acid): this last product almost invariably contains small quantities of sulphate of soda, the presence of which may be detected by the addition of chloride of barium, which yields a white precipitate, sulphate of baryta.

KING'S IMPROVED SUPPORT FOR PRINTERS' GALLEYS.

The annexed engraving represents a simple little device designed to support a printer's galley when the same rests upon the case, during the process of making corrections in the type or during the transfer thereto of type from the stick. Ordinarily the galley is rested against the ledge of the case or else placed diagonally across the latter, thus covering several letter boxes and necessitating its being moved whenever the types contained in such receptacles are required. The present device sustains the galley in such a position that none of the boxes are wholly closed, so that access into any one of them may easily be had.



As shown in the engraving, it consists simply of a metal casting, forming a straight grooved piece between two parallel pieces, disposed at the ends and at right angles thereto. The groove in the central portion and notches in the cross pieces fit over the transverse partitions of the case, and the galley rests against one crosspiece while the other presses against the longitudinal partition or edge. The invention is a handy convenience for compositors.

Patent now pending through the Scientific American Patent Agency. For further particulars address Messrs. Johnson & King, 100 11th street, Brooklyn (E. D.), N. Y.

The hydraulic ram is especially useful where there is a small stream of water and only a slight fall. A fall of two feet, and a flow of $1\frac{1}{2}$ cubic feet of water—92½ lbs.—per minute, will deliver 0.010 of a cubic foot of water per minute at a height of 38 feet.

NEW DOUBLE SHAPING MACHINE.

Messrs. R. Fernau & Co., of Vienna, Austria, have recently put in market a double-acting shaping machine, of which the specialty consists in the arrangement of the feed motion, which will be understood by reference to the perspective sketch and the detail. The boss of the driving pinion is extended, and has a curved slot formed in it, which imparts an oscillating motion to a lever; this motion is transferred to a horizontal shaft, through which it is conveyed to the tool holder. On the front end of this shaft is a cast iron cap, which serves as a lever and also as a cover. In a slot in the cover (see Fig. 2) is placed a bolt, which can be moved up or down at will, the end of the bolt projecting, as shown in Figs. 1 and 2, into a triangular opening in the piece within the cap, so that the oscillating movement of the cap gives greater or less motion to the piece above mentioned, which carries at the upper end a pawl and ratchet driving a toothed wheel, that in its turn conveys motion to a worm and wheel. The spindle of the latter carries a horizontal pinion gearing into a rack, and gives motion to the wheel.

Skilled Labor.

The richest mines of wealth of a nation are its workshops, its factories, and its farms, filled with men of highly trained and skilled labor, it being a universal law that the world's great prizes go to the best. This is not simply an abstract question, but one affecting us all in our prosperity and success every day and every hour of the day, and every day in the year. France, Switzerland, Prussia, and Germany have laid us, and are laying us, every year under contributions of millions of dollars for very superior workmanship, taste, and skill. Their silks, their laces, their cloths, their china and porcelain, their bronzes, their fabrics in metal and wood, and their objects of *virtu* and art could be largely produced in this country if we had developed and educated our artisans and mechanics up to the same perfection in workmanship that they have in those countries.

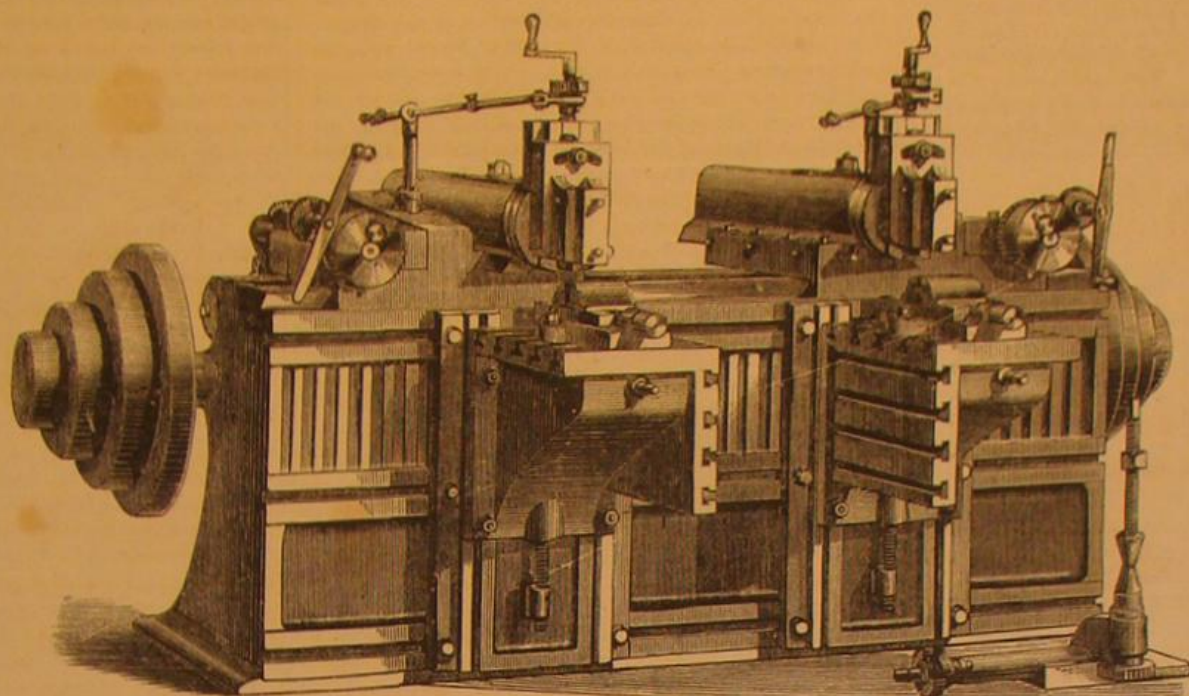
Their mode of thorough instruction in their workshops and manufacturing establishments produces men of the highest order of training, ability, and skill. If we take, as an example, the small State of Wurtemberg, in Germany, with a population of 1,778,000, we find that they have forty-nine industrial and technical schools for the training of boys and educating them in all the industrial arts. In these schools there is a mercantile and commercial course, and one for the application of chemistry to the chemical arts and manufactures, where there are fifty-one professors and teachers of chemical and physical mineralogy, modeling rooms, mechanical workshops, rooms for drawing, botanical garden, and astronomical observatory. There are other schools for building instruction and tradesmen, where builders are trained for masters and constructors of public works, etc., and plasterers, carpenters, grainers, painters, smiths, etc., are educated for foremen and masters; and the schools are crowded with those for whom they were intended, while the graduates are eagerly sought everywhere on the Continent for their superior excellence.

There are also schools for education in all agricultural pursuits, in which practice is combined with theory, they having under their care four hundred square miles of territory. These schools are largely attended, for in one year 12,040 persons, in 523 places, were getting a thorough, complete, and practical agricultural education. Connected with these schools are institutions for practical training in anatomy, physiology, and diseases of animals; and a smithy is attached, in which 4,000 animals were shod per year.

The result of this discipline is shown in the superior skill of the workmen, the excellence of all their works in the arts and sciences, and the harmony existing among them. A thorough acquaintance with a particular industry necessitates a wide range through the field of knowledge, and makes a familiarity with all the causes which produces such effects. The brain is the motive power as well as the guide, for it points the way, and all things move as it points. Skilled labor is its own protection. While its progress may be temporarily impeded by the glittering tinsel of some superficial work, yet its final success is conclusive proof that "all is not gold that glitters," for merit in all things must win.

Carelessness and ignorance are the most fruitful sources of loss of life and property. Proportionately, as the mind becomes trained and disciplined, carelessness ceases; greater care is manifested in the management of all the affairs of

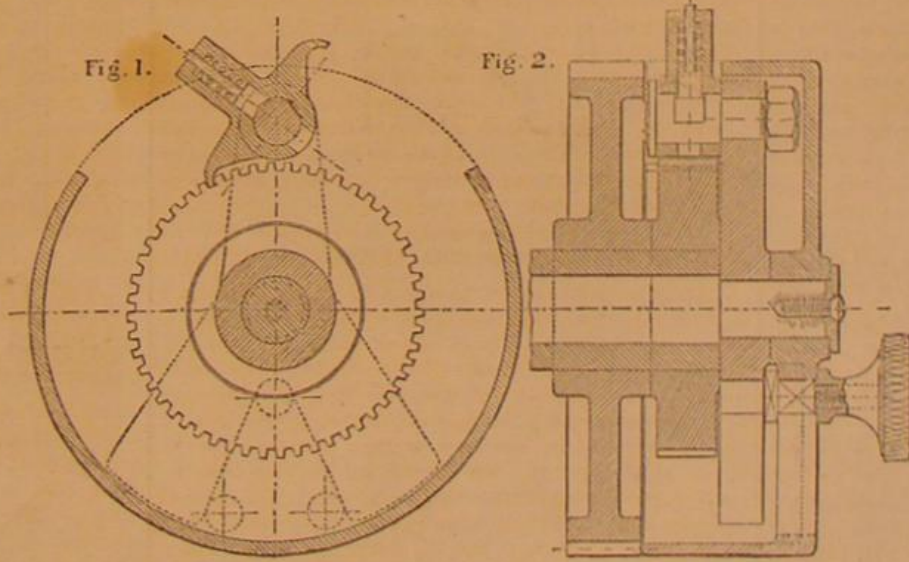
life and the products of our workshops. The great hurry, which has characterized our people, to reach results and to accumulate riches causes that neglect and superficial workmanship which is so prevalent. Scarcely a paper is published that does not contain in its columns some startling accident, accompanied by great loss of life, occasioned by defective machinery or ignorance in its management. Railroad collisions nearly all result from these causes. The disastrous errors which frequently occur in many cities among chemists and druggists arise from an ignorance which never would or could exist if a compulsory and skillful training in schools established for the purpose, under practical as well



DOUBLE SHAPING MACHINE.

as theoretical masters of the particular industry sought to be acquired, had been gone through. We often read of the falling of a floor filled with people. This shows an ignorance of building and of the strength of different materials, a knowledge of which is so indispensable in this important branch of industry. Schools established for a thorough training in mining would not only save life and property, but cause a more profitable development of our mineral resources.

"Knowledge is power." It is the limiting director of the productiveness of all labor. As a knowledge of all the arts, a thorough acquaintance with the laws of nature exists, so will be the progress in improvement in all the affairs of life. Its application to all the industries causes a greater productiveness from the same labor. It has decreased the labor of farming, and increased its producing power. The superseding of the scythe and the cradle by the mowing and reaping machines has enabled a much greater number of acres to be tilled; at the same time a larger value is realized from the same quantity of land.



DOUBLE SHAPING MACHINE—SECTIONAL VIEW.

The greater the skill, the greater the wages. Every hour spent in improving the mind is a bid for increased pay. "The laborer is worthy of his hire," and that worth is enhanced just in proportion as a knowledge of his work is great or small. The foreman of a workshop receives greater compensation than any other workman. Why? Because he possesses greater intelligence on all matters connected with the work. This subject is capable of being drawn to a great length; but enough has been said to show the benefits arising from knowledge and skill in all branches of industry, and that industrial and technical schools should be established everywhere.—*Philadelphia Inquirer*.

THE volume of a confined mass of gas is inversely proportional to the pressure to which it is exposed; the smaller the pressure the larger the volume, and the greater the pressure the less the volume.

Sir Isaac Newton's Experiments.

When Sir Isaac Newton changed his residence, and went to live in Leicester Place, his next door neighbor was a widow lady, who was much puzzled by the little she had observed of the philosopher. One of the Fellows of the Royal Society of London called upon her one day, when, among other domestic news, she mentioned that some one had come to reside in the adjoining house, who, she felt certain, was a poor crazy gentleman, "because," she continued, "he diverts himself in the oddest ways imaginable. Every morning, when the sun shines so brightly that we are obliged to draw the window blinds, he takes his seat in

front of a tub of soapsuds, and occupies himself for hours blowing soap bubbles through a common clay pipe, and intently watches them till they burst. He is doubtless now at his favorite amusement," she added; "do come and look at him." The gentleman smiled, and then went up stairs, when, after looking through the window into the adjoining yard, he turned round and said: "My dear madam, the person whom you suppose to be a poor lunatic is no other than the great Sir Isaac Newton, studying the refraction of light upon thin plates, a phenomenon which is beautifully exhibited upon the surface of a common soap bubble."

This anecdote serves as an excellent moral not to ridicule what we do not understand, but gently and industriously to gather wisdom from every circumstance around us.—*Druggist's Circular*.

Corner Lots.

To persons about to build a residence in the city, the following article from the *Land Owner*, on the most desirable corner to locate on, will be read with interest:

When a lot is on the northwest corner of two streets, it is best, in a sanitary point of view, for its frontage to be on the west side of the street and the depth on the north side. The house thus gets the sun in the front bed rooms in the morning, and on the side of the house, looking south, nearly all day. When a lot is on the northeast corner, it is best that its frontage should be on the east side and its depth on the north side of the street. The east side of the street looks west, from which quarter our prevailing cold summer winds come. All rooms looking west are very cold at night, especially at the time of year when sudden changes of temperature are common. If the front bed room windows face the east side of the street, they can be kept closed at night and air secured from the sheltered side windows on the north side of the street, on which the sun shines nearly all day. If a lot is on the southwest corner, it is better that the frontage be on the south side, and its depth on the west side of the street. The rays of the sun do not strike the south side of the street, while they do strike the west side in the early half of the day—thus getting the sunshine and heat in the front bed rooms at the most desirable hours. When a lot is on the southeast corner, it is best that it should have its frontage on the south side and its depth on the east side, for the reason, before stated, that the sun does not strike the south side of the street, while its rays are poured on the east side from about noon till 5 p.m. The cold winds of night can be kept from the best (the front) bedroom by having the windows closed on the east side and by opening them on the south side. These are important facts to be remembered by those who are subdividing large lots for sale, or by those who are erecting houses on large corner lots, where they are in a position to front them either way.

No one looking for a residence site, who can afford to buy a corner lot, should fail to do so. By having a corner all difficulty about securing abundant sunshine and air in each room is avoided. Of almost equal value with sun and air is the cheerfulness of rooms in a corner house. The effect upon women, who have little exercise or change, is exceedingly beneficial. There is, from a corner house, an outlook that whiles away many an hour which would otherwise be dull to the dweller in the house. The average cost of a corner lot over a middle one in a residence location is 40 per cent, and it is worth more than this difference. A corner house will rent for nearly enough more than a middle one to justify the purchase of the former from an investment point of view alone. Those who wish a sunny, well aired, and really cheerful dwelling should strain every point to secure a corner. Better a corner and poorer house than a fine house hemmed in between other dwellings.

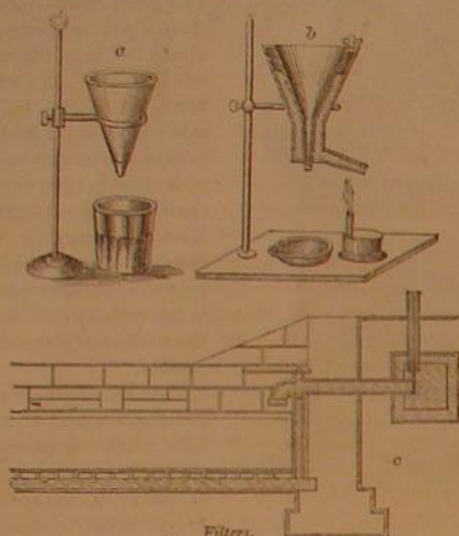
FILTERS AND LIQUID METERS.

In many localities, where the water supply is drawn from rivers adjacent to cities or from sources liable to be contaminated by decaying organic substances, filtration of the fluid, before using it for drinking or cooking, is an important sanitary precaution. To this end various devices have been invented, all so constructed that the water passes through certain substances which, while arresting the passage of matter mechanically suspended, are sometimes of such a nature as to absorb deleterious gases and effete substances. In the annexed engravings, from Knight's "Mechanical Dictionary," will be found representations of several different inventions in the filter line.

LABORATORY FILTERS,

used by chemists, are of the simplest construction, and are represented at *a* and *b*, in Fig. 1. The first is made of a circle of bibulous paper, folded and opened into a quadrant and inserted into a funnel of glass or paper. For filtering matters which become viscid on cooling, such as gelatin, tallow,

Fig. 1.



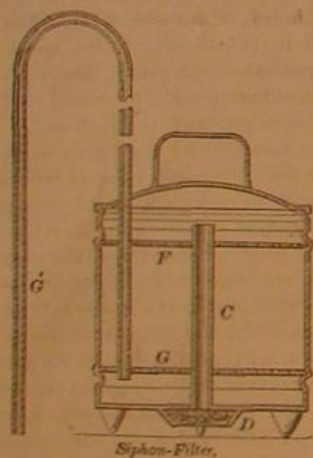
Filters.

wax, etc., the apparatus shown at *b* is used, in which the filter is placed within a water bath which has a leg heated by an alcohol lamp.

DOMESTIC FILTERS

are frequently made in the form of a submerged jar or box composed of porous stone, through which the water passes

Fig. 2.



Siphon-Filter.

and is withdrawn by an exterior faucet, as represented at *c*, Fig. 1. In another form the filter is placed within a barrel, and the water passes through a coarse filter, *D*, Fig. 2, and up a central tube, *C*, to an upper chamber and thence through filtering material placed between two perforated diaphragms, *F* and *G*. The water is drawn from the lower annular chamber by a siphon, *G*, having a stop cock at its lower end. A good domestic filter is easily constructed of a deep wooden tub divided by a tight vertical partition

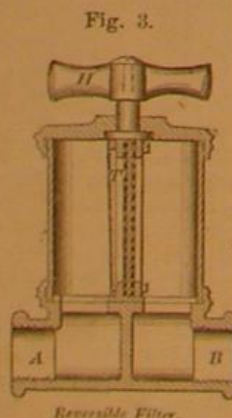
through the middle, the partition being perforated near the bottom. The tub should be nearly filled on both sides of the partition with granulated charcoal, made from sugar maple and screened through a mesh of one sixteenth of an inch, the fine dust being separated by bolting. The foul water enters the tub on one side, passes down and through the holes in the partition, and rises up on the other side, leaving all its impurities in the charcoal. Fig. 3 is a

REVERSIBLE FILTER

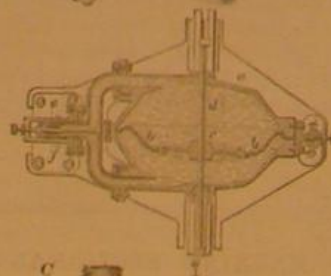
interposed in a length of pipe. The water flowing from *A* to the filtering surface, *T*, has its impurities detained, while the strained water runs off at *B*. When the filter surface, *T*, has become foul, the handle, *H*, is turned, throwing the dirt to the delivery side, where it is carried off by the current of passing water. *A*

CHARCOAL FILTER

is shown in Fig. 4, which is used for sugar refining. Upon the bottom of a high cylindrical vessel, which is charged with animal charcoal, *C*, a filter cloth is spread, and upon this the lower charcoal layer is tightly packed, while the remainder of the filling is left loose. Another cloth and a perforated plate complete the column. The sirup to be filtered is let in from the cistern, *S*, the supply being regulated by the ball cock, *b, d*. *t* is a tube by which air is allowed to escape, and *m* a manhole for giving access to the interior for cleansing, etc. An arrangement of a filter in connection with a cistern is represented in Fig. 5. The water passes down through the



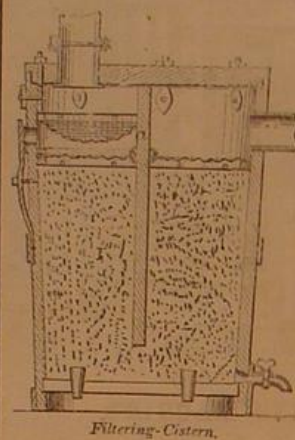
Reversible Filter.



Liquid-Meter.

charcoal or other filtering material in a permanent chamber, on one side of an axial division, and, after passing beneath the latter, rises up and is drawn off from the other side.

Fig. 5.



Filtering-Cistern.

In order to ascertain the quantity of a liquid discharged or received through an orifice.

MECHANICAL LIQUID METERS of various forms are employed, the principal being known as the diaphragm, the balanced (in which compressed air is used), the piston, the propeller, and the flexible tube and roller.

In Fig. 6, at *A*, is shown THE SIEMENS AND HALSKE SPIRIT METER,

which registers the quantity of spirit discharged and also the amount of absolute alcohol contained therein. The liquid entering at *a* passes through the pipes, *c, d*, one of which terminates in a chamber, *e*, whence it is carried by the pipe, *f*, through the vessel, *g*. The other conducts it directly to the upper part of *g*. The parts of the pipes passing through *g* are perforated so as to make currents in the vessel in order thoroughly to mingle the spirit, and the two pipes meet at *h*, whence the liquid is led by *i* into a chamber, *j*, and thence to the volumeter,

Fig. 6.

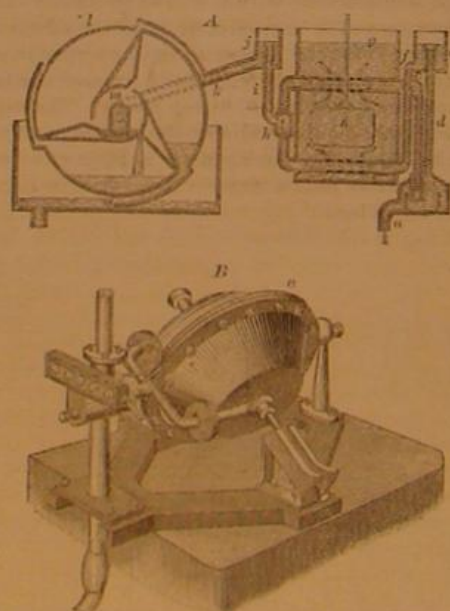
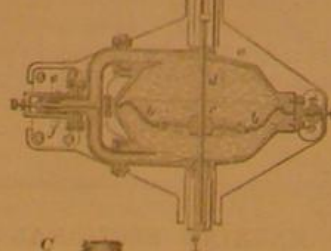


Fig. 7.



Liquid-Meter.

this then begins, while the aperture through which it received its supply is carried, by the rotation, above the liquid in the central chamber. The registering dials are actuated in the usual manner. The amount of pure spirit is determined by a hydrometer, *n*, in the tank, *q*, the instrument being filled with alcohol, and rising and falling according to the density of the spirit. Its motions actuate suitable registering devices which give an indication each time the volumeter is emptied, and to an extent showing the quantity of pure spirit contained therein.

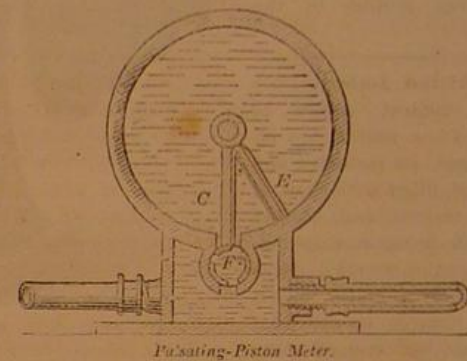
DUROY'S WATER METER

is represented at *B*. A diaphragm, *b*, in a casing, *a*, carries a closely fitting metallic disk, *c*, held in position by the rod, *d*. Water enters through either duct, *e* or *f*, raises the diaphragm, and forces out the water on the opposite side until the vessel is full, when the diaphragm fits against that side. When the weight rises to the top, that side is given a preponderance, causing the vessel to turn on its pivots until the relative places of the sides are changed. At the same time, the supply opening is closed and that for discharge opened. Payton's meter, *C*, same figure, contains two S-shaped arms, whose extremities are during rotation in close contact with each other and with the sides of the box. The arrows indicate the direction of the current.

ATWILL'S PULSATING PISTON METER,

Fig. 7, has a piston, *E*, which turns on an axle shaft com-

Fig. 8.



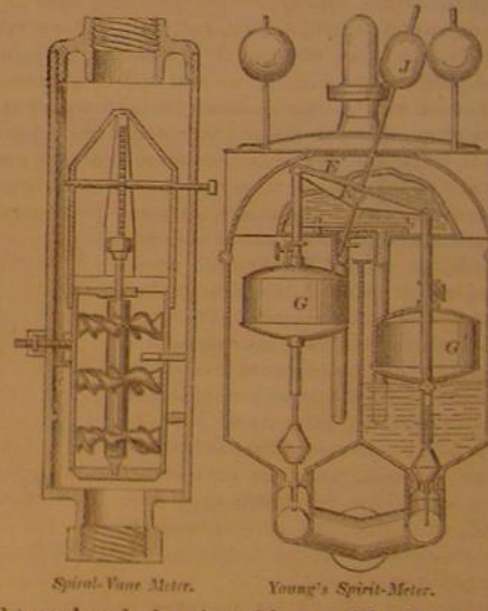
Pulsating-Piston Meter.

municating motion to the register and carrying an arm which, at the end of each stroke, changes a cylindrical valve, *F*, so as to cause the water alternately to enter and discharge from the measuring chamber at opposite sides of the internal partition, *C*. The spiral vane meter, shown in Fig. 8, is simply a water wheel within a pipe connected to a register to indicate the flow of water. The flow is regulated by a sliding valve. In

YOUNG'S SPIRIT METER,

same figure, a float, *G*, in the measuring chamber, is at-

Fig. 8.

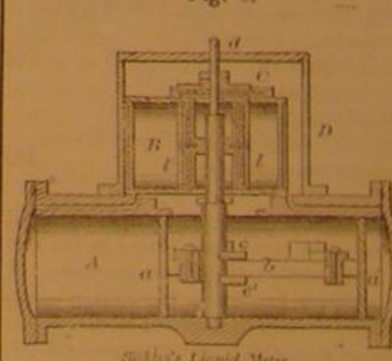


Spiral-Vane Meter.

Young's Spirit-Meter.

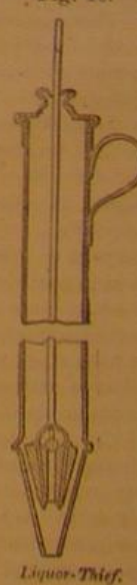
tached to each end of a pivoted beam. The alternate downward motion of the floats, as the chambers are discharged,

Fig. 9.



Siphon Liquid-Meter.

Fig. 10.



Liquor-Thief.

which is a hollow drum, *l*, having a concentric cylinder, *m*, the space between the two being divided into three compartments. Three slits in the central cylinder permit the liquid to flow successively into each compartment, as it in turn occupies the lowest position, and the apparatus remains stationary until the lower chamber is full. The discharge of

directs the induction flow from one to the other. The valve stems have a limited sliding motion in the floats, so that each

of the latter will rise to a sufficient height without raising the valve to permit of emptying the chamber. At the point of discharge, the weighted rod, J, is thrown past the vertical and, closing the valve to one chamber, opens the induction pipe to the other, depressing that float sufficiently to close the escape valve. In

SICKLES' METER.

Fig. 9, the liquid flowing into the chamber, D, is, by means of the valve, C, admitted alternately to each end of the hollow valve, B, which is divided into compartments by the partitions, I F. From these the fluid flows alternately through appropriate ports, behind the pistons, *a a'*, on the rod, *b*, which has tappets that strike the pins, *c c'*, on the upright shaft, *d*, causing its partial rotation and operating the slide valve, C, which admits the fluid into the compartments of the valve, B.

We add, in Fig. 10, one more device used in connection with liquids, to which the name of

LIQUOR THIEF

has been applied. It is simply a tube which is let down through the bung hole of a cask and then closed, so as to withdraw liquid therefrom. It is closed at the bottom by a plug, actuated by a rod passing through the top, as shown.

PRACTICAL MECHANISM.

BY JOSHUA ROSE.

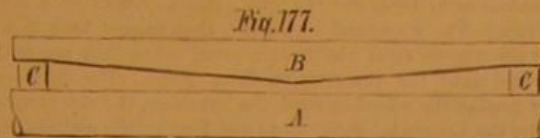
NUMBER XXXVIII.

MARKING OUT ENGINE GUIDE OR MOTION BARS.

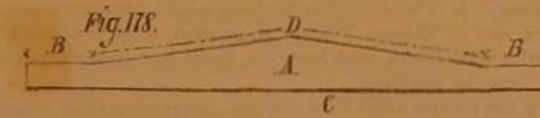
If an engine guide bar is to be made parallel in its breadth and thickness, it may be marked off from the directions already given for marking a scale. Such bars, however, should always be made thicker in the middle than at the ends (as they are always made in English locomotives) for the following reasons: If the strain upon the bars is equal at all parts of the stroke, the middle of the bar will be subject to deflection because of its distance from the blocks or supports at the ends. Again, towards and at the end of the stroke, the connecting rod stands nearly parallel with the center line of the bore of the cylinder, and then the strain upon the guide bars is very slight; but as the stroke proceeds, the angle of the connecting rod increases until (near the center of the stroke) it becomes the greatest, and therefore places the most pressure upon the guide bars. If, then, the latter deflect in consequence of this pressure, the gland and packing ring in the cylinder cover act as a fulcrum, and the piston rod as a lever, forcing the piston against the top and bottom of the bore of the cylinder, tending to wear it oval and also to wear it to a larger bore in the middle than at the ends, because the deflection of the bar is inappreciable at the ends, whatever it may be in the middle. That the deflection of such bars is sufficient to be of practical importance will be perceived from the following:

During the years 1864, 1865, and 1866, I fitted up under contract nearly one thousand guide bars (for locomotives) their average size being about 30 inches long, $3\frac{1}{2}$ inches broad, and $\frac{1}{8}$ inches thick or deep at the ends, and $\frac{3}{8}$ inch thick in the middle of their length. They were filed up in the vise, and made practically true to a surface plate. When the first few sets were delivered to an inspector for examination, they were rejected on the ground of being hollow in their length, to a degree plainly perceptible in the surface plate marks, which showed very plainly at the ends of the bar, and graduated away until, in the middle of each bar, they were barely perceptible. This difference was obviously in the wrong direction, since the middle of the bar should, if there be any difference, mark the plainest, because it sustains the most abrasion. I was sent for by the inspector, who had a bar placed upon the bench, supported by a block of wood under each end; and by request, I applied the surface plate, and found, to my astonishment, the marks to be as above stated. As a consequence, the whole of the set of eight bars were returned to me to be refitted. Upon replacing them in the vise and applying the surface plate, I found each bar to mark as true and even as could be desired, and hence returned them untouched, perceiving that the bars, stout as they were, deflected from their own weight, the amount of the deflection being doubled by supporting them, in the one case in the middle and in the other by the ends. The inspector claimed that, by testing the bars while supported at their ends, he had tested them in the position in which, and supported them as they would be, when in their working places; but since no provision had been made for holding them (while being filed up) in that position, and since the top bars stand upside down when upon the engine, it was plainly impracticable to file them up in such a position. The bars were passed, the controversy having served to demonstrate their appreciable deflection, and also that the bottom bars should be filed up a little rounding and the top ones level in their respective lengths. To mark off such a bar as is here described, one face must either be first trued up, or the marking-off must be performed at two separate operations. The better plan is for the marker-off to examine the bar as to size, and have one face planed off. If either face appears defective, it should be the first planed. If the bar appears sound all over, the outside edge face of the bar should be the one to be planed off preparatory to marking off; and in setting it to surface it, care should be taken to set it true with the top and bottom faces, if they are parallel to each other; and if not, to divide whatever difference there may be between them. The bar may then be placed upon the marking-off table in the position shown in Fig. 177, A being the marking-off plate, B the guide bar, C C pieces of wood to lift the bar off the plate. By means of small thin

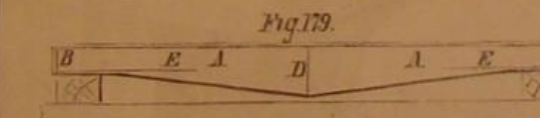
wedges, the planed face, B, of the bar is set at a true right angle to the surface of the plate, and tested by a square. The next operation is to mark off the top or uppermost face, and the question here arises: Shall it be so marked that there will be an equal amount of metal taken off the top and bottom faces, or otherwise? First, then, since the quality



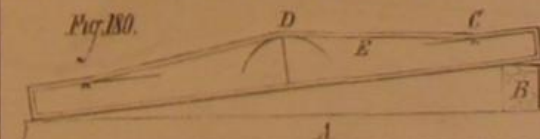
of the metal is the best towards the surface, it is a consideration to take off as little as possible, so as to leave a hard wearing surface; this may appear a small matter, but it is always right to gain every superiority attainable without cost. Therefore, all other things being equal, we should prefer to take as little metal off the top face as would be sufficient to make it true, and should therefore mark it out with that view. Here, however, another consideration arises, which is that the outline of the bottom face is not straight, and cannot therefore be planed lengthways from the center of the bar to the ends; and if such bottom face is to be shaped across its breadth, instead of lengthways, it is a comparatively slow operation, and much time will be saved by so marking off the bar that the bottom will only just true up, so that all the surplus metal will be cut off the top face, which, being done in a larger machine, and lengthways, is a much more rapid operation. There is, however, a method of obtaining both the advantage of taking as little as possible off the top face, and planing the bottom face for the most part lengthways. It is shown in Fig. 178, A being the bar;



the two faces, B B, may be first planed parallel (as required) with the face, C; the back of the bar may then be planed in two operations from the point, D, to the junction with B at each end. Were the method of procedure employed, it would pay to leave the most metal to come off the back of the bar; but there are yet other considerations, which are the facilities in the shop. If the shaping machines are not kept fully occupied, while the planing machines are always in demand, it will pay (if there are not many bars to be planed) to leave as little as needs be to be taken off the bottom of the bar and the remainder off the top. If, however, many bars are to be planed, the most economical of all methods will be to plane the backs by placing, say, 8 of them at a time across the table of the planer, cutting off the ends at the same chucking. Supposing this plan to be adopted, we set the scriber of the marking block just below the lowest part of the surface of the bar, and draw a line along its planed surface, and then another line along each end, to denote the thickness of the parallel parts at each end, making this line longer than is necessary, as a guide in setting the bar in the shaper (in case the ends are shaped and not planed). We next mark off the length of the bar at the ends, using a square and allowing about an equal amount to be taken off each end; and then, still using the square, we mark a line equidistant between the end lines, to denote the center of the length of the bar, which will then present the appearance shown in Fig. 179, the inside line, A A, being for the top



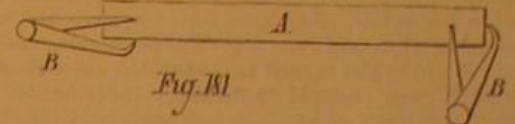
face, the lines, E, for the parallel ends, the lines, B B, for the ends, and the line, D, denoting the middle of the length of the bar. We now turn the bar so that its planed face is uppermost; and setting a pair of compasses to the required thickness of the middle of the bar, we set one point at the junction of the lines, A and D, mark off with the other point a half circle, and then (turning the bar over) adjust it upon the table, as shown in Fig. 180, A being the table, and B a



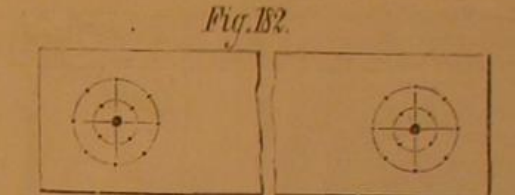
block of wood and wedge to adjust the bar so that, if the scriber block be applied along the table, the needle or scriber point will mark just fair with the top of the circle at D and the mark, C, at the end of the taper part of the bar, A (the mark, C, showing the required distance from the end of the bar). Having made the adjustment, we draw the line, E, thus completing the marking of that half of the bar. We next remove the block of wood and wedge to the other end of the bar, and repeat the last operation, when the marking of the bar will be, so far as its outline is concerned, complete. It will be observed that we have drawn the lines in each case on the one planed surface of the bar only, and not all around the work. The reason for this is that the planed face is a guide, whereby to chuck the work and ensure its being set true. In the absence of one true face, it would be necessary, in marking off the first face, to mark the lines all around the work, which, when planed up, would serve as a guide whereby to set the work during the successive chuckings.

After the faces and ends are planed up, the holes in the

ends may be marked by the compass calipers and compasses, as shown in Fig. 181, A being the bar, and B B the compass



calipers set to the required distance. At the junction of the marks thus made, we make a light centerpunch mark, and mark off the circles for the holes, first marking a circle of the requisite size and defining its outline by other light centerpunch marks. We next draw from the same center a circle smaller in diameter, and define its outline also by small centerpunch marks; after which we take a large centerpunch, and make a deep indentation in the center of the circle, which will appear as shown in Fig. 182. The philosophy of



marking the holes in this manner is as follows: If the outside circle alone is marked, there is nothing to guide the eye during the operation of drilling the holes (in determining whether the drill is cutting the holes true to the marks or not) until the drill has cut a recess nearly approaching the size of the circle marked; if the drill is not cutting true to the marks, and the drawing chisel is employed, it will often happen that, after the first operation of drawing, the drill may not yet cut quite true to the marks; and it having entered the metal to its full diameter, there is no longer any guide to determine if the hole is being made true to the circle or not. By introducing the inside circle, however, we are enabled to use the drawing chisel, and therefore to adjust the position of the hole during the earlier part of the operation; so that the hole being cut is made nearly if not quite true before the cutting approaches the outer circle, which shows the full size of the hole. If, on nearly attaining its full diameter, the outer circle shows it to be a little out of truth, the correction is easily made. It is furthermore much more easy to draw the drill when it has only entered the metal to, say, half its diameter than when it has entered to nearly its full diameter.

The object of making a large centerpunch mark in the center is to guide the center of the drill, and to enable the operator to readily perceive if the work is so set that the point of the drill stands directly over the centerpunch mark. This is of great importance in holes of any size whatever, but more especially in those of small diameter, say, for instance, $\frac{1}{8}$ inch, because it is impracticable to describe circles of so small a diameter whereby to adjust the drilling; and in these cases, if the drill runs out at all, there is but little practical remedy. The centerpunch marks for such holes should therefore be made quite deep, so that the point of the drill will be well guided and steadied from the moment it comes into contact with the metal, in which case it is not likely to run to one side at all. If a motion or guide bar requires to have one corner rounded off, as it should have to prevent its leaving a square corner on the guide block, which would weaken the flange of the latter, the corner cannot be marked off, but a gage should be made as shown in Fig. 183, A in the left hand

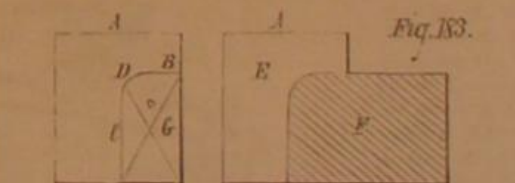


figure being a piece of sheet iron, say $\frac{1}{8}$ inch thick, with the lines, B and C, and the quarter circle, D, marked upon its surface. The metal, G, is then cut away, and the edges carefully filed to the lines, thus forming the gage, A, which is shown upon the bar, F, in the position in which it is applied when in use. It is obvious that such a gage will scarcely suffice to get up a very true round corner; this, however, is accomplished by leaving the corner of the work a little full to the gage and then filing it up to the piece of work fitting against it.

Reference having been made to drawing the position of the recess formed by a drill before it has entered the metal to its full diameter, we may as well explain that process. Suppose A, in Fig. 184, to represent a piece of metal requiring to have a hole of the size of the circle, D, drilled in it, and that the recess cut by the drill is out of true, as shown by the circle, C. A round-nosed chisel is then employed to cut, at D, the groove there shown, running from the outside to the center of the recess, and which will have the effect, when the drill is again introduced, to draw the recess toward that side, thus causing the recess to be true with the marks.

THE largest flouring mill in America, it is said, is owned by Hon. C. C. Washburn, of Minneapolis, Minn. It is seven stories high, and crowded with machinery from top to bottom. Its cost was \$300,000, has 40 run of burrs, and turns out 1,000 barrels of flour per day.

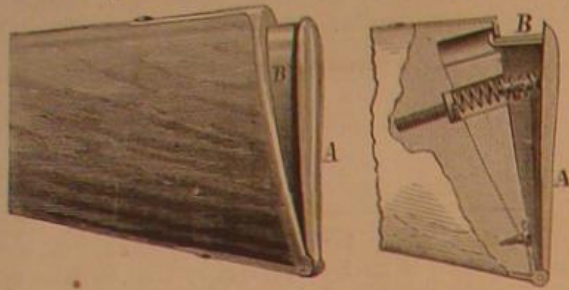
MILLER'S RECOIL CHECK FOR GUNS.

We illustrate a novel invention which is quite sure to be appreciated by soldiers, sportsmen, and all who handle firearms to any extent. Regulation rifles frequently kick with tremendous vigor, and there are few of our hunting readers who will not be able to recall lame shoulders and perhaps a few bad bruises, produced by the unexpectedly forcible recoils of their guns, especially in duck and pigeon shooting. The present device is intended to check this backward blow by neutralizing the same through the medium of a spring, and thus to admit of the use of much heavier charges in the piece and to insure steadiness of aim.

The exterior of the invention is shown in Fig. 1. From the section, Fig. 2, it will be seen that the hinged check plate, A, is applied to the lower part of the stationary butt

Fig. 1

Fig. 2



plate, and is guided by the portion, B, entering a suitable recess in the stock. Its outward movement is regulated by the flanged edge of said portion, B, which catches on the butt plate, as shown. C is a center pin on the check plate, which is surrounded by a coiled spring. The latter holds the device out from the butt, and also yields before the shock, thus breaking the force of the same, and rendering its effect upon the shoulder a mere push instead of a sharp blow. By means of the screw which holds the spring, the tension of the same may be regulated at will.

The invention is readily constructed, and may be applied to any gun. Patented through the Scientific American Patent Agency, November 2, 1875. For further information address the inventor, Mr. W. D. Miller, care of J. H. Johnston, Great Western Gunworks, Pittsburgh, Pa. A working model is on exhibition at the gun store at 943 Broadway, New York city.

IMPROVED UNIVERSAL WHEELWRIGHT'S MACHINE.

We illustrate herewith a new universal wheelwright's machine, which is designed for planing the rims of vehicle wheels on three sides after said rims are driven on the spokes.

When the rim consists of short sections, it is necessary that each section shall conform to a circle greater than the circle of the wheel, so as to give a rise at the joints, which the tire will bind down, thus strongly arching and bridging these weak points. In order to produce this rise, the felloes are generally shaped out to the desired circle before they are driven on the spokes. They always, however, need redressing by hand, as the aforesaid work cannot be performed with sufficient accuracy to insure the meeting of the joints either on the periphery, the face, or the rear sides. It is also necessary to form the rim, when finished, thicker where it rests upon the spokes than under the tire. This labor, in common with the foregoing, has also heretofore been accomplished by hand. With the present machine the whole is quickly done in a single operation.

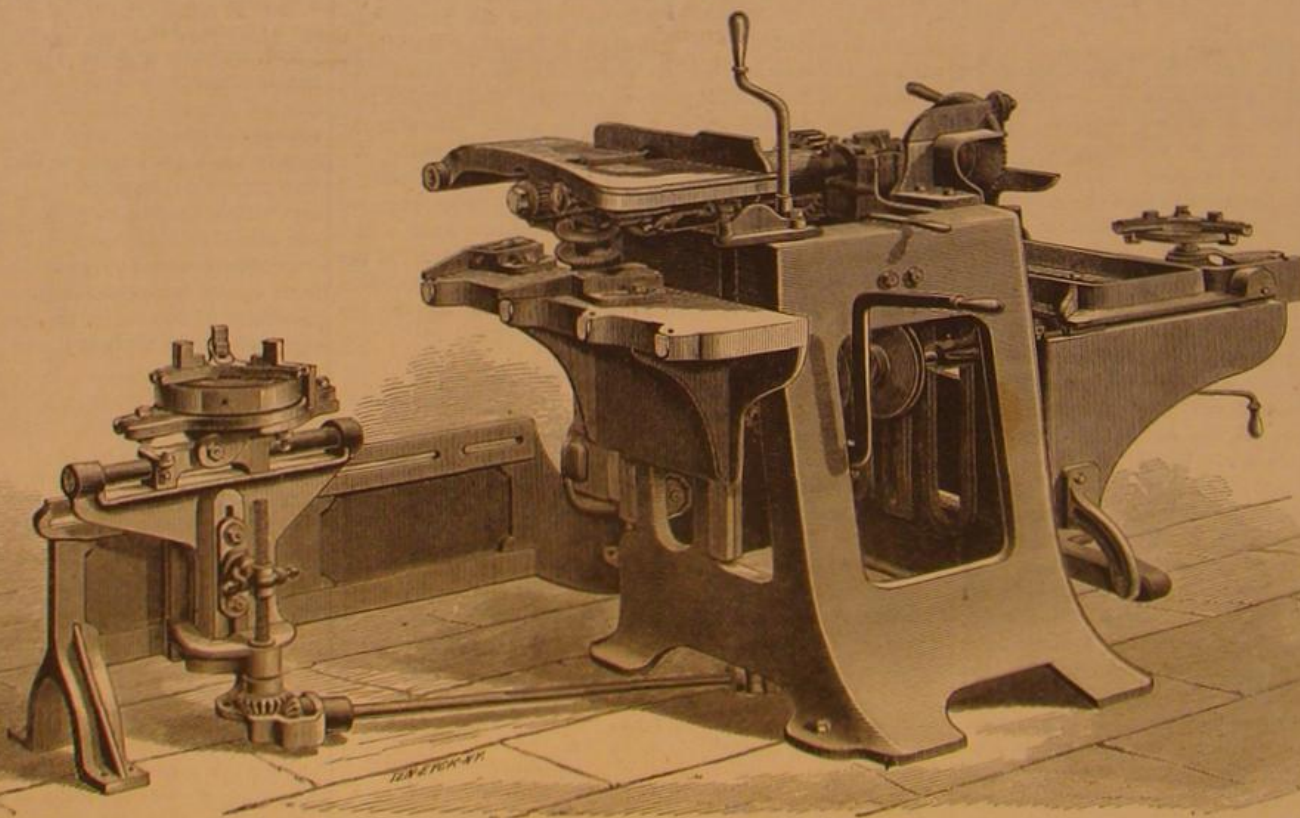
In construction the apparatus resembles a "two-sided sticker," having a horizontal and vertical mandrel with self-feeding arrangements. It has also a buzz planer table over the horizontal cutter head. Extending out from the front side of the machine is an arm, upon which suitable devices are mounted for carrying a self-centering chuck, in which the wheel is held by the point of the hub during the planing of the rim. To this chuck, a cam-shaped disk is attached, which has as many faces as there are joints or sections in the wheel rim. The wheel is fastened in the chuck, so that the joints in the rim correspond with the high points of the cam. The wheel now being elevated to the proper height by means of a screw, friction gears, and lever, it is

moved toward the machine, the chuck, to this end, being mounted on a collar, loosely fitted on a sleeve and having about ten inches to-and-fro play. The face of the wheel rim then resting over the horizontal cutter, the buzz planer table is lowered to give the required depth of cut, and the wheel is rotated and planed to a true face. The table is raised so as to taper out the cut gradually, leaving a true surface. The wheel and chuck are then moved back to allow the rim to clear the buzz planer, when they are both lowered until the rim rests on three stops. The operator now pushes the wheel toward the machine, the rim sliding under the horizontal cutter head and feed roller, and the periphery coming in contact with the vertical cutter, which is composed of bevel saws. The nut on which the chuck is mounted rests against a stop, preventing the movement of the wheel toward the machine. The feed roll then rotates the wheel, the horizontal cutter planes the rim to thickness and the required bevel, and the vertical head dresses the periphery.

The cam-shaped disk resting against a stop gives the wheel a vibrating motion to and from the vertical cutter head, by which the rise at the joints is produced. The wheel is so placed in relation to the line of the feed roll shaft that the latter is inclined to draw the wheel toward the machine, always keeping the cam against the stop, causing a uniform vibration. Bent rims are dressed to a true circle by removing the stop, so that no vibration whatever is imparted.

It is stated that with this machine the wheels are made with certain uniformity, that all ordinary material can be planed straight out of wind and square on the buzz planer table, and to thickness on the sticker table. A saw board or table, can be substituted for the buzz planer table, and a saw for the cutter head, when all kinds of straight sawing can be done. If it be desired to perform a still greater range of work, one of Messrs. Bentel, Margedant, & Co.'s universal wood-worker tables, with back top, bevel rest, gaining frame, etc., may be attached.

On the reverse side of the machine, a spoke-sawing wheel and a tenoning and boring apparatus is arranged, the whole of simple construction. The hollow auger is secured to the mandrel and carries a dished saw which, at one rotation of the wheel, saws off the spokes and bores the tenons. Wheels from 30 inches to 6 feet in height may, we are informed, thus be tenoned as desired. The change from a wheel tenoner to a boring or routing machine may be quickly made without the use of a wrench, and all kinds of boring may then be done. Two men may operate, on opposite sides of the machine, on different work at the same time. A horizontal shaper may be made of the rim planer which will shape, round, and corner all ordinary work. The capacity of the rim planer is 35 to 50 sets of wheels in ten hours; that of the wheel tenoner is much greater. The wheel tenoner

**BUFFINGTON AND FORNEY'S WHEELWRIGHT'S MACHINE.**

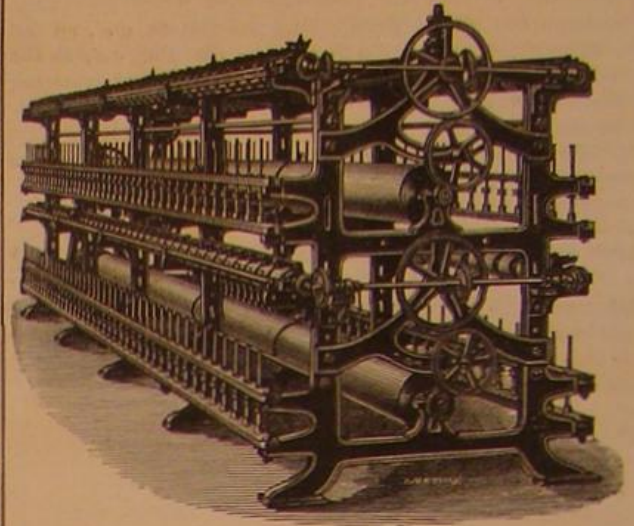
is, if desired, made separate, and with or without the boring attachment. The varied capabilities of the machine apparently fully justify its title of universal. In point of economy of room and in combining the functions of several usually distinct machines, the invention will prove one of much utility to wheelwrights and wood workers generally. Manufactured by Messrs. Bentel, Margedant, & Co., Hamilton, Ohio. For further information, address the patentees, Messrs. Buffington & Forney, Burlington, Iowa.

An article called fish flour has been brought forward in the last few years. The flour is prepared from dried fish, thoroughly desiccated, and then ground in a mill.

VON BULOW, the pianist, says beer drinking is the great fault of his countrymen. They do not get drunk, but drink till their blood becomes sluggish and their brains stupid.

AMERICAN SILK-SPINNING MACHINERY.

It is estimated that 6,000 persons are employed and over \$10,000,000 capital invested in the extensive silk factories of Paterson, N. J. The process of silk making begins with the assortment of the skeins of raw silk, which are imported from Japan, Italy, China, and France; then follows washing in soap and water to get rid of the gummy material left by the worm, and then drying in an ingenious apparatus which throws out the water by centrifugal force. Winding next follows, when the silk is wound off from the skeins upon



bobbins, after which the bobbins are taken to the doubling rooms, and there the silk from two, three, or four spools is wound together upon one. Finally the silk is spun, and this is done upon spinning frames of two or three stories and containing hundreds of spindles which revolve at a very high velocity.

The manufacture of these frames has recently been begun by the Danforth Locomotive and Machine Company, of Paterson, N. J., and numerous improvements have been added. We give herewith an engraving of the two story frame, which is adapted to either tram or organzine, and is made of any desired length and to contain any required number of spindles. The latter are adjusted with nicety, and are capable we are informed, of running at a speed of from 7,000 to 8,000 revolutions per minute without perceptible wear. The machine also has a longer drag than is usual, which gives the thread a better opportunity to become properly twisted, and thus free from the kinks or curls so annoying to silk manufacturers.

Silk making in Paterson, in Hartford, Conn., and in some localities in this city is an industry of which the growth has been more rapid than is generally realized throughout the country.

The exhibition of silk machinery of American production, which, it is promised, will be made at the Centennial, will, we believe, attract the attention of manufacturers the world over, and perhaps serve to emphasize the fact that already excellent silks of American make are found on the counters of the dry goods warehouses, in close and in some cases successful competition with those from celebrated foreign looms. It is very much to be regretted that a

recent conflagration in Paterson has destroyed a large amount of very fine silk machinery, including two large looms especially constructed for exhibition at the Centennial.

New Mode of Illumination for Lighthouses.

Professor Batestrieri, of Naples, proposes for this purpose an apparatus composed of several disks of polished silver or copper, so arranged as to transmit successively the light received, so that all the rays falling upon the disks are concentrated into one powerful beam. The invention resembles the system of Fresnel, but the latter utilizes only about one third the light received, while M. Batestrieri's device, it is said, utilizes the greater portion. With an oil lamp having a burner 2-7 inches in diameter, at a test of the above described apparatus, a beam of light was transmitted which enabled a newspaper printed in ordinary type to be read at the distance of 0.6 of a mile.

GREENHOUSES AND HOTHOUSES.

The long winter of our Northern and Middle States tries the patience of our gardeners, and renders doubly acceptable any hints and directions for the construction of greenhouses, wherein plants can be nurtured till the advent of spring; and where propagation can be carried on, so that a large supply of plants, both for flowers and fruit, may be ready for planting out as soon as the frost leaves the ground. Where the horticultural operations are extensive, the plan shown in our Fig. 1 is perhaps the best that could be adopted. The buildings can be constructed of any required size, and the heat is well confined to the back of the house by the brick wall. Flues are built in the wall with furnaces at the ends; or steam or hot water pipes are used for heating. Grape vines are usually trained under the sloping roof, and thus enjoy the maximum of light and sunshine. The wall is very handy in a fruit garden, even when not covered with glass. Fruit on trees trained against a brick wall (as shown on the left of Fig. 1) ripens much earlier; indeed, in England peaches and nectarines will hardly ripen at all in ordinary seasons unless the trees enjoy the reflected heat from a wall, which, by the way, should be painted black. Gardeners who devote much time to the cultivation of the

a bronze tazza, ornamented with well known decorative plants. The margin is fringed with *isolepis gracilis*, used expressly to tone down the harshness of the metal work. Two or three plants of the palm-like *curculigo*, says a correspondent of the *English Garden*, from the pages of which we select the engraving, are placed in the center; and these, by furnishing bold and graceful foliage, contrast well with the horizontal lines of the tazza below, while their cool and

streets and placed above the buildings, as in some cities, and we hope the time is not far distant when this desirable change will be made. As to underground wires, they cannot be easily worked, even when carefully insulated, on account of the interference of static induction. All telegraph wires, without regard to their position, are thus affected, but wires placed underground or in water are affected 50 times as much as those which pass through the air, the amount of the static charge in aerial wires being inversely proportional to the distance of the wires from the earth. The amount of the static charge in all telegraph wires, whether they are stretched through the air or buried under the ground, is proportional, also, to the length of the wire; and consequently an underground wire of half a mile to a mile in length may be worked without any inconvenience from the presence of the static charge, while one of greater length may give rise to the

Fig. 1



RECENTLY CONSTRUCTED HOTHOUSES.

deep-toned greenness forms a pleasing contrast to the character of the stand itself. Heaths and similar hard wooded plants are added, and with good effect.

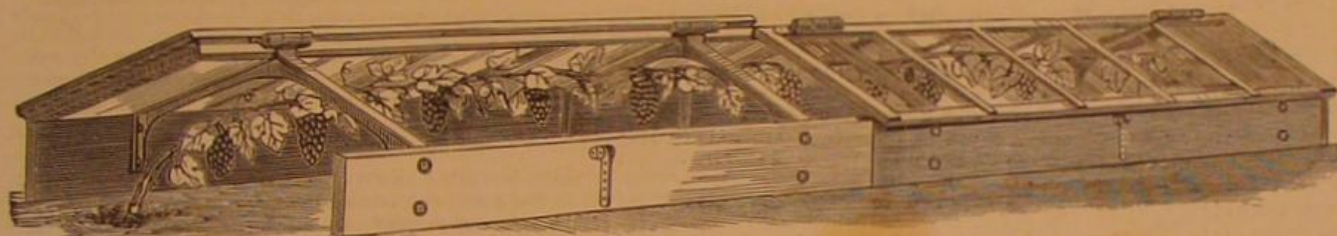
Take the Poles out of the Streets.

Complaints are frequently made against the objectionable practice of the telegraph companies in placing their poles in

most serious trouble.

In London, all the railroads have stations centrally situated, most of the roads coming into the heart of the city. The South-Eastern Railway, for instance, has a station at Cannon street, which is only one third of a mile from the General Post Office, where the headquarters of the English telegraph lines are situated. Now, these telegraph wires are placed

Fig. 2



GRAPE VINE AND HOTBED FRAMES.

grape will find the glass frames, shown in our Fig. 2, economical and efficient. The timber used in making them is small in quantity, and the glass is well placed to ripen the fruit. Air is readily admitted to the vines by raising the glass frames, the height of which can be adjusted by the attachment shown in the engraving, which displays the construction so clearly that no further explanation is necessary.

Another convenient form of glass frame is shown in Fig. 3; it is especially suitable for use on hotbeds. Being of little depth, the sun's heat is concentrated by the glass on the rich earth of the well manured bed; and the frames, which are well suited to cucumbers, melons, and early tomatoes, are so constructed as to slide open for purposes of ventilation.

Winter is the time when people are most apt to feel the need of a greenhouse; and if they do not construct one then, they usually get their plans perfected, and begin building in the early spring. We have published illustrations of more elaborate and expensive greenhouses than the one represented herewith; but we have seen none in which the arrangement is better, and the cost of construction less, than the one shown in Fig. 1. While Fig. 2 and 3 present no special novelty, they are each well adapted for the different purposes for which they are intended, and can be built cheaply.

PLANT VASES FOR INDOOR DECORATION

The votaries of floriculture are now turning their attention indoors, and inquiries as to proper and tasteful modes of parlor and dinner table decoration are beginning to reach us. The usual way of keeping plants in houses is to place them in vases or tazzas, of wood or pottery, although some are now made in bronze or iron, of very handsome designs; terra cotta is also employed, and, although cheaper than metal, is capable of equally effective ornamentation. Filled with a light earth, and covered with the moss called sphagnum, hardy and half hardy plants will thrive well in these vases; care must, however, be taken not to water them too profusely, as (there being no way of escape through the bottom of the vase for superfluous water) too much moisture will rot the roots.

The accompanying illustration represents



ORNAMENTAL PLANT STAND.

Fig. 3.



the streets of cities; and the popular belief is that the wires ought to be put underground. It is true that the main streets of New York are sadly disfigured by the clumsy wooden poles, and probably no improvement can be expected until we have a better city government. But the idea that it would be easily practicable to work the wires underground is a mistake. They could, however, be taken out of the

on poles and follow the lines of the railroads into the stations, where they first pass under ground, running as subterranean lines only from the railroad termini to the central telegraph station. Hence, the quantity of underground wire in London is comparatively small. In addition, it may be stated that in all parts of the city there are certain large distributing telegraph offices which are connected by wires with all the sub-stations in the city—of which there are 400 to 500—and every wire from each of these distributing offices to the several hundred sub-stations is carried over the house tops; where there are several wires running to the same station, they are insulated on poles which are fastened to the tops of houses. In addition to those that have been mentioned, there are in London 800 private lines, running to all parts of the city. They use what are known as the Wheatstone dial instruments. There is not a single rod of wire working all these instruments that is under ground, the wires all being carried over the house tops. Frequently 40 to 50 insulated wires are made into a single cable, which is suspended on fixtures attached to the roofs of houses.

In 1854 a telegraph company was organized in England which constructed an underground line between London and Liverpool, 210 miles, the cable containing 10 wires. But in less than two years after the line was built, its insulation became so much impaired that the company was obliged to take up and replace a considerable portion of the cable. One wire after another still continued to fail, until there were only five of the ten that would work at all. After this, as others failed, sections of the underground line were abandoned, and wires placed on poles were substituted, until, finally, so much of the underground system had failed that the company decided to place the whole line on poles. The copper and gutta serena which constituted the valuable portion of the underground cable were taken up and sold for enough to replace the whole system with a good overland line. All similar lines that were ever constructed in England have been abandoned, except one of thirty miles, constructed by the government nearly three years ago as an experiment, which is the only line outside of the cities.

In like manner, says Mr. G. B. Prescott, 20,000 miles of underground lines in England, France, and Germany have been abandoned. In the city of New York there are over 5,000 miles of telegraph wires in operation, four fifths of which are used for local communications, stock-reporting instruments, and private lines.

If a law should be passed compelling the companies to place their wires underground, the whole system of communication would have to be changed. But, even were it practicable to work our system upon the underground lines, it would be impossible to place all the wires in the city of New York lone underground in less than four or five years.

The Manora Breakwater.

At a recent meeting of the Institution of Civil Engineers, the paper read was on "The Manora Breakwater, Kurrachee" (the design for which was illustrated on page 99 of volume XXVII. of the SCIENTIFIC AMERICAN), by Mr. William Henry Price.

It was stated that the Manora Breakwater was the most important feature of the Kurrachee Harbor Works, which were commenced in 1860, from the design of the late Mr. James Walker, assisted by Mr. William Parkes. Besides the breakwater the chief works were: In the lower harbor, a stone groyne 8,900 feet long, dredging and removal of rock; and in the upper harbor, an increase of one fourth to the area of the backwater, involving a new tidal channel 2½ miles long, crossed by a screw pile bridge 1,200 feet long, and an embankment 2,780 feet long, to close the old channel, also of a jetty 1,400 feet long, with quays. All these works were now nearly completed, and had already produced great benefit, the entrance having been made direct instead of circuitous, deepened 6 feet and sheltered, the anchorage space enlarged, and the internal accommodation improved. The trade of the port was \$17,500,000 per annum, and railway communication with the Panjab would further develop it. About \$2,350,000 had been expended on the whole of the harbor improvements.

The Breakwater projected from Manora Point for a length of 1,503 feet, into a depth of 5 fathoms of water, in order to shelter the entrance from the southwest monsoon seas, and to prevent their tearing up sand from the bottom and depositing it as a bar. The characteristics of the sea, wind, and tides, as bearing on the design, were alluded to, and it was stated that the bottom was irregular near the shore. The structure consisted of a base of rubble stone, leveled off generally to 15 feet under low water; and on this concrete blocks, each weighing 27 tons, were set on edge, leaning back at a slope of 3 inches to 1 foot, and without bond, two blocks forming the width and three the height, and together making a square of 24 feet in cross sections, the top being about the level of high water. The rubble base was deposited from native boats, and was leveled for the superstructure by helmet divers. Two European mason divers were employed, and six native divers trained on the work, the latter chiefly for shifting the rubble. No accident occurred, and the party generally did not suffer in health. After mentioning circumstances which determined the use of concrete blocks and of Portland cement, particulars were given of the composition of a 37-ton block, the materials being cement, river sand, shingle, and quarry lumps, with salt water. The ratio of the bulk of the cement to that of the finished block was nearly 1/11. About 3,500 tons of cement were used. The mixing station, block ground, and molding of the nineteen hundred and seventy-two blocks, including three hundred and twenty-five of special smaller sizes, were then described; and it was remarked that the Messent mixers had been found very efficient. The blocks were sometimes used one month after being made, and once, as an experiment, a 27-ton block was safely lifted in seven days. When the work was fairly established, the blocks cost for current expenses \$3.75 per cubic yard, though the average total rate was raised beyond this by extra expenses in the earlier stages.

The blocks were lifted on to the trucks by a steam hydraulic traveling crane of 50 feet span; each truck carried one block, and was taken separately by a tank locomotive to the breakwater. The blocks were set by a steam traveling crane, called the Titan, which ran on rails laid on the finished work, and overhanging the end, so as to carry the blocks of three tiers in advance to their places, thus dispensing with staging. The framing of this crane supported a traveler and crab, worked by an 8-horse power engine on the top, which also drove the traveling gear of the entire machine. The cost of the Titan, delivered and erected at Kurrachee, was \$14,395. The rate of setting was limited by the progress of the foundation and by the supply of blocks, but during the last season ten 27-ton blocks were set daily on an average, while on one occasion six blocks were laid in one hour and forty minutes without special pressure.

The base was commenced on the 17th of March, 1869; and later in that year the shore end stump, 45 feet long, to make a starting place for the Titan, with other preparatory works, was completed, after some unavoidable delays, and the first block was set on the 1st of November, 1870. The delays of the foundation were merely felt in the first season's work, but a length of 225 feet was built in four months, taking the breakwater out to 270 feet from the shore. During the second season, 1871-72, after a few days spent in repair of monsoon damages, a length of 523 feet was built in about four months, making a total of 793 feet. During the third season, after the repair of monsoon damages, a length of 710 feet was built, completing the breakwater on the 22nd of February, 1873, to its full length of 1,503 feet, which had thus been barely twelve months in actual building.

The action and effect of the monsoon sea, and the repair of damages, were then detailed. In 1871 the center joint

opened here and there, and one block was over from the top course on the harbor side. Slight damage also occurred to the shore end in the sea angle. The nature of the settlement was described, also a curious rocking action, and the closing up of the cross joints under the action of the sea. The repairs of the damage, in the first season, cost \$925. During the second monsoon, 1872, twenty-five blocks were washed out from the top course on the harbor side, eighteen of these block being, in one length, 86 feet. The damage was again traceable to inequality of settlement. The sea side did not suffer, nor did the shore end, though both showed evidence of the force of the sea. The damage was repaired in a few days at a cost of \$2,560. The monsoon of 1873, the first after the completion of the breakwater, did trifling damage, and was confined to the shore half length, still pointing clearly to weakness of foundation. The repairs cost \$995. In the monsoon of 1874, the outer end and scar, which had not then been in any way specially secured, lost five blocks during unusual weather, though no other part of the outer half length suffered, but the shoreward half opened here and there. The repairs of this season cost \$2,090, and included the re-erection of an iron beacon on the outer end. The nature and extent of the subsidence (which in some parts amounted to 3 feet, but without dislocation), were then noticed, also the action of a mollusk, the pholas, on the concrete blocks, and the effect of the sea on the rubble base, which did not, however, affect the stability of the superstructure.

The cost of the breakwater had been \$467,825, or \$311.25 per lineal foot, but this amount included preliminary charges, the current expenses during the last season being only \$170 per foot. This sum included the repair of damages during the progress of the work, and during the two monsoons since its completion, but not the expense of engineering and office establishment. The work had been carried on in the Bombay Public Works Department by the author and his assistants, advised by Mr. William Parkes, as consulting engineer, and without employment of any general contractor. The completion of the work was favorably noticed by all the government authorities concerned.

Recent American and Foreign Patents.

NEW CHEMICAL AND MISCELLANEOUS INVENTIONS.

IMPROVED HORSE-HITCHING DEVICE.

John Schoonmaker, New York City.—This consists in attaching to the reins which are caught upon hooks on the forward part of the wagon body, so that, should the horse attempt to run away, the whole weight of the wagon will come upon his mouth and hold him back.

IMPROVED STILL.

Henry Deymann and Edward Melchers, Toledo, Ohio.—This inventor proposes an improved column for refining stills, in place of the so-called French column, so that a finer spirit, with less steam pressure, is produced by means of simpler construction, which prevents leakage, decreases the trouble and expense connected with the repairs of the French column, and which may be put in the space of one story, with a considerable saving in copper plate. The essential features consist in arranging the chambers of the columns, on opposite sides thereof, with alternating horizontal and vertical partition plates and connecting overflow pipes and draining stop cocks. The intercommunicating arrangement of the chambers virtually produces two columns in one, so as to require about half the height and material only, and offers the advantage of having all the overflow pipes at the outside.

IMPROVED INKSTAND.

Herman Schirmer, Wheeling, W. Va.—This is an ink vessel with an inverted conical tube extending nearly to the bottom of the vessel, and having an orifice at the lower end in connection with an air regulating device by which the height of the ink in the tube is regulated.

IMPROVED PHOTOGRAPHIC PLATE HOLDER.

Frank A. Howson and William S. Howson, Brooklyn, N. Y.—This is an improved combination holder for the ground glass and plate for photographic cameras, by which, in every case, the exact image that was focused on the ground glass is obtained with perfect certainty on the sensitized plate. By its use the ground glass door of the camera may be dispensed with. The device is provided with lower grooved glass holders, glass buttons or studs at the top, and a side support, on which the ground glass and plate are insulated, and securely fastened by a spring top plate.

IMPROVED MONUMENT.

John N. Wallis, Fleming, and Theodore Wallis, Scipio, assignors to themselves and James A. Moore, Auburn, N. Y.—This inventor proposes grave-stones of a more tasteful form than those commonly used. He suggests making the monuments of stone and glass, having inclosed chambers for the preservation of flowers and other objects.

NEW HOUSEHOLD ARTICLES.

IMPROVED CURTAIN FIXTURE.

William H. Maine, Abington, Mass.—This is a spring curtain roller provided with a device for preventing the unwinding of the spring when the roller is removed from the brackets. A spiral roller spring acts on a spindle, revolves the same, and throws a pin instantly out of its seat against a cam of a sleeve, so as to retain the spindle and prevent the unwinding of the spring. The roller thus remains in locked position as long as it is out of the brackets, and is instantly available for use when replaced in the brackets.

IMPROVED COMPOSITION FOR SOAP.

William F. Darnoby, Nashville, Tenn., assignor to himself and Edward B. Stahlman, of same place.—This compound, the inventor states, is an excellent article both for laundry and toilet, and is very cheap. It is made of Kirk's double extract, Colgate's soda soap, sal soda, water, spirits of ammonia, ether, and oil of sassafras.

NEW AGRICULTURAL INVENTIONS.

IMPROVED CHECK-ROW ATTACHMENT FOR CORN PLANTERS.

George C. Flagg, Columbus, Ill.—This includes several new and ingenious devices, so constructed that wheels mark the rows in one direction and marker arms mark it in the other direction. The machine is so guided that the ends of the inner markers may meet, or nearly meet, the ends of the marks made by the outer markers upon the previous crossing, so that the ground is marked in accurate check row by the machine crossing the field in one direction.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED CAR COUPLING.

Oscar E. Ford, Meridian, Miss., assignor to himself and Min or H. Clinton, Dallas, Tex.—This coupling consists of drawheads with forward-projecting parts, which are recessed at their inner sides, and provided with laterally sliding spring-acting jaws that interlock by the entering of the projecting parts of the drawheads into the space formed by the shorter part. The drawheads are thus firmly connected without chance of getting detached, while the jaws have play in vertical direction by the widening of the recesses at the rear part, which allows the coupling of cars of different heights.

IMPROVED CRANK STOP.

William H. Phillips, Bridgeton, N. J.—The cranks of windlasses and other shafts have been heretofore disconnected by the backward rotation of said shafts, but the shafts required to rotate several times in order to effect such result. This inventor effects the disconnection at the first backward rotation of the shaft, and to this end provides a pivoted catch, which engages a sliding piece that locks the crank to the shaft.

IMPROVED SPARK CONVEYER.

Charles K. Cullers, Bunceon, Mo.—This device is principally a kind of ball-and-socket joint for connecting the sections of pipe for conducting the smoke for the locomotive back along the top of the train to the rear end, the said joint being free to oscillate to any required extent, and allowing the necessary contraction and extension of the pipe, and at the same time keeping tight.

IMPROVED SADDLE SHOE.

Victor C. Thebaud, Buffalo, N. Y.—A large number of inventions are in existence for getting rid of the unnecessary weight of metal in flat irons, most of which accomplish their object by abolishing the fixed handle and substituting an adjustable one which will serve for several bodies. The present inventor suggests a very different plan, and proposes a shoe for the iron, which is easily attached and replaced at will, so that an effective ironing surface is always obtainable. The device is made with external flange, having curved side extensions at the front and a fastening screw at the rear part to be readily applied to the iron.

IMPROVED TREADLE FOR MACHINERY.

Andrew N. Hagerty, West Alexander, Pa.—This is an auxiliary treadle and connecting rod, in combination with the main treadle and connecting rod, to work a pawl for starting the machine by a ratchet wheel. The object is to insure the turning of the machine in the right direction, and to avoid the necessity of starting the balance wheel by hand, thus leaving both hands free for managing the work.

IMPROVED RAIL JOINT.

George A. Mead, Salem Center, N. Y.—In this device, the tongue or tenon of one rail enters a slot in the other. The slotted part is bolted together by a couple of bolts, arranged the same as in fish-plate joints. The object is to make an endless joint, and to dispense with the fishplates commonly used.

IMPROVED WATER REGULATOR AND INDICATOR FOR STEAM BOILERS.

Dexter Cook, Elmira, Ohio.—This is a cylindrical tank traveling in vertical guides and supported by a spring. It is connected at top and bottom with the steam and water spaces of the boiler. When the water in the boiler falls below a certain level, the tank, becoming lighter, is raised by the spring, and the fact is indicated by a graduated scale and pointer and by a whistle allowed to sound by mechanism connected with the tank. The latter is also connected with a feed valve, so as to open the same, and thus allow water to enter the boiler when a deficiency is indicated, and closes the valve when the level is reached.

IMPROVED FEATHERING PADDLE WHEEL.

Peter Gregerson, Wauzeka, Wis., assignor to himself and Phillip Miller, same place.—The paddles are hung by pivots above their centers, and are held to their work by stops. The latter are controlled by sliding rods which, acted upon by a cam on the wheel shaft, push said stops beyond the outer edge of the paddles, and then retract them by springs. There are other devices which allow the cam to shift right or left, as the wheel is turned in either direction, and an ingenious mechanism is provided for purposes of adjustment.

IMPROVED GATE.

Robert Samuel Rinker, Mount Jackson, Va.—The object of this invention is to provide an improved automatic or self-opening gate; and it consists in an arrangement of elbow levers and catch hooks, controlled by a cord or wire, with a weighted lever, upon one end of which lever the wheels of the vehicle pass to raise the weight and set the gate, so that it can be readily opened from either side by the person in the vehicle by pulling a tripping cord, arranged upon both sides of the gate, within convenient reach, upon a post, each vehicle serving to raise the weight and set the gate for the next succeeding one.

IMPROVED BRICK KILN.

Holland B. Evans and Earnest G. Kemper, St. Charles, Mo.—The invention relates to a new construction and arrangement of the several compartments of the kiln and their flues, which cannot be made plain without the aid of drawings. In general the flues are so made that their heat can easily be controlled, and by using the invention it appears that as many more bricks as are contained in the compartments can be burned with the same or less amount of fuel than with a kiln of the same dimensions constructed in the old way.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED RECORDING AND SIGNAL FARE BOX.

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The Baxter Engine—A 48 Page Pamphlet, containing detailed drawings of all parts and full particulars, now ready, and will be mailed gratis. W. D. Russell, 18 Park Place, New York.

Notes & Queries

H. M. D. will find directions for making a fireproof artificial stone on p. 113, vol. 24. M. H. can fasten emery to wood by the method for emery and iron, described on p. 363, vol. 33. H. J. will find directions for making nitro-glycerin, duralin, dynamite, etc., on p. 212, vol. 33. H. F. S. can brown his gun barrels by using the recipe given on p. 11, vol. 32. F. F. will find a recipe for stove blacking on p. 57, vol. 25. T. should French polish his pianoforte work. See p. 11, vol. 22. M. H. K. will find a recipe for white fusible metal on p. 374, vol. 32. The process of repairing delivred mirrors is described on p. 346, vol. 25. S. N. will find directions for staining glass on p. 300, vol. 30; for etching glass, on p. 379, vol. 33. H. A. S. will find directions for making clarified cider on p. 204, vol. 33; for preserving cider, on p. 139, vol. 33. S. & B. will find on p. 139, vol. 32, directions for making paste that will probably answer their purpose. As to State laws regulating the sale of patents, see p. 187, vol. 33. S. T. S. can mold rubber by following the directions on p. 233, vol. 29. W. T. can clean shells by the method described on p. 122, vol. 27. H. D. M. will find a recipe for Babbitt metal on p. 26, vol. 33. C. B. will find directions for silvering glass on p. 340, vol. 33. Full directions for nickel plating have frequently been published in these columns. See pp. 155, 235, vol. 33. This also answers E. J. C.—R. R. M. can make a mold, for use on type, of plaster of Paris. The metal that is lightest in water is the lightest out of water. B. H. C. will find full directions for putting a white enamel on iron on p. 362, vol. 32. This also answers A. F.—C. S. F. will find an account of the oleomargarin process on p. 23, vol. 32. P. D. R. can fasten rubber to iron by the method given on p. 42, vol. 30, for leather. A good recipe for paste that will keep is published on p. 219, vol. 30. D. G. F. will find a description of the phosphorus lamp on p. 10, vol. 27. V. can read the inscriptions on coins by following the directions on p. 246, vol. 26. H. G. W. will find directions for making spongy platinum on p. 330, vol. 25. H. N. M. can cement glass to brass by the method described on p. 1, vol. 33.

(1) N. S. asks: How can I unite the mercury in a thermometer which has become separated by agitation? A. Fasten a string 3 or 4 feet long to the instrument, and swing it round your head. The centrifugal force will cause the mercury to unite.

(2) R. F. L. asks: How can I stick leather on the face of iron and wood pulleys? A. Glue the leather to the wooden pulley. Paint the iron pulley with a good coat of white lead in oil, and let it dry; then glue the leather on.

(3) L. B. asks: What is black rosin, and is it known by any other name? A. Black rosin is also called colophony, and is the residue left after the distillation of turpentine.

(4) H. L. M. asks: How can I get a white metal that will flow perfectly into an iron or brass mold, and which, when turned out, will stay bright? A. Melt together 4 1/2 lbs. of tin, 1 1/2 lb. bismuth, 1/2 lb. antimony, and 1/2 lb. lead. This alloy fuses at a low temperature and does not tarnish.

Can the color be taken out of horsehair, so as to make it white? A. Wash in weak lye, and fumigate with the vapor of burning sulphur (sulphurous acid).

(5) G. G. B. asks: What do pattern makers use to blacken their patterns with? A. Lamp black mixed with copal varnish and alcohol.

(6) J. N. J. asks: Why do iron and steel weld with less heat with than without borax? A. The use of borax is as a flux, to make the steel heat evenly, and to prevent the corners or edges from burning before the rest of the metal is of the proper heat.

(7) M. D. F. asks: How can chilled iron be drilled? A. By hardening the drill in mercury instead of water.

(8) C. R. asks: What pressure per square inch is required to crush pieces of ice together so as to form one clear homogeneous mass? A. Consult Professor Tyndall on "Forms of Water."

(9) J. H. asks: In what quantity, and at what intervals, should quinine be taken as a remedy for chills and fever? A. In many cases two grain doses are recommended to be taken before each meal, whenever an attack of chills is anticipated.

(10) E. C. & Co. ask: Would it be beneficial to soft maple lumber, for building a large friction pulley, to boil it in olive oil? A. Yes. 2. Would it harden the timber, and make it less liable to split? A. Yes. 3. Would the gear slip more after such treatment? A. Yes.

(11) H. A. S. asks: How is bromide of camphor made? A. Triturate the camphor first with a drop or two of dilute spirits of wine, and then digest with bromine water. The bromine unites with the camphor to form an unstable bromide of camphor, which is crystalline, and is decomposed by heat, by contact with air, and by action of ammonia.

(12) D. C. G. asks: Is there any preparation of phosphorus, either fluid or dry, that is luminous in the dark when hermetically sealed? A. A full description of the phosphorus lamp will be found on p. 250, vol. 33. It consists of a strong solution of phosphorus in olive oil. The solution is kept in a small, glass, stoppered bottle, and when required for use the cork is removed and the solution agitated.

(13) W. J. H. asks: What would be the difference between suspending a weight (that works such machinery as clockwork) direct, and hanging the same weight around a pulley attached to weight? Would there be any difference in effect upon the train of wheels, providing the amount of pressure on drum (not the weights) were same in both cases? A. Neglecting friction and rigidity of cordage, if the weight required in the second arrangement were 100 lbs., that in the first need only be 50 lbs.

(14) T. D. W. If two persons are in a top wagon, about 500 lbs. weight rests upon the two axles, which are as stiff as they are usually made. Now if the axles can be made 2 1/4 times as stiff, how many lbs. will the change take away from the load drawn by the horse? A. The question is rather indefinite, but we do not imagine that there would be much difference in the two cases.

(15) C. P. asks: How many lbs. strain will there be on a rope which has a horse at each end, pulling in opposite directions, supposing each horse to be pulling 1,000 lbs.? A. One thousand lbs. This question is anything but new. See p. 186, vol. 24.

(16) M. R. asks: Is centrifugal force of a wheel in motion a radial or a tangential one? A. Radial, as we understand your question, that is, in the direction of a radius.

(17) J. G. says, in answer to N. K. B.'s query as to the area of a polygon: If A be the area of the circle and P the perimeter of the regular polygon, the area of the latter is

$$P \frac{A}{3.1416} \frac{P^2}{4n^2}$$

n being the number of sides which must be given. If these be given, A and P, as before, and B, the area of the regular polygon, the number of sides—

$$3.1416 \frac{A}{P^2}$$

(18) S. says, in reply to W. J. E., who is troubled with dreams: If you abstain from sleeping on your back you will not dream. It is very rare that a person who is not laying on his back dreams.

(19) L. C. Jr. says, in reply to H. J. E., who asked how to apply wax to stove patterns: As the stove plates of to-day are more or less ornamented with designs, having well defined depressions or elevations, the casting must be heated till it is hot enough to melt the beeswax and not burn it. Then apply the wax by rubbing it here and there over the surface of the plate; a small quantity only is required. After which, and while the wax is in a liquid form, give the casting a thorough brushing with a new shoe brush; this will spread the wax uniformly over the entire surface and at the same time remove all the surplus wax. Then allow the casting to cool, and, with a second shoe brush, give it a thorough brushing, and you will have a surface to your pattern that will give you a mold with as sharp corners as your pattern.

(20) W. J. R. says, in answer to T. D.'s inquiries as to compound gears: I judge from T. D.'s list of gears and pitch of lead screw that he has got a Pratt & Whitney lathe, which, unlike most other lathes, has, on the inside gear on the stud, double the number of teeth that the cone gear has. Therefore, with gears on stud and screws having the same number, the revolutions of cone and screw will be as 2 to 1, and the pitch of lead screw is made practically 16 instead of 8. The SCIENTIFIC AMERICAN's rule will work by counting the screw as 16. The following index is useful for T. D.'s lathe:

Thread.	Stud.	Screw.	Thread.	Stud.	Screw.
2	4	112	28		
3	5	125	32		
4	6	140	36		
5	7	157	40		
6	8	176	45		
7	9	197	50		
8	10	220	56		
9	11	245	63		
10	12	272	70		
11	13	301	78		
12	14	332	84		
13	15	365	90		
14	16	400	96		
15	17	437	105		
16	18	476	112		
17	19	517	120		
18	20	560	128		
19	21	605	136		
20	22	652	144		
21	23	701	150		
22	24	752	157		
23	25	805	165		
24	26	860	172		
25	27	917	180		
26	28	976	187		
27	29	1037	195		
28	30	1100	200		
29	31	1165	207		
30	32	1232	216		
31	33	1301	225		
32	34	1372	232		
33	35	1445	240		
34	36	1520	248		
35	37	1597	256		
36	38	1676	264		
37	39	1757	272		
38	40	1840	280		
39	41	1925	288		
40	42	2012	296		
41	43	2101	304		
42	44	2192	312		
43	45	2285	320		
44	46	2380	328		
45	47	2477	336		
46	48	2576	344		
47	49	2677	352		
48	50	2780	360		
49	51	2885	368		
50	52	2992	376		
51	53	3101	384		
52	54	3212	392		
53	55	3325	400		
54	56	3440	408		
55	57	3557	416		
56	58	3676	424		
57	59	3797	432		
58	60	3920	440		
59	61	4045	448		
60	62	4172	456		
61	63	4301	464		
62	64	4432	472		
63	65	4565	480		
64	66	4700	488		
65	67	4837	496		
66	68	4976	504		
67	69	5117	512		
68	70	5260	520		
69	71	5405	528		
70	72	5552	536		
71	73	5701	544		
72	74	5852	552		
73	75	6005	560		
74	76	6160	568		
75	77	6317	576		
76	78	6476	584		
77	79	6637	592		
78	80	6800	600		
79	81	6965	608		
80	82	7132	616		
81	83	7301	624		
82	84	7472	632		
83	85	7645	640		
84	86	7820	648		
85	87	7997	656		
86	88	8176	664		
87	89	8357	672		
88	90	8540	680		
89	91	8725	688		
90	92	8912	696		
91	93	9101	704		
92	94	9292	712		
93	95	9485	720		
94	96	9680	728		
95	97	9877	736		
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98	100	10480	760		
99	101	10685	768		
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COMMUNICATIONS RECEIVED.

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

On Screw Cutting Gears. By R. H. B.
On the New Force. By H. M. P.
On Solar Heat. By W. L. S.
On the Contraction Policy. By F. A. L.
On Release of Patents. By G. E. B.
On the Hydro-Pneumatic Puzzle. By M. P., by C. M., and by N. B. J.
On Spiritualism. By E. P. M., and by F. G. F.
On the Orbit of the Sun. By J. S.
On Making Rifles. By B.
On Poisons. By H. S. W.
On Carbonic Acid Gas. By C. W. S.
On Oceanic Currents. By T. L.
On Electric Whistles. By L. S. W.
On Chemical Action. By E. V.
On a Dioptric Light. By C. G., and by W. C. G.

Also inquiries and answers from the following:

I.—G. W. P., Jr.—T. B.—J. M.—A. J. B.—A. C.—G. E. C. S.—S. H.—S. H.—C. H.—D.—S. E. H.—F. S. B.—A. H.—H. A.—J. G. S.—C. A. P.—C. L.—A. C. R.—J. A. W.—E. E. E.—H. B.—J. Q. H. B.

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

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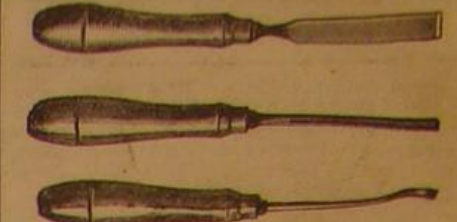
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