SCIENTIFIC AMERICAN

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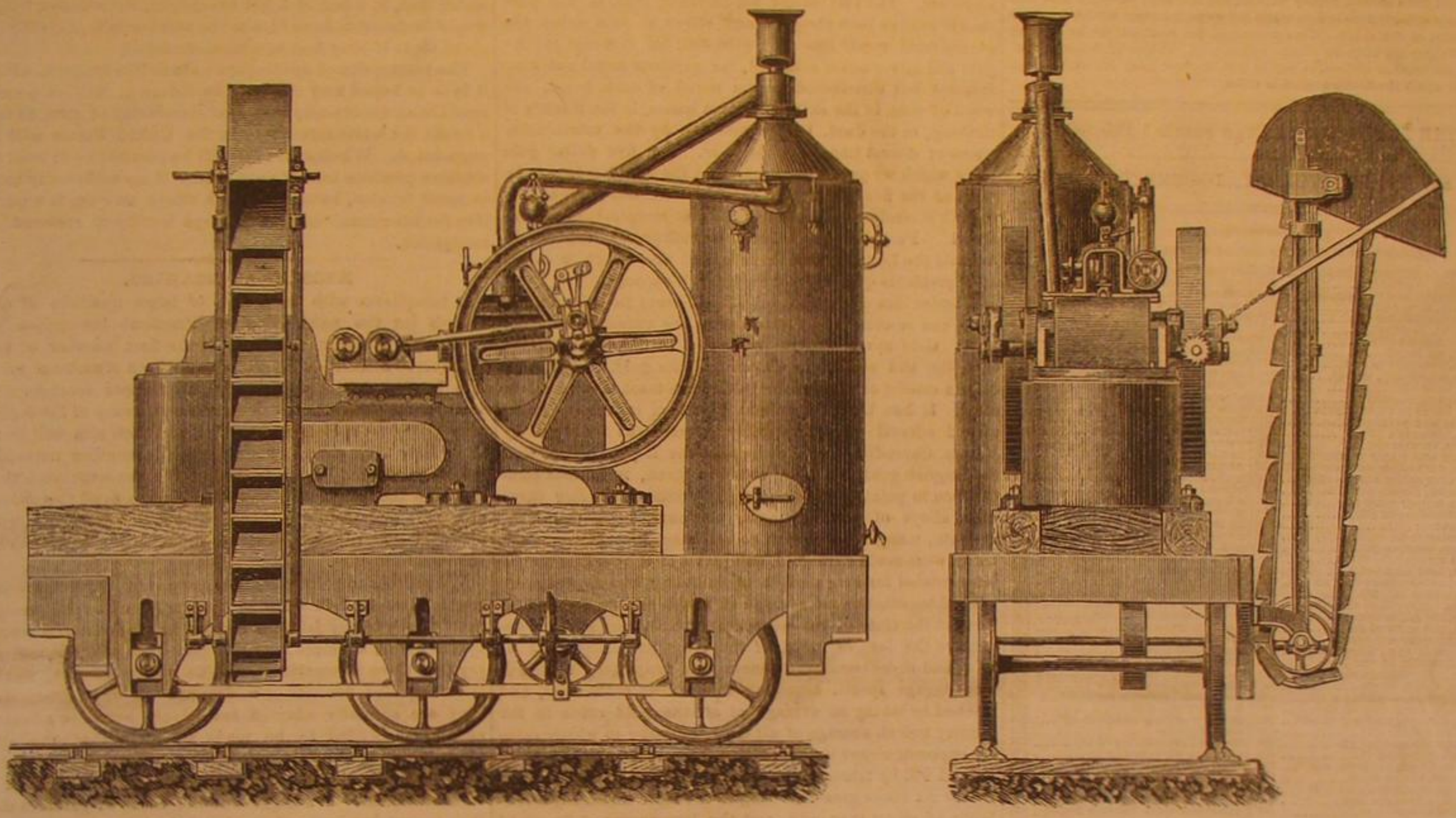
BALLASTING MACHINERY.

Our illustration shows a very useful form of machine for breaking stone and ballasting railroads, and for macadamizing 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 railways; 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 tuns of slag per day. The total weight of the apparatus is about 26 tuns.

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 plummer blocks, in which runs the crank shaft in adjustable gun metal; two massive fly wheels, each weighing one tun, 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 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 delivers the material into trucks on the opposite rails. The boiler is fed by an injector

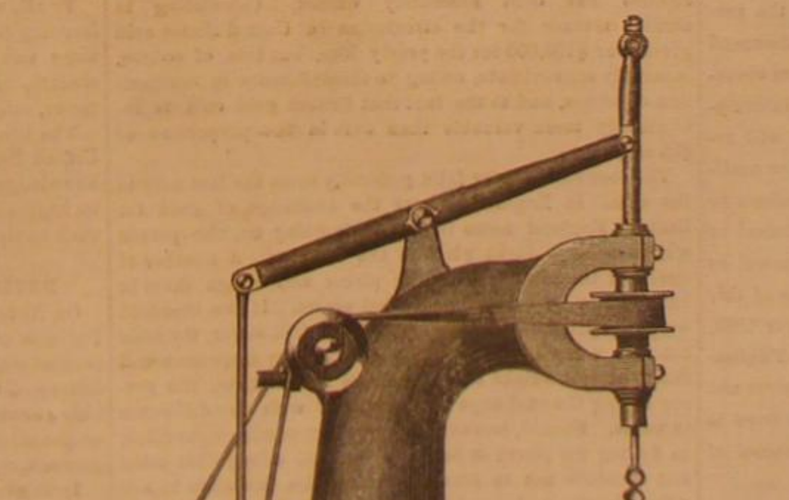


RAILWAY BALLASTING AND STONE BREAKING MACHINE.

WOOD-BORING MACHINERY.

We publish herewith an engraving of a very simple boring machine, the whole construction of which is obvious from 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 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 ½ 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.



FURNESS & CO.'S VERTICAL BORING MACHINE.

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

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VOLUME XXXIII., No. 24. [NEW SERIES.] *Thirtieth Year.*

NEW YORK, SATURDAY, DECEMBER 11, 1875.

Contents.

(Illustrated articles are marked with an asterisk.)

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 1·90C 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 unfailing 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 305) 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 Grahamite 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 be 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 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 bottom 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 fulfil 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 chemischer 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 an other 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 up per 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 *débris* 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.

Fig. 1

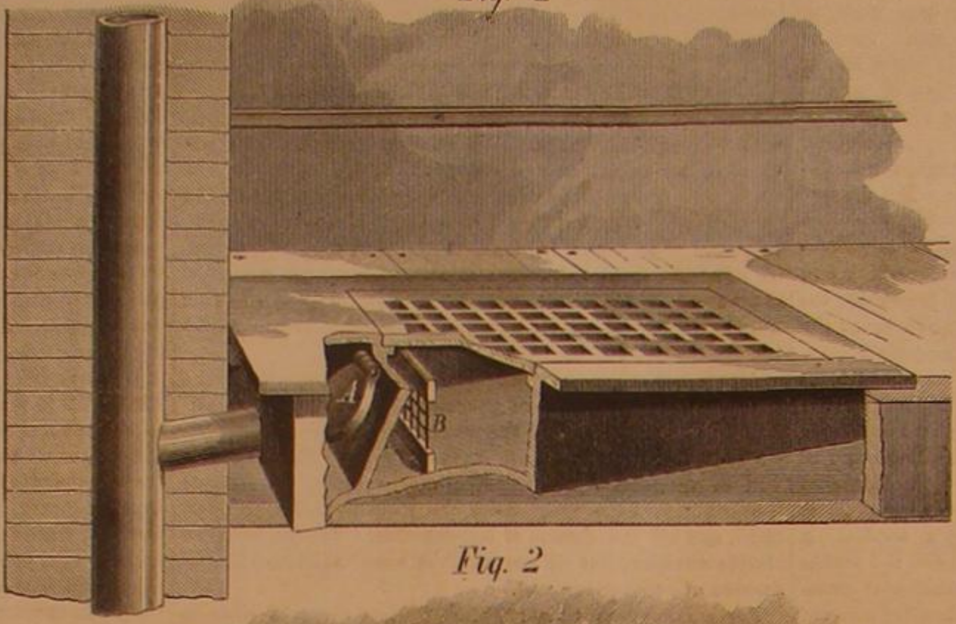
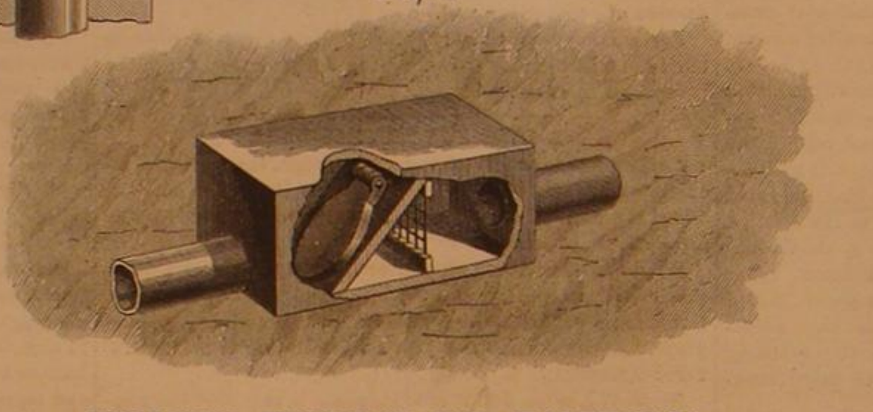
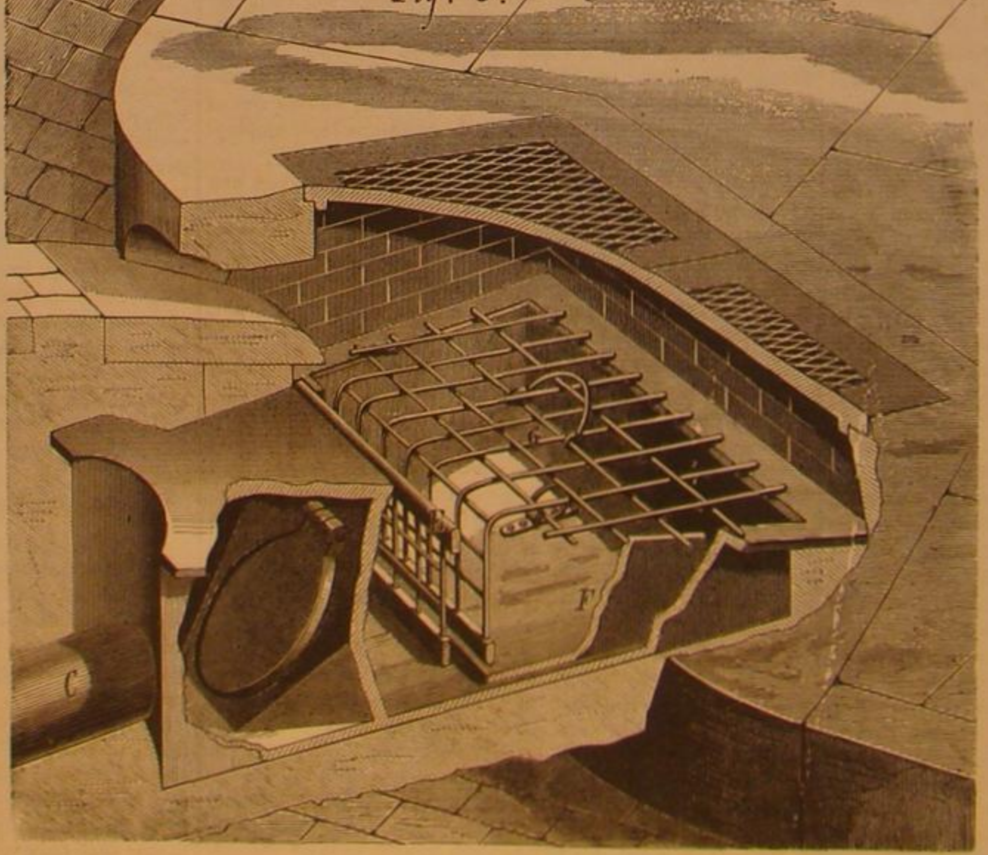


Fig. 2



MORRELL'S FLOODWAY FOR WAREHOUSES.

Fig. 3.



MORRELL'S SEWER FLOODWAY.

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, 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 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

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 tunnage 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 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.

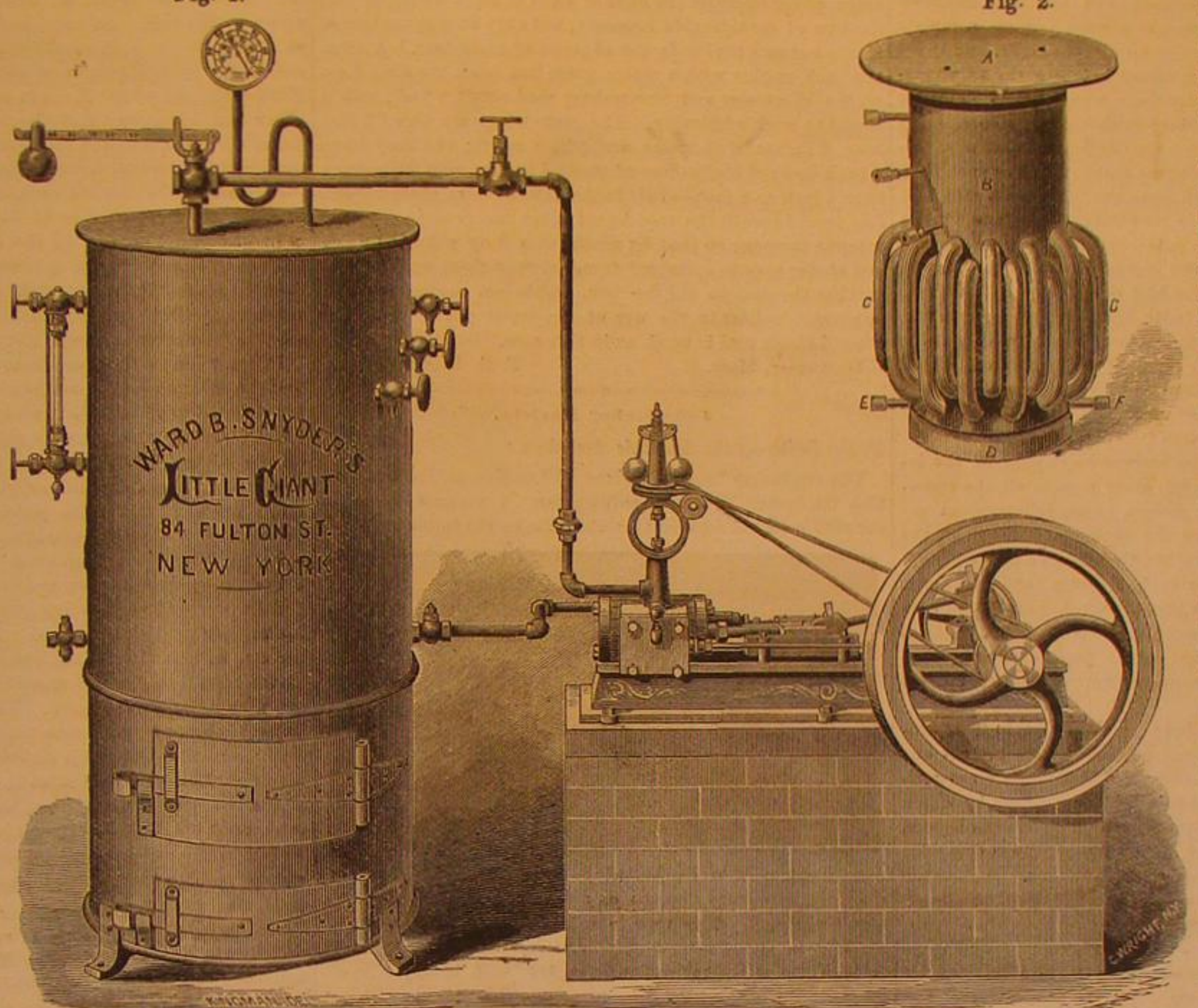
M. Desains, from his investigations, logically concludes that the cold lines are due to atmospheric vapor of water. The position of the principal ones, measured from the extreme end, is found to be so near the position of the solar lines that the difference is almost imperceptible. For four of the former 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 59'. We look for further information as to the results of M. Desains' experiments.

THE LITTLE GIANT STEAM ENGINE.

Another motor, designed especially to meet the requirements of those who need light power for manufacturing or 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.

Fig. 1. Fig. 2.



SNYDER'S LITTLE GIANT STEAM ENGINE

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: Hight 3 feet 4 inches, and diameter 18 inches. The diameter of the engine cylinder is 2¾ 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.

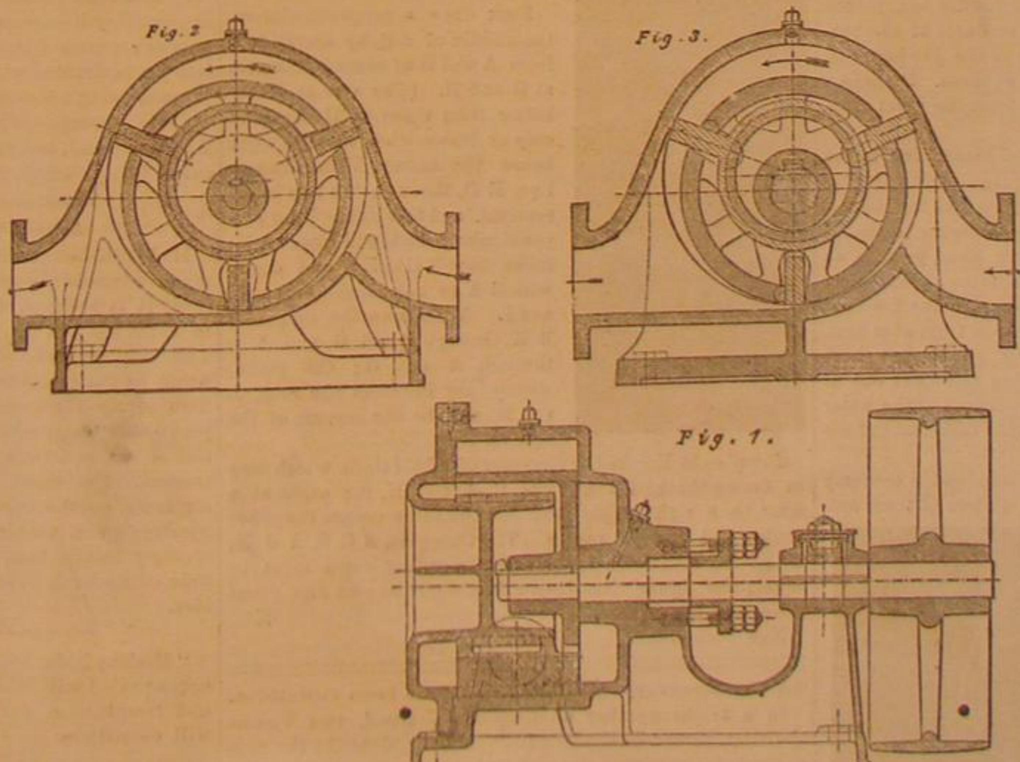
The bird of the old mythology which not only endured roasting with complacency, but sprung up fresh, and vigorous, from its ashes immediately after it had suffered cremation, was tame, torpid, and quiescent compared to the idea the latest form of which we herewith illustrate. Searching once in Ewbank's "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 others, and is of such a diameter and thickness that its interior and exterior surfaces touch the inner and outer cylinders, the places of contact preventing water from passing. . . . This machine was originally designed, like most rotary pumps, for a steam engine. It was patented in England by John Trotter, in 1805, and is described in *The 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 303 of our volume XXXI.; and Myers obtained an American patent for exactly the same claims, 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 Dundonald, 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.



THE McFARLAND ROTARY PUMP.

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 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:

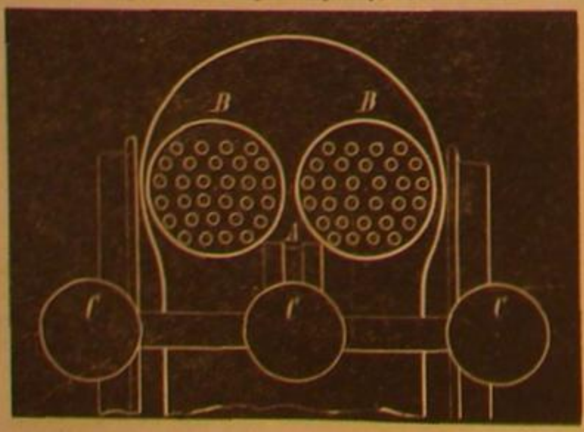
The locomotive has probably attained a degree of simplicity and efficiency which is susceptible of but little improvement. It is true that it does not always possess complete symmetry and just proportion in all of its details, and it yet remains for some fortunate inventor to do for the valve mechanism 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 preventor 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-



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

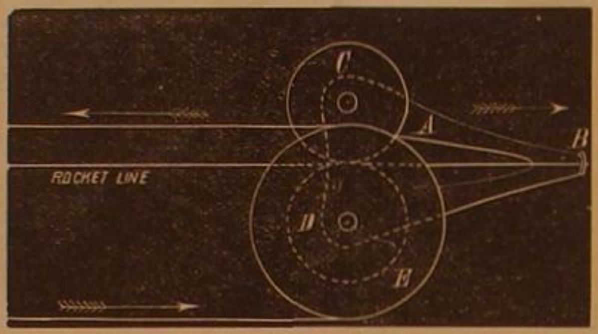
I wish that such engineers as have experience with the water grate would give us their opinion of it, as to its economic value, etc. It has always seemed to me that, if properly put in, with the tubes inclining considerably and with screw plugs opposite the ends of each tube, it would be productive of considerable economy, not only as a generator of steam but as a saving in the expense of grate bars. A ninetun 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 ½ 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-



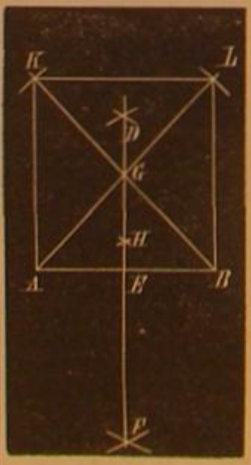
ner: The line is to be placed between two griping rollers, C and D, which are pivoted on a frame, A, and passed into a guide hole, B. The rope to establish permanent communication is passed over a griping sheave, E, which is made fast to one of the rollers, and revolves with it on the same pivot, and 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.



First draw a perpendicular on the middle of A B, by describing, from A and B as centers, the arcs at D and H. (The arcs at F are better than those at H, but can only be drawn when there is room below the base.) Then draw a line, E D, through the two intersections, and this line will be perpendicular to and will bisect A B; make now E G = EA, and draw, with G A as radius, the arcs at K and L. Then draw the diagonal, B K, through B and G, and A L through A and G; the points where they intersect the arcs, L and K, will be the corners of the square.

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. X.

New York city.

On the Recovery of Silver from Cast Iron Crucibles.

In a recent number of Dingler's *Journal*, two Vienna chemists, named Tavorsky 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 crystalization 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 constituents 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 crystalize 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 rapidity. 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 disagreeably 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 crystalizes 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 ⅛ 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 Nebulæ.

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 nebulæ. 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 nebulæ. 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 pecuniarily 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.

PRACTICAL MECHANISM.

BY JOSHUA ROSE.

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 calliper 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

Fig. 168.

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

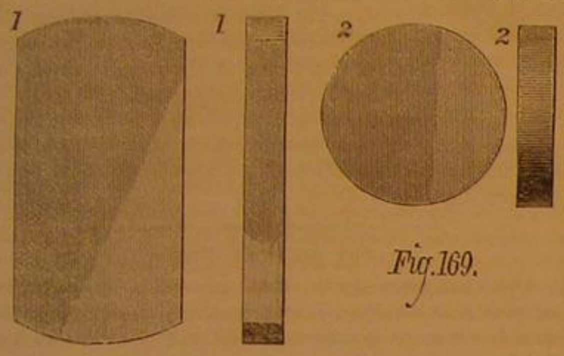


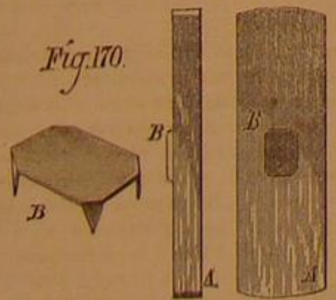
Fig. 169.

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

Fig. 171.

Fig. 170.



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 ¼ 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.

Fig. 172.

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 surfaced 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.

Fig. 173.

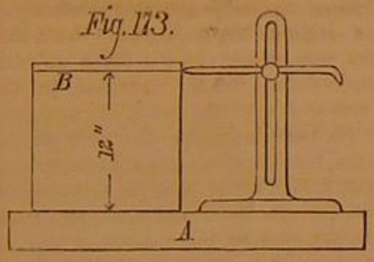


Fig. 174.

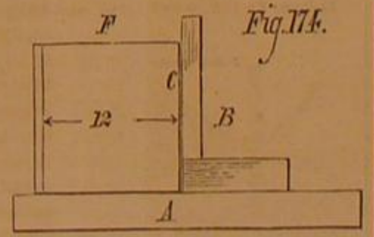


Fig. 175.

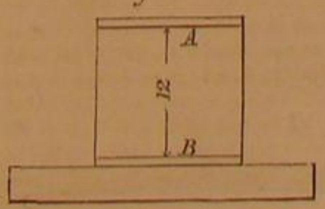
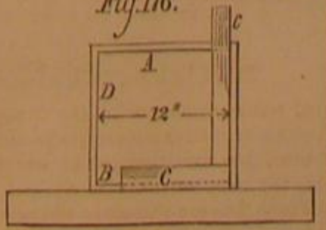


Fig. 176.



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 ⅜ 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 ⅜ 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.

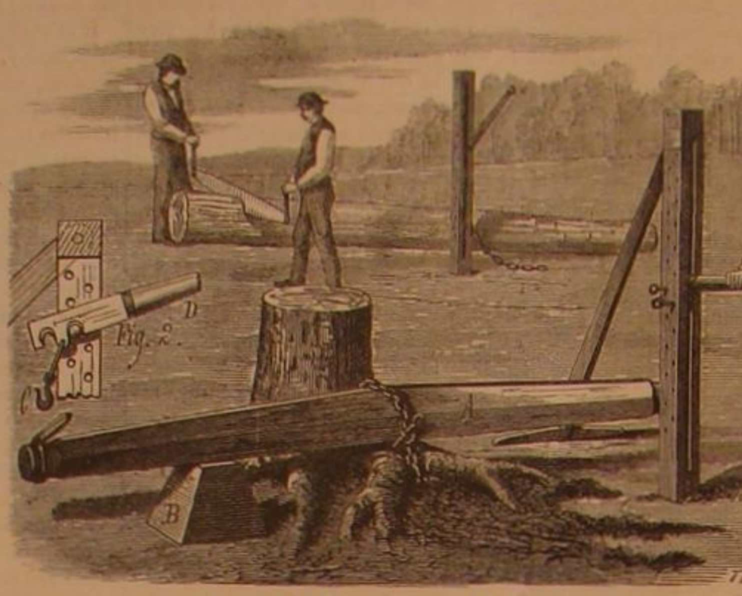
Mr. E. J. Reed says: "A faint idea may be formed, perhaps, of the extent to which the place was fired upon when I say that from a tax of 6d. per cwt., which the government levied upon the proceeds of the sales of old iron, shot, and shell, picked up and sold by the people a sum of nearly $75,000 was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

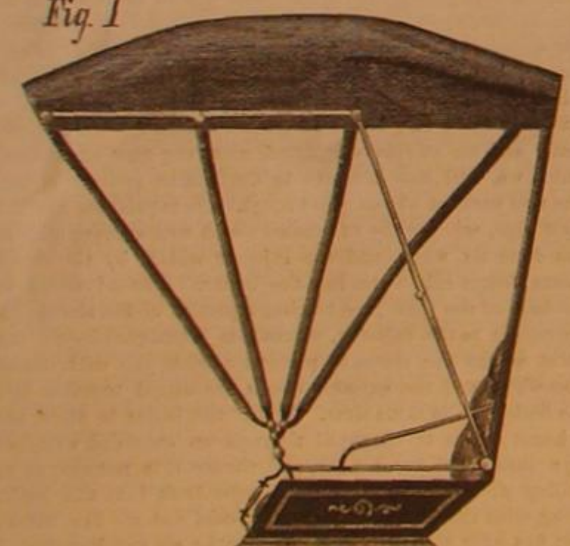


HALE'S IMPROVED LEVER POWER.

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 dented when it strikes on 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 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. Brewster & 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.

Fig. 4

TOPLIFF'S TUBULAR BOW SHAFTS.

Production of Sulphuric Acid.

Mr. Hermann Sprengel's application of atomized liquids in operations where a liquid is made to act as an absorbent of gas possesses great advantages. The method has been applied with success to the purification of coal gas, and to the condensation of hydrochloric acid, and by its use great improvements in the production of sulphuric acid have been effected. It is well known that sulphuric acid as contained in the chambers contains about 50 per cent of water, and that all this water was once steam, and was taken as such from the steam boiler. Before being condensed in the chambers this steam occupied a certain space, and moreover helped (on account of its heat) to expand the bulk of the other gases used in the formation of sulphuric acid. In winter time the yield of acid is better, and the consumption of niter less, than in summer time; and the greater the chamber space (that is, the smaller the volume of gas allowed to pass the chambers in a certain time) the less will be the consumption of niter (in proportion to the acid produced) and the easier will be the conversion of all sulphurous into sulphuric acid.

Hence, as the lowering of the temperature of a gas necessarily implies the shrinking of its volume, both of which favor the process of sulphuric acid making, Mr. Sprengel commenced to manufacture sulphuric acid by means of what has been called pulverized or atomized water or spray, which he injects into the chambers as a substitute for steam. This effects (1) a saving of fuel equal to the amount which is required to convert this pulverized water into steam, and (2) a cooling of the chambers equal to the loss of the amount of heat which would have been generated by the combustion of the coal thus saved.

The spray is produced at present by means of "some" steam, which is made to escape from a platinum jet, under a pressure of about two atmospheres, into the center of a flow 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 ¼ tun 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 6½ per cent less pyrites and with 14⅔ 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.

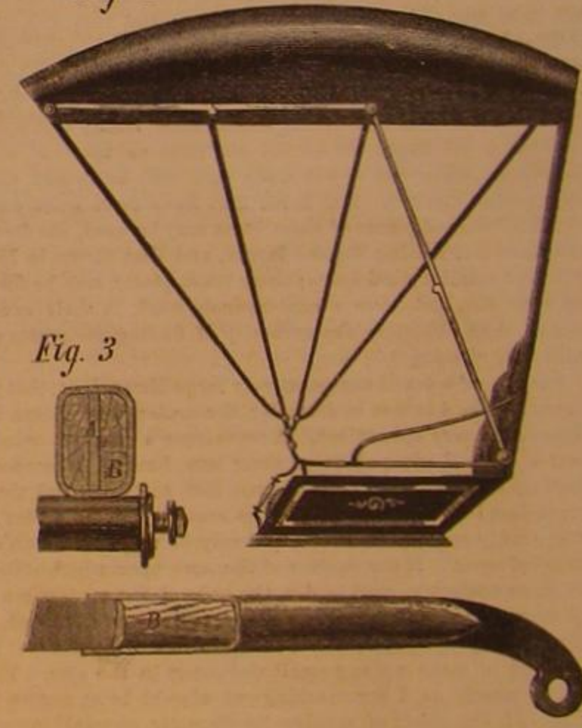
At the works of the Lawes Company the construction of the apparatus came to about $50 per chamber, while the saving in steam, acid, niter, and labor during three months amounted to $1 25 per tun of acid of 1.6 specific gravity, made from pyrites.

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.*

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 higut, for the special exhibition of panoramic pictures. At the 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 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 hight.

Fig. 2



TOPLIFF'S BOW SOCKET.

A New Mucilage.

The *Journal de Pharmacie* states that if, to a strong solution of gum arabic, measuring 8½ fluid ounces, a solution of 30 grains of sulphate of aluminum dissolved in ⅔ 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 dwarfer ferns, such as *adiantum*, *pteris*, and *asplenium*, together with an abundant undergrowth of other well arranged foliage plants, such as *dracænas*, variegated *yuccas*, *caladiums*, fine specimens of the velvety-purple silver marbled *cissus discolor*, noble crotons and alamandas: the girders of the dome above being nearly hidden in wreaths of variegated *cobæa*, 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 selaginella, 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.

Dohhoff 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 fœtal 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.

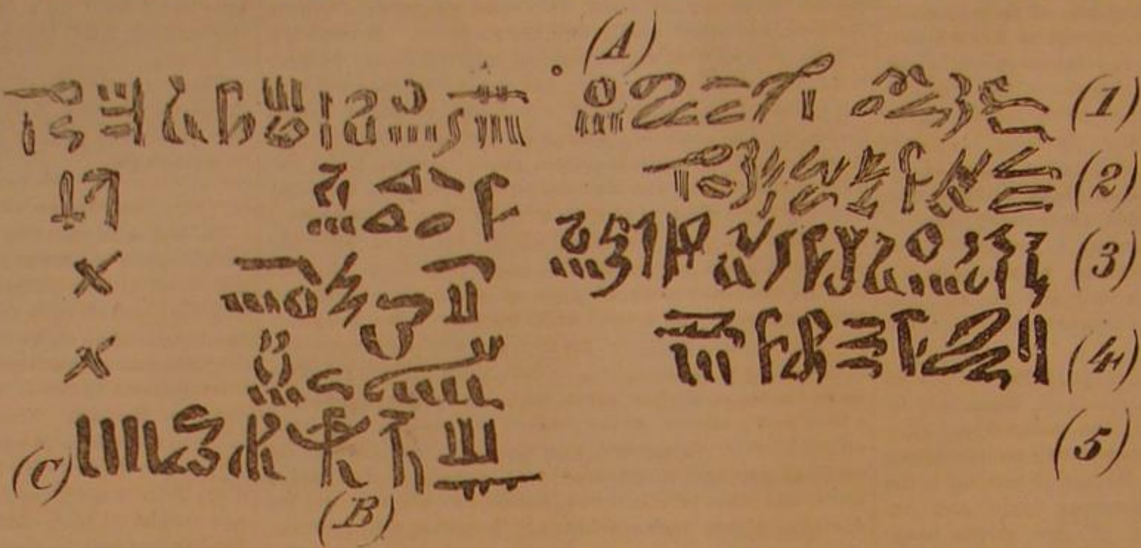
Gaudin, Paris, patents a method of treating plaster rubbish with carbonate of soda, by which it is rendered fit for use over again. Old plaster, even after it has been reburned, sets too quickly for use. By calcining the rubbish and mixing it with some saline solutions instead of pure water, this is 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.

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



THE ABOVE TRANSLATED INTO THE HIEROGLYPHIC CHARACTER.

During the winter of 1872–3, Ebers, the German archæologist, 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 Leipsic, 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 English 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. 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, $\frac{1}{64}$ drachme; goose fat, ⅛ drachme; milk, 1 tenat. For sick bowels, the same: Pomegranate seed, ⅛ drachme; sycamore fruit, ⅛ 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 Nebseeht."

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 merest*. Then make thyself a remedy according to the secrets in botanical knowledge from the plant *pa chestet* 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 (?) *merest* 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 Dunglison) 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 archæological 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 sciences 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 Nordenskjold'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 Nordenskjold on his arrival in St. Petersburgh.

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.

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 unseating 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 outwardly 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 SADIRON.

Oliver Swift, Madison, Wis.—This is principally a new way of attaching the handle of a sadiron, 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. Blood, 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 GASELIER.

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 hight 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 hight 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 it 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. Roush, 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. Sehorn, 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 hight 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, Barnesville, 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 condensible. 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, japonica, burnt umber, and copperas 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 the recipe on p. 202, vol. 24.—J. K. can preserve wood from decay by the process detailed on p. 319, vol. 31.—A. F. will find a description of the hydrogen lamp on p. 242, vol. 31.—H. 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 ¾ 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° Fah.? 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 0° Fah.? 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 200 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. Your 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 sirupy 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 ethereal 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 distils 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 develope 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 ⅛ inch is but some $\frac{1}{16}$ in thickness, while another whose width should be ¾ is but little more than $\frac{1}{16}$ 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° Fah.? 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 long and of 6 feet beam, displacing about 100 feet of water. I have 36 two inch steam pipes 39 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 3¼ bore, upright, and cuts off at ¾ stroke. The boiler is horizontal, 4 feet long (besides the bonnets); it is of ¼ 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 2½ 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. 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 2½ 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 2½ 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, Neva 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 formulæ 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 16 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 gage 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 1¼ 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 mucilage, 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 fluorspar 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 fluorspar, 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 21·722 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 8½ 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 8½ 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 $W = \frac{D^2 B}{l} \times k$, in which D = depth of bar in inches, B = horizontal breadth in inches, l = length in feet from support to center of weight, k = 536 for cast iron, 598 for wrought iron (mean of 4 authorities, varying somewhat with quality of metal and manufacture), W = breaking weight in lbs. In the given case $\frac{4^2 \times \frac{1}{2}}{\frac{3}{4}}$ × 536 or 598 = 3,752 cast and 4,186 wrought iron, when the flat side is vertical. If the longer side is placed horizontally, then $\frac{(\frac{1}{2})^2 4}{\frac{3}{4}}$ × 536 or 598 = 612¾ for cast or 683·4 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.—R. 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.

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: "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.]

INDEX OF INVENTIONS

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8,770.—CARPETS.—J. Barrett, New York city.
8,771.—SASH PULLEYS.—G. A. Blake, New Haven, Ct.
8,772.—DOOR KNOB.—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. Steinhaus, 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. Barrows, Attleborough, Mass.
8,786.—CHAIN LINK.—D. A. Beam, 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. Müller, New York city.
8,790.—LIFTER HANDLE.—J. M. Read, Everett, Mass.
8,791.—HANDLE BASES.—W. M. Smith, West Meriden, Ct.
8,792.—RADIATOR PIPES.—G. W. Walker, Malden, Mass

SCHEDULE OF PATENT FEES.

On each Caveat	$10
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CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA,

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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.—R. V. De Guinon, 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.—R. 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. McKervey *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 dasher. Nov. 11, 1875.
5,362.—A. J. R. Phillips *et al.*, Philadelphia, Pa., U. S. Ice creeper. Nov. 11, 1875.
5,363.—M. R. 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.—Rossmond 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 foundered 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, Baston, 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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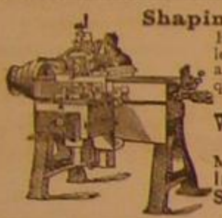

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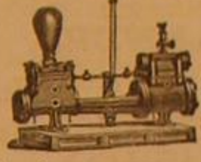

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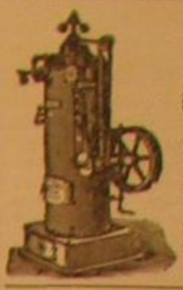

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