

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


## RAILWAY BALLASTING AND STONE BREARING MACHINE.

izing common roads. It is the design of Mr. Marsden, of $\mid$ ers the material into trucks on the opposite rails. The boiler Loeds, England, and the stone-breaking arrangement is the is fed by an injector rial for such purpose, giving a close road free from dust, while the material is left in the best possible form for binding together. The best possible form for binding togetber. The machine is used on the London and North western Railway. and is capable of breaking down for
ballasting about 120 tuns of slag per day. The total weight of the apparatus isabout 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 horizontel cylinder, 14 inches in diameter by 14 inches stroke, is placed between the arms at 14 inches stroke, is placed between the arms
at at the rear of the machine. These arms carry
plummer blocks, in which runs the crank shaft plummer blocks, in which runs the crank shaft
in adjustable gun metai ; 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 screwdown starting valve, and the motion of the slide valve is effected by an eccentric working on to a weigh bar or rowking shaft, which has an $L$ tover link to the valve spindle. The cut-off is ar 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 he lengthened
or shortened to cut off sooner or later. or shortened to cut off sooner or later.
The boiler is of the vertical tye
The boiler is of the vertical type. The elevatars radiate round the bottom shaft, and the angle of delivery can be altered by the windlass attached to the side of the machine. The


FURNESS \& CO.'S VERTICAL BORING MACHINE.
at which it can be driven without noise, bevel wheels being entirely dispensed with, motion being imparted by strapa. The upright frame is in one casting, the table moving up and down in slides, and worked by a rack and pinion, worm and wheel. It will bore holes from $\frac{1}{2}$ 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 ne cessarily possess advantages over the same class of machines made in this country, but it may interest our mechanics to see an engraving of one of the best of its kind used in England.

## The Monopolies of Inventors.

A large fortune made from valuable patents was that of the late I. M. Singer, who left property valued at $\$ 9,000,000$ in the United States and $\$ 4,000,000$ in Europe. It has often been observed that inventors are not apt to amass wealth. This statement, however, is wide of the truth if it means that inventors are more apt to die poor men than those who engage in other branches of business. We are very confident, says the Artisan, that, if a comparison were in. stituted 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 engraged in any other branch of business. We might enumerate instance after instance We might large fortunes have been mede, as in the Mr . Sing. Should we do this how 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 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

## Srientific Americam.

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PUBLIBHERS' CARD.
The present volume of the Scientific American is draw ing rapidly to a close. Three numbers (including the pre sent) and the year will be ended. Some eighteen thousand of our subscribers will find, printed on their wrappers cover ing this week's papers, the announcement that their subscrip tions are about to expire, and the request that they will remit for the new volume. To prevent any break in the conti nuity 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 pro spectus. 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.

## WEAT 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 inancially as it was prior to emitting said sum-no poorer should receive back the gold and silver at face value, the governnent would lose over $\$ 100,000$; for it would pay for gold and silver never returned, for precious metal not nongold and silver never returned, for precious metal not non-
existent but distibuted in the metal of cash boxes, the existent but distibuted in the metal of cash boxes, the
wood of tills, in the skin of human hands, in the threads of oood 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 fiva 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. Amorican dollars consist of nine tenths gold to one tenth similar silver alloy. It has been determined by actual experiment, con
ducted several years ago under government auspices by ducted 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 de termine 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, an reached by taking an average of all the gold coins in the are exposed, shows that each coin bears an annual loss of are exposed, shows that each coin bears an annual loss of
about 1 190C by friction. In silver the loss is supposed to be five or six times greater, owing to the more unceasing circu lation of silver than gold, and the less degree of fitness of
the metal to bear friction. At the close of 1872, a careful 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 $£ 93,945 \cdot 5$, and on the silve $£ 99,996$, or, for the entire period, the sum of nearly $\$ 2$, 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 composi tion of alloys, and to the fact that British gold coin is in rinsically 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 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 sov ereign, 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. machine of coin are thrown inco a wonderfully doncat hour with unfailing accuracy, and automatically separates the light from the full weight coins. The former go to the $\operatorname{mint}$ for recoinage, and the government reimburses the bank, the wear and tear of such coin being compensated for by Wational 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, re
duces 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 boses of correctly weighed gold, sent by the Bank of England to Scotland, frequently came back without having been opened, ard 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 precions 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 bo to show how any person, young or old, whether naturally skilled or not, may learn to drawo. 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 inolves 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; tiat they are specially adapted for leisure hours or minutes, and are intended to be made so plain that the sim plest 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 hey cannot do a better thing for their boys than to make hem 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 dercting 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 drav. Its practice quickens the mental percep tions and insensibly promotes a taste for other usefu tudies, of which many, suggested from time to time in ou 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 evint conveys a useful lesson to establishments where similar ar angements are in operation, and because it is a verification of the scientific theory concerning the nature of explosive aseous mixtures.
In this establishment, the furnace under the boilers is fed by the refuse matter of the workshops (shavings, sawdust tc.), which is swept into openings in the floors of the differ nt 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 shavinge, from several woodworking ma chines 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 suc tion, and then sends it by pressure down the iron pipe into the furnace below, performing the double function of blow ing the fire and furnishing fuel in the form of dust. When his dust fuel is not needed, the connection of this pipe with he furnace is closed, and the blast sent up through the sur ounding flue, while the exit of the dust and shavings out hrough the roof is prevented by a wire grating or screen in cupola on the roof, wherein this dust is retained. Thi cupola has to be cleaned out from time to time, the dust be ing thrown down the large brick flue. Workmen thus em ployed 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 ap. plied 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 inuminating gas is liable to explode when mixed with air in the right proportion, so will the dust of inflam-
mable material. There are already numerous examples on mable material. There are already numerous examples on
record of the same nature. Last August an explosion took record of the same nature. Last August an explosion took
place at the works of the Milburn Wagon Company at Toplace at the works of the Milburn Wagon Company at To-
ledo (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 the windows and roof, was caused by a cloud of dust of some
very fine varieties of flour being ignited by a candle. A very fine varieties of flour being ignited by a candle. A
great explosion also occurred at Glasgow, where the stones 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 th 3 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 $450^{\circ}$ Fah., a ges 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 lelow; or inflammable gas may be have been produced by the decomposition of the wood shav-
ings at the bottom of the flue, or by imperfect combustion, ings 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 forn 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 vichich ther hav 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 correspond ingly gigantic branch of commerce. The active constituent
in the hop is volatile; but a worse feature is that it is powin the hop is volatile; but a worse feature is that it is pow-
erfully acted upon by the atmospheric oxygen, which in erfully 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 thatif 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 bsen how to preserve the hops themselves. It is now announced in the German papers that C. B. Jung, a merchant in Fürth, in the German papers that C. B. Jung, a merchant in Furth, 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 and he tried nitrogen, hydrogen, carbonic oxide, carbonic
acid, etc. : and he patented his process in several countries. At last he selected carbonic acid as the most effective and the cheapest gas, as it can be made by mixing limestone or chalk and sulphuric acid. He operated thus: He loosely filled a box (lined with tin) with hops.: he brought a tube to the bot
om of the box, and by it conveyed under the hops the car om of the box, and by it convejed under the hops the car
bonic acid, which, being heavier than air, remained below, bonic 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 coples 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, proporthe country, furnishing them the measurements, propor-
tions, and all the details of construction. The ice boat is a simple machine, but its use involves some skill and is prosimple machine, but its use
ductive 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.

## $\triangle$ HINT FOR THE HOLIDAYS.

As the season for gift-giving draws nigh, the annually re urring problem, what to give, presents itself. What will affurd the most pleasure or yield the largest benefit for the oney to be expended?
We do not propose to answer or attempt to answer a quesfew instances in which a very useful, pould merely suggest a propriate gift would be a year's subscription to the ScIEN tific American.
Employers often find it advantageous to manifest their ap preciation of the fidelity and painstaking care of the better preciation of the fidelity and painstaking care of the bette
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 pieasant effect which such attentions from employers have upon the employed.
Equally happy will be the effect of such a gift upon an oung 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 as surance 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 presen
for its cost could be made to a wide-awake son of the soil. This not only for the wide range of entertaining and instruc tive scientific matter it presents, but also for the information it furnishes in regard to improvements in farming ma chines and implements, and still more in regard to the handling and care of them. To be a successful farmer to-day, a an 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 profes holiday gift to the doctor, lawyer, minister, or other profes-
sional man. Each and all of these have to do mainly with the great army of producers, of whose thoughts, labors, in terests, 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? Consid 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 attempt ig 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 inter course, a means of diversion and of instructive recreation. Is it a gift for the village schoolmaster that you are seek ing? A copy of the Scientific American will give him weekly respite from the domination of text books, tell him
n, 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 in ventions, 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 through out 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 Supplemen 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 Scien tific 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 re garding 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 light. The news, therefore, that Russia has not only reently officially applied for space through her representativ 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 produc tions, which will far exceed anything hitherto contributed y Russia to any of the great expositions heretofore held in Europe.
remariable 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 shor period of 7 hours and 45 minutes. The saw was on the nvil (being flattened, smithed, hammered, and blocked) 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, grind ing, hardening, tempering, and coolingafter 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 equired 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 etch ng 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 fulfil the purpose intended, while some of them are even
utterly impracticable. Some modern industrial establishutterly impracticable. Some modern industrial establish
ments in Germany, especially the Metallurgical Museum of Nuremberg, have undertaken the task of submitting the pro esses 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
Rudolf Wagner editor of the "Annual Chemical Technol ical Report" (Jahrbuch des chemischer Technologie), mentions in a recent German industrial journal that he found that soluions 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 preftrable 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 siuilar 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 nain sewer pipe will be prevented by the invention from escaping into the, upper rooms through the reservoirs. All
draft through said pipe is also checked at draft through said pipe is also checked at
the reservoir at each floor. We also rethe reservoir at each floor. We also represent a modification of the device, show-
ing 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 raservoir, as shown in Fig. 1, is set inc'ined so as to cause the hinged valve, $\mathbf{A}$, to rest in a closed position until such time as water may enter in sufficient $q$ rantity to lift the valve from its seat. The water then escapes, after which the valve instantly falls back to its former position, thus effectually prevonting 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 t'se 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 stceet corners. Just beneath the open ing the box connecting with a pipe, $C$ jading to the sewer, is set. This box is divided into two compartments by an in clined partition, in which the valve, connected similarly to that before de scribed, is hinged. In front of the valve aperture is a movable grating, $\mathbf{E}$, which serves as a strainer. There is also a mo vable pan, F, surmounted by another grating, G. The pan, which can easily be taken out, allows of the removal of collected obstructions, which are stopsed by the inner gratings, and thus admits of the quick cleans ing of the flcodway. The invention is simple, and could pro bably be cheaply constructed. Its use might prove an im portant sanitary precaution in localities where the sewer arportant sanitary precaution in means for p:eventing escape of gas.
p:eventing escape of gas.
Patented through the Scientific American Patent Agency, October 5, 1875. For further information address the in ventor, at Morrell's Storage and Safe Deposit Buildings, corner of Fourth avenue and 32d street, New York city.

## The Death of the Vice President.

 Vice President Henry Wilson died on the morning of the 22 d of November, oda third and fatal attack of apoplexy. Tise first stroke of the disease occurred sone two years ago. and a second attick quite recently had prostrated him a.ld aroused serious fears for his life. From the last, however, he appeared to be recuvering when the fatal visitation came and resulted in almost instant and punlees 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 humbl -st position in life. His origin was not only in utter poverts but almost in vagrancy, and at 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 jears 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 thereengaged as a shoemaker. In three years, le made seven thousand pairs of shoes and saved seven hundred dollars, which sum he determined to devote to the acquisition of a good educa tion. 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 ad vocating the election of General Harrison for the Presidency,


MORRELL'S FLOODW AY FOR WAREHOUSES.
a course which resulted in his being chosen to the Legisla tare of Massachusetts from Natick. Detailed reference to his political career,which extended from the cobbler's bench the second position in the gift of the nation, js withou State
 MORRELL'S SEWER FLOODW AY.
herein until he was elected to the Vice Presidency. His re cord in the cause of emancipation is a most noble one, and the mere history of the great reforms to which he gave un deriating 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 short ened his life had the apoplectic stroke not torminated
fatally fatally

## Rallway Tunnel under the London Docke.

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 Hawkhave been designed by Sir John Hawk-
shaw, aad are being carried out by Mr, shaw, 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 exhib. iting his curious success in this line. The insects he employs appear to be the species of flea common to dogs. The first lesson, he says, is to put the insects in a small circular glass box, where, by jumping and knocking their heads against the glass for a day or two, the idea is finally beaten into them that it is useless to jump; and during the remainder of their natural lives, to wit, about eight months, they are content to crawl. Having corrected their intellects in regard to jumping, the instructor now fastens a delicate pair of wire nippers to the middle part of the flea's body; to the nippers any desired form of miniature vehicle, such as a wheelbarrow, a car, a wagon, etc., is attached, and the flea thus harnessed trots away with the load, to the great amusement of the looker-on. The professor harnesses his insect pupils into a great variety of other positions, and makes them perform many curious and makes them perform many curious delling wheel, orchestra playing, racing, telling wheel, orchestra playing, racing,
etc. They are allowed to feed twice etc. They are allowed to feed twice
daily upon the instructor's arm. It redaily upon the instructor's arm. It re-
mains for Mr. Darwin and his conpeers 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 tion 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 tion of the principal ones, measured from solar lines that the
found to be so near the position of the difference is almost imperceptible. For four of the former difference is almost imperceptible. For four of the former
lines in an artificial spectrum, the angular distances $198^{\prime}$, lines in an artificial spectrum, the angular distances $19 \cdot 8^{\prime}$,
$80^{\circ} 6^{\prime}, 39 \cdot 5^{\prime}$, and $52 \cdot 8^{\prime}$ are given, while the solar spectrum $30^{\circ} 6^{\prime}, 39 \cdot 5^{\prime}$, and $52 \cdot 8^{\prime}$ are given, while
gives cold lines at $19 \cdot 1^{\prime}, 29^{\prime}, 41^{\prime}$, and $59^{\prime}$. We look for fur gives cold lines at $19 \cdot 1^{\prime}, 29^{\prime}, 41^{\prime}$, and $59^{\prime}$. We look for fur
ther information as to the results of M . Desains' experi ments.

## 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 fromamateur workshops all over the country. At the present time, the me. chanic 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 mical supply of the small The feature which will The feature which will, above others, commend the apparatus, in its entirety, to steam users, will be its very low cost, as we know of no other efficient engine and boiler of one horse power sold at the price of one hundred and fifty dollars.
The shupe 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 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 surmount ed above by the head, A. Twenty-nine water tubes, C , projecting into the fire space, are expanded into the portion, B. These areeach 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 en gine cylinder is $2 \frac{\pi}{4}$ inches, stroke $4 \frac{1}{2}$ inches, and about 300 rivolutions per minute are made. Two larger sizes of enrevolutions per minute are made. Ther of two and three horse power
gine, 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 lo. comotive pattern and is driven from the crosshead. The governor is the crosshead. The governor is
driven by a belt from a pulley bedriven by a belt an anley beneatly finished and fitted, and the 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 $1,200 \mathrm{lbs}$. 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 The boiler, in fact, is a stove in
itself, and might well serve to itself, and might well serve to
warm a shop besides driving the enwarm a shop besides driving the en-
gine.
The manufacturer is Mr. Ward B. The manufacturer is Mr. Ward B.
Snyder, of 84 Fulton street, New 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 oasting with complacency, but sprung up fresh, and vigor ous, from its ashes immediately after it had suffered crema tion, was tame, torpid, and quiescent compared to the ides 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 enployed, to which a revolving motion is imparted by a crank ployed, to which a revolving motion is imparted by a crank


8NYDER'S LITTLE GIANT STEAM ENGINE
thers, and is of such a diameter and thickness that its inte
rior and exterior surfaces touch the inner and outer cylinders, the places of contact preventing water from passing. . This machine was originally designed, like mos otary pumps, for a steam engine. It was patented in En


## THE MCFARLAND ROTARY PUMP,

pertory 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 en gine, illustrated on page 308 of our volume XXXI. ; and My ers obtained an American patent for exactly the same claims,
llustrated 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 enor mously expensive system of examination as to novelty, in which our Patent Office indulges at the expense of the in ventor, and which results in delaying the issue of his patent.) But referring to The Repertory of Arts for the de scription of John Trotter's invention, we stumble across an engraving of a rotary engine invented in 1843, by Thomas Cochrane, Earl of Dandonald, which is almost line for line dentical with the pump of Trotter (1805), and the fin dentical with the pump of Trotter (1805), and that of the 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 En glish Mechanic, republished our engraving of the Myer engine, and immediately Mr. E. L. Voice writes to point out that it is identi cal with an English patent issued to a Mr. Newton, in 1864, and Mr. Andrem Leighton shortly after waros claims that it was an original production of Mr . A. Higginson, of Liverpoo? 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 n that journal, page 118 August 1a, 1875. Mr. Mos heard of any oar ther heard of any other invent or of the engine or pump but merely says: "It is su perior to anything yet pro duced. I invented a n d made a model of it in 1868 . Total to date, eight invent ors of the same device, six of which (and perhay more) have received letters 1 atent.
The McFarland rotary pump is substantially the on comparing our engraving herewith with the Myers en gine alluded to above. It is only fair to Messrs. McFarland however to say that whil the other patessrs. McFariand machine appears to be doing cood port and giving, their satisfaction. But the comg good work and giving genera satisfaction. But the comparison of the following descrip ter engine, given above, will be suf ficient to establish its identity.

In our engravings, Figs. 1 and 2 are respectively a longitudinal and transverse section of one of these pumps adapted for lifts up to abou 60 feet, while Fig. 3 shows the slightly modified construction adap ted 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 diame'er 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 sid 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 ou through three slots formed to receiv them in the driving drum Th them in the dring drum. Th outer erthers arms against the interior of the casing, a shown in Fig. 2.

It will be seen from the engrav ings that, as the shaft revolves in the direction of the arrows, the driv ing drum carries round with it the arms turning on the boss of the cover, and each arm as i 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 ex plained. It will be seen on reference to Fig. 2 that, owin 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 equi－ librium．The pump thus works with but very little fric tion，and the flow is very regular．

## C゚ロtrespyoudeute．

## To the Editor of the Scientific American

The locomotive has probably attained a degree of simplici ty and efficiency which is susceptible of but little improve ment．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 me－ chanism of the locomotive precisely what Corliss has done for that of the stationary engine：with this difference，how－ ever，that the complexity of the Corliss device must be avoid－ ed in that of the locomotive，for the reason that the peculiarly rough nature of railroad work demands the utmost simplici－ ty 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（how－ ever 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 lo－ comotive，to meet with approval，must possess all the econo mic qualities of the Corliss device，name，independent ex haust 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 raiiroad men．
The greatest source of waste in locomotives is in their con sumption of fuel．Probably not one half（some say not one quarter）of the fuel used is utilized；and inventors are zeal ously 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，di－ rectly 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 ex－ cellent 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 combus tion，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 econ－ omizer 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 wate 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 thre outside cranks，and exhausting its steam into them
that direct steam could be used in all three in case of emer－ gency．Such an engine would be extremely steady upon the track，however rapid its motion．This plan would，ow ing to the central crank， $\mathbf{A}$ ，bring the center of gravity of a engine rather high．This could，however，be easily remedied by making the boiler with two barrels，B，so that the sweep 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． power would be fully as great as that of the single barrel．
I wish that such engineers as have experience with the I wish that such engineers as have experience with the
water grate would give us their opinion of it，as to its econ water grate would give us their opinion of it，as to its econ
omic value，etc．It has always seemed to me that，if proper y put in，with the tubes inclining considerably and with crew plugs opposite the ends of each tube，it would be pro ductive of considerable economy，not only as a generator of steam but as a saving in the expense of grate bars．A nine tun tank engine with a water grate has been running here on the Worcester and Shrewsbury road about a year，and it seems to work admirably．The grate tubes are about 3 feet long， 2 inches in diameter，and $\frac{8}{4}$ 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 access－ ible 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 dis turbing the coal in the fire box．This last seems to be a 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 dea for saving life from shipwrecks．I propose to run a heaved rope out on a small rocket line in the following man

er：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 commu nication 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 re olving the sheave by means of the rope，the whole can b ade to travel in either direction．

B．Frese．
Chicago，III．

## 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
 anront olume．
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 inter sections，and this line will be per－ pendicular to and will bisect A B make now $E G=E A$ ，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 othe angles will be right angles．The triangles，$\triangle G B, A G K$ etc．，being made equal，their corresponding sides must be equal；the figure thus drawn has right angles and equa sides，and is a square．
New York city．
On the Recovery of Silver from Oast Iron Orucibles． In a recent number of Dingler＇s Journal，two Vienna chemists，named Tavarsky and Priwoznik，describe the new methods for obtaining the silver absorbed by cast iron cruci bles 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 crystalizatiou of sulphate of copper．This liquor is not essily utilized in any other manner；buton putting in the iron， the sopper is precipitated，while the iron goes into solution The cement copper thus prepared，and containing all the sil ver，along with the graphite，silica，and other insoluble con
stituents of the cast iron，is treated in the usual manner for the separation of the silver．This process，however，is edious，and the amount of material to be worked is increased instead of being diminished，for 100 llss ．of cast iron yields bout 113 lbs ．of cement copper．
The late disector of the mint at Vienna，Von Schrötter proposed a method for overcoming this difficulty．The cru cibles are first broken up and then dissolved in dilute sul phuric acid without heat．To avoid the trouble of evaporat ng 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 $20^{\circ}$ B．，the iron dissolved rapidity．Wherechamber acid can be easily obtained，it would doubtless be the cheapest． Even with acid of $60^{\circ} \mathrm{B}$ ，it is not expensive，and the latter offers the advantage that the heat generated in diluting $i$ elps the reaction and hastens the solution．The iron elps the reaction and hastese the solution．The iron is issolved in wooden ressels long， 6 feet wide，and 20 inches deep，with a grating made laths，about 8 inches from the bottom，on which the piece crucible are placed．As the solution becomes more con centrated，it sinks to the bettom，and the ironis continually rought 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 $20^{\circ} \mathrm{B}$ ．By evaporation to $66^{\circ}$ B．，the green vitriol crystalizes out．The inseluble residue amounts to about 20 per cont．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 contain $1 \cdot 4$ 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 prac ticable，and that the green vitriol produced pays for thelabor In the Royal－Imperial mint at Vienna， 315 old castiron cru cibles，weighing 115，192 lbs．，have been treated in this way producing $405,574 \mathrm{lbs}$ ．of commercial sulphate of iron．The weight of the residue was $23,038 \mathrm{lbs}$ ．The poorer portion， and the residue from amalgamation，weighing $13,429 \mathrm{lbs}$ ．，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 064 per cent．The amount of silver in a cast iron crucible depends on the rich－ ness 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 thealloy 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 $83 \cdot 5$ per cent are fused will，no doubt，be more favorable．

## A New Form of Leclanche＇s Cell．

A new form of Leclanché＇s cell has been constructed by Dr．Muirhead，in which the carbon and black oxide of man－ ganese are packed in the outer case around a glazed porce lain jar perforated with holes about $\frac{1}{8}$ 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 inc is exposed，and the perforations of the jar are in no dan ger of being choked up by deposition of chloride of zinc．

## A New Theory of the Nebulx．

M．Planté has recently communicated to the French Acade ny 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 eonsist 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 ond of the positive electrode is brought to one pole of the magnet．The cloud of metallic matter carried from the lectrode 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 irregu
larities of genius，and the most dazzling success of ambition．＂ －Greville＇s Memoirs of George IV．

Market Street Bridge in Philadelphia was recently total y destroyed by fire．The loss pecuniarily amounted to bu $\$ 115,000$ ；but a large section of the city was temporarily greatly inconvenienced，owing to the breakage of the gas con nections．The Pennsylvania Railroad will shortly erect a emporary 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 illus－ trated in these columns．

## practical mechaniby.

by Joshea rosi.
Number Exxvil.
Lining out work.
For measuring purposes, the usual inside and outside calipers are employed, in conjunction with a pair of compass calipers, namely, a tool composed of one inside caliper leg and one compass leg, the use of which is to find the true center of either inside or outside work.
For making parallel lines upon shafts or other round work, we have the angle piece, shown in Fig. 168. It is

apparent that, if it is placed (as shown) upon a piece of round work, in such position that the edges, $A$ and $B$ (C being the work), will contact with the work, those edges will stand true and parallel with the work, and may therefore be used as a guide whereby to draw the lines.
Our next requisites are termed centers or center pieces, their uses being to stand in holes or between jaws, and to receive center marks or lines. For use on small work, espe cially 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 pre vious piece of work. Again, it may be necessary to first
mark a center line, and subsequently other lines; and then 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 exch 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 Vary easily and readily made, and may be used on rough or finished work If the surface of the work upon which either of these centers is used is flat, the ends of the centers must of course be also flat; and in the case of the last described, a piece of paper, leather, or other material may be inserted in one end to make up any small deficiency in the size. The center punch used for marking out should be as shown in Fig. 171, the object of making its diameter so small toward

the point being that it shall not obstruct a clear view of the line. A heavier centerpunch may of course be employed to increase the size of the centerpunch marks when the same is necessary. The hammer should also be a small one, weighing about $\frac{1}{4}$ of a lb., and having a ball face to efface any centerpunch marks erroneously marked or to be dispensed perform any necessary operation other than the simple mark ing 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 font 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 in-
stances very easily obtained. stances 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 $i t$, 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 Fig. $772 . \quad$ to the lines on $A$, we shall have re to the lines on A, we shall have re-
moved 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 tak en off one face, and then perform the whole of the marking off at one ope ration. The latter plan is prefera ble, because it gives us one true face to work from in mark ing off, and obviates the necessity of having to prevent the rocking of the work upon the marking-off table, by the inser-
tion of wedges, which is otherwise very commonly requisite. It is preferable, then, upon all work easily handled and chucked, and in which the lining off must be performed on more than one face, to surface one face before performing the marking out ; and supposing our block to have one face so surfaced, we will proceed.
We first well chalk the surface of the work all round about where we expect the lines to come, which is done to make the lines show plainly; we then place the work upon the table with the surfaced face downward; and placing a

rule alongside of $i t$, we set the'scriber so as to take off the necessary amount
from the top, as hown in Fig. 173 ( $\Delta$ 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 tand true with the square blade, as hown in Fig. 174. $\Delta$ being the mark-ing-off table, $B$ the

surfaced face of the work. We then (with the scribing block) mark, across the surfaced face of the work, two lines, 12
 inchesapartand of equal distance from the top and bottom faces of the work, as shown in Fig. 175, at A and B. Our off, on the surf aced face 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 esting upon the table, the square blade standing vertically and at the necessary dis-
ance from the edge of he block, as shown in Fig. 176, A and B being the lines drawn by the scribing block, and C C, he square in position to draw one of the necessary perpendicular lines, he other, shown at $D$, being supposed to have quare while it was turned around. Here, then, we have the lines for four of the faces, maned upon a face already sur
faced to the size, thus disposing of five out of the six faces; and since the line for the sixth face stands diametrically opposite to the surfaced face, the latter has only to be kept down evenly upon the table of the planer to ensure the sixth face being cut true: after which, and when each of the remaining four sides is chucked to be operated on, we have a true face to place next to the angle plate, and a true one against which to apply the square to test if the work is held true. Thus we find that the surfaced face of the work, when used with the face of the marking-off table and the face of the planer table, becomes a gage by which (with the aid of the square) all the other faces may be marked and cut true. It is obvious that, had either one of the faces of the work been faulty, we might have taken off it as much metal as possible, leaving only sufficient to clean up the face diamet rically 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 defec tive 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 hould be marked very true with the lines, otherwise they destroy the truth of the marking; because the machine ope rator, 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 oppo site 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 opera tion. Suppose, for example, our work had been a piece of metal 1 foot square and \& 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, wer we to face off one of the edges first, we have $\frac{8}{8}$ 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 equired thickness.

## Locomotive Steam Saver.

Mr. James Metcalfe, locomotive foreman at the Manches ter and Milford workshops, Aberystwyth, some time ago con eived 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 ipe to the injector, and so forcing it into the boiler again The question was not, of course, as to the advisability of ac complishing 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 experi ment, 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 exbaust steam are forced together into The water and the exbaust 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 invenion 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 t is put into a wide-mouthed glass bottle, well stoppered, and kept for use. It is spread pretty thickly over the tains, 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 contai ning 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 cr injury. Ordinary writingink 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, per. haps, of the extent to which the place was fired upon when I say that from a tax of 6 d . 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 contemplare clearing land daring 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, Fıg. 2 of a hand lever, D, is inserted. The front hook, C, Fig. 2 of a hand lever, $D$, is insert end of said hand lever is provided with recesses, which are strengthened by side shoul-
ders to rest and turn easily on the cross pin ders 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 ob. sarved, 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 cption. 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.

## 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. Tho 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 under stood from the description of its construction.


The sockets consist of long tubes made of a tough quality of sheet iron which extend up on the side of the top, a lit tle 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 ex hibited several of these bows to us, whicb he quite severely tefted in our presence. They stood the test of a man exerting his full strength on a single bow acrass 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 leathercovered devicas.
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 motal 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 artanhed. 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 cemplete and strong.
The invention is one of much practical utility; and it has already, we are informed, been adopted by many of the first carriage makers in the country, among them Messrs. Brew.


## HALE'S IMPROVED LEVER POWER.

ster \& Co., of Broome street, in this city. It is the subject of several patents, which cover the various improvements as the same have suggested themselves and been added by the inventor.
For further information address the manufacturers, Messrs Topliff \& Ely, Elyria, Ohio.

## 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 offected. It is well known that sulphuric acid as contaiced 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 gield of acid is better, and the consumption of niter less, than in summer time; and the greater the of niter less, than in summer time; and the greater the
chamber space (that is, the smaller the volume of gas alchamber space (that is, the smallor the volume of gas al lowed to pass the chambers in a certain time) the less will
be the consumption of niter (in proportion to the acid probe the consumption of niter (in proportion to the acid pro-
duced) 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 sul phuric acid making, Mr. Sprengel commenced to man ufacture sulphuric acid by ufacture sulphuric acid by means of what has been called pulverized or atom-
ized 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 re quired 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 heat which would ha
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 fiow


## TOPLIFF'S TUBULAR BOW SHAETS.

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 bove size, amounts to about $\frac{1}{8}$ 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 $6 \frac{1}{2}$ per cent less pyrites and with $14 \frac{8}{4}$ per cent less niter than the steam acid which was made from the same material during the two years preceding the application of tiee spray. These numbers, moreover, refer to the gield 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 betterdistributed 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 savin's in steam, acid, niter, and labor during three months a mounted to $\$ 125$ per tun of acid of 1.6 spe y mounted to $\$ 125$ per tun of acid
cific gravity, made from pyrites.
No doubt different localities, different care, acd 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 inex pensive means by which it has been attained, and the large consumption of the article which it helps to cheapen.-Chemiral Neros.

## The Slege of Paris.

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


TOPLIFF'S BOW SOCKET.
center or hub, of the building is a spiral stairway, and also an elevator, by which visitors find access to a lofty balco ny whence they look down upon the pictures, which are ar ranged upon the inner walls of the structure. As the bal dis is circular, the visitor only has to walk a $\operatorname{sh}^{n} \mathrm{r}$ 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 Pruseian army in their entrenchments around the graat city their entrenchments around the graat city,
which is beheld in the distance. Some of the scenes are quite spirited. A view show. ing the working and firing of a battery of great siege guns, by the Prussians, is par ticularly noticeable. Stauding upon the elf vated 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 hight.
by fifty feet in bight.

## A New Muclage

The Journal de Pharmacie states that if, to a strong solution of gum arabic, measuring $8 \frac{1}{8}$ fluid ounces, a solution of 30 grains of sulphate of aluminum dissolved in of 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 visitod 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 gardens, and imparted much of Batavian primness to thedesigns; and Queen Anne was never at home so much as undesigns; and Queen Anne was never at home so much as un-
der the trees of the splendid Bushey Park, which forms part der 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 $2,000 \mathrm{lbs}$. 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 giveherewith a well executed engraving of the building. "Of giveherewith a well executed engraving of the building. Of conservatories recently erected in the neighborhood of Lon-
don," 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 stemsthese, 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 ex oven palms themselves lack that freshness of aspect and ex quisite 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 in'erested in new and rare forms of tropical vegetation. Their distinctive features, too, are all the more apparent, inasmuch as they are growing among which well develod Dickonia squarrosa cyathea dealb and oll ralbata, ath ferns, such as adiantum, pteris, and asplenium, together with erns, such as adiantum, pteris, and asplenium, together with
an abundant undergrowth of other well arranged foliage plants, such as dracesnas, variegated yuccas, calkdiums, 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 coboca, the yellow-margined leaves of which, enlivened here and there with great purple flowers, had a fine effect. On one side is a tastefully rranged 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 crown 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 Ween supplied to a large cotton-spinning mill in Bolton, by W. J. Edwards, 20 Market place, Manchester. The lelt 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.
and to transmit 350 indicared 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 special Iy adapted for main driving, and has the advantage of run ning 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 becom ing 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.
Tho belt system having been in general use in the United States for the past thircy years, it is gratifying to observe that our British cousins are at last beginning to appreciate its advantages.

Influence or Season on the Skin
Donhoff calls attention to the fact that the obvious differ once 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 aver age 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 sub stance of the skin. These differences are quite as decided in fertal 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 aver age 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 corres ponding change in the diet and regimen of the parent animals is proved by the fact that they are equally manifest $n$ the young of individuals kept under cover and on the same food all the year round.

Utilization of Plaster Rubblsh.
Gaudin, Paris, patents a method of treating plaster rubbish with carbonate of soda, by which it is rendered fit fo use over again. Old plaster, even after it has been re burned, sets too quickly for use. By calcining the rubbish and mixing it with some saline solutions instead of pure water, this is prevented. Alkaline solutions are best, and of these a solution of carbovate of soda in water is the cheapest. Plaster from old walls and ceilings when thus reated 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＂Trismegis tus，＂or thrice great，translated，from engraved tables of stone long before buried in the earth，certain sacred charac－ ters 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 sub－ tle，can pass．Hermes＇wri－ tings，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 reated of rules by which the king was to govern，of astro nomy，cosmogony，and geogra－ phy，of religion and of priest－ hood，and of medicine．On the last mentioned subject，six books are known to have ex isted．Though many scrolls have been found treating on all of the above topics，the Herme－ tic writings have remained un－ discovered；and hence their very existence has repeatedly been denied，and the tradition been derid，as of tradition considered as one of the many curious myths which overhang
the ancient history of myste－ rious Egypt．
During the winter of 1872－3， Ebers，the German archæolo－ gist，while residing in the vi－ cinity 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 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 e tire work was in a state of remarkable preservation．Hurry ing to Leipsic，Ebers at once began the deciphering of his reasure；and the results of his studies are now given to the world，with the announcement that the work is，beyond que tion，one of the long．lost six Hermetie 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 ori－ gin 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 pa－ pyrus 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 en－ graving is made．The characters are facsimiles except in point of color，those which are lightly shaded being written n red，and therefore of course impossible for us to repro－ duce．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 mechod of inscribing the hierogly－ phics，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 orier to translate it，it is first necessary to resolve the hiera－ ic contractions into their corresponding hieroglyphics．This is done in the second engraving；and che 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 na－ ture 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 $\mathbf{C}$ ，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 in－ dicate the number of suns or days．Another ideographic symbol is the bee，to indicate honey．The mode of writing the weights is also curious．The tenat or unit of volume was about six tenths of a quart，and the drachme is probably the same as the Arabic dirhem，and is equivalent to 48 En ．
glish grains．The first page of the scroll opens thus： ＂The for all portions of the body of a patient．I came medicine liopolis，with the Great Ones from Het－aat，the Lords of Pro tection，the Masters of Eternity and Salvation．＇
The preface continues somewhat in the same strain throug he page．On the second leaf is found the extract given above， introduced by a kind of charm，which the physician is $t$ ear in mind while administering the doses．The following ranslation is literal
Chapter treating of the taking of meclicine．The medi cines approach．The expulsion of everything is accomplished from my heart，The expulsion of everything is accomplished
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 1 ing outstretched，＂it is curious to note that（according to Dunglison）the priestly physicians of Egypt are said by Dio orus to haveformed their diagnosis principally on the posi on 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 ac companying so－called charms，serve still further to enhance its archæological importance．It will elicit the deepest in

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


THE ABOVF TRANSLATED INTO THE HIEROGLYPHIC CHARACTER．
 terest in every civilized country and will，we trust，give new lif to the science of Egyptology from the study of which，and from the revelations which ye may be expected from the an cient tombs of Egypt，it may be hoped that a clew will be foun to the rediscovery of those art 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 coun ries may have been to develop the great mechanical discoverie f the century，$i t$ is to England hat those discoveries are main y due；and our riches have been erived as much from the geniu and patient intelligence of men like Stephenson and Faraday，as from our stores of coal and iron． But until recently manufacture and machinery were regarded very much as outlying province of human energy，which migh be left to take care of themselves． They brought wealth to th （1）country and fortunes to individ no more a matter of general an crn than ore now seconized as a lind of public care；and even in his public care；and an in his pacity of Foreign Secretary，Lord
Derby was inviled at Mancheste to treat them as of primary im portance．Without going the length of Dr．Playfair the othe day，and treating the natural sci
On the medicines．Beginning：I think of the time when Horus and Set were conducted to the great Hall of Heliopo－ is，so that counsel might be taken on the Hodes of Set and Horus．＊＊Words which are spoken on the taking of me dicines in their regular order，and frequently．＂Then follow the extracts above，and some more recipes of which the fol－ owing are specimens：＇＂Caraway seed，$\frac{1}{8}$ drachme；goose fat， 1 drachme；milk， 1 tenat．For sick bowels，the same：Pome granate seed，$\frac{1}{8}$ drachme；sycamore fruit，$\frac{1}{8}$ drachme；beer， 1 tenat．＇
Ebers translates but two pages literally，and gives a sy oopsis 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 accu－ mulation of urine and diseases of the abdomen；＂the book of the eyes；＂medicaments for preventing the hair turning ray，and for the treatment of the hair ；on forcing the growth f the hair．salves for strencthening the nerves，and medi cines for healing thenerves；medicine for curing diseases of the tongue；medicines for the removal of lice and fleas；me dicines for ears hard of hearing；＂the secret book of the hysician；＂＂the science of the beating of the heart；＂and ＇the knowledge of the heart，as taught by the priestly phy－ ician Nebseeht．＂
The difficulties in the path of the translator in the shape technicalities are of course very great；and probably for his reason，he reserves the complete translation of the book or future publication，when it will be issued with notes， tc．，obtained by further study．One extract is given，how ever，to show the general style of directions to the physi cian．It reads as follows；
＂Rules for the re－lcet，that is，suffering in the pit of the tomach．（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（let）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 com plaint，sepu pu $n$ merest．Then make thyself a remedy ac－ cording to the secrets in botanical knowledge from the plant pa chestet and from scraps of dates．Mix it and putit in wa or．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（？）
onces as almost a substitute for all human culture，it is evi dent that，as a matter of fact，all culture is being brought to bear upon them，and thatthey are absorbing energy and attract ing thoughtin every sphere of life．In view of this remarkable revolution of thought，one is a little provoked by the very mat－ ter－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 never－ theless something of a reversal of theorder of facts．What has made labor dear in England？Above all things the in－ vention 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 tage of their development at which they are concentrating heir energies on asserting the dominion of intelligence over Nature．It is this which is implied when we call the pres－ ont a mechanical age．

## New Route to siveria．

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 In－ dustry $M$ ．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 re－ gular 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 leat last year，has signified his intention of being present to welcome Professor Nordenskjold on his arrival in St．Peters－ burgh．

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．

Fecent gaterican aud forelgu zedents.
NEW WOODWORRING AND HOUSE AND CARRIAGE
BUILDING INVENTIONS.
improved scroll sawing machine.
Lemuel C. Pratt, New York city.-By a simple and cheap contrivnce, this invention gives sufficient forward and back motion to a at the cutting point, so as to cut more evenly than such saws now o. The invention is specially designed for simple and cheap saws for boys and amateurs.

IMPROVED END GATE.
Edward G. Martin, Kankakec, 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 edge and swung outward to dump the load, and it may be readily attached and detached. Devices are added to prevent the rear ends the pressure of the load.

IMPROVED CHIMNEY COWL.
Theodore C. Nativel, San Jose, Cal.-The ventilating cowl is formed of two parts or cylinder flues, one inclosed by the other. The or support for the section of the outer flue, leaving air passages beor support for the section of the outer flue, leaving air passages between. Theng 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 conwire netting wound on rollers and held by clamps. It is so constructed that it may be readily
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.
improved bung and vent
Harry B. Cornish, River Falls, Wis.-In this we have an improved time the bung may be easily removed, and air is freely admitted through the bent device without necessitating the unseating of the through the bent device without necessitating the unseating
bung. It is a useful device for barrels containing liquors.

## NEW HOUSEHOLD ARTICLES.

improved venetian shade.
Charles Widemann, New York clty.-The new feature in this in vention consists in rods which are attached to the under side of the oottom 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 maj 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 at taching the handle of a sadiron, the object being to enable the use implement more convenient to use. On the iron are two notche 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 James M. Blood, Denver, Co. Ter.-This consists of a journaled iecting 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 of the spring. 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 of which is so adjusted as to balance and

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 a 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 intermediat 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 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 rollersmay be altered at a trifling expenso to suit the various sized windows.

IMPROVED YEAST COMPOUND.
Jacob Pfeiffer, Brooklyn, N. Y., assignor to himself and Pau Koch, of same p:ace.-Mr. Pfeiffer suggests a new compound whick, he statep, 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 IAMP BUINER.
John H. Houch, Sauk Center, Minn.-In this an inclosing shell is John H. Fouct, Sauk Center, Minn.-In the 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 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 apertures is such that a portion of them
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 polc of a 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 trengthen the midale part of the yoke, and to keep the device from slipping out of place

MPROVED 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 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 sit-
ting in his seat; and by suitable means, also, the plows are lifted up ting 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 and supported above the ground when being moved to or from the
fleld to be plowed. Plows of this description, the inventor claims, forms, and the width mar be a given force than those of othe right or left, for which it is contrived, and which has a fastening de vice 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 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 gradattached to it. By the
ually heated and boiled

IMPROVED MOWING MACHINE.
Andrew G. Gray, St. John, Can.-The novel features in this mowing machine are ingenious devices wherebs 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 will enable the cutter
with the drive wheels.

IMPROVED CORN PLANTER.
Wilson Gardner and George L. Hays, Piketon, Ohio.-This is ww and useful agricultural implement. The construction of the feature in the operation, however, consists in the adjusting of a ropping device so as to bring the points of rimless wheels in line with the marks left by said wheel during a previous passage, where y 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 onstructed so that it may work at any desired closeness to the row plants, or at any desired depth in the ground, or for use as an
rdinary 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 egeily op erated and controlled.

IMPROVED POTATO DIGGER.
David J. Roush, Syracuse, Ohio.-By the advance of this machine wo polygonal wheels carrying radially disposed curved fingers ar otated. Said fingers enter the ground and remove the potatoes, which pass to screens between the rows of fingers, where they ar which is vibrated to free them from patioes also fall upon a screen, to a receiving box, from which they are subsequently removed oonsiderable ingenuity has been expended in the mechanical con struction of the mac
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 ll vehicles of a heavy draft. It consists in the particular construc from one end to the other of the car, and is mgie arawbar extend 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 xles of the car, which gear wheels are laterally adjustable thereon, that, when the traction of the horse in starting is brought to ear on the drawbar, the gear wheels are made to revolve, which Wheels, being nearly of the same diameter as the supporting and avoid the sudden strain which is so objectionable.

IMPROVED VISE.
Alexander O. H. P. Sehorn, Murfreesborough, Tenn.-In this rise, the use of screw threads is avoided. Instead, spring jaws ar set screw, by which the jaws are instantly and rigidly adjusted.
improved millstone dressing machine.
Gustav Heydrich, New Ulm, Minn.-This invention is designe even manner. It consists of a series of adjustable and recessed hisels, operated by a revolving shaft, which is hung in vertlcally adjustable bearing, and provided with spirally-arranged cams. Th
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 o any suitable hight without taking up space in operating. It is by a cord and pulley in grooved posts, and are folded into a base box set in.
the gate.

MPROVED 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 before removal. It bensecured on the bale after compression but catch at the end, for the purpose of tightening the bale band, the aspen by a peight and provided with a claw, so that it may be elevated out of the way or drawn down when

## 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 rain and terminating in an eye, through which the eye that engages the hook passes. The brace is thus supported, and the eye 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 eide pieces folded in gusgets and pockets, and connected a
the edges. The advantages are simplicity, durability, and cheap ness.
Heinrich Voltz, Cincinnati, Ohio.-This inventor has devised an mproved 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 with molds are made allic guide frames, and are retained by strong binding springs.

IMPROVED SHIRT.
Clinton M. Ball and John C. Ball, Troy, N. Y.-This shirt bas the eck band attached to the body only ar back of neck opening, and attached at upper edge only to front of neck bana ront, 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 reces ormed in the rear edge of its outer part to receive the end of the ongue of the buckle. The advantage of this is that, when th buckle is applied to the hip strap of the harness, the horse's tail, When switched, cannot catch either
buckle, or upon the end of the tongue.
IMPROVED CRACKER SHOW CASE.
Casper Kroeger and Werner Kroeger, Milwaukee, Wis.-This is a atachable show or sample box, provided with a glass front, and having hooks for attaching it to the fronts of the box or case con ents are bulk of the material on sale. These sample compart ronts of the cracker boxes, they make a handsome appearance. IMPROVED DENTAL FILLING.
Lyman W. Sutton, Jr., Jersey City, N. J.-Dr. Sutton proposes ystalized metallic tin as a new dental filling. The metal is ob tained, by a suitable chemical process, in spongy crystals, which
are very plastic and condensible. The completed flling takes a are very plastic and condensible. The completed illing ta
fine polish, and is said to resist both corrosion and abrasion.

IMPROVED PORTABLE VAPOR BATH.
George Washington Brosius, Gallatin, Mo.-This is a box comosed of a bottom board, top boara, and four sides, consisting o om are fastened together by hooks and eyes, so as to be readily pu ogether and taken apart. Within are convenient arrangement or 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 wate scape. The object is to use metal for its smoothnessand capability make eharp angles, and at the same time to have the lining so tha wir IMPROVED MODE OF CURING MOSS.
Peter Unsworth, Algiers, La.-This inventor suggests a new pro of caustic soda to which sumac, fustic, japonica, burnt umber, and opperas have been added. In this way gray moss that has bee eadened 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 constructa picket pin which may easily be inserted in the ground without the necessity of hamonstrua which shall have a firmer hold when set, this inven he upper end of the shank is also bent to form a handle for hold The upper end of the shank is also bent to for

MPROVED PAPER BOX
Felix Salomon, New York city.-This invention consists in bind gig the edges of the paper boxes with metal strips, and soldering he bores to resist wear better and to retain their shape longe The inventor says that the improvement renders pasteboard boxe almost as stiff and as strong as wooden ones.

IMPROVED RECOIL CHECK FOR GUN STOCKS.
William D. Miller, Pittsburgh, Pa.-This inventor proposes to rovide 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. rer 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 or operathg the scr the lamp for the leather into place for drivi he tacks for securing the edges of the leather, and for drawing said tacks.
mproved metallic burial case
Herry M. Gray, San Francisco, Cal.-The novel feature in this . 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.

Zusimess and tertsoual. The Charge for Insertion under this head is One Dollar a Line. If the Notices exceed Four Lines,
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titement. Adarese Union Iron Mills, Pittsourgh, Pa., for 11thograph \&c
" Pantect," or $U$

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Company, 57 and 88 Park Row. New York.

A. J. W. can harden tallow by using the A. J. . . can har vol. 24.-J. K. can preserve
the recipe on p. 22a,
wo od from decay by the process detailed on p. 319 , wo गd from decay by the procoss detailed on p. 319 ,
vol. $31-$ A. F. will ind a description of the hydro-

(1) J. B. asks: Is there any chemical that
will cause the hair and fleshings from hides in a tanners 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
teim applied to the resistance of electric force or measurement thereof? A. It is a unit of resist.

ance 2 . How long will the Danieli battery work, | if freely supplied with sulp pate of copper, with a |
| :--- |
| uniform force? $\begin{array}{l}\text { A. That depends upon the size of }\end{array}$ | uniform foree? $A$. That depenens upon the size of

the cell and the amount of current which it gives For cell and the amount of current which it gives. for about four months. 3 . How long can they be
used before the porous cups need to be rent used before the porous cups need to be renewed?
A. The porous cup may beused, with care, foryears A. The porous cup may beused, with care,foryears.
4. What is the power of D Daniel's compared with Li Wokwood's batery? A. Precisely the same. The
Lockwood is ouly a modifed form of the Daniell. Lockwood is ouly a modified form of the Daniell.
5. Does not the Daniell require the least care, and 5. Does not the Daniell require the least care, and tical purjoses? a. No. There are other forms

(3) W. B. W. asks: What chemicals poseess the property of destroying and disintegrating vegetiag metals, as acids do? A. We think that
stroying stroyng metala, as accad do? A. We think that
strong potash 1 ye in contact with steam at a high sull.
(4) G. B. R. says: I am ex perimenting with
electricity, and I I have made an electro-magnet; but passing the current through it makes both poles north or both south, according to the direc-
tion of the current. Has such a thing been done tion of the current. Has such a thing been done
before? A. Nothing of the kind bas ever been efore to our knowledge
(5) A. K. asks: What kind and number of laying the wire between the bricks and plaster of the wall? A. No. 18 copper wire covered with
guta sutta percha and enclosed in lead.
(6) W. B. B. asks: 1. Does carbonic acid diameter, cratate any damage, such as a dangerous explosion, if suddenly liberated? A. Yes. Atthe
and 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 remain
ing portion of the liquid that the temperatur the latter is reduced to such a degree as to convert ic int the solid snowlike form. This sudden and extreme reduction of temperature causes a
corresponding contraction of the glass tube, 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
theabove tube to $300{ }^{\circ}$ Fah.?
Does it increase the pressure in the tube? A. It would enormously in
crease the pressure. 3 . What is the effect if the crease the pressure. 3. What is the effect if the
tube be placed in a cold mixture, say one of $0^{\circ}$ 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 press-
ure in tubes for a number of years, provided they are in tubes for a number of years, provided the
are tight? A. Yes. 6. Does it remain heated af
A. ter itis compressed in tubes, or only during com-
pression? A. Only during compression. It rapdily gains the temperature of the surfounding
(7) H. S. asks: What will take grease out of sheepskins arter 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 vaporate, leand in a hor
(8) W. E. G. asks: 1. In a line of telegrap nuch restance ling, work coils? A. About woo obms. 2. How many cups of
battery will be required if the wire is No. 8 and battery will be required if the wire is No. 8 and
has two relass, each measuring 125 ohms? A. About 24 of Daniell's cells. Your telegraph, (9) H. H. asks: What produces the bri Hant coloring of the autumn fuliage? A. The ac tion of orga
the leaves.
(10) F. asks: 1. Do the Chinese know the
secret of welding copper? A. Yes. 2. Do they nake copper edge tools? A. We are not informed on this point.
After kalsomining, is thereany known chemical (combinable with the kalsomine) that will not wash
off when water is applied? of when water is applied? A. We do not know
of anything that can be applied that would not, in
(11) H. G. asks: What
(11) H. G. asks: What will remove grease $t$ in benzine or chloroform.
(12) W.H.G.asks : Can the aroma of Havana tobacco be taken from the stems? A. Yes, Crus them and digest for some time in hot water. Then decant the liquid and digest a second time with a
ittle diluted alcohol, and fnally remove the resilittle diluted alcohol, and Anally remove the resi-
due and carefully dry it. If it is desired to extract dhe nicotine, evaporate the decanted liquid to a rupy consistence, and then agitate with time. The alcohol, undertheseconditions, willextract all of the nicotine salts from the aqueous so-
lution, and rise to the top,forming a distinct layer lution, 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 etber össolves the nicotine and som 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 etherial solution is decanted into a retort prothe etherial solution is decanted into a retort pro-
vided with means of transmitting dry hydrogen through it. Heat is now applied, and the ether is
driven oft. When the ether vapor riven oft. When the ether rapor ceases to come
over, the temperature is raised to $356^{\circ}$, when the over, the temperature is raised to $350^{\circ}$, whe
nicotine itself distils over and is collected.
(13) W. J. S. asks:
to
force linseed ould it be beneficial and hubs of buggy wheels, after the spokes are driven, to prevent the natural shrinkage, which

(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 on suct spring in water and blazing off in oil in the usual manner
(15) E. W. H. says: 1. How is the dial of a aate the dial graduated? A. It is usual to gradof wire are used for the coils? $A$. The size of wire should be selceted with regard to the currents to be measured. No. 18 or 20 will be found
convenient we think. 3. Are there not 2 coill alfferent sizes of wire? A. Some galvanometer are made with several colls 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 shnwn in your sketch appies to the
(16) G. A. B. asks: What is the object of making soldering itons square instead of round?
(17) N. W. asks: What do you consider the most nearly correct theory of the earth's daily revinion on its axis? Whence comes the mo-
tive power? 4 . The earth perists in its motion or the same reason that a stone does after its eaving the hand whichthrows it, or as a railroad train will run several miles, by the motion ac-
quired, 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 haif a mile, less distance than haif a mile, atter running at
ligh speed. The motion was given to the eartb 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 resisi ing obstructions, which keeps the motion up.
(18) J. B. F. asks: Of what ingredients should a composition be, for the ornaments for tove plate and similar light patterns? $\begin{aligned} & \text { A. Use a }\end{aligned}$ soft alloy. See p. 91, vol. 30 .
(19) J. T. M. asks: Would a small tube made or canvas dipped in hot parafin answer as a texible pipe to convey hot and cold water? $A$.
No. 2. What would answer better?
A. Leather
hose. $\begin{aligned} & \text { (201 J. P. asks: What is the generally ac- } \\ & \text { cepted explanation of the reflection of ras }\end{aligned}$. eepted 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 forma tion of the rainbow, etc.? A. The reflection from the inner surface of a transparent medium is simlar to that from the outer surface. Observation and experiment huve proved that it is a universal law that, when light passes from a dense into fected In such a direction a that the anglesof reffec tioctod in such a direction that the angles of refiec surface between the two medio is perfectly eve It acts like a mirror, and the smooth surface of still water is as good a reflecting mirror for the ishes under it as for men above, of which fac you may easily satisfy yourself by observing an aquarium. A piece of plate plass will also con-
vince 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 be come separated when the light is made to rall drops in the rainbow are not due to this reflection but to the refraction of the rays when they ente plaration of this we refer you to any modern text ook on natural philosophy.
(21) J. H. asks: What difference will it sufficient throw to allow a full opening of the ports? At present the valve opens the ports ex-
actiy actly one half. A. She will take a larger supply
of steam at the beginning of the stroke, and dean the bling of the strike, and
(22) E. P. W. asks: Do you know of any hemical that can be used to permeate or saturate hard or soft wood, to render it impervious to wa-
ter, and prevent swelling when submerged thereth? An exterior coating is not desirable. A. Boil he wood in parafinn.
(23) M. asks: How fast should the edge of a crircular sheet iron disk run, for cutting wrought
iron ? $A$. Ten or twelve thousand feet per minA. Yea.
ute.
Should

Should the flues of a boiler be caulked when
(24) W. B. D. says: I hive used black oil in boilers, and found it very good to remova
soales. Has it any bad effect on the iron?
(25) W. H. says: In your issue of October 16 are figured several boring tools. These form or she to be required in a deepand proportionately smal olole, I see no excuse for making such tools, save
habit and example. The common form of boring ool affords an example, almost unique, of universal perversity and failure to recognize a very
imple situation. Those tools, if properly formed might have elght times the strength of shank and still enter a hole equally small. It is simply ne cessary to form the tool oo that the cutting edge
is on a level with the axis or center of the shank
or bar. I send thre wooden models of boring
tools, one a thread tool. A. Were elther 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 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 $1 / 8$ inch is but some $\frac{3}{16}$ in thickness, while another whose whath should be $3 / 4$ is but little more than $\frac{16}{16}$ 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
$400^{\circ}$ or $500^{\circ}$ Fah. ? A. Because when the piston rises, the water boils, and the pump barrel is filled Why is lead given to a valve on the steam enine A. Generally, in order to wake the reciprothumping, as it is usually termed.
(28) N. S. asks: I have a boat 30 feet lovg ong and of 6 feet beam, displacing about 100 fee
of water. I have 36 two inch steam pipes 39 inch es long, connected by a 3 way piece so that the wa ter 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 or two 3x6 engines running on quarters? What boiler may be obtained frer small, but it may answer for a moderate speed.
(29) C. C. says: I have a small boat 19 feet 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 $31 / 8$ bore, upright, and cuts off at $\$ 4$ stroke. The boiler is horizontal, 4 feet long (besides the bon-
nets); it is of $1 / 4$ inch iron, with a dome 22 inche high and 1 foot in diameter. It has one flue 12 nches in diameter, in which the fre is built; and there are 6 return tubes varylog from 2 inches to make the grate $23 / 8$ feet long and as wide as the want, and what should the a sitch and wheel do 1 want, and what should the pitch and number of
blades be? A. Use a proveller 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
Yes.
(31) B. L. says: A friend of mine says that in ringing a bell, he has frequently got it into such 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 besond be weight of his body is due to the resistar ce a hich says that this is not so, as he moves bis body too slowly. Will you please settle this question ? A
We thing We think sou have the right idea, as we under-
stand your statement.
What is the meaning of nominal power of a steam engine? A. It is power rated by an arbitrary st
ditions.
(32) F. B. says: I. I intend making a fouroar 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 tip ping? A. To be perfectly safe from tipping, it will require to be very broad. If you want to rood examples in racing shells. 2. What must use to make it waterproof? The canvas must not 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 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 der with a long diameter, ora long cylinder with short diameter? A. The reply to your frst ques ion answers this also.
(34) F. K says: Our main water pipes are
21/inches inside, and our fire plug 2 inches. What 2yinches inside, and our fire plug 2 inches. Wha
ize of hose should I have to throw a stream of wa ter to best advantage? Would you advise me to
to have gum or leather hose? A. Use $21 / 9$ inch hose 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 urface on cast iron? A. Two or three ordinar Bunsen cells. 2. What size of Sme e's cell will it equire to finish the plating on the same surface A. One large Smee. 3. How long does it take to
(36) R. F. B asks: 1. How many cable ouch 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 Not 1 . sydney, and one at Tor Bay, Nova Scotia. 3 . Where can I get information in reference to the States coast survey charts.

## December in，1875．］

（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 when used in an engine expansively，air will not give the same resuits as steam，as，for want of
elasticity，the pressure will fall off much more ra－ team．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 bave no means of making anything like a respectable test， emperature pansion，there will be little difference in the two cases．You will find formulæ for the expansion in answer No．14，August 21， 1871.
（38）P \＆K．ask：1．Are bored wells from 6 account of having too little reservoir？Does not the cost of boring wells nearly equal that of tha ordinary method of digging？Is drilling a six inch hole in hard rock impracticable for wells，inas－ much as it costs too much？A．We think that some of our readers，who have had experience in fully than we feel able to do．We hope to hear from them．
（39）J．T．W．asks： 1 ．What strain or pres－ s 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 en－ gine with a cylinder of $11 /$ inches bore and 3 inch－ es stroke？A．It would run the engine，but would
not do much work．
（40）L．W．F．asks ：1．Are vernier calipers A．Before．2．Are they secured by rivets or ta－ pering pins？A．Rivets．
（41）M．H F．asks：What is meant by cush－ ioning as applied to steam in an engine？A．Cush－ ioning takes place when the exhaust port is closed
before the piston reaches the end of the stroke， before the piston reaches the end of the stroke，
which leaves some steam in the cylinder，which the wiston compresses like a cushion
（12）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 s
typers put white lead in the composition．
（43）G．H．M．asks；How can I attach can－ as to the leather side of tanned lamb skins？A． Try
（44）J．F．asks：1．Which is the best non－ conductor of heat，wood or plaster of Paris？A． it has been dried？A．No，unless it is great．
（45）McC．T．\＆Co ask：Is exhaust steam grate bar ${ }^{3}$ ？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 crack－ ing 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 by dissolving pure
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 trialsi 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 theglue water，and adding alcohol afterwards；but theglue
thickened up and would not combine with the al－ 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 vine－ gar，wine，and other liqui
interior with hot paraffin．
（49）O．S．asks：I stamp embroidery pat－ pattern which I wish to copy，and then trace the outlines on the paper underneath by pricking
through the pattern with a flie needle．I then re－ through the pattern with a fine needle．I then re
move the paper，and place it on the cloth which I move 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 pow－
dered，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 re placed by a clean piece，after which a hot iron is run over to melt the rosin in to the cloth．So far I have not been successful，as the pattern rubs off bofore I can get it worked．Will you tell what to put in the powder to make it stick ？A．As a sub－
stitute 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 irron．
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 flucric acid is used forthis 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 hydrofuoric
cid is often used in the gaseous state．A leaden
ray is partially flled with the powdered fluorspar and over this is poured the hot oil of vitriol．Th plate of glass，previously prepared，is then secure ver the dish tightly，and the gas，as it is libera ed，exerts its peculiar corrosive action on the un－
（51）W．C．J．asks：Do you know of any wind is applied as a motor？A．No．
（52）J．V．R．says：I have a quantity of made wine，that has fermented in too warm place，and has consequently become somewhat
acid．How can I correct it without injury to it avor？A．The free acid may be neutralized by addition to the wine of the proper quantity of bi
（53）C．A．W．says：1．I have some bits of gold which I wish to melt up ard cast into dif erent shapes．Can I melt it on a common forge or old in a small black lead crucible with a littl borax，and subject it to＇a very bright red heat for some time，or until complete fusion ensues． Can I pour it best into a charcoal mold？A．No． Molds made of iron slightly waxed or greased ar used for this purpose．3．Do I need a flux？A．
Yes．4．Will silver admit of the same treatment？ 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 quan－ tity 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 $S \in a$ ？A．The
solid matter is $21 \cdot 722$ parts in 100 ，nearly all of the solids being salts of sodium，magnesium，lime，
（55）J．B．S．asks：Why was it that，in es－ tablishing a uniform gage for railroads， 4 feet $81 / 2$ inches was chosen instead of 4 feet 8 or some
other even number of inches？A．The first rail roads were constructed for coal traffic，and were of the same gage as the colliery tramways， 4 feet $81 / 2$ inches；and the latter are so old that no one can now tell why this width was chosen．
（56）E．D．P．asks：1．What are the melt ing points of gold and silver？A．Gold melts at and silver at $1873^{\circ}$ ．
（57）R．P．G．asks：By what process is co－
coa nut oil obtained？A．It is obtained from the cocoa nut，either by expression or decoction．It is of a flne white color，liquid at $80^{\circ}$ Fah．，and of the consistence of lard below that point，becoming
solid at about $40^{\circ}$ ．It is used for making toilet soaps，and is sometimes employed medicinally in cases of consumption．It must not be couround－ ed with cacao oil or butter，
the cacao or chocolate nut．
（58）C．A．K．asks：1．Am I right in be－
lieviog that coal is formed by the decomposition lieviog 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 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． perfect．
（59）W．J．H．says：We have lately put up runging a few for re－sawing lumber．After 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 16 gage should be run on a wheel 6 feet，No． 17 on ameter．This is a good rule to act upon，butan extra tough saw of No． 16 gage may run success－ fully 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 fle or sharpen to acutean
of Pa．
（60）A．S．T．asks：1．Please tell me the best way to temper tooth chisels for cutting mar－
ble．Harden at a bright cherry red in a mix ture 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 rosinand beeswax，then draw to the proper color．The above mixture will harden without flre－crackiug．
2．Does filing thetooth hurt the steel ？A．No．－J． 2．Does fling
E．E．，of Pa．
（61）J B．J．says，in arswer to D．A．R．＇ bar：If the iron bar is firmly fixed at one end，and the load applied at the other，then $\mathbf{W}=\frac{\mathbf{D}^{2}}{\mathbf{B}} \times k$ ，in
which $D=$ depth of bar in inches，$B=$ horizontal to $b$ beadth in inches，$l=$ length in feet from support to c anter of weight，$k=536$ for east iron， 598 for wroughtiron（mean of 4 authorities，varying some－
what with quality of metal and manufacture）， $\mathbf{W}$ $=$ breaking weight in lbs．In the given case $\frac{4^{2} \times 1 / 2}{7 / 2}$ $\times 538$ or $598=3,752$ cast and 4,186 wrought iron，when （ ${ }^{2}$ horizontally，then $\frac{(1 / 2)^{2}}{3 / 8} \times 536$ or $598=6123 / 4$ for cast or $683 \cdot 4$ lbs．for wrought iron．For safety，one （62）$J$ a
（62）J．G says，in answer to F．B．＇s query
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 imposible case） such a distance in a straight live during the fall of the ball that the direction of the earth＇s attraction
couid no longer be considered parailel during this time，the ball will not strike the same point of the floor as when the train is at rest，nelther will it do so if，during the fall，the train changes its motion
either in direction or velocity．

## COMMONICATJONS RECEIVED．

The Editor of the SCIENTIFTC AMERTIAN ac mowledges，with much pleasure，the receipt of original paper
On an Air Locomotive．By F．G．W．
On Diphtheria．ByJ．W．H．
On Imaginative A．
On Speciflc Gravit
On the Mechanical Equivalent of Zinc．By
On
．M．P． 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．
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 may conclude that，for good reasons，the Edito declines them．The address of the writer should always be given．
Enquiries relating to patents，or to the patenta bility of inventions，assignments，etc．，will not be
published here．All such questions，when initial only are given，are thrown into the waste baske as it would fill half of our paper to print them all； but we generally takepleasure in answering briefly by mail，if the writer＇s address is given．
Hundreds of inquiries analogous to the followin are sent ：＂What is the value of dry extract of ble glass？Who has a steam process for drying lumber，aud will furnish particulars？Who make a picture frame mitering machine，working two
knives？Who sells self－rocking cradles？Wh nakes the hest air pump，and what is its capacity Who makes cotton spinning and weaving ma chinery？Who sells steam pumps，suitable for irri Whosells twols 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，sub
ject to the charge mentioned at the head of that column．Almost any deaired information can in column．Almost any desired inforD．
this way be expeditiously obtained．
［OFFICIAL．］
INDEX OF INVENTIONS
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Cock，compression，P．White．．．．．．．．．．．．．．．．．．．．．．．．．．．．．．．．．．．．．．．．．．5977
Coke oven，B．Altken ．．．．．．．．．．．．．．．．．．


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| combined，G．Croll． |  |
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Signal, switch, J. Imray
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Smoke house, C. D. Harb
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Swing, rotary. I. N. Forrester.
Table, knockdown, F. P. Jeaver
Table leg, adjustable, J. H. Balsl
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Tool-grinding :uachine. M. L. Mowre Toy building block, E. U. Kingey. Toy money box, C. C. Johnson
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Treadle for machinery, A. N. H
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## DESIGNS PATENTRD.

8, itio.-CArpers.-J. Barrett, New York city 8,771.-SASL PuLLEYs.-G.A. Blake, New Haven, C 8,772.-Door Knos.-B. Mallory, New Haven. Ct.
8,773 to 8,775.-OIL CLoti.-C. T. Meyer et al., Bergen, 8.776. J. J. 8,7in7-Tobacco Pipe.-L. Nax et al., Philadelpha, Pa.
8,778, 8,779.-Sodi WATER APPARATUS.-F. H. Shep8,778, 8,779.-SODA WAT
herd, Boston, Mass.

${ }_{8}^{8,78.2}$.-Prano Frame.-C. F. Stelnway, New Tork city. 8,783.-Flowkr STAND.-H. P. Roberts, De Ruyter,N.Y.
8, $784 .-$ Metal Truni Coverina.-A. V. Romadka, Milwaukee, Wis.
8,785.-WATCII CiAIN.-E. Barrows, Attleborough,Mass. 8,786.-Chain Link.-D. A. Beam, Newark, N. J. 8,787.-SLiow Case.-W. H. Grove, Phlladelphta. Pa.
8,788.-SATCHEL HANDLe.-G. O. Monroe, Newark N. 8,788.- SATChrl Handle.-G. O. Monroe, Newark N.
$8,789$. CLock CAses.-H. J. Müller, New York city. 8,790.-LIFTER HANDLE.-J. M. Read, Everett, Mass. 8,771--HANDLE BABEs.-W.M.Smith, West Meriden, Ct.
8,792.-RADIATOR PIPEs.-G. W. Walker, Malden, Mssa


## CANADIAN PATENT8.

Libt of Patrante Grantied in Carada, November 8 to 12, 1875.

5,317.-S. T. D.
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5,318.-E. Brader
of hemlock bark. Nov. 8,1875 .

5,350.-J. Fairburn, Upton Station, P. Q. V
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5,351. - C. $\mathbf{w}$. B
5,351.-C. W. Baldwin, Chicago, Il., U. S. Duplex hy-
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plying oil to lamps, etc. Nov. 9, 1875.
$5,351 .-\mathrm{F}$. . Glanz et al., Buffalo, N. $\mathbf{Y}$
$5,351 .-$ F. M. Glanz et
molding machinc. Nov. 9,1875 . 5,355.-R. Willson, Ithaca, N. Y., U. s. Horse rake. $\underset{\text { 5,356.-L. }}{\text { N. }}$. ${ }^{\text {Nov. }}$ Gr
5,356.-L. D. Green,
pump. Nov. $9,1875$.
pump. Nov. $9,185$.
5,357.-H. F. McKervey et al.
Carcoupler. Nov. 9,1875 .
Car coupler. Nov. 9. 1875 . Cheboygan, Mich., U. S.
5,358.-J. W. Brooks, Boston, Mass., U. S., et al. Ma-
chine for trimming heels. Nor. 11, 1875., chine for trimming heels. Nov. 11, 1875.
$5,359 .-$.I. W. Brooks, Boston, Mass., IT. S. Hecling
 ror attaching :and trimming heels. Nov. 11,1 isi5.
S, :Bi.-A. IIomes, IIamilion, Ont. Churn dashe

|  | 5,362.-A. J. R. Philips el al., Fuld |
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| 169,680 | 5,864.-E. W. Johnson, Foreston, M., U. cleaner. Nov. 11, 1875. |
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|  | 5,372.-A. Poppenhusen, College Como. Nov. 11, 1875. |
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|  | 5,374.-J. W. Dixon. West Manayuok straw, etc., paper pulp. Nov. 12, 1 |
|  | J,375.-E. Bazin, Paris, France. |
| 14 | from foundered vessels, etc. Nov |
|  | 5,376.-A. Riddell, Guelph, Ont. Su pamp. Nov. 12, 1875 . |
|  | 5,377.-J. D. Gould, Boston, Mas |
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|  | 5,378.-D. Kearney, Montreal. P. Q. alarm and extinguisher. Nov. 12, 1875. |
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| ,617 | 5.380.-J D.Hobbs, Northfle |
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