SCIENTIFIC AMERICAN

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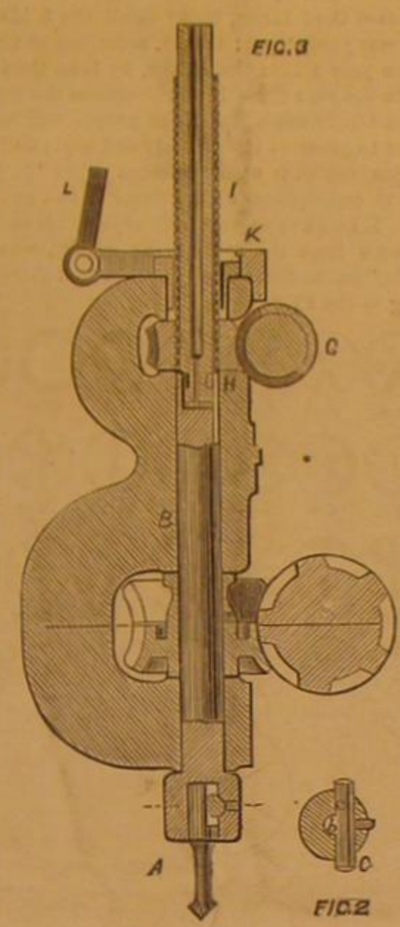
MULTIPLE DRILLING MACHINE.

The advantage of drilling the rivet holes in wrought iron structures, instead of punching them, has long been recognized by engineers, and the same is true of steel, where the gain in tensile strength is about 25·5 per cent. The illustration, extracted from the *Engineer*, shows a machine in the form especially adapted for traveling over the upper or lower flanges of straight or hog-backed girders, and drilling through the whole of the plates at once, in the position they will permanently occupy. It is driven by a steam engine, self-contained, which is supplied with steam from a portable boiler alongside, connected by a strong flexible pipe.

The arrangement of working parts is such that the combination may also be regarded as bringing to bear six or more independent drilling machines upon one piece of work and under the eye and control of a single attendant. The whole of the spindles work normally in conjunction, being fed down together self-actingly, and also being run up quickly together out of their work by simply striking the feed belt on the group of pulleys at the left hand end of the machine; yet any one of them may be worked independently at pleasure, for, by giving the small handle of the feed clutch half a turn, the self-acting feed becomes disconnected and the spindle may be wound either up or down by hand, with a removable hand wheel, as shown on one of the spindles. The drilling heads are also independent in their adjustment upon the cross slide, to suit varying pitches of holes. They admit of being brought together within 3¾ inches. Yet it will be observed that the driving wheels, by the arrangement of passing each other alternately at a higher and lower level, admit of being kept nearly 6 inches in diameter, and thus the stress upon their teeth is so light that, with well formed teeth of gun metal, driven by a steel screw, the wear is not appreciable

The method of securing each drill in socket is designed to obtain the perfectly true running of the drills, so that the drill points find their centers without the aid of a center punch pop, and afterwards run truly through the work; and it enables any drill to be released by merely tapping one end of the small cotter, and this may be done without stopping the revolution of the spindle, as would have to be done in the case of an ordinary cotter, or a set screw fixing. This part of the invention is applicable to all drilling machines, and forms a very efficient way of driving and securing a drill. The shank of the drill is truly parallel, fitting into a bored parallel hole in the drill socket. It has a flat formed on one side which serves to drive the drill, which is detained by a one-sided cotter going through the socket; and by the taper



on the cotter tightening against the flat on the drill shank, the drill is secured from dropping out of the holder.

The drilling tools, A, are secured in the sockets of the drill spindles, B, by a round pin, C, Fig. 2, having an inclined flat formed upon it, which, when the pin is struck in one direction, tightens against a flat formed on the drill shank. By striking the pin on the opposite end, the fastening of course is loosened. D is the belt drum on the end of the driving screw, E; from this drum motion is imparted to the feed pulleys, F, Fig. 1, the middle one of which is a loose pulley, the inner is the feeding pulley, and the outer one is for running up the drills quickly out of their work.

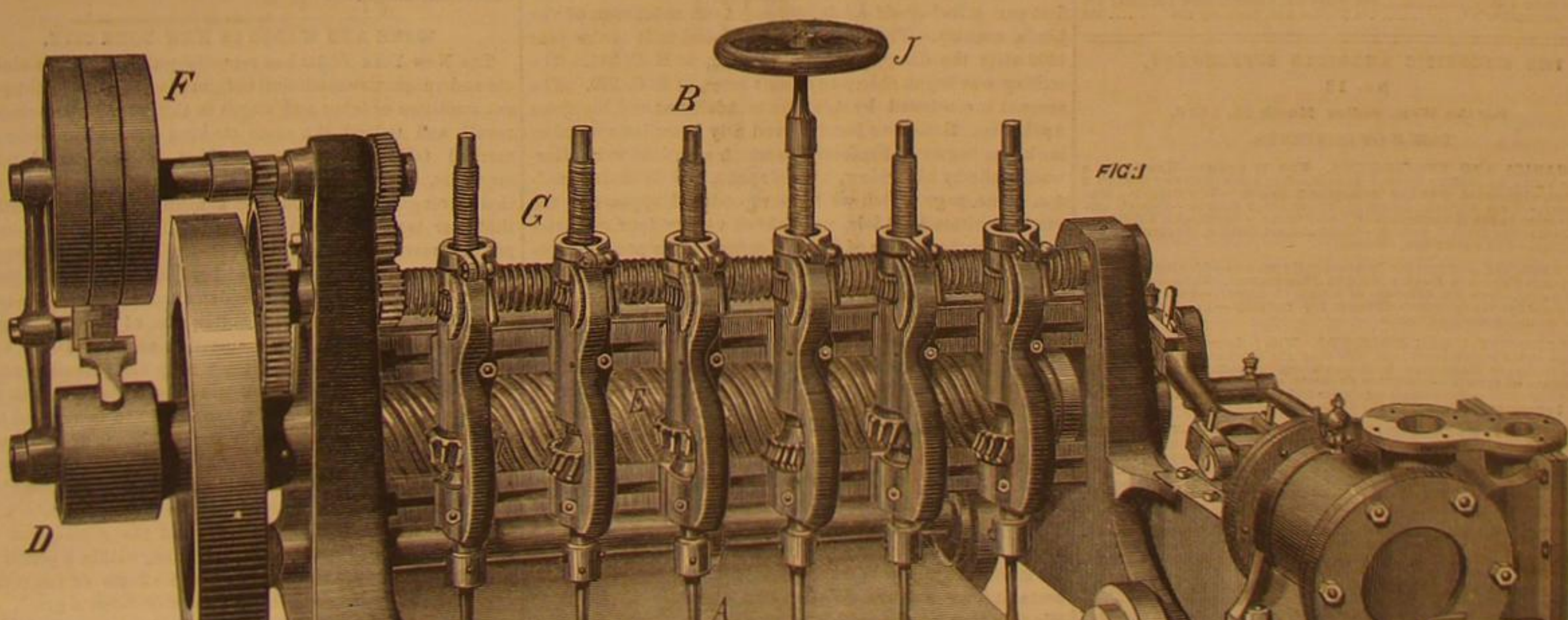
The feed and return motion are communicated to the spindle, B, by the screw, G, working into the worm wheels, H. The latter have an internal thread like a nut which works upon a feed screw, I, Fig. 3, whereby, when the screw is prevented from revolving, the spindles feed down; but if the screws are left free to revolve, they will turn with the nut or may be rotated by the handle as at J.

The means whereby the screws are set free or are prevented from revolving is shown at K, Fig. 3, where there is a small bush embraced by a friction brake which is gripped or slackened by means of the handle, I. By this arrangement the bush may be allowed to revolve or caused to stop at pleasure. The bush besides is fitted with a feather key taking into the feed screw: thus, when the brake, *t*, is on the bush, the feed screw cannot revolve, and the motion of the worm wheel operates upon it to wind it up or down. On the brake being released from the bush, the screw becomes free to turn round by hand, carrying round with it the bush and may then be made to wind the spindle, *c*, up or down, independently of the movement of the worm wheel.

Petroleum as a Lubricant for Turning Tools.

Considerable comment has appeared of late in foreign mechanical journals relative to the use of petroleum as a means of facilitating the action of turning tools in operating upon very hard alloys. A writer in *Les Mondes* states that a mixture of 7 parts zinc, 4 copper, and 1 tin, resisted all tools even when the latter were tempered to extreme hardness. As soon, however, as the cutting edges were moistened with petroleum, the alloy immediately yielded and was turned without difficulty. It is also said that, by using a mixture of petroleum and turpentine, steel annealed to straw yellow can likewise be turned.

We know of no direct practical confirmation of this, but should be glad to hear from any of our readers who may test the suggestion. Meanwhile we shall experiment for ourselves, and note the results as soon as perfected.



MULTIPLE DRILLING MACHINE.

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Contents.

(Illustrated articles are marked with an asterisk.)

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For the Week ending March 25, 1876.

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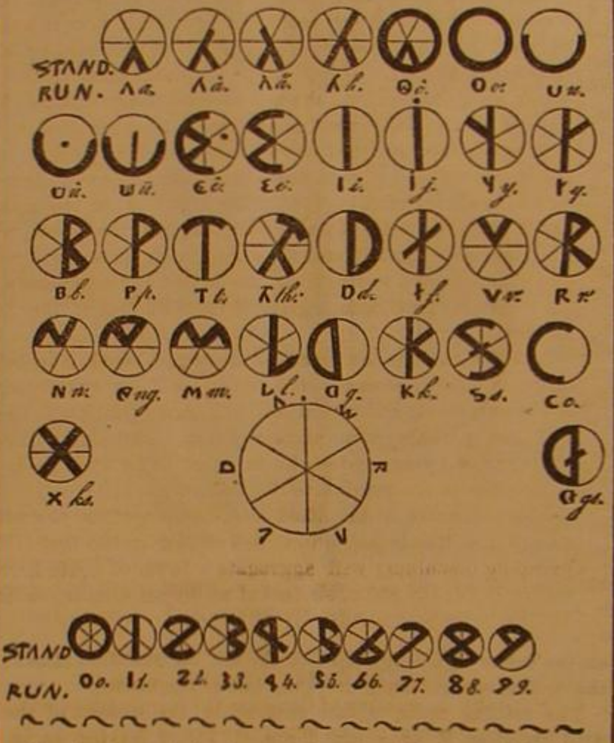
THE OERA LINDA LETTERS AND FIGURES.

The scheme of letters and figures given herewith is a reduced facsimile of a page of that remarkable Frisian manuscript, lately come to light and called the Oera Linda Book, after the family in which it has been an heirloom from time immemorial. The present owner is C. Oera de Linda, chief superintendent of the royal dockyard at the Helder, in Friesland, North Holland. In obedience to a family tradition, the book has been religiously preserved through many generations, though no one knew whence it came or what it contained, both the language and the writing being unknown.

A Frisian scholar, Dr. Verweijs, heard of the work not long ago, obtained permission to examine it, and at once discovered it to be written in a more ancient form of Fries than that which appears in the book of ancient Fries laws, hitherto the oldest known literary monument of that people. The tradition to which the book is indebted for its preservation was found to rest upon two endorsements, the later, by Hiddo, surnamed Oera Linda, being dated the 3,449th year after Atland was submerged: that is, according to Christian reckoning, the year 1,256: the earlier, by Liko Oera Linda, was written in the year 803. Hiddo describes the work as a history of his family and of the Fries people, and earnestly directs his son to preserve it with body and soul; and relates that he had just copied it upon "foreign paper" to prevent its perishing in consequence of a wetting it had got during a local flood. Liko quite as earnestly enjoins his successors to keep the work from the eyes of the monks, who spoke "sweet words," but underhandedly sought to destroy everything relating to the Fries.



The book consists of several parts, differing widely from each other, and of dates very far apart. The writer of the first part calls herself Adela, wife of Apol, chief man of the Linda country. The first date mentioned in it is the year 1602 after the disappearance of Atland, or B. C. 591. The writing was begun thirty-two years later, or B. C. 559. The account is continued by Adela's son Adelbrost and his sister Apollonia. Some two hundred and fifty years later, another book was begun by Frethorik, to which additions were afterward made by his widow, by their sons, and by their grandson. The page which we have reproduced appears in the portion written by Adela, upwards of twenty-four centuries ago: or about the time of Solon, Confucius, the prophet Daniel, Pythagoras, and shortly after the destruction of the first temple at Jerusalem by Nebuchadnezzar.

According to Adela's account, this portion of her book was copied from an inscription on the walls of Waraburgt. The divided circle, with the letters *w r a l d a* around it, is the Jol-wheel, the first symbol of the Almighty, also of the beginning from which time is derived: "this is the Kroder, which must always go round with the Jol." According to this model, Frya (the primal priestess, the first daughter of Earth) formed the set hand which she used to write her Tex. When Fasta was chief mother, she made a running hand out of it. The sea king, Godfried the Old, made numbers for the set hand and for the runic hand. "It is therefore not too much," says the Waraburgt inscription, "that we celebrate it once a year. We may be eternally thankful to Wr-alda that he allowed his spirit to exercise such an influence over our forefathers."

The Tex of Frya was what we may term the Magna Charta of the Frisian people. Fasta was the first Eremœder or chief priestess, appointed by Frya, some time in the happy period before the dispersion of the Frisians by the sinking of their country beneath the waters of the North Sea. The Jol feast was the midwinter festival, now called Christmas.

The Waraburgt inscription further narrates that Finda's people, that is, the yellow race, whose surviving remnant in Northern Europe is the Finns, also had a system of writing; but it was so difficult and full of flourishes that they lost the meaning of it. Subsequently, the Finda people, including the Thyria and the Krekalanders (Tyrians and Greeks) learned the Frisian text, but corrupted it so that it lost its legibility.

Touching this reference to the Greek alphabet, the learned translator of the Oera Linda book calls attention to the acknowledgment of the Greeks that their writing was not their own invention. They attributed the introduction of it to Kadmus, a Phœnecian. The names of their oldest letters, from *alpha* to *tau*, agree so exactly with the names of the Hebrew letters, with which the Phœnecian was closely connected, that there can be little doubt of their source. But the forms of their letters differ so entirely from those of the Phœnecian and Hebrew writing, that in that particular no connection can be thought of between them. Whence, then, did the Greeks derive the forms of their letters?

The book of Adela's followers shows that, at the time Kadmus is said to have lived, a brisk trade was carried on between the Frisians and the Phœnecians, whom they called Khadmar, or coast people, a name too closely resembling Kadmus to escape a suspicion of identity.

The same book also describes, at length, the founding of Athens by a Frisian colony, whose priestess was Min erva, and the subsequent deification of Min erva by Grecian priests, who sadly corrupted the pure religion she had introduced. This, in connection with the Waraburgt inscription above described, makes it very clear how it came to pass that the earliest Greek letters had, to a marked degree, the forms of the Fries letters, with the names of the letters of Finda's people.

It is even more surprising to find our current figures existing, in so perfect a form, from such remote antiquity. The scheme is suspiciously perfect: still, the internal evidence of the genuineness of this remarkable record of a civilization in Western Europe, antedating Athens and the Trojan war, is too cogent to be lightly set aside.

The single circumstance that the writers of the record were perfectly familiar with the pile dwellers of Switzerland, whom they call Marsaten and describe at considerable length, is proof enough that the book is either as ancient as it purports to be, or else is a very recent forgery. Previous to 1853, when the first remains of that people were accidentally discovered, there was no other record of their existence. We usually call our figures Arabian, but it is well known that the art of expressing all numbers by means of ten signs was unknown to the Arabs of the East. It was learned in the West. Perhaps, if a few more records of Friesland had been kept from the monks, the matter would not be under such a cloud. Our figures are also called Indian, and their currency in the East is quite consistent with the story of this book, since a considerable part of it is devoted to the fortunes of a Frisian colony in the Punjab (established B. C. 1551), from which a knowledge of the numerals, as based on the lines of the Jol, may have been communicated to the surrounding nations. No names of places in this colony are given; but it is narrated how the Frieslanders first established themselves on the east of the Punjab, and afterwards moved to the west of the rivers, in both of which localities the sun was directly overhead, at midday, in summer time. Confirmation of this account is found in Herodotus and Strabo, who speak of a people then called Germans; in the writings of the historians of Alexander's expedition, who speak of an Indian colony from the distant unknown North; and Ptolemy, who mentions two places called Minnagara, one 24° north, on the west side of the Indus, the other 6° to the eastward, and in north latitude 23°. The name is pure Fries, and comes from Minna, chief master at the time the exhibition sailed.

WORK AND WAGES IN NEW YORK CITY.

The New York *Times* has recently published some elaborate and suggestive statistical information relative to the present condition of labor and wages in this city. The principal result and indeed the most striking one adduced is the marked falling-off in the numbers of the trades' union members. These societies have lost fully two thirds of their strength since 1873, and a membership of 48,180 in that year is now reduced to less than 18,000. It needs no especial discernment to see the reason of this; it is the logical effect of the disastrous strike of 1872, succeeded by the financial crisis of 1873. The one demonstrated the fallacy of trade union domination, the hollowness of the promises of those men who provoked the agitation and urged and compelled others to join in it, and the misery and privation which must inevitably follow a struggle where the strength and union and staying power of those sought to be coerced is in marked contrast to the disorder and weakness of those who assume the aggressive. It cannot be denied that the results of that uprising dealt the cause of the unions a terrible blow, and it only needed the sudden collapse of the pecuniary resources of hundreds of employers, and the consequent enforced idleness of thousands of workmen, within a period too short for a complete recovery from the effects of the strike, to reduce the trade societies in this city from a great, to a comparatively insignificant power in the labor market.

Few can adequately realize how sudden and vast a change in the condition of labor took place when the financial panic swept over the country. Perhaps this can best be gleaned by a short retrospect of the condition of affairs in 1872, when the great strike occurred, and a comparison of matters then with matters now. At that time the total number of workmen employed when the shops were full was 82,938, out of which aggregate 61,050 men joined in the strike. As this last mentioned total is obtained from trade union records, it follows that the balance were non-society men; so that in 1872 there appeared but 20,888 men outside the unions, or, in other words, the membership of the latter was in the proportion to outsiders of about three to one. At the present time the total number of workmen is 76,850, of whom 18,000 are society men. The proportion now is exactly the other way, the non-union men having a majority of over four to one.

Now the strike of 1872 was based on the very obvious fallacy that "ten hours pay should be given for eight hours work;" and this, reduced to its simplest terms, amounted to a demand for 20 per cent more wages. It is instructive to place side by side the wages then paid (in a vain effort to force which to higher figures the workmen threw away $1,674,950) with the wages of to-day. By the aid of the *Times'* article, we have prepared the following table:

Trade.	Trade union scale of wages per week before panic.	Lowest trade union scale of wages per week now.
Carpenters and joiners	$21	$15 down to $9 (8 hours)
Bricklayers	$27	$12
Stone cutters	$27	$21
" masons	$27	same but often infringed
Plasterers	$30	$12 (8 hours)
Shoemakers	$20 to $30	$10 to $18
Brass molders and finishers	$18	$15 (mainly piecework)
Fresco painters	—	$10 to $15
Painters	[illegible]	$15
Goldbeaters	$14 to $18	$10 to $12
Sailmakers	$20 (piecework)	$15
Carriage builders	$21	$15 and $12
Caulkers	$24	$21
Coopers	$20	$10
Cabinet makers	$18	$10
Varnishers and polishers	$18	$10
Machinists and blacksmiths	$18	$10 to $.2 (piecework)
Iron molders	$21	$12
Box makers	$20	$12
Laborers	$15	$6 to 12

If we may take this as an index, the reduction of wages is something over 33 per cent; and therefore men are now gladly receiving pay one third less than that which they struck against in 1872. Nor is this all: a still more impressive contrast is yet to be drawn. When the strike broke out in the last mentioned year, the signs of prosperity were everywhere, the shops were reasonably full, and the aggregate of 82,938 persons given above shows the men actually employed at the time. But as is well known, works stopped, employers failed, and men left for other localities: hence we account for the difference of 6,588 men which there is between the numbers of workmen then and now; but besides these is a deficiency which does not show, namely, the ratio of employed to unemployed. Out of our 76,350 working men, 25,210 are idle. Therefore not only have wages been reduced one third, but the actual supply of work has fallen nearly two thirds. In brief we employ one workman to three employed in 1872; and for the wages then paid to three men, we now obtain the labor of four.

Turning now from general conditions to separate trades, it is easy to trace, in the decline of some, the natural effect of the cessation of the unnatural haste which characterized the expansion of certain industries. Take for example, building. In 1869 real property in this city would sell for fully one fourth more than it now will, and rent in the same proportion. As a result every one who had unimproved lots built on them, and our higher uptown streets presented the anomalous spectacle of block after block of mere shells of houses rising like mushrooms with astonishing rapidity. Then was the harvest time for the bricklayers, and the masons, and the carpenters, and their wages were $5 and $4.50 per day. But as soon as the financial trouble came—in fact, as soon as the strike began—work stopped, and as it has not been resumed, and probably will not be for a great many years to come, to an equal extent, necessarily the trades thus depressed have suffered severely. On the other hand, the hatters, the bakers, the tailors, and all who contribute to human necessities, although their trade is dull, have undergone no heavy losses.

The metal trades have been as severely affected as the building trades; and in general, it appears that all those callings whose work involves capital to be laid out have suffered. People are not poor for if they were, the fact would be apparent among the carriage, pianoforte, cigar, and cabinet makers. For articles of luxury there is a fair demand, but not at high prices. The tendency is to economize and hold on to money, as witness the extremely large surplus in the hands of some of our city savings' banks, one institution having over four millions, another over two millions, and others over one million of dollars above their liabilities.

The signs, on the whole, are encouraging, for habits of thrift and a persistent opposition to high prices will speedily bring down living expenses, from the unnecessarily high figure at which they now stand, to the rates obtaining previous to the war. And this done, and the purchasing power of wages increased, we may soon look for the return of substantial prosperity to our industries.

THE DRAINING OF THE ZUYDER ZEE.

In the year 1170 the waves of the ocean, driven by a hurricane, broke down the dunes and dikes on the northern boundary of Holland, and, pouring in upon the low land, converted a thriving and populous district into an inland sea. There are scores of quaint and curious legends regarding the submerged cities in the Zuyder Zee; and it is said sometimes that, when the water is still, the turrets and pinnacles of the ancient buildings can be recognized protruding above the ooze and mud on the bottom. For seven centuries this great lake has existed; but long before the close of the present century, the islands of Uik and Schokland, once hills, will again be hills, and where now the storms beat up waves, as high and as dangerous as any in the North Sea, will be a broad expanse of fields and pastures.

There is no country in the world which possesses a greater interest to the engineer than does Holland. Her sea shores are lined with the great dikes built of Norway granite, timbers, turf, and clay, heaped up to a hight of thirty feet or so, and broad enough at the top for two wagons to drive abreast. Over a billion and a half of dollars have been expended in making these vast embankments. The canals, which form a perfect network of waterways over the country, are wonderfully substantial; so also are the country roads, with their triple line of trees, between the leafy arches of which one can drive for miles in the shade. But the greatest of Dutch engineering work is the draining of the lakes, ninety of which already have been converted into arable land. It took sixteen years of continuous operations, including three years of pumping by gigantic engines, to remove the water of Haarlem Lake, which covered an area of seventy square miles. Now, however, in the draining of the Zuyder Zee, a task has been begun which throws all previous undertakings far in the shade, and which, as a colossal piece of engineering, will take rank with the Suez canal, and the Mont Cenis and British Channel tunnels.

The Zuyder Zee covers an area of 1,200 square miles, about equal to that of Rhode Island, less Narragansett Bay. Of the provinces which constitute the Netherlands, North Brabant, Gelderland, Friesland, and Overyssel extend over a larger area. North and South Holland, Zealand, Utrecht, Groningen, Dienthe, and Limburg are all smaller. All the area of the Zuyder Zee will not, however, be drained, it being the intention to remove the water from but 753 square miles. Of this total 73 square miles will be devoted to dikes, roads, and canals, leaving an extent of 680 square miles of arable land. The new province of Zuyder Zee will then rank tenth in point of size—Zealand and Utrecht being smaller—and will render Holland about one eighteenth larger than it is at present.

The preliminary soundings have recently been made, and have shown most satisfactory results. With the exception of along the coasts and about the sand banks, the bottom of the lake is a deposit of 160 feet of clayey earth. This soil is rich almost beyond description. It may be used for crops for a century without impoverishment. We have been informed that, at the time of the separation of Belgium from Holland, when for four years the countries were in a state of war, the frontier cities of Holland were protected by large inundated ditches. When peace returned, these bodies of water were drained, and the soil devoted to agriculture. The deposit precipitated even in so short a time resulted in enriching the land so that never before had it yielded such enormous crops, and even now that section is one of the most fertile in all Holland. Now, with 160 feet of the richest earth at his disposal, it may easily be imagined that, with his proverbial agricultural skill, the Dutch farmer will some day astonish the world with the extent and magnitude of the vegetable productions gleaned from the bed of the Zuyder Zee.

In a few months the plans for the whole work, now being made by Heer Leemans, of Kampen, will be submitted to the government, and operations will shortly follow. These will last probably some sixteen years. Pumping will continue for two years and eight months. The average depth of the lake in the portion to be drained is 14·4 feet. The volume of water to be lifted and discharged on the other side of the dike is 306 billion, 505 million cubic feet. The pumping machinery will aggregate a force of 9,440 horses, and will lift 158,850 cubic feet of water per minute, or 228,787,200 cubic feet per day of 24 hours.

ANOTHER OBNOXIOUS POSTAL LAW.

Since the assembling of Congress, the people have patiently awaited the repeal of the obnoxious postal law, passed during the closing hours of the last session, the effect of which was to double the postage on transient newspapers, magazines and periodicals, books, and merchandise. It was generally understood that this much desired measure would early engage the attention of our representatives; but although the House has taken satisfactory action with moderate celerity, it still hangs in the Senate, having been referred to the Committee on Postal Matters, of which Senator Hamlin, the originator of the very objectionable law passed last winter, is the chairman. This committee has been engaged in devising an entirely new schedule of rates for third class postal matter, which has recently been laid before the Senate by Mr. Hamlin. The act fixes the following rates:

For distances not exceeding three hundred miles, one cent for each two ounces or fractional part thereof; for distances between three hundred and eight hundred miles, two cents; for distances between eight hundred and fifteen hundred miles, three cents; and for each additional thousand miles, one cent additional for each two ounces or fractional part thereof. A special rate is, however, proposed for transient newspapers and magazines, namely, one cent for every two ounces or fractional part thereof for any distance not exceeding one thousand miles; but for any greater distance, double this rate is to be paid.

The object of this discrimination is to relieve the government of a portion of the expense involved in carrying the mails over long distances, in sparsely settled portions of the country, and thus to place the post office on a basis which shall more nearly approximate self-maintenance. This is all that the most earnest supporter can urge in behalf of the bill, which otherwise is a marvel of stupidity and vexation. It is a retrograde measure, reminding one of the rates 30 years ago, when 6c., 12c., 18c., and 25c. were the charges on letters, the rate depending upon the distance. But no intelligent person demands or expects the postal service, in which every body has an interest, to be self-sustaining like the Patent Office department, whose receipts are in excess of its expenses every year. In fact, there is no tax that the public pay more willingly than that due to postal deficit; all they ask is that the department be economically managed, and that business capacity be shown in making contracts for carrying the mails, etc.; but no one desires to reduce the accommodation it affords to the public.

The immediate effect of the proposed measure will bring chaos on all the postal affairs to which it relates. It presupposes a geographical knowledge throughout the entire population, which never could exist. Not only must a man know the distance of every post office from his residence, but the distance of every post office from every other post office, else he could not stamp his packages correctly. As it would require a public of Zerah Colburns to keep such mathematical knowledge in their heads, tables will have to be prepared, and the people taught to use them; or else the postmasters, especially at large centers, will have to employ clerks for the express purpose of imparting the necessary information. Publishers and business houses mailing packages of papers, books, or merchandise will be put to vast inconvenience, for the distance of the destination of each packet will have to be determined before the required postage stamps can be affixed. Then when errors are made, in prepayment, the post offices will be filled with periodicals and bundles retained for short postage; and the service will be put to more expense, in notifying the senders of the fact.

The bill is fifty years behind the age. It is a retrogression to the earliest days of the existence of the post office. That system went out of existence when the ten cent postage to California was abrogated; and its principle was then scouted as an absurdity. The people want no more tinkering of the postal laws for the benefit of the express companies—a fact too plainly apparent. The immediate result of the law which it is now sought to repeal has been a large decrease in the receipts of the post office, for the government found itself left with the most unprofitable part of the service, the long distance carriage; while for short distances the people have used the expresses, whose rates are cheaper.

The outcry which arose all over the land last winter, when the public appreciated the effect of Senator Hamlin's ill considered law, should have indicated to that official the drift of public sentiment, sufficiently well to have prevented his perpetrating the present blunder. The people feel that the mail is a great and useful vehicle for the dissemination of knowledge, and that it is, moreover, a valuable convenience for the distribution of seeds and other light merchandise among the agriculturists throughout the country. Senator Hamlin's bill should not pass; and the sooner Congress sets about fulfilling the will of the people, by simply repealing the present unjust law and re-enacting the old one, the sooner will it merit the approbation of the public.

TO OUR SUBSCRIBERS.

At this season of the year, many thousands of subscriptions are renewed, and a large number of clubs comprising new names are formed; and we are happy to state that our old patrons have never renewed their subscriptions at the commencement of a year more promptly, and we have never had so large an accession of new subscribers as have come to us since the 1st of January.

If any person fails to receive the paper or any premium to which he is entitled, we would thank him to inform us at once. Notwithstanding the provision we had made for a large increase in our circulation, by printing several thousands extra of the first ten numbers of the year, we find some of the editions already exhausted, which will prevent our sending complete sets of back numbers from the commencement of the volume. The first six numbers can be supplied, and some of the subsequent issues, but, we regret, not all. If persons, when remitting their subscriptions, express a wish for such back numbers as we can supply, those not out of print will be sent: otherwise, the subscriptions will commence from date of their receipt.

Our mail clerks, wrapper writers, and folders are under special injunctions to write the subscriber's name and address legibly, and to fold the paper neatly. We shall be glad to be informed if any one receives slovenly work of any kind from this office.

It is our desire to give satisfaction to every person doing business at this office; correspondents should write over their own signatures, and give address legibly, enclosing a postage stamp. No attention is paid to inquiries if the name and address of the writer is not given.

DEFEAT OF THE SEWING MACHINE MONOPOLY IN CONGRESS.

The Committee on Patents of the House of Representatives has reported adversely on the application of A. B. Wilson for an extension of his patent for sewing machines. This is the celebrated four motion feed now used by the Wheeler & Wilson and other machines. The dispatch to the Associated Press says that the application has been before Congress for several years; and protests against the extension have been received, during that time, signed by nearly one million persons. All of the small sewing machine companies, which had been required to pay a heavy royalty to the sewing machine combination composed of the four leading machine companies, have fought the extension savagely. This refusal will ultimately reduce the price of sewing machines very greatly, as soon as the four motion feed becomes public property. The Committee say that the applicant has already made two or three large fortunes out of his invention, and that it is time now to give the public a chance. The testimony taken before the Committtee shows that the cost of making a sewing machine is not more than from $12 to $15.

This action of the House Committee defeats the scheme of the monopolists for the present session, but will not prevent a renewed attempt hereafter.

M. NOMAISON has devised a simple apparatus for removing the bark from timber, an operation now commonly performed only when the wood is in soak. He proposes a small steam generator which sends dry steam into a chamber in which the wood is enclosed. Under the influence of the steam, the bark easily peels off.

THE AQUEDUCT OF LA VANNE.

An aqueduct, one hundred and thirty-five miles long, which is nearly, throughout its whole length, one solid mass of stone, a colossal monolith, may well be considered one of the engineering marvels of the century. Such is the great aqueduct which, toward the close of the late French Empire, was constructed to bring into Paris, from the Departments *de l'Aube* and *de l'Yonne*, the pure water of the La Vanne River. The greatest difficulties met with in building the structure were found in crossing the forest of Fontainebleau, a distance of thirty-seven miles, entirely destitute of good building material, and cut up by immense hills of almost impalpable quicksand. To this section the *béton Coignet* construction, afterward continued through nearly the whole work, was begun. As shown in the engraving, the Fontainebleau section is composed of a series of arches, some of them as much as fifty feet in hight. Eight or ten bridges of large span (from 75 to 90 feet) are also included, all made of solid masses of *béton Coignet*. The composition of this concrete was: For foundation and gravel walls, sand and gravel equal parts, 5; hydraulic lime 1, Portland cement ½, parts. For pillars, abutments, etc., sand, and in some cases gravel, 4, and hydraulic lime 1, parts. The other portions were made from sand 4, hydraulic lime 1, Portland cement from ¼ to ½ parts. This concrete, properly dampened, was combined in a mill of especial construction, and agglomerated at once in molds at the spots needed.

AQUEDUCT OF LA VANNE, FRANCE.

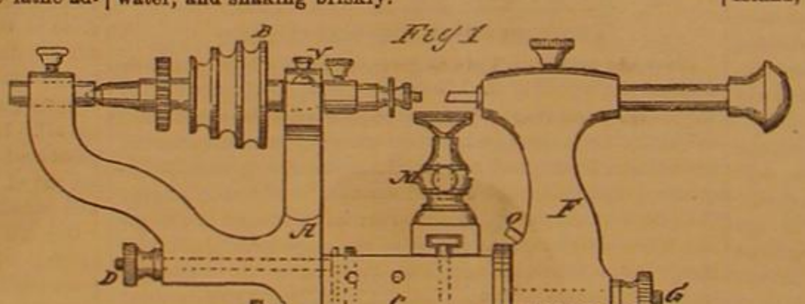
IMPROVED WATCHMAKER'S LATHE.

In the improved watchmaker's lathe, illustrated in the accompanying engraving, the novel features consist of an adjustable bed, the hight of which, in relation to the centers, may be varied to suit different kinds of work, an adjusting tail stock, and an attachment for cutting gear wheels and pinions. Figs. 1 and 3 are side elevations of the lathe adjusted for turning; in Figs. 2 and 4 an end and a side elevation are shown, exhibiting the adjustment for gear cutting.

The stationary part, A, of the lathe carries the live spindle, B, and supports the bed, C, which is clamped to it by T-headed bolts, D, so as to be raised and lowered by the adjusting screw, E. The tail stock, F, is pivoted to the end of the bed by the clamp bolt, G, so that it may be turned down out of the way, as in Fig. 2, when not required for use. When said stock is in working position, a block, H, is screwed on the bed in order to adjust the center, J, in line with the live center, through the screw, K, on said block acting against the stud, L. The screw, I, also secures the tool rest, M, and the bed, N, for the slide, P, which carries the gear-cutting center, R, to be worked backward and forward to feed the blank to the cutter. Said slide is operated by the hand lever, Q. The template, S, is fastened by a lever latch, T, working into notches in the edge. There is a pointer, U, to gage the gear-holding centers to the rotary cutter in setting the bed, N, and slide, P.

The cap, V, for holding the live spindle in the bearing of the head stock, is hinged to the stock and fastened with a single screw, W, to facilitate the changing of the mandrels, two or more of the latter with different centers or attachments being employed for different kinds of work.

Patent pending through the Scientific American Patent Agency. For further information address the inventor, Mr. Daniel M. Williams, Calvert, Robertson county, Tex.



WILLIAMS' WATCHMAKER'S LATHE.

Comparative Cost of Gas and Candle Light.

Eight star candles give as great a quantity of light as a gas burner consuming 5 to 6 feet per hour. The cost of 5 feet of gas, at prices charged in Louisville, Ky., is 1·35 cents. That of the candles is 3·2. Therefore, to produce the same quantity of light in a parlor, the gas is cheaper than candles. But counting in another way, candle light is greatly cheaper than gas. Thus a candle placed on a table, one foot from a book, gives twice as much light to the reader as a gas light placed four feet above the book. By this comparison it will be seen that the candle costs only four tenths of a cent per hour, while the gas costs 1 35 cents. The rule in calculating the strength of light is that it decreases as the square of the distance.

A pound of star candles costs 16½ cents and burns 42 hours, giving a soft, pleasant light, and, at 17 inches from an object, gives a light equal to a gas burner 4 feet from the object, consuming 5 feet per hour. The calculations are as follows: The square of 17 inches is two feet. The square of 4 feet is 16 feet. That is to say, the quantity of light from gas must be in the proportion of 16 to 2, or of 8 to 1, to make the gas and candle light equal at the distances given above. From which it appears that, for reading and many other uses, candle light of the same power costs only one third as much as gas.

STAINS inside of wine decanters can be removed by putting in a handful of chopped raw potato, with some warm water, and shaking briskly.

Novel Use of Apomorphia.

Ed. T. Robinson, M. D., says: The report of the following case may be interesting to your readers, so far, at least as it suggests the value of the comparatively new remedy apomorphia, in a class of cases in which I have not heard of its having been used. On the 30th of November, 1875, I was called to see a little boy, three years old, who had, two hours previously, accidentally swallowed a biconvex lens-shaped tin whistle. I found it lodged near the cardiac terminus of the œsophagus. The little fellow was suffering considerable pain, writhing his body when he attempted the act of deglutition, which act seemed irresistible every few seconds. A small quantity of bread and water was given him to ascertain whether the œsophagus might be completely occluded. He rejected it almost immediately, with no admixture of the stomach contents. I then administered hypodermically in his arm $\frac{1}{12}$ of a grain of apomorphia. In three minutes, by the watch, the emetic quality of the drug was manifested by pallor. He was then placed on a bed, flat on his belly, when, after three or four violent attempts, he in one heave emptied entirely the stomach, the whistle taking the lead, and ringing, as it fell in the basin, producing a most agreeable sound to the ears of the anxious mother, who before had but little faith in my expedient. The whistle measured $1\frac{1}{16}$ inches in diameter. The child, when seen an hour later, was bright and running about as well as ever.—*Medical Record.*

The Total Solar Eclipse of September 17-18, 1876.

The track of totality in this eclipse is wholly upon the Pacific Ocean, and in such course that only two or three small islands or reefs appear to be situated near the central line. Using the *Nautical Almanac* elements, which are almost identical with those of the American *Ephemeris*, wherein the moon's place is derived from Peirce's *Tables*, St. Matthias Island, west of Admiralty Islands off the northeast coast of New Guinea, is traversed by the central track of the shadow, with the sun at an altitude of 5° at 6h. 16m. A.M on the 18th, local time. Thence, skirting Ellice Islands, it passes between the Fijis and the Samoan or Navigator group to Savage Island, in 170° west of Greenwich, latitude 90° south, which is apparently the only spot where totality may be witnessed under anything like favorable conditions, and even here the duration of totality is less than one minute. The after course of the central line does not encounter any land.

In the northern of the two large islands of the Fiji group (Vanua Levu) 169° east, a partial eclipse will occur, commencing at 7h. 47m. A.M., 44° from the sun's north point towards the west, for direct image, and ending at 10h 16m., magnitude 0·86. In the larger island of the Navigator group, Savaii of the Admiralty Chart, there will also be a partial eclipse, though nearly approaching totality; eclipse begins 8h. 23m. A.M. at 53° from the sun's north point towards the west, and ends at 11h. 2m., magnitude 0·97.

Assuming the north point of Savage Island to be in 169° 48' W., with 18° 55' south latitude, a direct calculation gives a total eclipse commencing at 10h. 8m. 6s. A.M. local mean time, and continuing 57 seconds with the sun at an altitude of 58°; the first contact of the moon with the sun's limb at 8h. 48m. A. M , 49° from his north point towards west for direct image; and the end of the eclipse at 11h. 29m.

In New Zealand the eclipse attains a magnitude of about 0·5 at Auckland, greatest phase at 9h. 18m. A.M.; towards the extremity of the southern island about Otago, one third of the sun's diameter will be obscured about 9h. 12m. local time. A partial eclipse between similar limits will be visible on the east coast of Australia and in Van Diemen's Land.—*Nature.*

ACCORDING to experiments by M. Rudorff, on cold produced by solution of 20 different salts, the two which give the greatest lowering of temperature were sulphuretted cyanide of ammonium and sulphuretted cyanide of potassium: 105 parts of the former dissolved in 100 parts water, produce a lowering of temperature of 31·2°; and 130 parts of the latter, in 100 parts of water, as much as 34·5°

MAGNETO-ELECTRIC MACHINES.

LECTURE DELIVERED AT THE STEVENS INSTITUTE OF TECHNOLOGY, BY PROFESSOR GEORGE F. BARKER, OF THE UNIVERSITY OF PENNSYLVANIA.

It will be remembered, from the previous lecture (see page 181, current volume), that every magnet is surrounded by a field of force, consisting of lines of force proceeding from it in every direction; and that whenever these lines are traversed or cut by a conductor, a current of electricity will be developed in the latter, which is the more powerful the more nearly the lines of force are cut at right angles. This is the principle of the magneto-electric machines to be described. It may not be superfluous to define a magneto-electric machine as one in which magnetism is used to produce electricity, while an electro magnetic machine is one in which electricity is used to produce magnetism.

In 1831, Faraday proved the conversion of magnetism into electricity, by using a flat iron ring having on both sides a carefully insulated coil of wire. On passing a current through one coil, a galvanometer needle connected with the other coil was deflected. Now, this could only be effected by an induced current, and this current could only be due to the magnetism produced in the iron ring by the first coil—a result which Faraday undoubtedly foresaw when he constructed his apparatus.

The principle of this discovery was then shown by the lecturer by introducing a very small magnet into a small coil of wire connected with a galvanometer needle, which was projected on the screen by means of the lantern. It was observed that the needle was deflected in different directions, according as one or the other pole of the magnet was introduced into the coil, or as one or the other end of the coil was selected for the introduction of the magnet. It was further observed that the effect was produced only at the instant of introducing and at the instant of removing the magnet from the coil. Here, then, we have the conditions requisite for the construction of a magneto-electric engine. We know that the lines of force must be frequently cut at right angles, and the whole problem becomes a mechanical one: How can it be done to the best advantage?

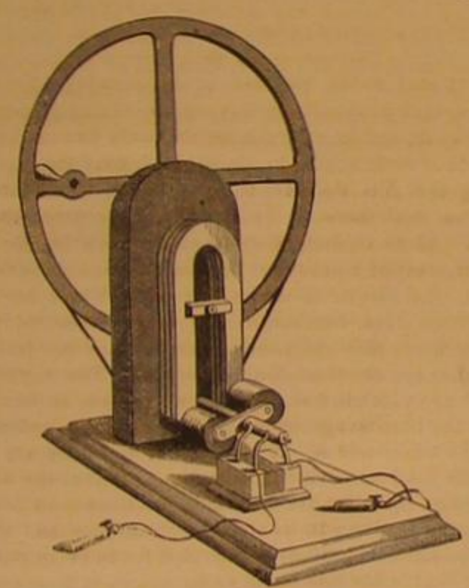


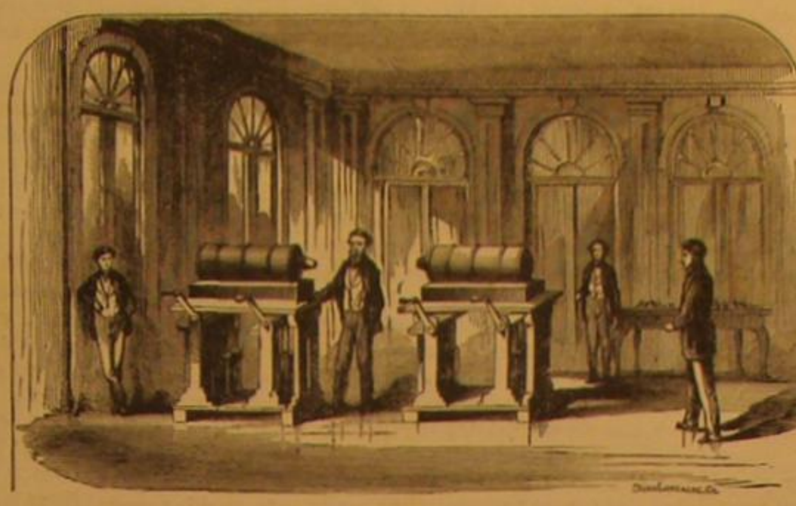
Fig. 1.—CLARK'S MAGNETO-ELECTRIC MACHINE.

So soon as the year following Faraday's discovery, Pixii, an instrument maker of Paris, made a magneto-electric engine for the celebrated Ampère. In this machine, the steel magnet revolves on a vertical axis below two coils of wire containing soft iron cores. The electrical current induced in the wire was strong enough to decompose water, melt thin platinum wire, and replace the battery in all respects.

The same year (1832), our distinguished countryman, Joseph Saxton, long employed in the Philadelphia Mint and the United States Coast Survey, used a stationary horizontal magnet, and revolved a series of four coils before its poles As Professor Joseph Henry had observed marked differences of effect with different thicknesses of wire, Saxton made two of his coils of fine and two of coarser wire. Now when the coils revolve before the poles of the magnet, currents in opposite direction are induced in them in the two halves of their revolution; and in order to throw these opposite currents in one direction, he invented a commutator, consisting essentially of double points of metal, connected with the axis of rotation, and making connection by dipping into a cup of mercury, so as to carry off each current before the next is produced. In other machines, the same is effected by insulating, on the axis of rotation, all but two strips, connected with the coils, and carrying off the current by means of metallic springs pressing against it.

As Saxton did not publish a description of his machine, although he had it exhibited in London for a long time, Clark, a London instrument maker, brought out, in 1836, the machine represented in Fig. 1, which is in its principles a copy of Saxton's, with the exception of the commutator.

In the next place, Page took two magnets and revolved his coils between them. This was the first machine made in America; and from this time on, greater power was sought by the multiplication of parts. Stöhrer, of Dresden, used three magnets and numerous coils, and, finally, Professor Nollet constructed an immense machine containing no less than 56 magnets, between the poles of which numerous bobbins or coils were revolved by steam power. With 300 revolutions a minute, an electric light was obtained from it, equal to 75 carcel burners or 500 candles, at a cost of 30 cents an hour. It had taken, before, 226 Bunsen cells to produce the same light, at a cost of $2.30 an hour. The lighthouse of Cape La Haye, near Havre, is furnished by this machine, and the lights on the British Coast are made with the Holmes improvement of the same machine.



THE GREAT ELECTRO-MAGNETS AT THE STEVENS INSTITUTE.

Fig. 2.

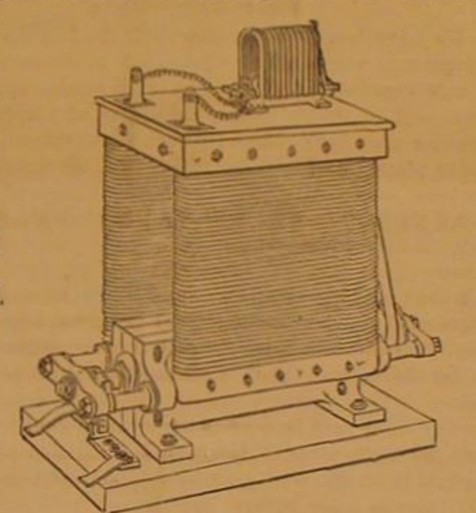


Fig. 3.—WILDE'S MACHINE, WITH SIEMENS' ARMATURE.

It was plain that no further improvement was possible in the direction hitherto adopted, as there was a practical limit to the amplification of parts. It was then remembered that the magnetic field of an electro-magnet was much more powerful than that of a permanent one, and that electro-magnets could with advantage be substituted for ordinary magnets, as they occupied much less space, and made a more compact machine. This result was favored still more by the invention of the Siemens armature in 1857. This was a new device for cutting the lines of force, in the place of the revolving coils or bobbins. It consists of a long soft iron bar, a cross section of which is shown in Fig. 2. The grooves represented there serve for the reception of the insulated wire, which is wound lengthwise over the bar. In order to use this new form of armature, the electro-magnet, between the poles of which it revolves, is made long and flat, as in Fig. 3, which represents the Wilde machine with the Siemens armature. A small magnet on top induces a current of electricity in the wire of a small armature, which in turn charges the large electro-magnet below, and produces a powerful current in the wire of the large armature. There are two of these machines in this country, one in Boston and one at the printing establishment of Frank Leslie, in New York. The latter is driven with a velocity of 1,800 revolutions per minute, and the current derived from it will electrotype several plates of his paper in twenty minutes. It is also used as a source of of electric light for photographing on cloudy days.

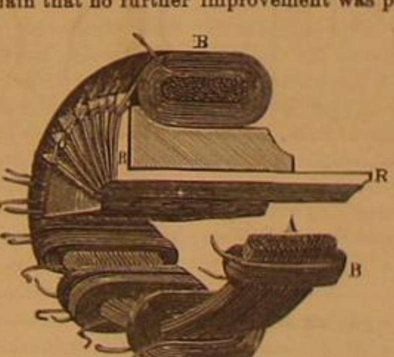


Fig. 4.—COIL OF GRAMME'S MACHINE.

But a yet further improvement was made in this machine. Siemens and Wheatstone proposed to do away with the small magnet entirely. That looked very much like perpetual motion. What is there to start the machine? There is always enough residual magnetism left in the armature, when the machine has once been started, to produce a feeble current of electricity; and if this is made to flow into the wire surrounding the large electro-magnet, it will charge it sufficiently to increase the current by which it is supplied. In this way, the large electro-magnet soon gains its full strength. The principle of such machines is, therefore, to divert a portion of the induced current back into the electro-magnet, and use the remainder for outside work.

Ladd, a London instrument maker, constructed a machine on this principle, which received the first prize at the Paris exhibition of 1867.

The next improvement was made by Professor Pacinotti, of Pisa, who made his armature in the form of a ring, so that the current should always flow in one direction. It consisted of a ring of soft iron, surrounded by insulated wire, and revolved between the poles of the existing magnet. The current was tapped and carried off half way between the poles.

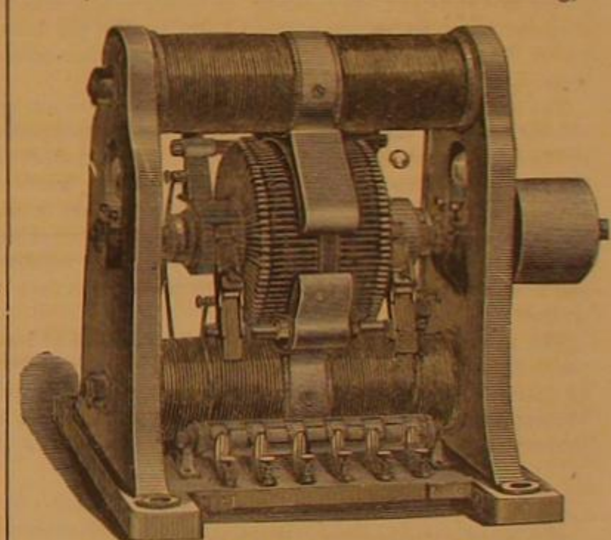


Fig. 6.—IMPROVED FORM OF GRAMME'S MACHINE.

This form was almost forgotten, when, in 1871, M. Gramme, a furniture dealer and general tinker of Paris, was led to construct a machine by studying one that had been brought to him to mend. The principles involved are of importance, as they led to the most perfect instrument of the kind yet invented. Conceive, as was shown by the lecturer, that a bar of soft iron, surrounded by insulated wire, is subjected to the influence of one of the poles of a permanent magnet, say the north pole. Let this magnet be passed gradually over the length of it. Then there will be produced a south pole in the bar wherever the magnet happens to be, beginning at one end and stopping at the other. At the same time a continuous current will flow in the coil as long as the motion lasts. Now, suppose this bar with its coil to be made in a ring and revolved before one pole of a magnet, and we have the same conditions in the best available form. If such a ring be revolved between the two poles of a magnet, however, they will act on it in opposite directions, and the currents so formed will constantly tend to neutralize each other at two points half way between the poles. In order to utilize both currents, it is only necessary to tap the neutral points by means of conducting wires. Fig. 4 shows the method of winding the coils adopted in practice. The wire, B, is divided into sections, say of 300 turns each, but there is no break in passing from one section to the other. A loop of the wire only is left exposed; and this is connected with a copper conductor, R, bent at right angles so as to pass through the ring. When the ring is revolved, several of these conductors touch

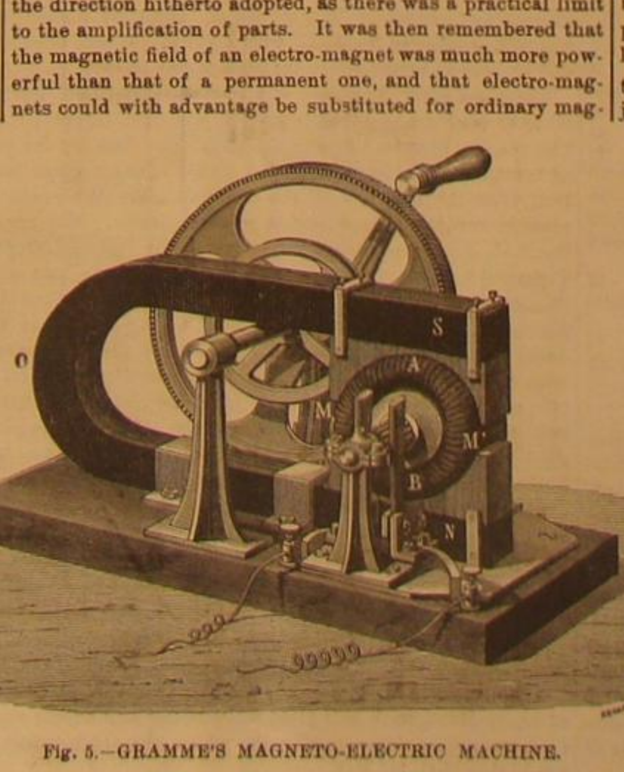


Fig. 5.—GRAMME'S MAGNETO-ELECTRIC MACHINE.

two metallic rubbers or brushes, by which the current is carried off. The rubbers or brushes are so arranged as to be always in contact with more than one of the conductors.

The original Gramme machine, which was exhibited before the French Academy of Sciences by M. Jamin, is represented in Fig. 5, in which the circular armature already described was revolved by hand between the poles of a permanent magnet. Since that time M. Gramme has made a great many important changes and modifications in his machine, the most notable of which are the substitution of electro-magnets for permanent ones; the adoption of the dynamic principle, as it is called, of starting the machine by its own residual magnetism; and the adaptation of a single armature to the purposes both of electroplating and the electric light. Fig. 6 represents the latest form of this machine. It is the one which was used by the lecturer. Its dimensions are 22 inches in every direction and its weight is 500 lbs.

This machine was driven by means of the engine in the workshop of the Institute in the basement below, the belting passing through the floor of the stage. The electric light so produced was of intense brilliancy. A dynamometer was attached to the instrument in order to measure the power used, and a class of Institute students was in attendance to take notes. They also studied the photometrical measurements made, to determine the intensity of the light. Their notes will be worked out with the greatest accuracy.

For the photometrical measurements, the lecturer placed the electric lamp in the rear of the hall, some 60 feet away, and caused it to cast a shadow of the pointer he used to show the parts of apparatus exhibited, on the screen. Then, on taking a standard candle and causing it to cast another shadow of the same object, he carefully approached the candle to the pointer until the intensity of the shadows was the same. Supposing this distance to be 2 feet, then will the light of the electrical lamp be to that of the candle as 2^2 is to 60^2, which is as 1 to 900; or in other words, the electric light yielded is equal to 900 candles. The actual light obtained, however, was still more powerful.

Professor Julius Thomsen, of Copenhagen, by an ingenious method of converting the light rays into heat, has calculated the mechanical equivalent of light (that is, of a standard candle) to be equal to 13·1 foot pounds per minute. Now, as one horse power is 33,000 foot pounds, the theoretical maximum amount of light obtainable from one horse power is $\frac{33000}{13.1}$ or 2,518 candles. In practice, the lecturer obtained in round numbers about 1,000 candles per horse power. The best effect was obtained when the carbon points were $\frac{3}{16}$ of an inch apart.

The lecturer in the next place threw on the screen a magnificent image of the carbon points, and showed the spectra of the solid and of the vaporized carbon. He concluded his lecture by removing the belt, which connected the machine with the engine, and connecting the powerful battery in the basement of the Institute with the brushes of the machine. The latter immediately began to rotate with great rapidity, and it was stated that 70 per cent of the power could thus be utilized.

The same machine has also been used by President Morton to exhibit all the experiments connected with a lecture on spectrum analysis to his class at the Institute, and so convenient did it prove that scarcely an hour was required to prepare all the requisite apparatus. C. F. K.

The Iron Works of the United States.

We are indebted to the American Iron and Steel Association, Philadelphia, Pa., for a copy of their "Annual Directory" of the iron and steel manufacturing establishments of this country. It is an important and valuable document, giving particulars in detail of all establishments connected with the above industries. The following is a general summary:

Whole number of completed blast furnaces, Jan. 1, 1876..	713
Annual capacity of all the furnaces, in net tuns..........	5,439,230
Whole number of rolling mills, Jan. 1, 1876	332
Whole number of single puddling furnaces (each double furnace counting as two single ones)............	4,475
Total annual capacity of all rolling mills in finished iron, net tuns..........	4,189,760
Annual capacity of all the rail mills, in heavy rails, net tuns..........	1,940,300
Number of Bessemer steel works, Jan. 1, 1876..........	11
Annual capacity in ingots, net tuns..........	500,000
Number of Bessemer converters..........	24
Number of open hearth steel works, Jan. 1, 1876..........	16
Number of open hearth furnaces..........	22
Annual capacity in ingots, net tuns	45,000
Number of crucible and other steel works, Jan. 1, 1876....	39
Annual capacity of merchantable steel, net tuns..........	180,250
Of which there are of crucible steel, in net tuns..........	45,000
Number of Catalan forges, making blooms direct from the ore, Jan. 1, 1876..........	39
Annual capacity in blooms and billets, net tuns..........	59,450
Number of bloomaries, Jan. 1, 1876, making blooms from pig iron..........	59
Annual capacity in blooms, net tuns..........	60,300

A New Mucilage.

The *Journal de Pharmacie* states that if, to a strong solution of gum arabic, measuring 8½ fluid ozs., a solution of 30 grains sulphate of aluminum dissolved ¾ oz. water be added, a very strong mucilage is formed, capable of fastening wood together, or of mending porcelain or glass.

A NEW nickel-plating solution, said to yield beautiful results, is prepared by mixing the liquid obtained by evaporating a solution of ¼ oz. nickel in aqua regia to a pasty mass and dissolving it in 1 lb. aqua ammonia, with that obtained by treating the same quantity of nickel with a solution of 2 ozs. cyanide of potassium in 1 lb. of water. More cyanide renders the deposit whiter, and more ammonia renders it grayer.

Correspondence.

Small Engines for Agricultural Purposes.

To the Editor of the Scientific American:

As many of your readers are interested in the performance of small engines, I will tell you what we have accomplished with one, diameter of cylinder of which is 3 inches, and length of stroke 5½ inches. I can only give you the amount of work done, as we have neither steam gage nor water glass. On February 2, we threshed 239 bushels of oats inside of 5¼ hours. The thresher was 120 feet from the engine, and was driven by ½ inch seagrass rope from engine to idler, thence by 3 inch belt to thresher. The snow drifted on to the engine so that it was nearly covered: the parts that were hot, however, kept the snow thawed. The boiler is of our own design, built entirely of 1 inch gas pipe, and has about 50 feet of heating surface. I have taken your paper for years, but I have never seen any design at all like this one. It works to a charm, does not leak a drop, and will stand immense pressure. It holds but 3 pails of water, and is as easily managed as any 36 or 40 horse shell boiler; and I have had some experience with such sizes. We have designed a pump expressly for this boiler, and I will venture to say it cannot be beaten for one holding so small a quantity of water. The amount of fuel used in threshing the grain abovementioned was 4½ cords of old rails, cut to two feet lengths. The engine made about 300 revolutions per minute, working steam at full stroke. I can give you no better data, but I think the results are hard to beat. We are farmers and not machinists, but we have constructed the entire engine and boiler. L. COOPER.

Cortlandville, N. Y.

Photo Suggestions.

We have long been familiar with the fact that telescopic images may very easily be produced in the camera by the simple expedient of mounting a small camera upon the eyepiece end of the telescope, the degree of amplification depending upon the distance between the eyepiece and the sensitive plate. As might be anticipated, the amount of angle included is exceedingly small, the object glass of a telescope being corrected only for axial rays; and indeed, owing to the tube, the transmission of an oblique ray would be quite impossible.

It may not be generally known that, by means of an opera glass used as a camera objective, a greatly enlarged image of any view to which it is presented may be obtained. Owing to the shortness of the tube, and to the optical principles involved in the formation of a large image by means of an objective when used in conjunction with a concave eyepiece, this form offers advantages, in the production of a directly magnified image, not possessed by the ordinary telescope. We recently made several experiments with an instrument which, owing to its expense and the niceties involved in its construction, is very seldom manufactured. It has a short body, about four inches in length, but possesses very great magnifying powers, attributable to its construction. It is comprised of three triplet lenses in each tube: an object glass of large diameter and short focus—not plano-convex, but rather as the form known as crossed; a center bi-concave triplet of large diameter and great curvature; and a plano concave triplet eyepiece, the flat piece being next the eye. This form of tube, when used as an objective for the camera, produced images of great sharpness in the axis, the sharpness being more extended than we have seen it with any other form. By means of this instrument we obtained an excellent and sharp photograph of the sun three inches in diameter.—*The British Journal of Photography.*

Preparing Relief Blocks from Photographs.

A German process for getting surface blocks from photos, to be printed by letterpress process, is: Take a piece of looking glass about 2½ inches larger all round than the original, and pour on it, in the dark room, the result of 1 oz. bichromate of potash in 15 ozs. water, put over a slow fire, and add gradually 2 ozs. of fine gelatin. When dissolved and at boiling point, strain through a fine linen rag.

The plate must be placed in a horizontal position. Spread all over with a fine broad brush. Give fresh layers till the film reaches about a line and a half thick. Let dry for two or three days, and keep from the light. Take a glass positive from the negative of the original; place the prepared plate in contact with it in the printing frame. Remove to the dark room; pour over tepid water till fully developed. Dry with filtering paper, paint over with glycerin, and wipe off also with filtering paper. Develop the relief upon the plate; its subsequent treatment need not be effected in the dark. To make the plaster mold, mix fine plaster of Paris with spring water in two vessels, to the consistence of oil in one, of thick cream in the other. Hold the plate in the hand, pour over it the thinner solution, tap the bottom of the plate gently with the hand to prevent air bubbles. Place the plate horizontally upon the table, and pour the thicker solution over to a moderate hight. Leave it to settle and dry for some 16½ hours. Cut away the thin edges of the gypsum with a knife. Separate the plaster mold gently from the relief plate. Pour stereo metal into the mold, and a printing plate will be the result. Rectify defects with fine-pointed tools in the plaster mold previously to casting.

ACCORDING to M. Tisserand, the French Inspector General of Agriculture, milk will yield more butter and cheese when the pans are set in an apartment where the temperature is not higher than 32° Fah.

Weighing Light.

The London *Times* gives the following description of Mr. William Crookes' new apparatus for weighing a ray of light: In a tube in which a vacuum has been produced, a very fine thread of glass is suspended by both ends, and at one part of it is a small cross thread, to which is attached a disk of pith with one side blackened. At the junction of this cross piece is a small circular mirror, so arranged that a ray thrown on it from a lime light shall be reflected on to a graduated scale, and any twisting of the glass thread shall be thus recorded. At one end of the glass thread is a turning disk and a Harding's counter, outside the tube. The light to be weighed is allowed to fall on the pith. This, as in the simple radiometers, is repelled, and its motion causes a torsion of the glass thread and a motion of the mirror spot along the scale. The turning disk is employed to unwind the thread against this action, the mirror spot going back to zero on the scale. The counter tells the degree of torsion the glass thread has undergone by counting the amount of unwinding required. Then a little iron weight, the one hundredth of a grain, which is within the tube, is lifted by a magnet on to the cross bar; its weight causes a torsion, the mirror spot travels along the scale, and the unwinding is performed as before. A candle placed six inches away from the pith was found to give 1,628 degrees of revolution, and the little iron weight 10,021 degrees. The candle light is therefore calculated to weigh 0·00172 grains. Mr. Crookes has made experiments on the sun's light, and has worked out some calculations on it. It is equal to 32 grains on the square foot, 57 tuns on the square mile, or 3,000,000,000 tuns on the whole earth.

There are two practical applications of this discovery which bid fair to be of considerable scientific value. The first is its employment as a photometer. If, for instance, the candle light above noted weighs 0·00172 grains, that weight could be made to cause a certain deflection of a dial finger. With this might be compared the deflection caused by any other light, and thus the intensity of one illuminator conveniently measured by the other, used as a standard. Mr. Crookes tried this and found that a correspondence between the light of a candle flame and that of a gas burner took place when the candle was 48 inches and the burner 113 inches distant. Consequently the light of the burner equaled in intensity that of 5½ candles. This gives a way of testing any burner, the deflection due to the light of which, when good gas is employed, is previously known. If the deflection should fall short, then gas of poor quality would be presumed. So also the varying intensities of sunlight might be measured, and this would prove a valuable addition to meteorological records.

New Lion Palace, Zoological Gardens, London.

The lion palace is two hundred and fifty feet long outside and two hundred and twenty-seven inside; the width of the asphalt pavement in front of the dens is thirty-six feet, the height is thirty-four feet. There are altogether fourteen dens, four large ones, one at either end, and two in the center; they are twenty feet long by ten feet wide, the smaller are about twelve feet square. The supports to the roof are varnished wood, such as is seen in new churches, and the blue tint given to the ceiling gives a general lightness to the whole edifice. The floors of the dens are sloped towards the front, and just outside, in front of the whole series of dens, there is a trough which has a constant flow of water running through it, so that the cleanliness and the comfort of the animals have been provided for in every possible way. The ventilation and warming apparatus is most perfect.

The following is a list of the animals: No. 1, "The Shah," a Persian lion; No. 2, lioness, East Indies; No. 3 Indian leopard and a Nubian lioness; No. 4, Indian leopard; No. 5, clouded tiger; No. 6, three Mexican pumas; No. 7, two lionesses and one lion, born in menagerie, July 8, 1872; No. 8, Indian tiger; No. 9, Indian tiger; No. 10, American jaguar; No. 11, South American jaguar; No. 12, three tiger cubs, about ten months old; No. 13, Indian tiger; No. 14, Indian tiger.

There is a considerable echo in the building, and the splendid roar of the lion can now be heard in all its true grandeur.

Anthracite Coal Prices for 1876.

By a combined agreement among the anthracite coal companies, the rates for 1876 agreed upon, to consumers only, for lump, steamer, broken, and chestnut sizes, free on board, at any of the shipping ports in the vicinity of New York, are as follows:

	Lump.	Steamer.	Broken.	Chestnut.
March and April..........	$4 20	$4 30	$4 40	$4 30
May..........	4 25	4 35	4 45	4 35
June..........	4 30	4 40	4 50	4 40
July..........	4 35	4 45	4 55	4 35
August..........	4 40	4 50	4 60	4 50
September..........	4 45	4 55	4 65	4 55
October..........	4 50	4 60	4 70	4 60
November	4 55	4 65	4 75	4 85
December..........	4 60	4 70	4 80	4 60

and at thirty-five cents per tun less free on board at Port Richmond, Pa., except for chestnut coal, which may be seventy cents per tun less than the New York free on board price: It being provided that all such contracts shall be made in writing prior to April 1, and that no commissions or allowances of any kind be made thereon, and that no such contracts be made with any other than a consumer of coal.

CAMPHORATED oil is highly recommended as a furniture polish. This is simply sweet oil in which gum camphor is dissolved. The camphor serves the additional purpose of driving away moths.

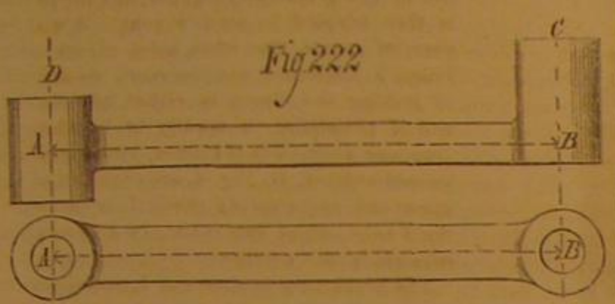
PRACTICAL MECHANISM.

BY JOSHUA ROSE.

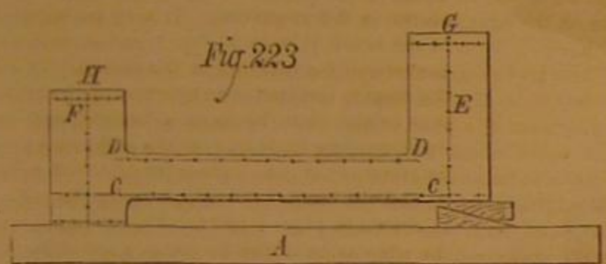
NUMBER XLIV.

TO MARK OFF THE DISTANCE BETWEEN THE CENTERS OF TWO HUBS OF UNEQUAL HIGHT.

When the hights of two hubs are unequal, as shown in Fig. 222, the distance required being that from A to B, we must make the necessary allowance (in the distance at which we set the compass or trammel points) for the difference in

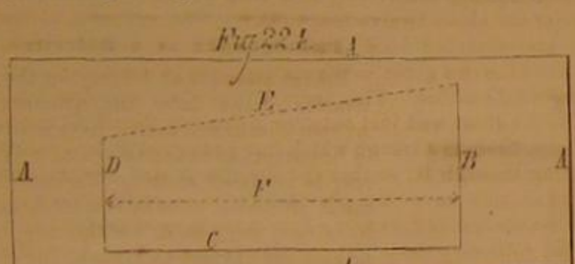


hight of the surfaces upon which our circles are to be marked, from the body of the lever or arm. If the arm is to be finished along its whole length, it is better to mark off the body of the arm first, which we perform as shown in Fig. 223. Setting our work upon the table, A, and wedging it as shown, we mark off with the scribing block the lines, C C

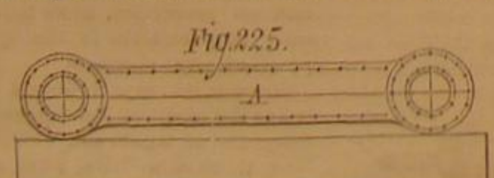


and D D, making their distance apart the thickness of stem required, and leaving about an equal amount of metal to be taken off each face. We then mark off the hight of each hub face, measuring from the line, C, and scribe a line around each hub face as far as the scriber point will allow. We next mark off (with a square, resting against the surface of the marking-off table) the lines, E and F, marking them as near the center of the hub as the eye will direct: their use being simply as guides in setting the work in the lathe or machine. These lines being dotted with a fine centerpunch, to prevent their becoming obliterated, we next measure the hight of the face, G, and that of the face, H, both from the line, C.

We now turn to the marking-off table, and on its surface draw a straight line a little longer than the length of our arm or lever, as shown in Fig. 224, the lines, A A A A, representing the outline of the marking-off table, the line, B, representing the hight of the hub from its surface, G, to the

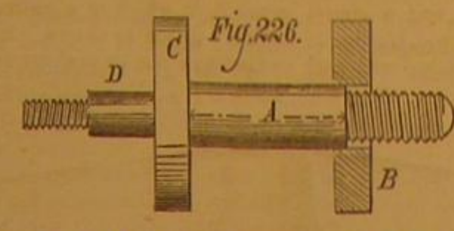


line, C, in Fig. 223, and the line, B, representing the hight of the hub from its surface, H, to the line, C, in the same figure. The two lines, B and D, are to be struck at right angles to the line, C, and the distance between them (as denoted by the dotted line, F) being the required distance from center to center of our lever. These lines being drawn, we have only to set our compass or trammel points to the length of the dotted line, E, to be able to mark off the correct distance apart for the centers of the circles to be marked on the faces of the two hubs. Proceeding, then, we place our lever on the marking-off table in the position shown in Fig. 225; and

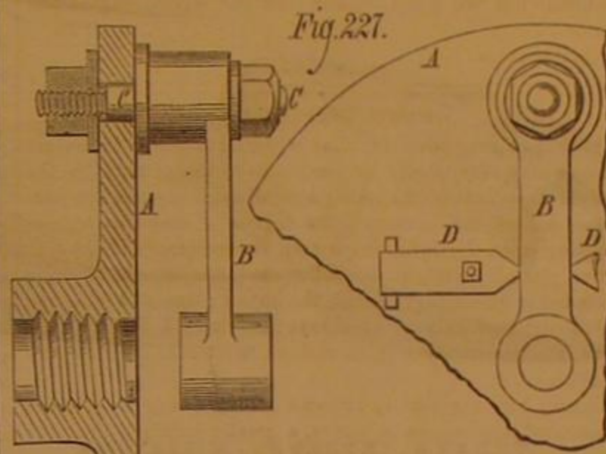


after putting a centerpiece in each hole, we draw (along the entire length of the lever and across the faces of the hubs) the center line, A, locating it in the center of the stem; we then apply the trammels, set as already directed, to mark off the centers of the holes. Setting our compasses at the intersection of the line, A, with the line marked on each of the hub faces, we strike the necessary circles on the faces of the hubs, as shown. We next mark off the breadth of the lever or arm on the face from the center line, A, and our marking is complete.

When, however, there are a number of such levers to be made, all requiring to be of nearly equal length from center to center of the holes, one only should be marked off for the hole centers, care being taken to mark it off with great exactitude. Then after that one is bored, and the faces of the hub are faced off true with the hole, a pin, as shown in Fig. 226, should be made, the diameter of the part, A being made to neatly fit one of the holes in the end of the arms or levers, and being marked shorter in length than is the length of the lever hole into which it fits. B is a washer, turned to fit easily to the diameter of A, and C is a collar, solid with A. D is a stem, turned parallel and true; and it is a little less in length than the thickness of the chuck plate upon which the

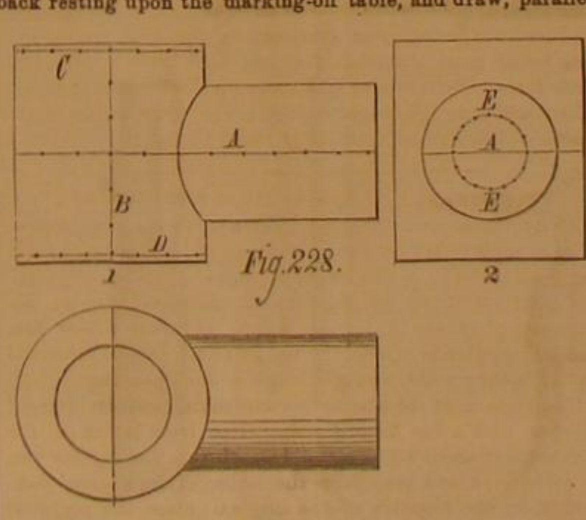


arm is to be held while the holes are being bored. Upon each end a screw is provided to receive a nut. The use of this stud is as follows: Upon the chuck plate of the lathe or boring machine, and at the requisite distance from the center, is bored a hole to receive at a close fit the plain part, D, of the stud; and into this hole that end of the stud is fastened by means of a nut. One end of the lever or arm (being bored to fit the part, A, of the stud) is placed thereon, the stud being bolted to the chuck plate while the hole at the opposite end is being bored: thus insuring that the holes are exactly the same distance apart in all the levers. The manner of chucking is shown in Fig. 227, in which A represents a portion of the chuck, B the lever or arm to be bored, C the stud, and D D the plates bolted against the chuck so that their ends contact with the stem of the work to prevent i



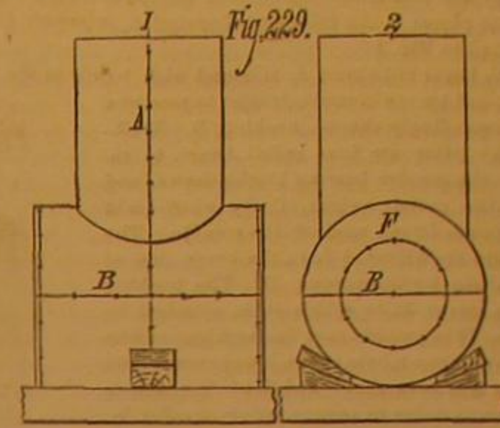
from moving sideways during the operation of boring. The use of this stud, modified in shape to suit the work, is also applied to the turning of cranks, eccentrics, and other similar work, requiring unusual exactitude in the position of a hole or holes, or of a diameter in its position relative to a hole.

To mark off a crosshead in which one hole requires to be at right angles to the other, we proceed as follows: First placing the crosshead upon the marking table, in position 1 in Fig. 228, we draw with the scribing block the center line, A, marking it all round the crosshead; and if the crosshead has a hole or holes in it, we put centerpieces in those holes to receive the center lines. We then place a square with its back resting upon the marking-off table, and draw, paralle



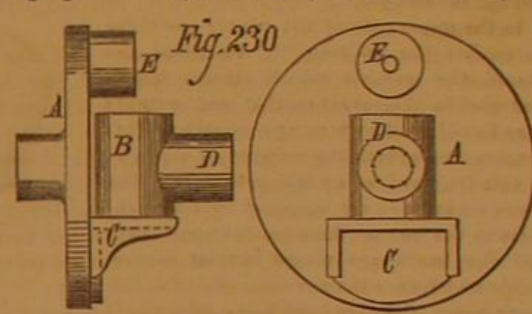
with the edge of the blade, the center line, B. From the intersection of the lines, A and B, we draw the lines, C and D, marking their distances from the line, A, with a pair of compasses, and carrying the lines round with the scribing block. We draw the circle, E, using the line, A, as a center and locating it, as nearly true as we can, the other way from the hub or stem. We now stand our crosshead in the position shown in Fig. 229; and applying a square to the line, A, we set it to a right angle with the face of the line, A, wedging it upright with the wedges shown. Then, setting the scribing block needle point even with the line, B, of position 1 in Fig. 229; and setting that line true with the surface of the table, we carry it across the other face, as shown in position 2, locating its position sideways to suit the forging or casting; and then we strike the circle, F, which completes the marking.

It will be noted that the lines, A and B, are mere guides whereby to obtain the centers of the circles from; and it may therefore be asked for what purpose those lines are center-punch-marked. The reply is that those lines must be used as guides to set the work by when chucking the crosshead on the lathe or machine. We may here also note that the length of those lines is often too short, in consequence of the shortness of the work, to form a very accurate guide for the setting. To obviate this difficulty, the machinist should first chuck the work by one of the lines, and then perform all the duty necessary at that chucking. Then, in the second



chucking, he should adopt one of the following methods to set the work true, independent of the second line:

In Fig. 230, A represents the face plate of a lathe, and C an angle plate, that is, a plate having its two flat surfaces at a right angle to each other. It is evident that if the work has the hole, parallel with the line, B, bored, and the end faces round that hole trued with it, we have only to bolt the angle plate, C, to the face plate, A, of the lathe, and then to bolt one of the turned faces of our work to the face of the angle plate, and set the latter so that the parallel stem, D, of the work runs true; and then it will be so set that the holes, if bored true with the tool, will stand at a right angle to each other. In all cases, however, in which an angle plate is used, or in which, from other causes, there



is a greater amount of weight on one than on the other side of the face plate of the lathe, there should be bolted to the latter a weight sufficient to act as a counterbalance, such a weight being shown at E, in Fig. 230; otherwise the work will be bored and turned slightly oval. The other method of chucking referred to is to bore out one hole; and having faced up the faces at the end of that hole, to then chuck the work with a parallel mandrel, fitting neatly into and projecting from the hole already turned. The work must be so set that the mandrel stands true or parallel with the face plate of the lathe; this may be done in conjunction with the use of the angle plate, thus insuring accuracy in the chucking of the work.

A Shower of Meat.

The Bath County (Ky.) *News* says: On Friday, March 3, 1876, a shower of meat fell near the house of Allen Crouch, who lives some two or three miles from the Olympian Springs in the southern portion of the county, covering a strip of ground about one hundred yards in length and fifty wide. Mrs. Crouch was out in the yard at the time, engaged in making soap, when meat which looked like beef began to fall around her. The sky was perfectly clear at the time, and she said it fell like large snow flakes, the pieces as a general thing not being much larger. One piece fell near her which was three or four inches square. Mr. Harrison Gill, whose veracity is unquestionable, and from whom we obtain the above facts, hearing of the occurrence, visited the locality the next day, and says he saw particles of meat sticking to the fences and scattered over the ground. The meat when it fell appeared to be perfectly fresh.

The correspondent of the Louisville *Commercial*, writing from Mount Sterling, corroborates the above, and says the pieces of flesh were of various sizes and shapes, some of them being two inches square. Two gentlemen, who tasted the meat, expressed the opinion that it was either mutton or venison.

Singing in Chinese.

The enlightenment of the Chinese in religious matters, more especially in singing, is a work of extreme difficulty. Mr Walker, a missionary at Foochow, writes to the *Missionary Herald*:

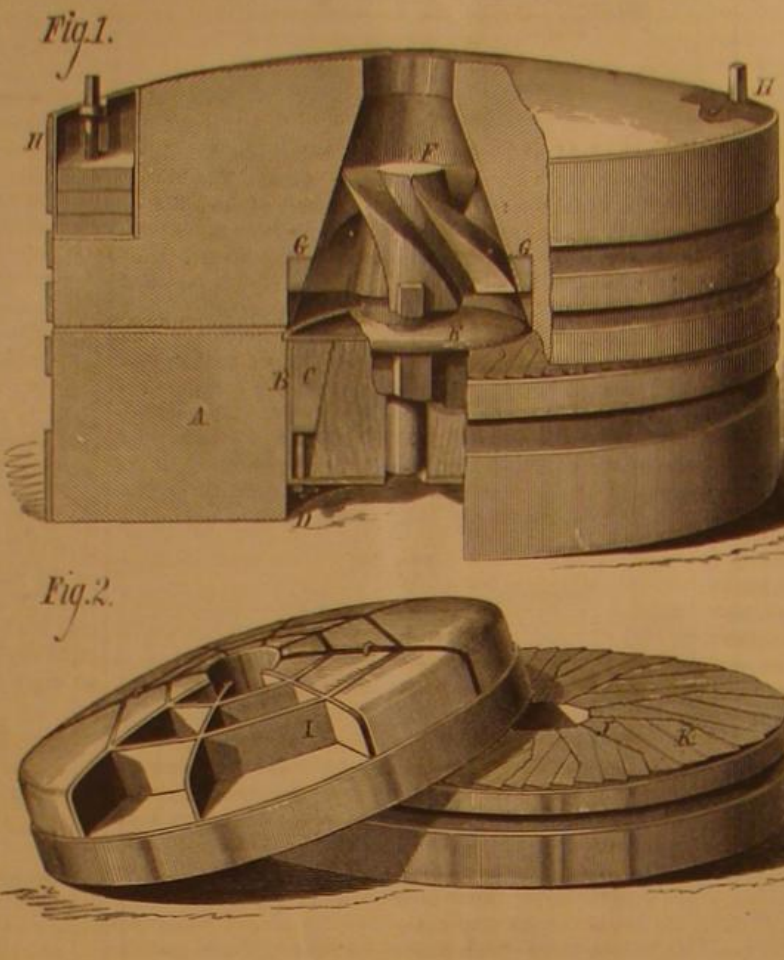
"There is one very serious drawback to the use of music as a means of preaching the Gospel in China. In singing, the word tones cannot be given, and this destroys the sense. For in Chinese, as a rule, every articulate sound represents at least two or three different words, while the more common, such as 'ting,' 'ling,' and 'sing,' often represent two or three dozen different words, and without the help of the tones they have no meaning whatever. So when a hymn is sung to a Chinese audience who are not already familiar with it, it has scarcely more meaning to them than it would have to a foreigner just arrived. In fact I have sometimes just sung a foreign hymn to the audience, and then interpreted and expounded it, and it seemed to answer as well as a native hymn."

IMPROVED MILLSTONE.

We illustrate herewith a new millstone, in which is embodied a large number of novel and useful improvements, mainly in mechanical construction, the object being to render the stone more effective in operation and more readily adjusted and balanced. These will be found noted in their proper places in the following description, reference first being had to Fig. 1.

The lower millstone, A, is bound with bands in the usual way, and its eye is made circular to receive a correspondingly shaped bushing, B. Within the latter are four radial boxes to receive the wooden bearing blocks shown, and also the metal wedges, C, by which said blocks are forced against the spindle. The wedges are adjusted from the lower side of the stone by the screws, D. The bushing has a cover, E, to which it is attached by bolts. This projects over the bushing, and its edge enters a rebate in the lower stone. Said cover is convex above and flat below, and is hollow in order to receive tallow or other lubricant. An upward projecting flange on the convex part enters a cavity in the driver, and serves to protect the spindle, which passes through, from contact with the substances ground, etc. The upper end of the spindle fits into a polygonal socket in the driver, so as to carry the latter with it in its revolution. The ends of the driver enter recesses in opposite sides of the bail, F, and so rotate the same, and the latter rests on the spindle end and has projections, G, which enter notches in the side of the eye of the moving stone. The bail has on its outer surface four spiral grooves, flaring downward so that they may not become clogged.

In the upper part of the runner are holes to receive the pockets, H. In these are placed the weights which receive screws swiveled in the covers so that said weights may be adjusted by turning the screws. This construction adapts the weights to serve as a standing and as a running balance. The screws may be easily operated by a wrench. Around the runner, between the usual main and edge bands, are placed several narrow bands which are cut away successively as the stone wears, the edge band being driven up.



TRUAX'S IMPROVED MILLSTONE.

When the runner is to be backed, a skeleton shell, I, Fig. 2, is placed upon it and secured by rods, J, which hook into the radial bars above, and are leaded into holes in the stone below. The plaster is then poured upon the shell and turned down true. The radial bars are made of such a length at their inner ends that the eye may be formed to the proper size without uncovering said end. This construction of the eye, the inventor states, enables him to put in a dress with 1½ inches draft for each foot of the diameter of the stone, and twenty-four furrows at the edge and two furrows in each quarter, or seventy-two in all. The main furrows, J, are on a draft of about 1½ inches from the eye for about two thirds their length. Their outer part and also the furrows, K, are on a draft of 1½ inches per foot of diameter of the stone. The furrows, J, are about three eighths of an inch deep at the eye, and gradually decrease in width and depth toward the skirt, being about three sixteenths of an inch deep at the two thirds point, where the draft changes. The furrows, K, also gradually decrease in depth and width from their inner to their outer ends. All the furrows at the skirt are not more than five eighths of an inch wide, and, for grinding corn and other coarse grain, not more than one eighth of an inch deep. For wheat the depth does not exceed one thirty-second to one twenty-fourth of an inch. This dress gives an almost unbroken skirt and full lands, producing an even grade of meal or flour, and, it is claimed, more flour to the bushel of grain than the ordinary dress.

Patent now pending through the Scientific American Patent Agency. For further information address the inventor, Mr J. W. Truax, Essex Junction, Vt.

IMPROVED FAUCET AND VENT.

The function of the device illustrated in the annexed engravings is twofold: First, to admit air into a barrel, keg, or other vessel, so as to counterbalance the atmospheric pressure at the outlet, and thus allow a free discharge of the contained liquid; and, second, to act as a faucet for drawing off the liquid, without, however, admitting air to fill the vacuum in the vessel due to the escape. Thus the invention may be used either as a vent or as a faucet, and to this end a sleeve, provided with oppositely located air vent and liquid discharge holes, is applied to a hollow gimlet-pointed stem, so as to be rotated thereon, and locked in either of the two positions necessary to the performanc of one or the other of the above stated functions. The invention also consists in a corkscrew and brush attachment, and in certain other features, due reference to which will be made as we proceed.

The implement is composed of a T-shaped open-ended tube, A, and a gimlet tube, B, in which is a spring-acted plunger rod, C (Fig. 2), having a piston as shown. Said piston is packed with cork and india rubber so that the swelling of said packing will compensate for wear. There is a rubber washer applied to the rod, C, immediately beneath the head or thumbpiece, which serves to form a tight joint around the plunger when the piston is forced down and locked by lugs at D, to hold it away from the vent holes.

A rotating tube, E, is applied to the body of tube, B, which is correspondingly reduced in diameter to form a smooth exterior, as shown in Fig. 1. This sleeve has liquid discharge holes, F, arranged spirally around it, and the hollow stem has similar apertures. The sleeve also has similar air vent openings, G, and in the stem are like holes to correspond. When the sleeve is adjusted in one position, the holes, F, therein will register with the similar apertures in the stem; and the piston having been pushed down and locked below said holes, F, the device will act as a faucet, the liquid discharge taking place through said coincident orifices and through the tube, A, as will readily be understood from Fig. 2.

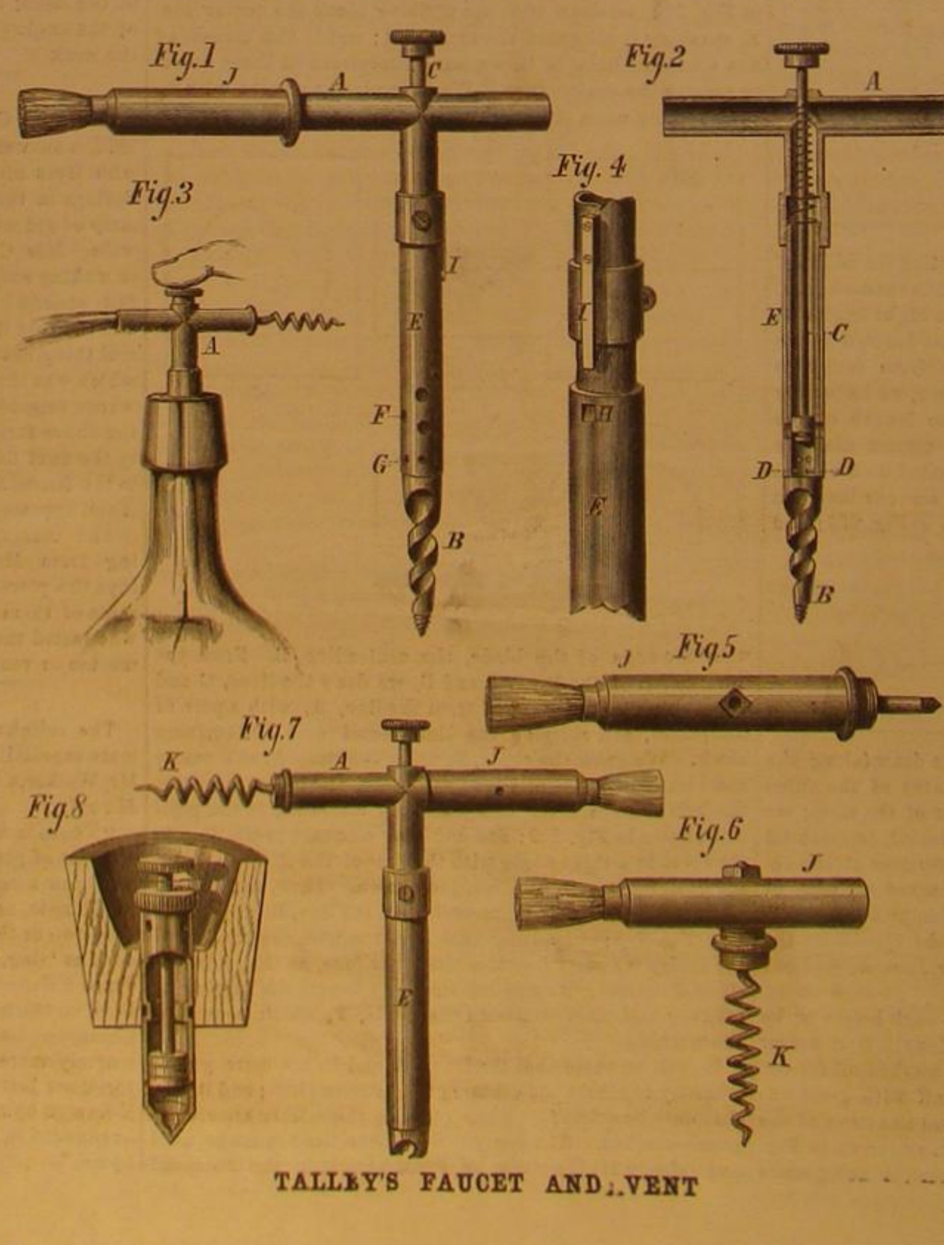
When, on the other hand, the sleeve is turned half round from the position above described, the vent holes, G, will similarly register, and the device is then adapted to act as a vent. It will be seen, of course, that when holes, G, are open, holes, F, are closed, and *vice versâ*. As a means of locking the sleeve in either adjustment, and of permitting it readily to be changed from one position to the other, two oppositely located notches, H, Fig. 4, are provided at the upper end, and a spring catch, I, is secured to the T tube, which enters and, by a square pin, engages in said notches.

The brush tube is shown at J, and the corkscrew at K. The latter is attached to one side of a screw plug having a milled rim. A small screw thread stem is formed on the other side of said plug, and at the base of the stem is a threaded boss or circular shoulder.

The various ways of applying the corkscrew, pursuant to this arrangement, are clearly shown in the engraving. It may be inserted in the brush tube as in Fig. 5, and so rendered convenient for carrying in the pocket. In use the stem is inserted in an aperture of the brush tube (which thus becomes a handle), and set up above by a little nut; or the corkscrew may be attached at one extremity of the T tube, A, and the brush tube slipped over the other, as shown in Figs. 7 and 1. Fig. 3 represents the adaptation of the device as a spout for siphoning bottles containing effervescent and any other liquids; and Fig. 8 exhibits the invention suitably modified to adapt it to the bung of a barrel, as an automatic bung.

The invention is an improvement on a somewhat similar device patented June 30, 1874. It is well suited, not merely to the uses of grocers, druggists, brewers, and saloon keepers, but to those of private families. The implement is inexpensively made, of strong and durable metal throughout.

Patented through the Scientific American Patent Agency, March 7, 1876. For further information relative to proposals for manufacture, purchase of territory, etc., address the inventor, Mr. James Talley, Jr., Kansas City, Mo. The inventor calls attention to the simplicity and cheapness, especially of the automatic bung, which can be supplied to brewers, distillers, and original package men, at a cost but little over common bungs.



TALLEY'S FAUCET AND VENT

Photography as a Detective.

Recent attempts at forgery, by the alteration of the dates and amounts of written checks and drafts, have resulted in investigation as to how erased writing may be rendered visible. Various chemical processes, more or less efficacious, have been suggested, but the simplest process yet devised seems to be the photographing of the suspected paper.

This is founded on the fact that certain colorless or feebly colored substances, while very slightly affecting the eye, act powerfully upon the sensitive film in the camera. Photographers are aware that a photographic proof nearly effaced through age may, by photography, be reproduced with all its primitive detail and intensity. Generally all yellowish stains may thus be brought out; and peroxide of iron in the smallest proportion, so as to be practically imperceptible to the eye, gives proofs of great clearness.

Common ink, says M. Gobert, to whom is due the credit of the suggestion, is a compound of tannin and oxide of iron. Now it matters little what chemical means are used to remove the ink marks; for however carefully the chemical be applied, some traces of peroxide of iron are sure to be left either on the surface or in the substance of the paper. It is only necessary, therefore, to photograph the sheet, and to enlarge it besides, to bring out in the proof the effaced writing in an entirely legible condition.

A RECENTLY proposed casing for steam pipes is composed of equal parts of fuller's earth and coal ashes, mixed to a paste with water and with as much calf's hair as it will take up. Before using, add one eighth its quantity of calcined gypsum and apply in thin coats.

CLEOPATRA'S NEEDLES.

Of the many monuments which at one period of history rendered Alexandria, in Egypt, the grandest city in the world after Rome, but few relics remain beyond the column known as Pompey's Pillar and the two obelisks called Cleopatra's Needles. Of the latter, one is still standing; the other lies prostrate, half buried in the sand, not many feet from the sea shore, its fall having probably been caused by an earthquake. These curious monuments, which are excellently represented in the engraving given herewith, measure 73·6 feet in length, and are supposed to have been made during the reign of Thothmes III, about 1,600 years before Christ, an epoch when ancient Egyptian art vigorously flourished. They were transported to their present site by Rameses II, from Heliopolis. No hieroglyphics known were more clearly cut and defined than those inscribed on the sides; but since the obelisks have been in nowise protected from the weather, the beauty of the carving has yielded greatly to climatic influences, and we can only obtain an idea of its former perfection by comparison with those obelisks which have been transported to Rome and Paris, and there carefully guarded for many years.

The prostrate monument belongs to England, and has been the property of that country since the beginning of the present century, when Mehemet Ali made it a gift to the English government. Up till quite recently, however, the British authorities have not concerned themselves regarding the stone, for the reason that, its inscriptions having become so impaired, Egyptologists reported it as of little value or scientific interest. Since the completion of the Thames embankment, the project has been broached of claiming the monument, transporting it to London, and setting it up in some commanding position. The Khédive of Egypt has acknowledged England's right to carry off the obelisk when she pleases; and the probabilities are that, sooner or later, the transportation will be effected, that is, as soon as some one suggests a wholly feasible plan for overcoming the engineering difficulties involved in the operation. The last time an obelisk went to sea (that of Luxor, now located in Paris), its behavior was not of the best; for in heavy weather its vast weight seriously strained and nearly caused the foundering of the vessel in which it had been stowed.

The most recent plan for shipping the Needle that has come to our knowledge was suggested last summer, and seemed to find considerable favor at the hands of engineers, though we have not heard of its having been adopted. This was to fasten wooden beams around the stone until its quadrilateral form was changed to a cylinder. It might then be rolled over a temporary road to the sea. The wooden envelope, it was considered, would diminish the specific gravity of the whole bundle so that it would float in the water; and so it might be towed to England, beached on the shores of the Thames river, and rolled up to its site. Our engraving, from *L'Univers Illustré*, shows the monument as it lies on the shore of the Red Sea.

Explosion of Krout.

About 9 o'clock on February 20, when the storm was at its hight, a number of the inhabitants on "the hill" were startled by a report resembling artillery. In a few minutes some of the most daring darted out through the tempest in the direction whence the noise proceeded, and encountered one of our German citizens, shouting at the top of his voice, like one crazed, "*O mein Sauer-kraut! Mein Sauer-kraut!*"

All endeavors to pacify him were unavailing; and while some took charge of the miserable man, others entered his dwelling. Here a scene presented itself that completely beggars description. On a lounge sat his wife, a picture of despair, endeavoring to "unkrout" her new dress, while three children nearly covered with sour krout were flying about the apartment, taking handfuls of the stuff out of their mouths, noses, and eyes. Every article of furniture in the room was displaced, and over the door and all around was krout—sour krout.

It soon transpired that a large barrel full of krout had been brought up from the cellar to the fire, to be thawed out; and the head being closely nailed in, the gas generated had no vent, and exploded with terrific force, bursting the barrel and scattering the contents in every direction. The entire apartment was, for the time being, converted into a strange phantasmagoria. From every piece of furniture hung festoons of sour krout, like Florida moss in southern forests.—*Adrian (Mich.) Press.*

Camphor Poisoning.

The *Pharmaceutical Journal* publishes a rare and interesting case of camphor poisoning, the leading features of which are as follows:

While some camphor was being weighed out, a lad of thirteen picked up two small pieces and took them away with him for the purpose of floating and burning them. Soon afterward he began nibbling the camphor, and, as it afterward appeared, liking the taste of it, continued to do so until he had eaten the two pieces. This was about four o'clock in the afternoon. Four hours afterward the child was with his brother in the dispensary, looking on, and was observed to do something which elicited the remark: "Are you dreaming?" No reply was given by the child, and it was noticed that something was wrong with him: his eyes were fixed in a stare, and he stood motionless and unconscious. His brother took him up to carry him into an adjoining room, where his father was, when he immediately became convulsed and perfectly rigid, with his head and legs bent back, so that he could only be placed on his side upon the floor. The convulsions increased until the flesh from the head to the shoulders became purple, and the pulse decreased rapidly until it could not be felt. The body then lost its rigidity and was apparently lifeless; but in about ten seconds the pulse could again be felt, the convulsions returned, and the child foamed at the mouth. Applications of cold water brought him round in about four minutes; violent vomiting then ensued; the child was for a time hysterical, but within an hour from the first attack he was so far recovered that he could be put to bed. The child afterward described the pieces of camphor which he ate as being each half the size of his thumb; and the assistant, who noticed him take one piece, thought it must have been about sixty grains in weight. The effects produced in this case were more severe than in any of those previously reported; and there was the further difference that unconsciousness preceded the convulsions, while in the other cases it followed them.

Prizes for Photographic Materials, etc.

The Industrial Society of Rouen, in their lately published programme, offer, among some fifty others, the following three prizes: A gold medal for a substance which shall be cheaper than egg albumen, and which shall replace it in all its applications to printing; a medal (sort not mentioned) for a process for producing oxygen as an article of commerce cheaper than it can at present be produced; a gold medal for a practical commercial application of photo-engraving to the production of prints. The competing works must be sent to the President of the Industrial Society of Rouen before the 1st of October, 1876, and should be signed. They must bear a motto, and be accompanied by an envelope bearing the same motto, and enclosing the author's name and address.

On the Digestibility of Milk.

Dr. Carter read a paper in London lately, entitled "Observations on the Digestibility of Milk," in the course of which he discussed various methods which had been generally used with a view of promoting its digestibility, pointing out that their efficiency was essentially due to the dilution of the casein of the milk, thus causing the precipitation, on its introduction into the stomach, in a granular form, of what would otherwise be firm, bulky, and compact. He further showed, by experiment, that simple dilution with water was insufficient for this purpose, and that this object was far better attained by admixture of alkaline or starchy waters with the milk. He summed up by giving a decided practical preference to barley water. His conclusions were illustrated by experiments and reference to cases.

CLEOPATRA'S NEEDLES.

The Royal Aquarium at Westminster.

The large building which has been slowly rising at Westminster, on the ground facing the Abbey and the Houses of Parliament, and which is to present under one roof the varied attractions of an aquarium, a summer and winter garden, with a museum and picture gallery, in addition to the more commonplace but useful features of a reading room, library, and restaurant, was formally opened on January 22 by the Duke of Edinburgh, in the presence of a large gathering of ladies and of the members of the society under whose auspices the scheme has been so far brought to a successful issue. The building, which has been erected by Messrs. Lucas, from the plans of the architect, Mr. A. Bedborough, stands on a site of three acres, stretching from the chief entrance, near the Westminster Hospital, as far as the St. James' Park station on the Metropolitan Railway, the freehold of the land having been secured by the society. It will give some idea of the extent of the center or main transept, which is to be used for promenade and concert purposes, and in which the opening ceremonial took place, if we state that it is 8 feet greater than the principal transept of the Crystal Palace, reaching to 160 feet. The hight from the floor to the level of the roof is upwards of 70 feet, and round the building are the galleries, which are used for the fine art exhibition and as a museum. So far the architect has proceeded on well-worn lines, and has produced a handsome and spacious hall, suited alike for promenade or for musical performances. This, however, although the chief part of the structure, is not to be its main attraction; for it is in the aquarium proper that the great *raison d'être* of the undertaking, according to the views of its promoters, will be found. The tanks for the reception of the fish are of enormous extent, but at present, although complete, they are untenanted. The system on which they are to be supplied will insure a constant circulation of water; and as it will thus be kept in freshness and comparative purity, it is anticipated that the results will be even more satisfactory than in those aquaria already opened in this country and on the continent, where the water is never changed. This method of keeping the water in circulation has been invented by Mr. W. A. Lloyd, the naturalist. There are thirty-one show tanks, nine for fresh water fish and twenty-two for sea water fishes and animals, in addition to the marine tanks which are to contain the food supply of the permanent inhabitants, and to serve for the segregation of the sick—forming, in fact, a sort of hospital. The water for the tanks, consisting of about 600,000 gallons of sea water and 200,000 of fresh, is to be supplied from reservoirs below the center transept, to which it is returned after flowing through the tanks. Another feature of the undertaking—and probably one of the most attractive parts of the programme—will be the daily concerts by an orchestra of forty-eight performers, selected by Mr. Arthur Sullivan, and conducted by Mr. George Mount. Classical concerts, personally directed by Mr. Sullivan, are to be given at intervals. Following the system recently introduced at the Crystal Palace and the Alexandra Palace, a theater forms part of the scheme, and in this building dramatic performances will be given.

English Products in the United States.

We called attention, recently, to the collapse of the English steel rail trade, which in this country at the present time is totally dead, no rails having been imported hither from Sheffield for over nine months. From a statement of exports from the United Kingdom to the United States, lately issued by the Chief of the Bureau of Statistics at Washington, the following figures are given, indicating the exports in January, 1875, and in the same month of the present year:

	1875.	1876.'
Hardware and cutlery	$56,296	$34,765
Pig iron and steel, tuns	2,637	1,948
Bar, angle, bolt, and rod iron, tuns	242	240
Railroad iron, all sorts, tuns	2,376	23
Hoops, sheets, boiler and armor plates, tuns	269	100
Steel, unwrought, tuns	793	640

The immense fall in railroad iron shows that the decline is not confined, in that class of exports, to steel rails alone, while the very small amount of other metal goods brought over indicates that the trade has shrunk greatly.

Nor is this decline visible in metal industries alone. The comparative returns for the two months show a falling off of over a million yards of cotton goods; in haberdashery, a reduction of over fifty per cent; over a thousand tuns out of eight thousand in tin plates; a million yards of linen (ten million odd to nine million odd). In silk goods there is a falling off of fifty per cent; the same in carpets, in writing and printing paper, in beer and ale, and in spirits. About the only exports on the list which hold firm are china ware, wall paper, articles of silk mixed with other materials, stationery other than paper, and worsted cloths. The value of the English machinery imported hither, on the other hand, has nearly doubled, from $73,475 to $126,870; but neither of these sums is large, and probably the increase is due to apparatus brought here in anticipation of the Centennial.

Etching Process.

In Ackermann's *Gewerbezeitung*, Herr Fichtner gives an account of a way of producing etchings in relief by asphalt. Select pieces of asphalt which do not melt at 90°, and are difficult to dissolve in turpentine; dissolve five parts in a mixture of ninety parts of benzole and ten parts of oil of lavender; the benzole must be separated by distillation from any impurities that would render it too sensitive to light(?), after which it must be thoroughly drained before being used. The oil must be perfectly free from water. Coat a perfectly clean and smooth zinc plate with the varnish, allowing the latter to run off like collodion; then dry in a horizontal position in the dark. Expose the plate under a negative from twenty-five to thirty minutes in the sun, or three or four hours in daylight, according to the sensitiveness of the asphalt film, which must be ascertained by experiment. The exposed plate is then developed with rock oil, to which a sixth of its volume of benzole has been added; the oil is poured over the plate and moved about until the whites are perfectly clean; the plate is then washed under a jet of water, dried in the light, and etched with diluted nitric acid. There must be a careful avoidance of air bubbles.

Improvement in Electric Illumination.

It is well known that the electric light is due simply to the electric current heating the medium it passes through; and the more resistance is offered to the current, the greater is the heat developed. The great intensity of the ordinary electric carbon lamp is owing to the badly conducting layer of atmosphere between the carbon points, and the layer being very much heated makes the carbon burn with a white glow. By reason of the great resistance of this layer of atmosphere, which only a powerful current can overcome, the light must necessarily be a very brilliant one.

It is possible, without the aid of air or gas, to make a solid body quite hot, as, for instance, in the case of a platinum wire; the illumination thus produced is, however, weaker and more uniform, and may be intensified or diminished. But it cannot be applied practically by reason of its great expense, and because, if the heat becomes too intense, the wire is apt to fuse. For this reason, the idea struck Ladiguin to replace the platinum wire with thin bars of graphite or carbon. This graphite possesses, at an equal temperature, much greater radiating properties than platinum. The heat capacity of the latter is twice that of the carbon, so that the same temperature will heat a thin bar of graphite to double the degree which would be attained by a platinum wire of the same dimensions under similar circumstances. Moreover, the electric resistance of the carbon in question is about two hundred and fifty times that of platinum, and the carbon rod may be fifteen times as thick as a platinum wire of the same length, supposing the current is to give the same amount of heat. Finally, there is no disposition for the carbon to melt, even at the highest temperature.

For these reasons the Ladiguin method of electric illumination may be regarded as a most valuable one, as, indeed, it has already proved to be. The only drawback to it seems to be that the carbon gradually combines with the oxygen of the atmosphere and burns away; but this defect the inventor has overcome by confining the carbon in an airtight glass, from which the oxygen has been removed in the simplest manner, and replaced by nitrogen.—*Polytechnisches Notizblatt.*

Remarkable Coal Mine Explosion.

The anthracite coal region in the vicinity of Wilkesbarre, Pa., was the scene of a very remarkable gas explosion on March 6, 1876. The following particulars are from the New York *Herald*:

The explosion occurred in the mine known as the Prospect shaft, and owned by the Lehigh Valley Coal Company. The mine has been in operation about five years, and has always had the reputation of making more gas than any other mine in the anthracite coal region. In consequence the utmost precautions have always been taken against an explosion while the mine was in operation, by applying the best means of ventilation known. On the night of the 19th of January last, the mine took fire from the ignition of a current of gas, just after a blast had been made by a miner, and it was found necessary to force water into the mine for three weeks, until it was estimated that nearly ten millions of gallons of water had been poured in.

Operations were lately commenced to take out the water, and this was done by means of buckets holding 1,100 gallons each, which were fixed in the shaft and raised and lowered alternately. It was calculated that about 60,000 gallons were raised in this way every twenty-four hours. The shaft has a depth from the surface of 600 feet. When the work of bailing the mine was commenced, there were about 100 feet of water in the shaft, showing that the chambers and gangways below, which traverse a space of about a half mile square, were all filled. As the water was lowered, the gas, which had been forming constantly since the fire, began to push its way through the water. It is calculated that the water was charged with millions of cubic feet of gas, more or less; the gas escaped up the shaft. The work of bailing continued until about nine o'clock on the evening of the 6th of March, when suddenly a low, rumbling sound was heard below ground; and in a moment after, an explosion like a hundred earthquakes broke on the air, and sent its terrible echoes along the valley for miles in every direction. The shaft is located on a high hill, and instantly a stream of fire, forty feet long and twelve wide, shot up into the air for a distance of 500 feet. The whole country around for miles was brighly illuminated by this vast column of burning gas. The houses in the vicinity of the shaft shook like reeds at the moment of the explosion, and thousands of people turned out in terror to see what had caused the unusual commotion.

At Wilkesbarre, a little distance in the valley below, the loud report was heard, and the great flame of light, shooting heavenward above the shaft in the mountain, caused the greatest excitement, which grew momentarily as the illumination continued. Those at a distance could only conjecture what the cause of the Vesuvius counterpart was. Many people really believed that a volcano had broken loose, and terror seized upon more than one nervous witness. The tremendous stream of fire shot up from the shaft for three hours, loud explosions occurring every fifteen minutes. In the meantime thousands of excited people from all sections flocked to the vicinity of the shaft, and stood mute witnesses of the greatest sight which any eye had ever looked upon. It is supposed that as the water was taken out of the mine, the pressure below became lighter, and the gas, which had been pushed back by the weight of the water before, now mingled with the flood, and to such an extent that the water itself was capable of being ignited at the touch of a match; this must have been the case, for one of the men, who stood near the mouth of the shaft with lighted lamp when a bucket of water came up, was splashed by the overflow, and a drop falling in the flames of his lamp instantly caught fire, and in a moment the frame heading which stands over the shaft took fire; and as the sparks dropped into the deep pit below, they ignited the gas there generated, and of course an explosion followed.

Successful Progress of the Mississippi River Jetty Works.

An Associated Press telegram of March 5 states that the three-masted schooner Mattie W. Atwood, 783 tuns, with cargo of 2,250 bales cotton, and drawing 13½ feet, was put to sea through the jetty channel at South Pass on that morning. This is the first merchant vessel that has passed through the jetty channel, where, seven weeks ago, there was barely 7½ feet of water; now there is 14 feet.

"Constant soundings and surveys are being made," says the New Orleans *Times*, "and we know from these that, in many places right on the bar, where there was formerly six or seven or eight feet of water, there is now eighteen and twenty and twenty-three feet. This will soon be practically demonstrated by the passage of the deepest laden vessels. 'Tis only a question of a few days or weeks, not months. The great engineer, Eads, and the indefatigable builder, Andrews, are to be congratulated on the success of this most important national work, and New Orleans cannot do too much honor to these men for what they have done toward consummating her future prosperity and commercial preeminence."

Giffard's Cold Air Engine.

The principle of the cold air generators is well known. When air is subjected to compression, heat is developed. When deprived of the heat, and subsequently allowed to expand, it re-absorbs heat so eagerly as to produce a notable lowering of the temperature, which is susceptible of application to a variety of practical purposes. A new description of airtight cylinder, new joints, and a new stuffing box have enabled M. Giffard to so far improve upon previous machines that his cold engine, when driven by an ordinary steam engine, will make 20 lbs. of ice for each lb. of fuel burned.

New Property of Glycerin.

R. Godeffroy, on examining a chemically pure glycerin from the Apollo Japan Works in Vienna, found that when heated to 150° it took fire, and burned with a steady, blue, non luminous flame, without diffusing any odor or leaving a residue. The glycerin had the specific gravity of 1 2609. This property enables glycerin of lower specific gravity to be burned by means of a lamp wick.

DECISIONS OF THE COURTS.

United States Circuit Court---Northern District of New York.

STOVE PATENT.—ESEK BUSSEY AND CHARLES A. MCLEOD *vs.* JAMES WAGER ESEK BUSSEY AND CHARLES A. MCLEOD *vs.* HICKS AND WOLFE.

[In equity.—Before WALLACE, J.]

A new combination, producing new and useful results, and not merely an aggregation of the results, due to the independent action of the several parts, is a patentable invention.

Bussey combined a reservoir in such relation to a top plate and partial back plate that the reservoir performed both the functions of a reservoir and of a partial back plate of a stove—a new result.

Liberal construction should be accorded patents, so as, if possible, to secure to an inventor what is really his invention.

The description and drawings of an original patent may be looked to, to disclose the real invention of a patentee, when the original claims are defective or the reissue claims obscure.

This was a bill in equity filed against the defendants for infringement of reissued letters patent, No. 5,485, dated June 3, 1873, granted to complainants for improvements in reservoir cooking stoves.

[*Esek Cowen* and *George Harding* for complainants.
Samuel A. Duncan and *George Gifford* for defendants.]

Recent American and Foreign Patents.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED CAR COUPLING.

Daniel B. Palmer and David S. Kepler, Chambersburg, Pa.—The object of this invention is to provide an improved automatic coupling for cars. The principal features of the invention consist in a pair of hook-shaped, vertically moving jaws, held together by springs and operated by levers, in combination with a long pivoted link permanently attached to one of the jaws, each set of jaws carrying one of said links. The invention also consists in the arrangement of the drawbar, and in a set of automatically releasing levers which, when the jaws are opened by the hand lever, take the link and lift it into such a position as to allow the link to be withdrawn when the cars are to be separated.

IMPROVED APPARATUS FOR TRANSMITTING POWER.

Joseph L. Crabtree, Flintstone, Md.—This is mainly an arrangement of parts to form a wheel, in combination with a cylindrical end flange, carrying interior cogs, which gears with a pinion upon an eccentric shaft, to transmit to greater advantage the power received. The device is adapted to over and under shot water wheels.

IMPROVED PIPE COUPLING.

Isaac Johnson, Chicago, Ill.—This invention relates to a novel mode of connecting the sections of a pipe made of lead and sheet metal, and consists in the employment of a hollow connecting piece annularly grooved near each end, the metal of each pipe section being quickly pressed into the groove. When the tool is pressed and turned around the pipe, the metal is drawn forward and the pipe shortened by filling the grooves, without pulling apart the ends.

IMPROVED EAVES TROUGH MACHINE.

Charles A. Codding, Dowagiac, Mich. This invention relates to certain improvements in machines for making eaves troughs. It consists of a platform placed upon rests or rockers, upon which platform is firmly attached a half cylinder. On each edge of the half cylinder is arranged a set of standards, through which rods run for the support of the former lever and their gripe attachments. These levers are made in a semi-cylindrical form, one end having a shank through which a hole is made for attachment to and lateral adjustability on the supporting rod. The under side of this shank also bears upon the bead or tube of the trough, forcing it down to the platform. The other end of these levers has a shank the upper side of which is beveled, upon which beveled face bears a set screw or bolt in the V-shaped gripe attachment, which latter are pivoted upon a supporting rod and made laterally adjustable.

IMPROVED FEATHERING PADDLE WHEEL.

Ross Forward, Cincinnati, Ohio.—This invention relates to the paddle wheels for use on steamers, and adapted to work at any desired depth beneath the surface of the water, thereby increasing the resistance to the paddles or blades, at the most effective point for propelling the vessel, and lessening the power required to move it at a given speed. The paddles of each wheel are pivoted transversely between two circular rims, also weighted on one side, below the pivots, and combined with mechanism for locking them at various angles, whereby they are made capable of assuming and maintaining an inclination to the surface of the water, both on entering and leaving it, and a vertical position while immersed in it.

IMPROVED EARTH AUGER.

William McK. Burns, Concordia, Kan.—This improvement consists in a novel construction and arrangement of the cutting bit, also of the contrivance of the reamer and the case. The bit consists of a long spiral steel plate, formed, for the most part of its length, on an acute pitch for carrying the earth away from the cutting edge quickly, so as not to clog on the bit, while it is carried to a much more obtuse pitch on the point, corresponding to the required rate of movement of the auger into the ground. Devices are added whereby the bucket may be hauled up separately.

IMPROVED GAS REGULATOR.

David B. Peebles, Edinburgh, Scotland.—The wet governor consists of a bell working in a tank in water. Around the bottom of the bell a float is made, which tends to raise it when immersed, and from the top and center of the bell is suspended a valve, the seat of which is fixed on the top of the vertical inlet pipe of the governor. On the bottom of the valve is arranged a closed tube about one and a half times its diameter, and this works inside a tube which communicates with the water by means of a pipe passing laterally through the vertical inlet and outlet pipes, and fixed thereto by nuts. The object of this arrangement is to give a pumping action to the valve when it moves, which tends to steady the bell and obviate bobbing or oscillation by the gas waves. Another important feature of the invention is the manner in which the governor is acted on so as to increase, diminish, or maintain pressure. In any part of the inlet gas pipe a small tube is fixed; and in the casing of the governor, preferably as near the governor as possible, another small tube is fixed. These tubes are connected to a small dry or wet governor. Another tube connects the chamber above the bell with the outlet pipe, and into this tube is inserted a disk of tin, through which a small hole is pierced. Instead of loading or unloading the bell of the large governor, in the usual manner, with weights, the small governor only requires to be adjusted to give any desired pressure.

IMPROVED APPARATUS FOR CHARGING RETORTS.

Joel F. Rice, Louisiana, Mo.—In order to prevent loss of gas and also cracking of retorts by sudden change of temperature, charges, holding a large quantity of coal and provided with devices for operating them quickly, have been devised, and, to some extent, adopted in practice. This invention is an improvement in this class of apparatus, and consists, chiefly, in the combination with a charger formed of a tube or cylinder (open on its upper side, and provided with means for reciprocating it horizontally), of a plug or stop device, and means for holding the same stationary, in order to force the coal out of said charger, as the latter is being drawn out of the retort.

IMPROVED WRENCH.

R. N. Collingsworth, St. Louis, Mo.—This invention consists in providing an ordinary carriage wrench with an arm, projecting laterally or at right angles from the shank thereof, and having a socket in its outer end to adapt it for application to nuts of shaft couplings, etc. The said arm also answers the purpose of a handle by which to rotate the wrench when applied to the nut of a carriage axle.

IMPROVED OIL CUP FOR JOURNALS.

Amer R. Yost, Somerset, Ohio.—This invention relates to an improvement in that class of lubricators which are permanently attached to a shaft or axle and provided with a device for forcing the lubricant out of the reservoir between, or in contact with, the friction surfaces. The invention is embodied in a cylindrical cup or reservoir secured to the axle, an adjustable screw cap therefor, and a plunger formed of a spiral spring, and a piston which is hinged thereto. The spring stem, or body of the plunger, is compressed by screwing the cap down on the tube, and the oil or other lubricating matter is forced out by the reacting force of the spring. The piston is hinged, to adapt it to turn downward, and thus prevent suction when being drawn out the tube.

IMPROVED CAR WHEEL.

Sebastian Stutz, Pittsburgh, Pa.—In this wheel the nave or hub is closed at the front by a cap cast in one piece with the body of the wheel, and the pipe box is inserted at the inner end and provided with a radial flange which adapts it to be secured to the hub by screw bolts. Passages or chambers are formed between this box and the hub proper, etc.; the lubricant circulates freely through them and in contact with the friction surfaces. The lubricant is supplied through an opening in the aforesaid cap of the hub.

IMPROVED SAND PUMP.

Edward F. Andrews, Augusta, Ga.—This invention relates to an improved pump adapted for collecting and removing sand, mud, and such like matters from wells, without at the same time removing any water. The pump barrel is formed of two parts, a piston chamber and a sand or mud chamber. These are separated by a strainer or sieve-like diaphragm, so that the sand and mud, drawn up with the water through vertical tubes arranged in the lower chamber, are prevented from passing up into the piston chamber along with the water, but deposited in said lower chamber, from which they may be discharged when the pump has been drawn out of the well. The water is discharged from the piston chamber while the piston is working.

IMPROVED TIGHTENER FOR ELEVATOR BELTS.

Peter H. Zacharias and John M. Swift, Ann Arbor, Mich.—An end clevis of a lever is fastened to one part of the belt, and the free end of said part is carried through a buckle on the other portion of the belt, and thence to a clevis on a hanging clamp attached to the lever. The belt is then tightened by raising the lever, and is secured by the tongue of the buckleentering a suitable hole.

IMPROVED FEED WATER HEATER.

Cassius R. Shepler, Port Perry, Pa.—This invention relates to a novel construction of feed water heater for steam boilers, which is also designed to operate as a boiler washer to prevent the accumulation of mud in the bottom of the same. It is a well known fact that in all boilers there will be, in spite of mud drums, an accumulation of mud in the bottom of the boiler, which prevents the water from coming into direct contact with the metal, which latter (becoming very much heated) frequently results in a disastrous explosion. This is especially the case with large longitudinal boilers and boilers used upon the western rivers, where the water is always more or less impregnated with sediment. The invention consists in a series of nozzles arranged in the bottom of the boiler, through which the feed water is delivered in jets against the bottom of the boiler, and the metal kept clean and free from an accumulation of mud at the points where it has a tendency to settle. The invention also consists in the peculiar construction of the feed water heater whereby the water is retained in the steam space for a longer time than usual.

IMPROVED CAR COUPLING.

John S. Purnell, Berlin, Md.—This invention relates to that class of car couplings which automatically couple upon being brought together. It consists in the peculiar construction and arrangement of devices in which a wide coupling pin with a curved face and shoulder is pivoted upon a horizontal detachable bolt or pin in the slotted drawbar, and is provided with an upper extension above the drawbar, against which a spring bears to restore and hold the pin in vertical position after being deflected by the entering link. The drawbar is provided upon the interior with a projection which holds the link horizontal, and also operates as a stop to the backward movement of the pivoted pin, thus preventing too great a strain upon the spring.

NEW AGRICULTURAL INVENTIONS.

IMPROVED PLOW.

Asa H. Piland, Margarettsville, N. C.—This invention relates to certain improvements in plows of that class in which one or more detachable sweeps are employed for the cultivation of cotton and corn in the earlier stages of its growth; and it consists in the peculiar construction of a combined moldboard and sweep, made in a single piece in the shape of a bat's wing, and adapted to be used at once as a moldboard and sweep.

IMPROVED CRANBERRY SEPARATOR.

John Buzby, Moorestown, N. J.—The object of this invention is to provide an improved machine for cleaning cranberries and separating the sound from the unsound or otherwise defective ones. This object is attained chiefly by means of inclined shelves or plates, upon which the berries are allowed to fall, and from which they rebound. The sound ones, being hardest, bound farthest, and thus pass into a different receptacle from the unsound ones. For the details of construction and arrangement of parts, reference must be made to the patent.

IMPROVED FERTILIZER.

Albert G. Griffith, Baltimore, Md.—The invention relates to an improvement in soil fertilizers of the class in which a suitable acid is employed to fix the nitrogenous matters contained in fecal substance, and thereby produce a compound which is so far free from noxious and offensive odors as to be adapted for handling and transportation in casks or boxes, like gypsum and other dry fertilizing substances. Horse manure forms the base of the compound, and to it are added certain proportions of sulphuric acid, bone dust, and Mexican guano. The product combines the highest proportions of nitrogenous and mineral elements which can be safely united in a fertilizer.

IMPROVED GRAIN DRILL.

Truman A. Hill, Jefferson City, Mo.—This invention relates to certain improvements in grain drills, and it consists, first, in two rock bars which are connected with the parts which conduct the grain to the earth, and are geared together by means of toothed segments, so that when actuated by a connecting rod they cause the alternating spouts to reciprocate in opposite directions; second, in the combination with the said rock bar of a clutch mechanism for throwing them in or out of gear; third, in the combination with the driving wheels of a worm and pinion gearing, and a graduated face and index hand for the purpose of determining the amount of ground seeded; fourth, in the peculiar construction and arrangement of the seeding devices; and fifth, in the means for connecting and disconnecting the same from the actuating mechanism.

IMPROVED FERTILIZING COMPOUND.

G. J. Popplein, Baltimore, Md.—The invention relates to that class of fertilizing compounds that are intended to replace, cheaply and conveniently, the elements that form the constituent parts or food of plants, and that have been eliminated therefrom by previous cropping, or are absent or deficient from some natural cause. The compound consists of tripoli united with soda or potash, both minutely subdivided and intimately mixed in proportions to suit the requirements of each particular crop.

IMPROVED COMBINED CORN PLANTER AND CULTIVATOR.

Henry H. Balding, Terre Haute, Ind.—This includes a number of useful devices whereby a corn planter is combined with an ordinary cultivator, so that the latter machine may be used for planting corn, as well as for its regular work. The novel features relate mainly to points of mechanical construction.

IMPROVED CULTIVATOR.

James A. Price, Houston, Tex.—This cultivator is provided with rear adjustable side beams, one placed in advance of the other, on opposite sides of the main beam, pivoted in front and curved backward therefrom. It may thus be readily adjusted for cultivating rows of plants of varying widths.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED GATE.

Van Rensselaer Cole, Reedtown, Ohio.—The panel of this gate slides to and from the latch post on friction rollers, and is mounted on a triangular frame hinged to the pivot post. The said frame is attached to the post by means of a peculiar form of hinge, and the panel may be detached from the rollers to set it higher or lower, so that it may swing over snow or other obstructions.

IMPROVED TILE ROOF.

Jonas Smith, Lebanon, Ky.—The greater durability and dryness of tile and metal-covered roofs, as well as the greater protection they afford against fire, have tended to rapidly extend their use in recent years, even in localities or districts subject to no legal restrictions in respect to the materials of which buildings are composed. The present invention is an improvement in this class, and relates to an improved form of tile or metal plate, and means of fastening for the same, whereby an economy is effected in the cost of the roof covering, its weight lessened, and the attachment of the individual tiles or plates rendered more secure than heretofore.

IMPROVED METHOD OF ATTACHING HUBS TO AXLES.

Alden B. Brown, Comstock, Mich.—This inventor proposes a combination of a threaded band with the axle box, having corresponding and interlocking ring flanges, and the axle having an enlarged threaded collar. By this construction the oil cannot get out, and dirt and sand cannot get in to wear the axle arm and box.

IMPROVED SAWMILL DOG.

Henry Williamson, Bay City, Mich.—The invention relates to an improvement upon the sawmill dog shown in patent No. 150,534, and relates to the construction and arrangement of parts whereby the sliding bar which carries the dog is attached to the frame and supported by its operating lever. This forms a simple lever power dog which is adjustable to logs of any size.

IMPROVED VEHICLE SPRING.

Silas Newcomb, Pike, N. Y.—The invention relates to an improvement in the class of wagons unprovided with a reach, and consists in combining rearward extended torsion springs and pivoted or hinged stay bars with the body of the wagon. The rear axle is therefore separated from the wagon body to the extent of such increase in the size of the arcs of which said springs and stay rods are radii. These arcs so far correspond that the axle is maintained in a practically vertical plane, and hence the bolt connections between it and the springs are not strained at each vertical vibration of the wagon body.

IMPROVED FOLDING TABLE.

George K. Hoff, Philadelphia, Pa.—This table may be readily folded into small space for being more conveniently carried to the place of use, and when opened it forms a stool or bench of considerable strength. The invention consists of two hinged symmetrical bench sections, with hinged folding legs that are fitted by suitable recesses, and locked to a central stiffening piece, which is hinged to one of the bench sections.

IMPROVED BASE FOR CHAIRS AND STOOLS.

William T. Doremus, New York city.—Around the upper part of the socket which receives the pivot of the chair is cast a downwardly inclined flange. The flange has four V-shaped grooves formed in it to receive the V-shaped upper edges of the upper ends of the legs, the ends of which rest against the sides of the socket. To enable the chair to be raised from the floor without having the legs drop out, bolts are passed down through the flange and through the legs.

IMPROVED RUNNING GEAR.

George W. Gilmore, Weatherford, Tex., assignor to himself and F. M. Davis, of same place.—This is an improvement in suspension vehicles, and upon the patent granted to James Patterson, April 16, 1850. The rear axle consists of two opposite arch bars connected at each end by angular pieces, and is braced and secured to the reaches by a middle post. The front axle has a fifth wheel formed upon it in one piece. The connection of the supporting springs with the axles, and the rigid connection of both front and hind axles by a brace, produce an iron suspension frame of great strength and durability.

NEW CHEMICAL AND MISCELLANEOUS INVENTIONS.

IMPROVED MILLSTONE DRESSING MACHINE.

Albert Hoppin, La Crosse, Wis.—The use of emery wheels for dressing millstones has proved economical, and also produced a better mechanical result than the devices previously employed. But the machines hitherto devised for the purpose have been cumbersome or otherwise objectionable. The object of this invention is to furnish a machine better adapted for such work. For details it will be necessary to refer to the patent.

IMPROVED FAUCET AND VENT.

James Talley, Jr., Kansas City, Mo.—This invention is an improvement upon a device patented to Love and Talley, Jr., June 30, 1874. The improvement relates to a rotating sleeve applied to the boring tube, and provided with openings on opposite sides, the adjustment of said tube in either of two positions rendering the device capable of acting either as a vent (for admission of air to the cask) or a faucet (for discharge of liquid from the cask). The invention likewise includes an improved corkscrew and brush tube attachment. For an illustration of this invention, see page 198 of this issue.

IMPROVED SUSPENDER AND OTHER LOOPS.

Joseph W. Bradley, New York city.—This invention consists of a re-enforcing loop of metal or other substance in combination with the loop of a suspender or other strap, commonly employed to connect the strap to a ring, buckle, or other device, the re-enforcing loop being secured by an eyelet or other suitable means. The straps with which suspenders and the like are commonly provided are subjected to rapid wear at the point where they loop over the buckle or ring, owing to friction and the deterioration of the leather by perspiration. To remedy this defect, the inventor applies metal plates and a narrow re-enforce loop to the strap loop, and thereby enhances, as he states, the value of the article without materially increasing its cost or impairing the flexibility of the strap.

IMPROVED PROCESS OF GLOSSING COFFEE.

Herman A. Kroberger, Philadelphia, Pa., assignor to H. A. Kroberger & Co., of same place.—This consists in glossing roasted coffee, while it is hot, with a primary compound of rice starch and French gelatin, and a strong solution of dextrin. The dextrin solution readily unites with the starch and gelatin compound previously put on, and forms a tenacious airtight covering with a beautiful gloss. The advantages of this process are threefold, namely, the percentage of loss in roasting is less, the evaporation of the aroma of the berry is prevented, and the appearance of the coffee is improved.

NEW HOUSEHOLD ARTICLES.

IMPROVED FLY TRAP.

David S. Kidder, Turner's Falls, Mass., assignor to himself and Frank W. Peabody, same place.—The flies alight upon a pan which is rotated by clockwork, and which is separated by partitions into three divisions. Gates are hinged to the side of the platform, from which the pan passes to cut off the escape of the flies in that direction. Said gates rise to let the partitions pass, and have vertical plates, so that they close progressively and prevent any opening at the outer part of the pan. Directly behind the gates is a covered way leading into a light chamber, through which the flies are crowded by the partitions as they advance toward the gates.

IMPROVED STOVE.

William Young Cruikshank, Shamokin, Pa.—The object of this invention is to utilize the vastly accumulating anthracite coal dust of coal mines in direct manner, without special preparation and expense, so that the same is fed in dried, heated, and well regulated state to be burned in the stove or furnace. The new features consist in a distributing cone, a drying plate, and a revolving feeder, by which the coal dust is conveyed in small and thin sheets continually to the fire below.

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Wanted—A purchaser for a new Invention, just patented. My reason for selling: I am a widow, and not able to introduce it. Address Mrs. S. P. Jones, P. O. Box 25, Glasgow, Ky.

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All Fruit-can Tools, Ferracute W'ks, Bridgeton, N.J.

Notes & Queries

B. W. J. will find full directions for mounting maps on cloth on p. 91, vol. 32.—J. E. S. will find a recipe for silverplating fluid, for use without a battery, on p. 408, vol. 32. For a silver bath, for plating with a battery, see p. 362, vol. 31. For directions for polishing silver ware, see p. 251, vol. 33.—J. D.'s circle-squaring demonstration proves nothing.—J. G. R. will find rules for calculating the proportions of screw-cutting gears on p. 107, vol. 34.—W. A. will find directions for silvering looking glasses on p. 267, vol. 31.—H. E. J. must use Indian or Chinese ink for Patent Office drawings.—A S. can mold rubber by the process described on p. 353, vol. 30.—J. L. W. can attach sheet rubber or leather to iron pulleys by the process described on p. 409, vol. 33.—C. M. C. can calculate the horse power of his engine by the rules laid down on p. 33, vol. 33.—F. G. R.'s instrument is a pantagraph. See p. 179, vol. 28.—L. L. T. can make rubber varnish for coating canvas by following the directions on p. 11, vol. 32.—O. W. L. can purify his silver solution by the method described on p. 324, vol. 33.—The instrument that M. McC. inquires about is the pantagraph, described on p. 179, vol. 28.—E. L. G., A. B. C. W. P. T., J. B., G. W. B., E. F. C., G. S. H., F. D. D., H. J., E. G. K., and many other correspondents who ask us to recommend books on industrial and scientific subjects should address the booksellers who advertise in our columns, all of whom are trustworthy firms, for catalogues.

(1) X. B. X. asks: What shall I mix with red lead to fill joints in iron? A. Use white lead ground in oil and mixed with enough red lead (dry) to make a putty.

(2) J. N. P. says: 1. I notice on some locomotive engines small tubes running from the boiler to the center of the steam chest cover. What is its use? A. They are pipes connected with oil cups in the cab. 2. What causes the deafening noise sometimes heard about a locomotive? A. We do not know to what you refer, unless it is that occasioned by the sudden action of the pop valve. 3. Is there a gage attached to the cylindrical reservoir of compressed air, used in the Westinghouse air brake, to denote the pressure of the air? A. We believe so. 4. Which is the best coal for burning in locomotives, anthracite or bituminous? A. That is an open question.

(3) W. H. D.—Your statement as to freezing of water is not complete. Let us know all the conditions of the question, and we will be glad to give you our opinion.

(4) H. C. E. says: A friend asserts that the fly or balance wheel of an engine gives power to the engine, and that the engine would not run without. I say that the fly wheel is put there only to regulate or keep the motion steady when the engine is going over her dead centers. Which is right? A. Your idea is the more nearly correct of the two. The object of the fly wheel is to regulate the speed of the engine, not only at the centers but on all occasions where there is a change in the amount of work. That engines will work without fly wheels is very evident from the numerous examples to be found in boats.

(5) F. T. H.—We do not get from your description a clear idea of the arrangement: but if the wheel is free to move and lift, that would account for the trouble.

(6) R. F. H. says: I had a coarse half round file, 6 inches long, that had become magnetized in a peculiar way. One pole was at the top and the other 2 inches from it. Is it usual for the poles to be thus situated? If so, how is it explained? A. We cannot say that such cases are usual; but it is probable, if the file were placed in the line of the dip, that a smart rap at two inches from the tip, that is, where the second pole is situated, would tend to magnetize it in the manner represented.

(7) W. T. says: Please publish for the benefit of those who contemplate running small boats by steam, carrying neither passengers, hired men, nor freight, what sized boats we can use and not be amenable to the inspection law? A. The act requiring inspection and licenses for steamers applies to all steamboats, of whatever size, whether run for pleasure or profit.

(8) W. J. W. says: It is desired to use hydraulic pressure, and to run several presses with one pump, pumping into a reservoir tank from which each press will be operated. It is desired to have the reservoir large enough to hold sufficient compressed air above the water to keep the pressure nearly uniform, the pressure being used irregularly, according to the work to be done. The pressure used is as great as 1,000 lbs. to the square inch, and the air over the water (in the reservoir) is soon absorbed by the water unless provision is made to prevent it. A rubber diaphragm has been used to separate the air from the water, but the use of the diaphragm necessitates the use of a bad form of reservoir to admit of sufficient size and strength. Cannot a reservoir in the form of a cylinder be used, with oil floating on the water to keep the air from the water? Would the water absorb the air through the oil? A. We do not know that this has ever been tried. It is customary in such cases as yours to use Sir William Armstrong's accumulator.

(9) M. V. A., of Brunswick, Australia, says: There is a dispute about the power required to lift water by the common suction pump. A. asserts that it does not take any more power to lift water 2 feet than it does for 1 foot. B. maintains that the power required will be as the vertical hight to which the water is raised. What is the fact? A. The idea of power is incomplete without the element of time; and on this fact B. is right. For example, it takes twenty times as much power to raise 1 lb. water through a hight of 20 feet in a minute, as it does to raise 1 lb. through a hight of 1 foot in the same time.

(10) J. H. P. says: In your last issue C. W. J. asks why it is easier to lift the upper millstone by the regulating screw while it is in motion, than when it is at rest. You ask if it is a fact. Take an illustration: Suppose a wagon wheel be suspended by a horizontal bar passing through the hub. To slide the wheel bodily on the bar would require considerable force. Now set the wheel revolving; and the slightest pressure against the wheel will cause it to move (slowly) along the bar. If you can explain this, you will have a clew to the other difficulty. When the wheel is in motion, the center of gravity or weight seems to move in a sort of spiral or inclined plane, and the friction is more easily overcome than when the wheel is at rest. So of the millstone: The friction of the shaft through the lower stone and the friction of the upper bearing is more easily overcome when the stone is in motion than when it is at rest. The friction (call it a weight, if you please) moves up an ascending inclined plane, instead of perpendicularly; the general jarring caused by the motion of the wheel causes the regulating screw to move more uniformly instead of by fits and starts. A. We must suggest to you, as we did to C. W. T., that if you have any experimental data in support of your statement we would be glad to receive it before attempting an explanation.

(11) W. J. W. asks: What size of engine will it take to run a boat 16 feet long and 4½ wide, at 5 miles an hour? I have an engine 2 x 3½ inches, and a boiler (upright tubular) 22 inches high and 9 inches in diameter? Are the engine and boiler large enough? A. The engine might possibly do (although it is rather small) with a boiler of sufficient size. We do not think your boiler would give very satisfactory results. For a boat of the size you mention, the diameter should be from 20 to 24 inches, and hight from 3 to 3½ feet.

(12) R. K. asks: 1. Would 8 or 9 lbs. of zinc be enough to put in a steam boiler to remove hard lime scale? A. So far as we know the principal action of zinc is rather to prevent corrosion. As to the experience of correspondents with zinc as a scale preventive, see p. 369, vol. 31, and p. 36, vol. 32. 2. Is it proper to blow off the water from a steam boiler with a pressure of 40 lbs., 4 hours after the engine stops, with the fire all raked out and the drafts turned off from the boiler? A. It is better to let the water remain in the boiler over night, until it becomes comparatively cool: and then allow it to run out, and clean the boiler at once, washing the parts inaccessible by hand with water from a hose.

(13) G. W. M. says: I have an engine 3 x 3½ inches; what size of propeller will it drive, to propel a boat 16 feet long by 5 feet beam? A. You can make a propeller 20 inches in diameter, 2¾ feet pitch. 2. What size of boiler will it take to run the engine at 300 strokes per minute? A. Use a vertical boiler 24 inches in diameter and 3½ feet high.

(14) W. P. H. asks: 1. How can the amount of air drawn into the firebox of a locomotive be measured? A. By measuring its velocity and the sectional area of the inlet. 2. What means can be adopted to measure suction in the fire box, and compare it with the suction in the smoke box (the difference being mostly due to the friction of gases in the flues)? A. Two delicate gages might be used, such as bent tubes, containing fluids. 3. It has been stated that a vertical boiler of two thirds the capacity of a horizontal one, will furnish the same amount of steam. Is this so? A. We would hesitate to endorse such a sweeping assertion.

(15) S. C. N. asks: What is the least amount of water pressure that would feed a boiler carrying 90 lbs. of steam per square inch? A. We could not answer this question definitely, without knowing size and arrangement of connections and amount of feed; but in general it would be well to have a pressure of water of from 3 to 5 lbs. greater than that in the boiler.

(16) D. H. D. says: I want enough hydraulic cement, or some cement that will harden or stop out water under water, to cement a space of about 8 feet in diameter in the bottom of my cistern. What is best to use? A. Portland cement is the best you can use, and you will find it advertised in our columns. If you can make the bottom of your cistern concave, it will present a greater resistance to the action of the water beneath.

(17) G. C. asks: How can I filter dust out of atmospheric air? A. It is claimed that a shield placed against an opening will cause the particles of dust in the current of air striking against it to fall below, where, if a pan of water is placed, said dust will be retained, and the purified air may enter below the shield, passing over the surface of the water.

(18) L. H. P. says: 1. Does E. H. R., in answer to H. F. R., No. 49, February 19, mean one fifth as much heating surface in the boiler as he has of radiating surface, or does he measure the entire surface of the boiler, including the tubes? A. He probably has reference to the effective heating surface in the boiler, which is usually taken as only one half the entire surface, meaning that which comes in contact with the fire. 2. What is the rule for finding the size of supply pipes for coils where exhaust steam is used, also for live steam? A. For exhaust steam the pipe should be large enough not to make an obstruction by friction within it, and no smaller than the pipe where it leaves the cylinder. There is no rule other than custom for live steam, which has most usually adopted 1 inch pipe. 3. In your answer to A. S., I think you are extravagant in your amount of heating surface for a factory. My experience has been that one superficial foot of heating surface to 100 to 125 feet of air for the first floor, 150 for the second, 175 for the third, and 200 for the fourth (where there are stairways and hatchways) is sufficient, even with exhaust steam. With live steam less will answer. The exposure and construction of the buildings should also be considered. A. All systems of heating should be adapted for zero weather; it is easy to turn down the steam to grade it for milder weather. For factories, however, where well protected, your quantities would suffice.

(19) S. & P. M. Co. say: We are engaged in the manufacture of artificial stone. What could we use for coating the stone with to render it weatherproof? A. Stone itself is not weatherproof; and the manufacturers of artificial stone have not yet succeeded in discovering an application that will make their imitation stone quite equal to the real. Pure Portland cement probably affords the best surface for unburnt ware, and glazing is the best for that which is passed through the kiln.

(20) O. A. L. asks: What is the rule for finding the length of a perlin post of a building, when it is set at a right angle to the rafter, for the following pitches: $\frac{1}{4}$, $\frac{1}{3}$, $\frac{1}{2}$, $\frac{1}{5}$, $\frac{2}{3}$? Let the width of the building be 36 feet, pitch ⅓. Then the hight is 12 feet and the length of the rafter is 21.633 feet. What would be the length of the perlin post? A. Multiply the hight by half the length of the rafter, and divide the product by half the span; the quotient will be the length of the purlin post. This is a general rule for any pitch. But unless you provide a post or wall to support the point in the span on which the purlin post rests, this is a very faulty construction, subjecting the tie beam to a cross strain; the proper position for the purlin post or brace is directly from the center of the span to the middle of the rafter, the center of span being held up by the suspension post or rod.

1. What is the average power of a horse in foot lbs.? A. The ordinary work of a horse has been estimated at 22,500 lbs. raised 1 foot in a minute for 8 hours a day. 2. A map of a certain town says that one dam in the river is of 30 horse power and another is 115 horse power. Please explain the term as there used. A. It indicates that the volume of water and the hight of the fall are sufficient to give that amount of power at each dam respectively.

What is the quickest time made by any steam vessel between New York and Liverpool? A. See p. 97, vol. 34. As the Liverpool steamers generally stop at Queenstown, the time is usually given from the latter port. The steamer City of Berlin made the trip from New York to Queenstown in 7 days, 15 hours, and 48 minutes.

(21) N. S. J. asks: Please give me the rule for determining the power of a screw press, having given the diameter, weight, and velocity of the balance wheel, the size and pitch of screw, the friction, and any other elements entering into the problem. A. It would take a very extensive investigation, and a great deal of calculation, to enable us to answer these questions. You will find considerable information on the subject in Nystrom's "Elements of Mechanics."

(22) M. D. L. R. says: I am building a portable engine. The boiler is vertical, of 26 inches inside diameter and hight 5 feet. It is set in a smoke box that runs down and forms the fire box. There are 30 tubes of 2 inches inside diameter; direction of draft is up between the smoke box and boiler, also through the vertical tubes. Will it do to have the fire to go between boiler and smoke box, thereby heating the outside of boiler shell? A. It will not improve your boiler. 2. How high shall I keep the water level in said boiler? A. About 4 feet. 3. Have I too many tubes for the size of shell? A. No.

(23) J. B. asks: How can I paste silk on to wood without spoiling the silk? A. Good flour paste has given satisfaction for this purpose.

(24) J. D. P. says: Please inform me of something reliable that will cure corns and warts. A. If the corn has attained a large size, removal by cutting or ligature will be necessary. If it hangs by a small neck, the latter method is preferable. It is done by tying a silk thread around the corn, and, on its removal next day, another still tighter, and so on until completely removed. When the base is broad, a cautious dissection of the corn from the surrounding parts by means of a sharp knife or razor is necessary. This is done by paring gently till the whole is removed. In all cases of cutting corns, the feet ought to be previously washed, as in case of making a wound in the the great danger may result from want of cleanliness in this respect. Mortification has been the result in some cases of this neglect. For the eradication of warts, the proper application of caustic potassa (stick) is highly recommended.

(25) J. M. and others ask: How can we dissolve shellac in alcohol, aqueous solutions of borax, etc.? A. Dissolve 5 parts borax in 25 parts hot water, and add 4½ parts of shellac in fine powder. Boil until solution is effected. Shellac does not form transparent alcoholic solutions.

(26) M. A. says: 1. How can I bleach felt hats? A. Hat felt may be bleached by means of sulphurous acid gas. Felt hats are dyed by alternate immersion in a hot aqueous solution of logwood 38 parts, 3 parts green vitriol, and 2 parts of verdigris, and exposure to the air (each part of this process having a duration of about 10 or 15 minutes). This dipping and draining is sometimes repeated as many as 13 or 14 times, or until a bright glossy black is obtained. The aniline colors may also be used for this purpose. Felt is much more difficult to thoroughly dye than ordinary woven woolen goods. 2. How can I make the stiffening for felt hats? A. A good stiffening is made as follows: Dissolve 3 parts carbonate of potash and 10 parts borax in hot water; then

add 50 parts shellac, and boil until solution is effected. The stiffening may be applied (to the inside of the hat) by means of a brush. As soon as this is done, the hat should be immediately immersed in very dilute oil of vitriol in order to neutralize any excess of alkali, and to properly fix the shellac.

(27) A. N. asks: Is there any danger of lead poisoning, or other serious consequences, from the use of sugar of lead as a wash for sores? A. The danger depends upon the strength of the solution used and the frequence of the application. Colic sometimes results from the very free use of solutions of acetate of lead. Pereira states that paralysis is caused by using acetate of lead.

(28) J. E. K. says: You gave the following recipe for a liquid for mixing rocket stars: Alcohol ¾ oz., camphor ⅛ oz., isinglass ⅛ oz. How can the isinglass be dissolved in alcohol? A. It cannot. The quantity of alcohol given is just sufficient to render the camphor capable of being properly incorporated with the other ingredients by maceration. Do not add the gelatin until all the other ingredients have been uniformly intermixed by gentle trituration in a mortar.

(29) S. B. asks: In crushing highly sulphurous ores with Cornish rollers at 120 revolutions per minute, will the sulphur have any effect on the iron or face of the rolls so as to injure its texture? A. We think not.

(30) A. B. asks: 1. Of what is Indian ink composed? A. Indian or Chinese ink is formed of carefully purified lampblack and size, or animal glue, with the addition of perfumes, not necessary, however, to its use as an ink. 2. In what substance is lampblack soluble? A. Commercial lampblack always contains more or less resinous and tarry matters, that are soluble in oil of turpentine, benzine, naphtha, etc.; but the purified lampblack (carbon) is itself insoluble in any menstruum.

(31) C. K. asks: What metal or alloy expands the most and quickest at a temperature within 300° Fah.? A. Zinc. Taken at 32° Fah., a rod of zinc 25 feet 4 inches long will have a linear expansion at 212° of about one inch.

(32) V. C. T. says: I have a lot of thin malleable iron castings, which I am having ground, polished, and nickel plated, but they all have a dull leaden appearance after being plated. They tell me the fault is in the casting, that the malleable iron was burnt. Can this be true? A. Malleable iron may be readily nickel plated if the work be first properly finished. If the castings are burnt, it will be necessary to refinish them before a satisfactory deposit can be obtained.

(33) E. S. T. asks: Why do preserves, that are in perfectly airtight jars, mold? A. If the preserves be placed in the jars while hot, so as to completely fill the jar and expel the air, the preserves will not mold.

(34) E. S. H. asks: How can I make colored fires? A. Try the following: For light blue 61 per cent of chlorate of potash, 16 of sulphur, 23 of strongly calcined alum. For dark blue, 60 per cent of chlorate of potash, 16 of sulphur, 22 of carbonate of copper, 12 of alum. For deep blue, use 54 per cent of chlorate of potash, 18·5 of charcoal, and 27·5 of ammoniacal sulphate of copper. It is hardly necessary to mention that great care is required in mixing these materials, and that each ingredient should be pulverized separately. For red fire use 29·7 parts chlorate of potash, sulphur 17·9, charcoal 1·7, nitrate of strontia 45·7, black sulphuret of antimony 5·7. For green, chlorate of potash 32·7, sulphur 9·8, charcoal 5·2, nitrate of baryta 52·3. For yellow, sulphur 23·6, charcoal 3·8, nitrate of soda 9·8, saltpeter 62·8.

(35) T. L. asks: Is a large deposit of soda, such as is generally deposited from soda springs, of any value? A. Yes. It might be profitably used as a flux in reducing ores.

(36) R. S. asks: How should bodies of cellular structure, being saturated with nitrate of silver to become conductors of electricity, be treated with hydrogen gas? A. Enclose in an atmosphere of pure hydrogen and heat to redness. Solutions of copper are preferable to silver, as they are much cheaper.

How is the double sulphate of nickel and ammonia prepared? A. See p. 139, vol. 29.

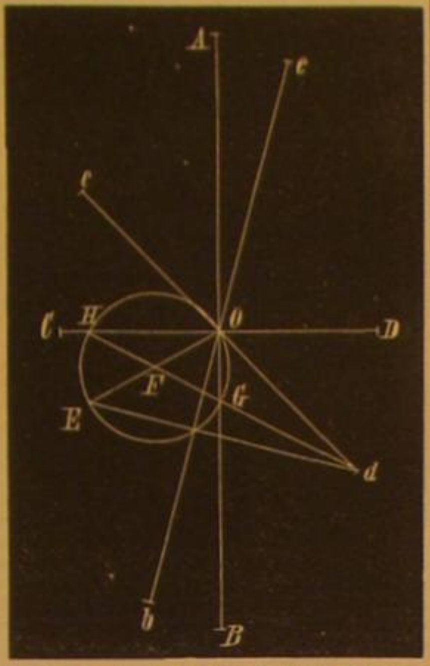
(37) G. S. says: I have a drum head that has lettering on it, done in black. How can I take the marks off without injuring the head? A. You should have stated, if possible, the character of the pigment employed in the lettering. The following is a list of the solvents commonly employed where this is not known: Water, ether, ether and alcohol, benzole, naphtha, chloroform, bisulphide of carbon, caustic alkalies, diluted acids, solution of cyanide of potassium. They should be applied consecutively in the order given. It must be borne in mind that many of the abovementioned solvents are extremely injurious to the material of the drum head, and care should be exercised to prevent any unnecessary contact.

(38) J. H. B. asks: How can I renovate a sponge mattress that has become hard by use and dampness? A. This has not been satisfactorily accomplished.

(39) C. & Co. ask: 1. In the manufacture of fluid magnesia, to what pressure would you charge the fountain with carbonic acid gas? A. To 12 ozs. water add ⅛ oz. magnesia and add citric acid to slightly acid reaction. Such acidity is generally found more palatable than a neutral solution. Sweeten, add a few drops oil of lemon to flavor, and 18 grains potassa bicarbonate. This is the proper fluid magnesia. Many sell a spurious article made of tartrate of soda with a little soda bicarbonate flavored with lemon. 2. How is the magnesia bottled? A. Bottle in the ordinary way, not using the carbonic acid apparatus.

(40) E. B. J. says: I desire to make a musical instrument, the sound being produced by striking wooden strips, of uniform thickness and varying length. Supposing the shortest strip is 4 inches long, what will be the length of the others down to 2 octaves below the note sounded by that one? What is the best material for the hammers, and what kind of wood gives the best sound? A. The relative lengths of the pieces, for an octave on the natural scale, are as follows: 1, 8/9, 4/5, 3/4, 2/3, 3/5, 8/15, 1/2. This progression is upward, the ½ length sounding a note one octave above the 1. Another octave upwards can be formed by halving the figures, thus: 1/2, 4/9, 2/5, 1/3, 3/10, 4/15, 1/4, and so on as long as desired. We believe they are generally laid on straw, and struck with wooden hammers. Some of our readers, however, may be familiar with the use of the instrument, and will correct us if in error.

Given a set of conjugate diameters of an ellipse, how can the axes be found so that the curve can be conveniently constructed? A. Let $c\,b$ and $c\,d$ be



the given conjugate diameters. From d draw a line perpendicular to $c\,b$, and make its length, d E, equal to cO. Join the points, O and E, by a straight line, and upon O E, as a diameter, describe a circle. Draw a straight line, d H, through d and F, the center of this circle. G and H, where the line cuts the circle, are points in the principal axes, and G d, H d, are the lengths of the semi-axes, so that A B and C D are the axes required.

(41) J. B. asks: How can I produce a gloss on hard rubber? A. Ebonite may be worked, in all respects, like any hard wood. Pumice powder and rottenstone are commonly employed as finishers.

(42) E. P. J. asks: 1. What is the precise diameter of the piston of a reciprocating engine, presenting 144 square inches of area? A. Calling π the ratio of the circumference of a circle to a diameter, the diameter in question is equal to 24 divided by the square root of π. As, however, the value of π cannot be precisely expressed in numbers, it is impossible to give the precise diameter of the piston. 2. What would be the horse power of such an engine with 2 feet stroke, running with 100 lbs. boiler pressure to the square inch at 100 revolutions per minute, and cutting off at 1 foot, or ½ stroke? A. The data sent are insufficient for an accurate calculation. See p. 33, vol. 63. 3. What is the calculation as to the percentage of power lost by friction in the reciprocating engine? A. It varies in different engines from 10 to 40 per cent. From 20 to 25 per cent would possibly present a fair average. 4. What would be the increase of power in the above named engine if the steam, both before and after the cut-off, were always operating at 1 foot leverage from the center of the shaft, as it now is at the half stroke, without commencing near one dead center and losing its expansion in the other? A. The mean leverage throughout a revolution is about 0·6366 of the length of the crank, and the center of the crank pin moves 1·5708 times as far as the piston in a revolution: so that the whole power exerted by the piston is transmitted to the crank, except what is lost by friction. It would seem impossible to do more than this, whatever the leverage might be. 5. With what speed would a 1 inch square column of water, with 15 feet head, enter a vacuum, without regard to friction in the tube? A. At a rate of a little more than 56 feet per second. 6. Is it true that air enters a vacuum at the rate of 1,300 feet per second? A. This is an average approximate value.

(43) H. E. E. asks: 1. What is squaring the circle? Is it finding a square with an area equal to the area of a circle of given diameter? A. Yes. 2. If so, does not the whole trouble lie in finding the area of a circle? A. Yes. 3. Does not geometry demonstrate the process beyond the possibility of error? A. No.

(44) H. D. P. asks: How is the bronze made that is used for bronzing statuary, etc.? A. Bronze statuary does not require the application of any bronze. Make your castings of: Copper 88 parts, tin 9 parts, zinc 2 parts, lead 1 part. You can then polish the castings to suit your taste.

(45) T. H. says: I saw in a recent issue of your paper a statement that man appeared on the earth 150,000 or 200,000 years ago. Will you refer me to the evidence of the existence of pre-adamite men? A. Sir Charles Lyell's work on "The Antiquity of Man" is a complete *resumé* of the whole subject, which is too extensive for our columns.

(46) P. S. says: I saw a meteor in Kansas on December 27, 1875, and I wish to know of what kind of matter such bodies are composed. A. Meteoric bodies are of two classes. Some are composed of entirely combustible, while others are of combustible and incombustible, matter. They revolve around the sun in orbits more elliptical than the orbit of the earth, so that parts of their orbits are internal and parts are external to the earth's orbit. When the earth and the meteoric bodies come near enough together so as to bring the latter within the earth's atmosphere, they are ignited by the resistance, and are either wholly or partially consumed. If their course and the attraction of the earth would bring them to the earth's surface, then the combustible ones would probably be wholly consumed before reaching it, while the others fall in the form of iron, etc. At times they only pass through the upper portion of the atmosphere, and, after receiving a very warm reception for a few moments, are allowed to go on, but not in their old paths.

(47) J. C. C. asks: What are the ingredients and proportions of the wax used by electrotypers for taking impressions of type? A. Yellow beeswax will do very well.

(48) L. & G. M. Co. ask: What preparation can be applied, with a pen, to mark numbers on the surface of tin plate? A. Squeeze the juice of a lemon into a cup, and put in a bit of copper, of the size of a cent. Let it stand for a day or two, then use it with a quill pen.

(49) J. H. says: I have a material containing free sulphur. By applying heat I drive the sulphur off in the form of gas. How can I condense those fumes, so as to obtain flowers of sulphur? A. It is necessary that the sulphur vapor should not come in contact with the air, otherwise a portion of it will be oxidized and converted into sulphurous acid gas. Sulphur may be volatilized or sublimed at a temperature of 792° Fah. If it then be condensed in suitable vessels, we have the substance commonly known as flowers of sulphur. This is done, says the United States *Dispensatory*, by allowing the fumes to condense on the walls of a brick chamber.

(50) R. E. says: J. H. P. states on p. 114, current volume, that no chimney burners are safe on account of the shortness of the wick tube, and he expects to do better with a tube 4 inches long instead of 1¼. He is certainly mistaken. Every coal oil burner should, and most of them do, contain a little flat tube, which serves for the escape of gas formed by heated oil. With this tube a no-chimney burner is just as safe, if not safer, than a burner with chimney. Lamps with chimneys get a great deal hotter than those without, for two reasons: The chimney, producing a better draft, causes a more perfect combustion of the oil, and consequently a whiter light and more heat from the same amount of oil burnt; and the chimney, being always near the flame, gets a great deal hotter than the constantly changing air would without a chimney, and will consequently radiate heat to all the surrounding objects, of which the oil reservoir gets its share. If J. H. P. wants to use a wick tube 2¼ inches longer than generally used, he will find that oil of 150 gravity, as the law now requires in most of the States, will not rise at all so high in sufficient quantity to feed the flame: his wick will therefore get charred, and he will be obliged to burn lighter oil, and so increase the danger of explosion.

(51) J. M. S. says: In a recent issue you recommended strips of plank to be used beneath the window sash for the purpose of ventilation. I have used the same, but for applying or removing expeditiously I hinged them at the center, and covered them above and below with felting or rubber to keep out the cold.

(52) M. W. L. says, in reply to C., who asks as to the weight of the 20 and 15 inch guns: They weigh respectively 115,200 and 49,100 lbs.

(53) J. J. B. says, in answer to a correspondent who complained of heating of millstones: To avoid hot grinding, reduce the speed of your millstones and grind slower; and in staffing the stone, put in a piece of writing paper, and let the stone be just so tightly fixed that the paper will slip out from under the staff, near the eye of the stone.

(54) J. J. B. says: To oil a mill spindle at the bush, bore a ⅝ inch hole through the wood block in bush, next to spindle. Take a piece of ⅜ inch iron gas pipe, bend, and insert it, bringing under the stone up through the floor, outside of the curb. Let the outside end be the highest. Use castor oil in oiling, as it never congeals, and you need never have any trouble in oiling millstones in the coldest weather.

(55) W. L. S. says, in reply to an inquiry as to why a telegraph sounder connected with the bell of an alarm clock does not work: Every telegrapher knows that a quick tap on the key, no matter how hard, will not affect the sounder, as it does not give time for the magnet to work. The stroke of the alarm striker is exactly of this nature, and therefore cannot repeat itself on the sounder.

(56) J. C. says, in reply to L. S. C.'s queries as to the effect of dampness on unused boiler furnaces: Into a closed vessel place 5 to 10 gallons heavy oil (petroleum paraffin); place the vessel at a safe distance, with a pipe to lead the vapor of the oil under the boilers. Close up every crack or crevice by luting, put a fire under the vessel, and evaporate the oil. The whole of the fire surface, and even where the brick is in contact with the boiler, will be sweated or covered with the condensed vapor of the oil. To protect the inside of the boiler, first dry it by a very light fire under it; then put a few gallons petroleum in each boiler and evaporate it by a light fire under the boiler. As the oil vapor condenses, the whole inside of the boiler will be coated with a rust-proof coat of oil

(57) D. F. J. says, in reply to J. A. H., who says that the carrying boards of his reels are flat, and that the flour sticks on them: If you give your carrying boards enough pitch, keep your stones in good order, and do not grind hot, you will not have any further trouble in that line. Sandpaper the boards and then put shellac on them.

(58) J. B. J. says, in reply to H. M.'s query as to the line of the magnetic meridian: Since the latitude and longitude of the place are not given, the question may be considered under two hypotheses: 1. The line may be in Maine or thereabouts, where the declination of the magnetic needle from the meridian has varied from 14° to 17° during the last 40 years. 2. It may be in some of the Western States, where an equal declination, but opposite in direction, has existed during the same period. If the first supposition be true, then the first surveyor made due allowance for the declination, and located substantially a true meridian. The subsequent surveyors, neglecting the declination, located a magnetic meridian, which is constantly and indefinitely fluctuating. If the line in question is west of the Alleghanies, it would seem that the first surveyor ran the line parallel with this needle, disregarding declination: hence it would not be a true meridian, the two subsequent surveyors being in this case approximately correct. The amount and direction of the discrepancy between these two latter appear to favor the first hypothesis: it is readily accounted for, however, under the second, when it is remembered that the deviation of the magnetic needle from the true meridian is a constantly varying quantity.

(59) D. C. R. says: S. H. B. and many others desire information as to building boats. In the first place, make the keel of required length and about 1¼ inches thick and 4 inches wide, with a rabbet to receive the edge of garboard strake. Put on stem and stern as required, and fasten them on some good support about 2 feet from floor; then place molds of the shape required, in about 5 sections, across the keel and secure them, and cut the first strake to fit keel and stem and stern. Nail on, and continue to cut and nail on until of the depth required; then bend in ribs and put in seats and other inside finish.

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

J. M. M.—It is ramie fiber.—T. T. R.—It is sulphide of lead (galena) accompanied by sulphate of baryta (heavy spar).—W. P. T.—It is sulphuret of iron, irised by a superficial oxidation.—J. L.—It is iron pyrites, at present not of much commercial value.—W. A. J.—It is bituminous shale, impregnated with sulphuret of iron, to which the glistening metallic appearance is due.—G D. M.—It is impossible to make an analysis of any value on 2 ozs. of water. One gallon is needed, carefully sealed up in a perfectly clean bottle of white glass. —G. J.—No. 1 is alunogen, a variety of native alum consisting of sulphuric acid, water, alumina, a little iron, etc. It may be purified by solution in water, and then, by saturation with alkali and crystallization, be converted into common alum. No. 2 is blende or sulphide of zinc. No. 3 is black argillaceous shale. No. 4 is ferruginous quartz.—M. R.—There appears to be no market in New York for sand of this character which has to be transported any distance.—J. R. M.—It is calcite or crystallized carbonate of lime.—C. E. G.—The metal is lead: the mineral is muscovite (potash mica.)

J. W. S. says: I am taking a carbolate of iodine inhalant for catarrh, and it scents my clothes with an unpleasant odor. Can you tell me of something to mix with it to produce a pleasant odor?—W. McD. says: How can I get a smooth surface on planished copper plates?—T. J. asks: How are the inches, etc., put on wooden rules?—W. S. says: R. W. R. states that he is carrying 20 horse power by a cotton rope. How does he maintain the proper tension during damp or dry weather?

COMMUNICATIONS RECEIVED.

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

On Thermometrical Tables. By J. B. G.
On the Sargasso Sea, etc. By M.
On Bored Wells. By L. L.
On Windmills. By A. McL.
On a Registering Barometer. By W. A. B.
On Projectiles. By R. H.
On Spacing Circles. By G. B. F.

Also inquiries and answers from the following:

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

HINTS TO CORRESPONDENTS.

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

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

Hundreds of inquiries analogous to the following are sent: "Whose is the best smut mill for wheat? Who sells incubators? Who makes fuses for blasting? Who makes small copper tubing? Who sells crushers for treating copper ores? Who sells railroad spike machines? Who sells ear trumpets? Who makes electrical musical reporters?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

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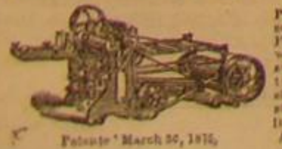

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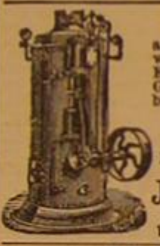

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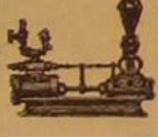

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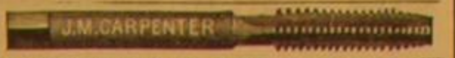

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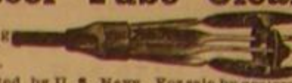

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