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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 3¼ 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

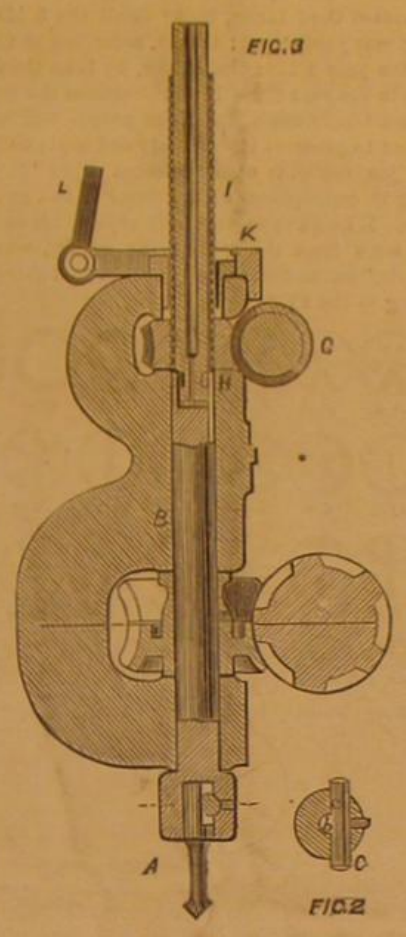


FIG. 2

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.

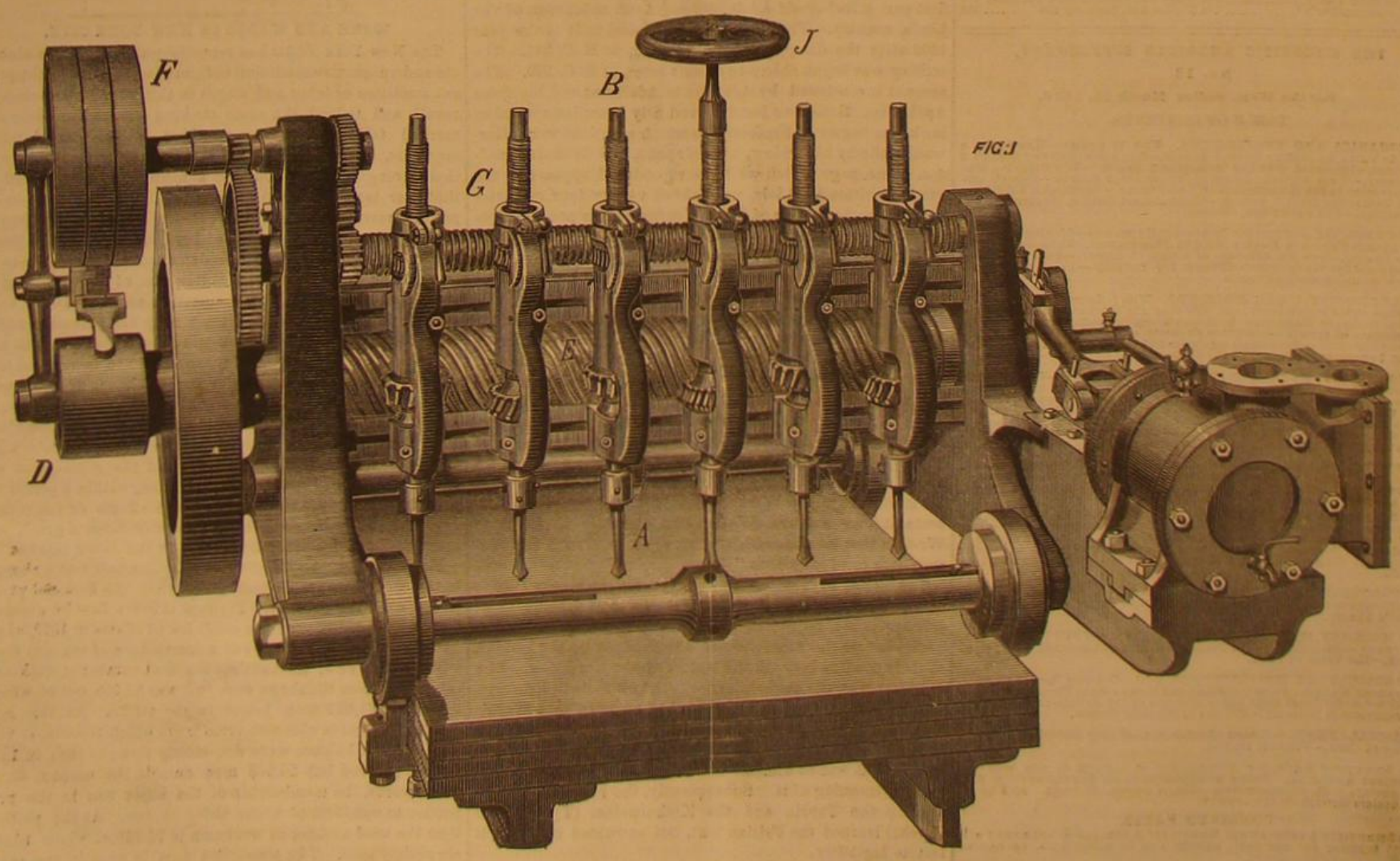


FIG. 1

MULTIPLE DRILLING MACHINE.

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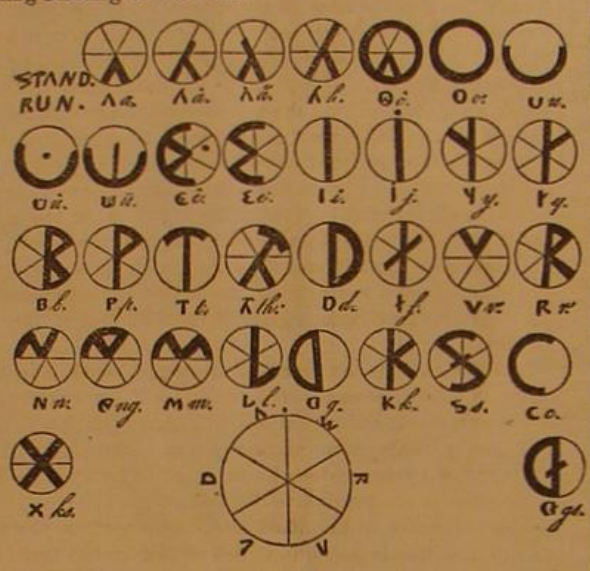
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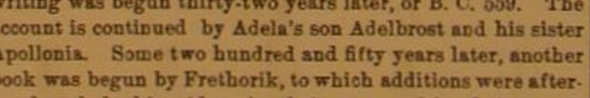
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THE OERA LINDA LETTERS AND FIGURES.

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 then. 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 1873, 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	$17	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	$27	$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 $12 (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 1873. 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 1873; 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 Urk 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 Committee 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 ½ 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.

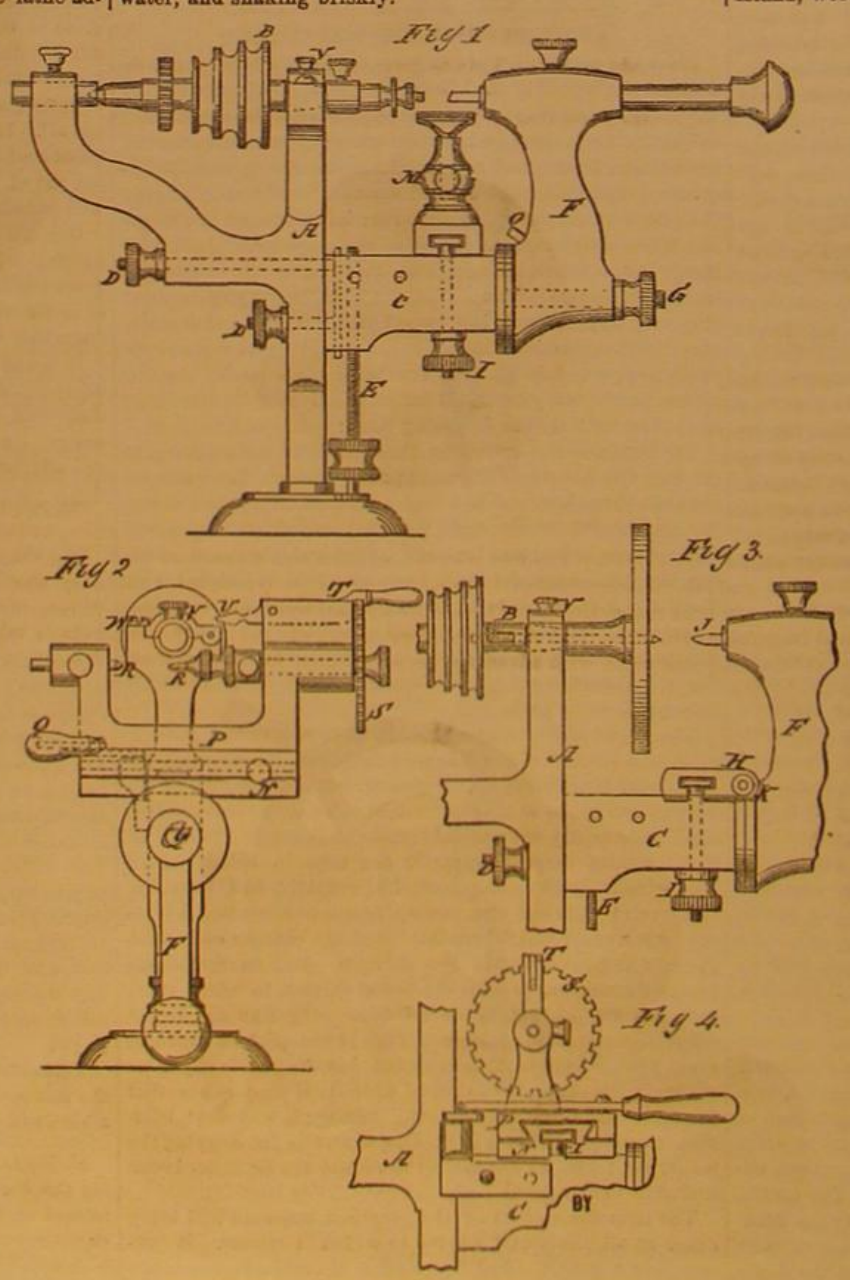
IMPROVED WATCHMAKER'S LATHE.

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 16¼ 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 $1\frac{3}{16}$ 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?

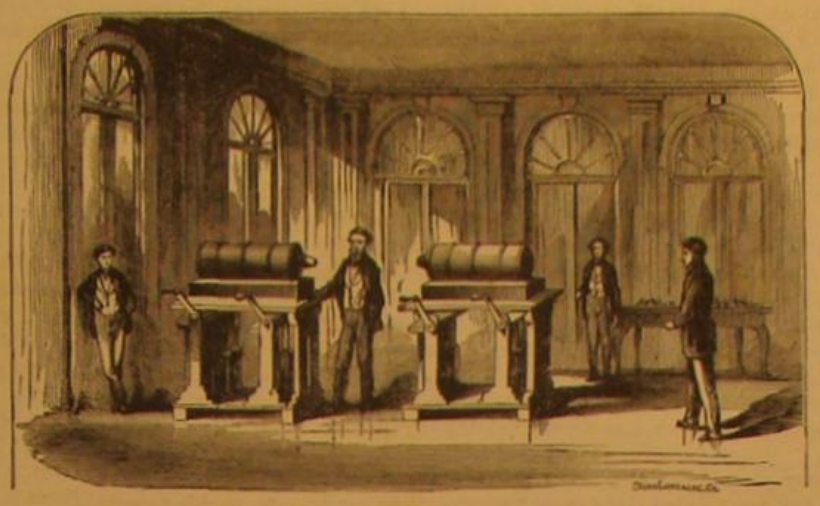
Fig. 1.—CLARK'S MAGNETO-ELECTRIC MACHINE.

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



THE GREAT ELECTRO-MAGNETS AT THE STEVENS INSTITUTE.

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

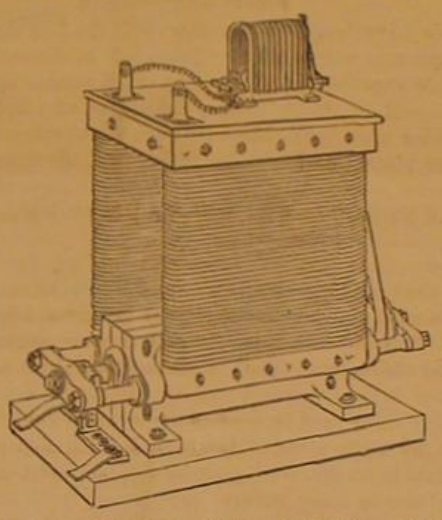


Fig. 2.

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

are made with the Holmes improvement of the same machine.

It was plain that no further improvement was possible in

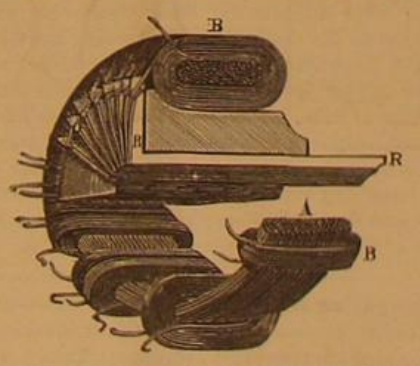


Fig. 4.—COIL OF GRAMME'S MACHINE.

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.

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

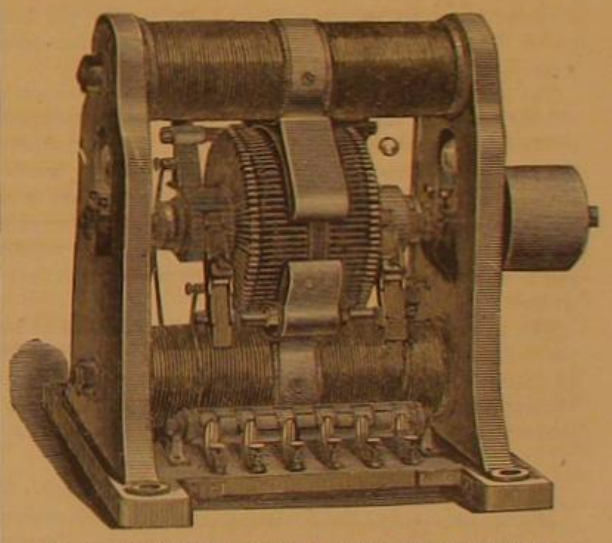


Fig. 6.—IMPROVED FORM OF GRAMME'S MACHINE.

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.

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

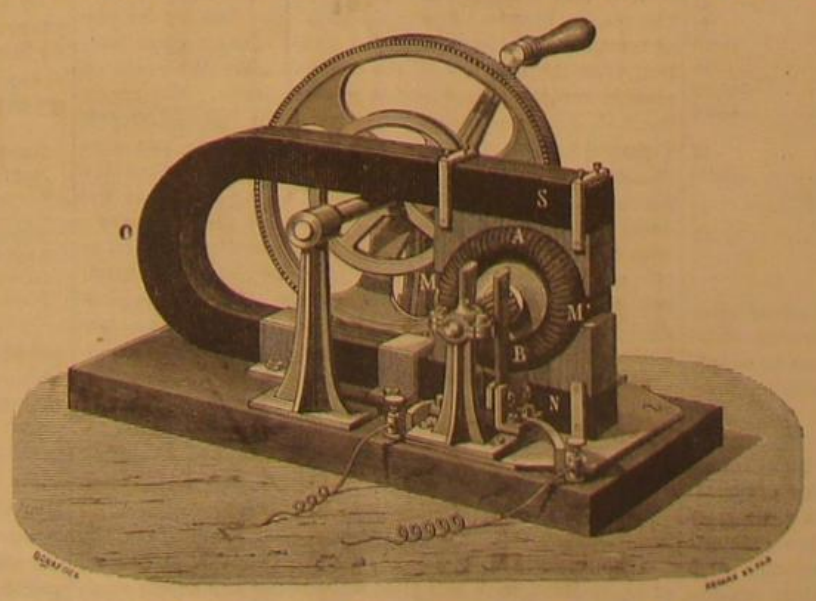


Fig. 5.—GRAMME'S MAGNETO-ELECTRIC MACHINE.

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 ½ 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 ½ 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 5½ hours. The thresher was 120 feet from the engine, and was driven by ¾ 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.

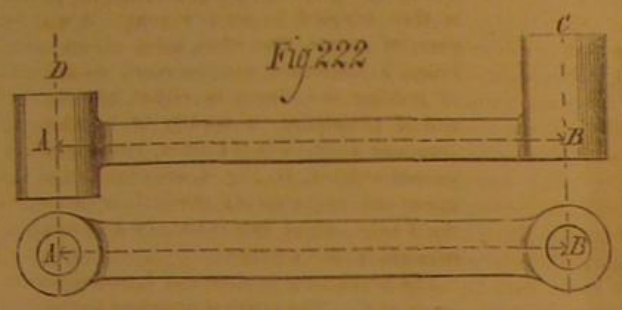
BY JOSHUA ROSE.

NUMBER XLIV.

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

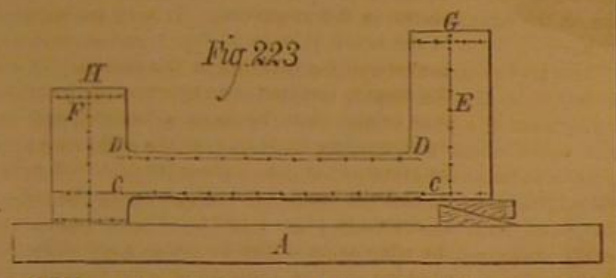
When the hights of two hubs are unequal, as shown in Fig. 222, the distance required being that from A to B, we must make the necessary allowance (in the distance at which we set the compass or trammel points) for the difference in

Fig. 222



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

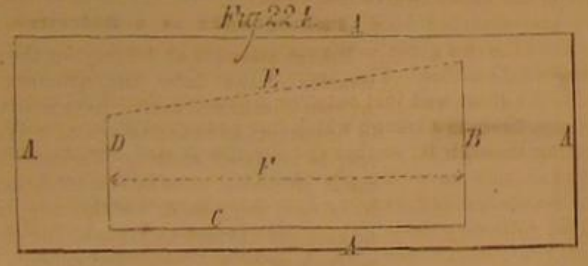
Fig. 223



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.

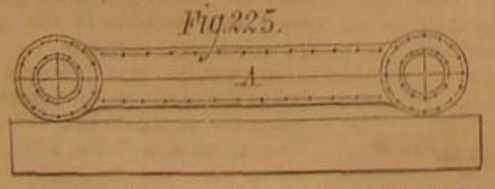
We now turn to the marking-off table, and on its surface draw a straight line a little longer than the length of our arm or lever, as shown in Fig. 224, the lines, A A A A, representing the outline of the marking-off table, the line, B, representing the hight of the hub from its surface, G, to the

Fig. 224



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

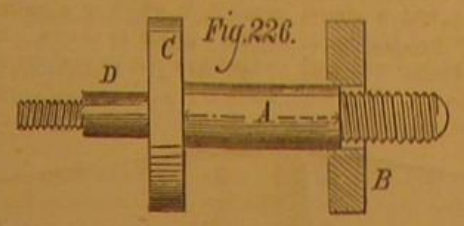
Fig. 225.



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.

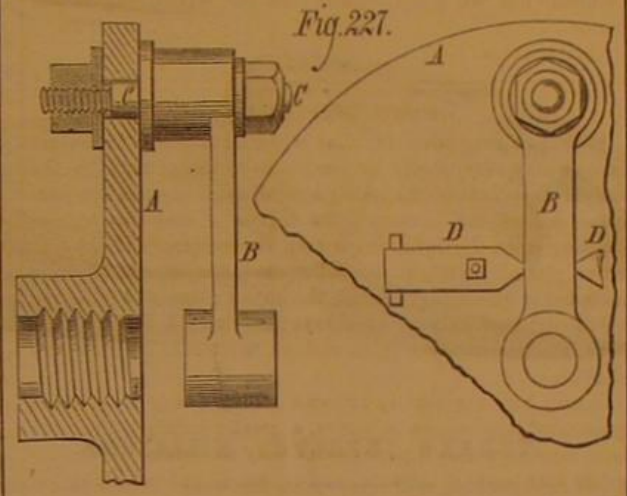
When, however, there are a number of such levers to be made, all requiring to be of nearly equal length from center to center of the holes, one only should be marked off for the hole centers, care being taken to mark it off with great exactitude. Then after that one is bored, and the faces of the hub 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

Fig. 226.



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 tha their ends contact with the stem of the work to prevent i

Fig. 227.



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

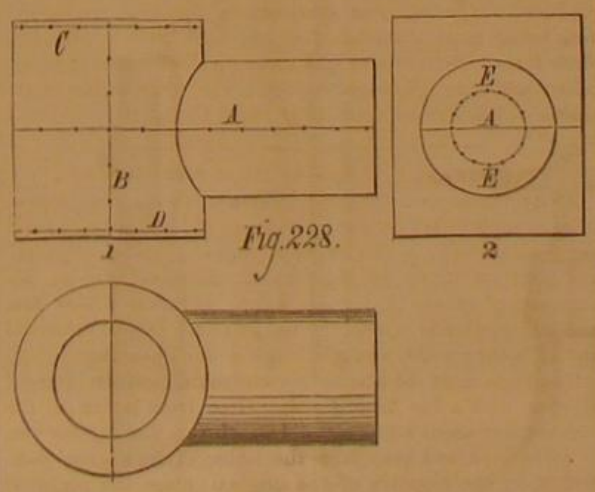
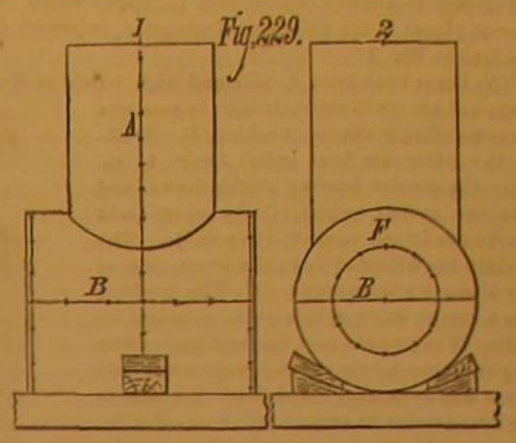


Fig. 228.

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

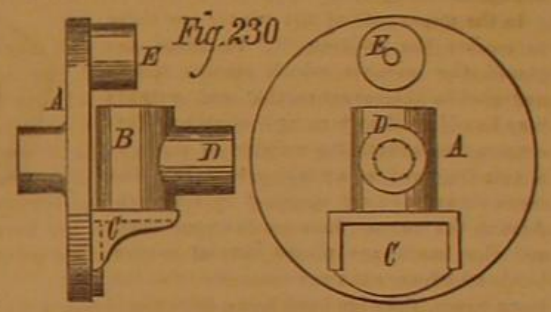
Fig. 229.



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

Fig. 230



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.

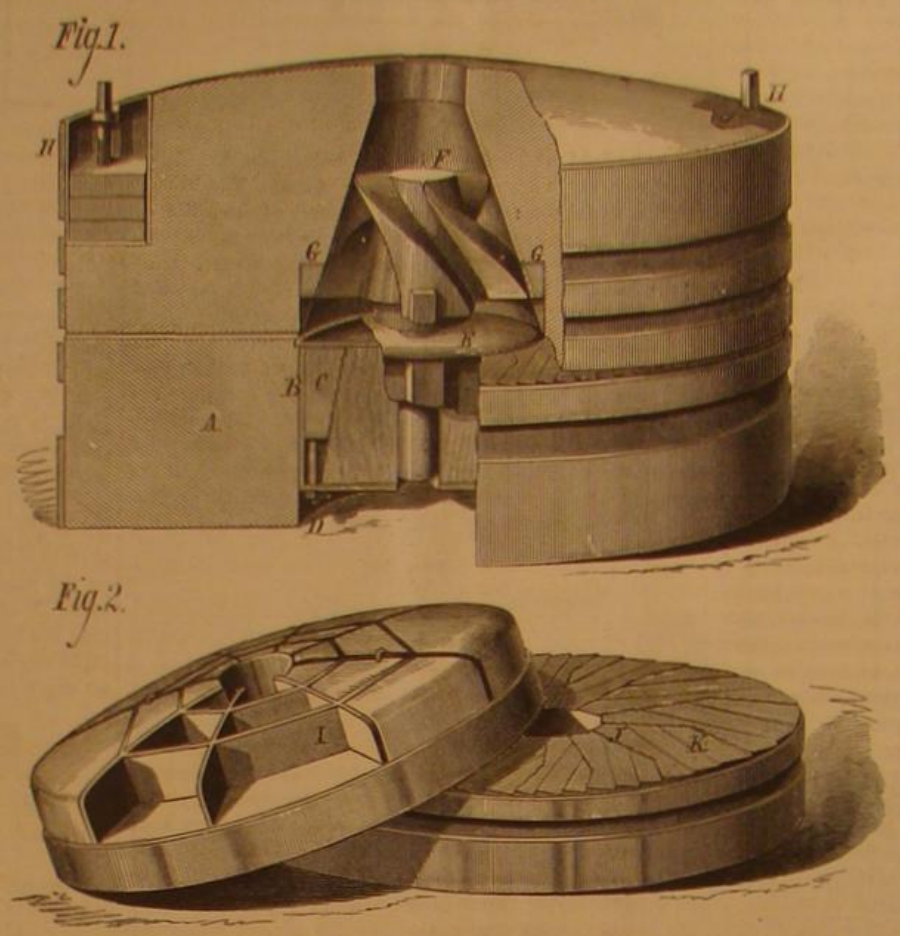
We illustrate herewith a new millstone, in which is embodied a large number of novel and useful improvements, mainly in mechanical construction, the object being to render the stone more effective in operation and more readily adjusted and balanced. These will be found noted in their proper places in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

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 1¼ 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 1¼ inches from the eye for about two thirds their length. Their outer part and also the furrows, K, are on a draft of 1¼ 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.



TRUAX'S IMPROVED MILLSTONE.

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.

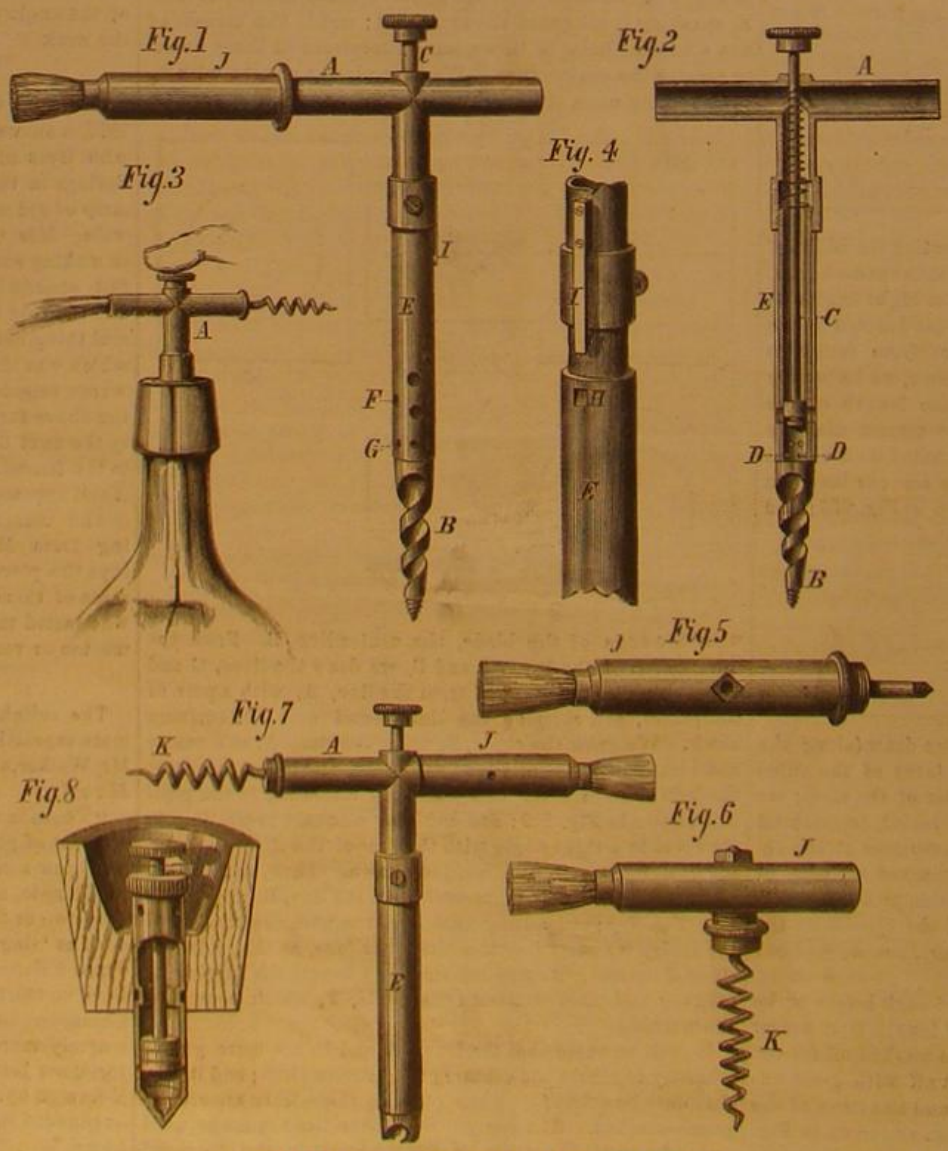
When, on the other hand, the sleeve is turned half round from the position above described, the vent holes, G, will similarly register, and the device is then adapted to act as a vent. It will be seen, of course, that when holes, G, are open, holes, F, are closed, and *vice versâ*. As a means of locking 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 circulatien 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 oe 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 *Gewerbeuitting*, 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 ss 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 brightly 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. 5,435, 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 buckle entering 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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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. 363, 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. I. 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, 2½ 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: ⅛, ¼, ½, ¾, ⅝? 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 ½ oz., isinglass ½ 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.

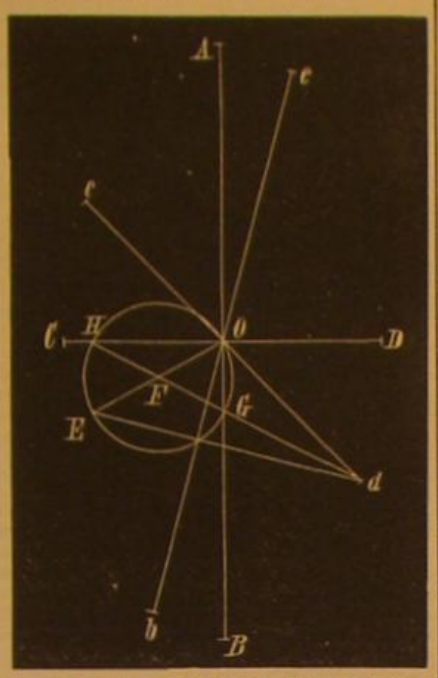
(37) G. S. says: I have a drum head that has lettering on it, done in black. How can I take the marks off without injuring the head? A. You should have stated, if possible, the character of the pigment employed in the lettering. The following is a list of the solvents commonly employed where this is 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 ½ 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, $\frac{8}{9}$, $\frac{4}{5}$, $\frac{3}{4}$, $\frac{2}{3}$, $\frac{3}{5}$, $\frac{8}{15}$, $\frac{1}{2}$. 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: $\frac{1}{2}$, $\frac{4}{9}$, $\frac{2}{5}$, $\frac{1}{3}$, $\frac{4}{15}$, $\frac{1}{5}$, $\frac{1}{4}$, 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 c O. 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 whol tubject, 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 2⅛ 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 ⅜ 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 alumogen, 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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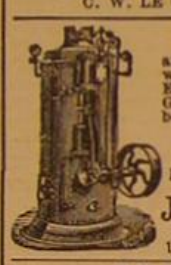
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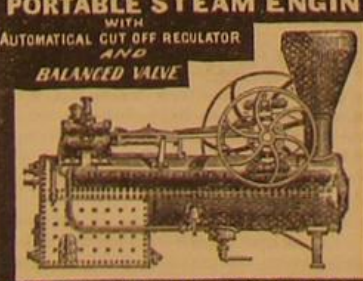


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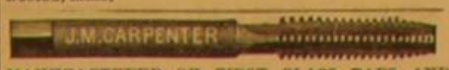
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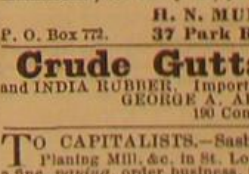


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Vol. XXXIV.—No. 14. [NEW SERIES.] NEW YORK, APRIL 1, 1876. [$3.20 per Annum. [POSTAGE PREPAID.]

RAPID TRANSIT IN NEW YORK.

We give below engravings illustrative of the elevated and of the underground systems of city travel. The former, under the auspices of the New York Elevated Railway, has lately been extended, and is now running in this city, with a single track, on Greenwich street and Ninth avenue, from the Battery to Central Park, a distance of five miles, being the first considerable portion of any purely local line for rapid transit that has, up to the present time, been constructed in this city. We also present, on other pages, sectional views of this work, together with other drawings pertaining to the above subject matter.

The question of rapid transit in New York has for a long period perplexed our citizens, has had a curious history, and is finally nearing a curious solution. Public opinion as to the particular system or form of transit best suited to meet the wants of our community has, from time to time, greatly varied. Twenty-five years ago the elevated railway plan was chiefly favored. That was a time when money was scarce; people felt poor, and wanted a cheap form of railway, quickly built. Various forms of these structures were engraved and discussed in the SCIENTIFIC AMERICAN at that period, but none were adopted.

As the times improved and money became more plentiful, the underground railway, with its solid tracks, superior speed, and unlimited scope for public accommodation, became the favorite, and the bare suggestion of filling our streets with elevated railways was hooted at and set aside.

Underground roads were, by the press and engineers, declared to be the only proper and adequate means for rapid transit, and charters therefor were now granted. Among these grants was that for an underground railway, directly beneath Broadway, the finest street in the world and (by reason of its large local population, central position, and celebrity) regarded by many as the best of all railway routes. One of our engravings illustrates the character of the stations designed for this railway. The street pavement is to be supported upon iron girders and ornamental columns, with masonry arches between the beams. The entire line of works, from the Battery to Central Park and Grand Central Depot, is designed to be of the most substantial and enduring character. The general plan of the works will be similar to the underground railways of London, which now ramify in all directions throughout that great metropolis, are constantly being extended, and have been proved, by years of experience, to furnish the only positive means of fast city travel worthy of the name of rapid transit.

Another of the charters granted was for the existing Fourth Avenue Underground Railway, details of which were fully illustrated in our paper a few months ago. This great work was completed last year at a cost of six millions of dollars, of which three millions or more were furnished from the city treasury. The line extends northerly from 42d street to Harlem river, a distance of four miles and a half. Over the four tracks of this underground railway the immense traffic of the New York Central and Hudson River Railway, the New York and Harlem, and the New York, New Haven, and Hartford, and their many branches is now conducted with such regularity, safety, and comparative silence that the fact of the working of these roads within the heart of the city is almost forgotten by the majority of people. When these roads were worked above ground, the columns of our local newspapers contained frequent and bitter complaints against them.

The financial revulsion of 1873, the effects of which still prevail, made our citizens again feel poor, and revived the cry for cheaper plans of transit, on the elevated system. Last year the legislature created a board of five commissioners to determine routes and authorize certain lines of these bridges, if they thought best. They have reported in favor of them; their report is now before the courts, and will, it is expected, soon be confirmed; in which case our citizens will probably have an extended experience

(*Continued on page* 214.)



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A BIT OF ANCIENT TRAVEL.

In our description of the Oera Linda alphabet (page 195 of our last issue), mention was made of the circumstance that among the many internal evidences of the genuineness of the Oera Linda manuscript was an account of a visit to the pile dwellers of the Alpine lakes, which could not have been written by any one in recent times. It is certain that the manuscript has been in the Oera Linda family for several generations, and equally certain that previous to 1853, when the first remains of pile dwellings were accidentally discovered, the existence of a people living in that way had been forgotten for a period of two thousand years. It rests with those who question the antiquity of the record to show how the following narrative, not to mention others, could have been invented at any time since the extermination of the lake men and the destruction of their remarkable settlements, of which the historians of Southern Europe make no mention.

The first and most ancient account of the pile dwellers is also the most complete and circumstantial. It occurs in the story of Apollonia, chief priestess or burgtmaagd of a place called Lindasburgt, which she describes at length, furnishing a remarkable picture of a civilization in Europe more ancient than that of Greece. Her visit to the pile dwellers was made about the middle of the sixth century before the birth of Christ. It was the rule among the ancient Frisians that, before a burgtmaagd could enter upon the duties of the office to which she had been elected, she must travel for a year. Upon her devolved the responsibility of teaching the maidens how to set to work when they went among the people, and naturally it was essential that she should be well acquainted with the country. It was during her tour of observation that Apollonia visited the pile dwellers.

"My journey," she writes, "was along the Rhine, on this side going up and on the other down. The higher I went, the poorer the people seemed to be. Everywhere about the Rhine the people dug holes, and the sand that was got out was poured with water over fleeces to get the gold; but the girls did not wear golden crowns of it. Formerly they were more numerous; but since we lost Schoonland (Scandinavia) they have gone up the mountains. There they dig ore and make iron. Above the Rhine, among the mountains, I have seen Marsaten. The Marsaten are people who live on the lakes. Their houses are built upon piles, for protection from the wild beasts and wicked people. There are wolves, bears, and horrible lions. Then come the Swetsar (Swiss), the nearest to the frontiers of the distant Krekalanders (Italian and Greeks), the followers of Kalta (Kelts), and the savage Twiskar (Germans), all greedy for robbery and booty. The Marsaten gain their livelihood by fishing and hunting. The skins are sewn together by the women, and prepared with birch bark. The small skins are as soft as a woman's skin. The burgtmaagd at Fryasburgt (Freiburg) told us that they were good, simple people; but if I had not heard her speak of them first, I should have thought they were not Frya's people (that is, white men), they looked so impudent. Their wool and herbs are bought by the Rhine people and taken to foreign countries by the ship captains. Along the other side of the Rhine, it was just the same as at Lydasburgt (Leyden). There was a great river or lake, and upon this lake also there were people living upon piles. But they were not Frya's people: they were black and brown men who had been employed as rowers to bring home the men who had been making foreign voyages, and they had to stay there till the fleet came home."

About two centuries and a half after Apollonia's visit, her descendant, Konerêd, added to the family record a history of Friso and his son Adel, in which another visit to the pile dwellers is mentioned. Hitherto Friso has been supposed to have been the founder of the Frisian race; but it appears that he only brought back to the ancient home of his family a colony of Frieslanders whose ancestors had traveled to the Far East about sixteen centuries before Christ, at a time when there was unbroken water communication between the Mediterranean and the Red Seas. The subsequent closing of the channel by an uplifting of the present isthmus during an earthquake is graphically described in the writings of Adela. Friso had been in the service of Alexander the Great, having built the conqueror's fleet on the Indus and brought it, under Nearchus, by way of the Red Sea to the Isthmus of Suez, over which the ships were drawn to the Mediterranean. He afterwards returned to Friesland with his followers, and was elected grevetman of the districts round Staveren.

When Friso's son Adel had finished his studies at the citadel of Texland, he was sent to travel through the States, accompanied by his wife Ifkja, a clever Frisian: this some time about the middle of the third century B. C., at which time the pile dwellers still inhabited the lakes among the mountains. Adel and his wife spent some time among them, not without great apprehension, for the plundering Twisklanders (Germans) were pressing hard upon them. On the return toward the lowlands, four servants of the party, who had loitered a little, were set upon and murdered by Twisklanders, who are described as banished and fugitive whites who had taken wives from among the Tartars, so called because they made war *on* everybody. They were all horsemen and bloodthirsty robbers, calling themselves Frijen or Franken. Hitherto the settlements on the Alpine lakes have been known only through their remains. The Paeonians, who inhabited Lake Prasias, as described by Herodotus (book V., chapter 16), were undoubtedly a branch of the same race; and his account tallies well not only with those of Adel and Konerêd Oera Linda, but also with the deductions of archæology. Herodotus, however, knew nothing of the existence of such a people so far to the west; consequently these descriptions, by contemporary writers so many centuries ago, are as valuable as they are interesting.

We may add that tribes living in a similar manner have been discovered in New Guinea, and very recently (by Lieutenant Cameron) in Central Africa.

THE NAVAL ENGINEER CORPS.

Many of our readers may not be aware that the usefulness of the United States Naval Academy at Annapolis has within the past few years been greatly extended by the addition of a thoroughly scientific and practical course of mechanical and marine engineering, and that the engineer corps of the navy is now mainly recruited from the graduates of the institution. The course of study for the cadet engineers comprises four academic years, during which time they are thoroughly instructed in designing, drawing, fabricating, and operating steam machinery, in mathematics, natural philosophy, and the English branches. Their physical culture is carefully attended to, the studies being varied by gymnastic exercises and infantry and artillery drills. The rank, pay, and position of the cadet engineers is the same as that of the cadet midshipmen, their courses of study being parallel. They are, however, appointed in a different manner. The cadet midshipmen, as is well known, are appointed on the nomination of senators and members of Congress. The cadet engineers are appointed from those passing the best competitive examinations. The positions are thus thrown open to those who can show themselves to be the best qualified to fill them, which is just as it should be.

Twenty-five appointments are allowed by law each year, and they are made in September, at the commencement of the academic year. The examination for entrance begins on September 5 next; and those wishing permits to be examined should apply soon to the Secretary of the Navy or the engineer in chief, by mail, for blank applications and pamphlets, containing full particulars as to the qualifications of candidates and the nature of the examination they are required to pass. Candidates must be from 16 to 20 years of age, and must have a fair education. They must send to the navy department, with their applications, certificates as to their good health and character, the dates of their birth, and information as to the educational advantages hitherto enjoyed. Candidates who receive permission must go to Annapolis at their own expense, and, if successful, must furnish themselves with an outfit of uniforms, clothing, and books, at a cost of $230. After admission to the Academy, the salary of the cadet is sufficient for all his necessary expenses, and he will receive from the government a thorough education at an institution which the last report of the Secretary of the Navy declares to be a "school of mechanical and marine engineering second to none in the world;" and on finally graduating he will be commissioned an assistant engineer in the navy.

THE SCIENCE OF CURRENCY.

A proposition has been sent to the Committee on Banking and Currency of the House of Representatives, suggesting that a committee of scientific experts be appointed, to enquire whether there is any science of money and currency, and if they find there is, to express the laws briefly and clearly; but if it shall appear that no such science is known, they shall endeavor to "evolve, discover, or create" such a science. Probably this plan will excite a general smile, for it is very hard to find a person who does not think that he knows all about such matters, and is only surprised that there are so many foolish people who will not agree with him. In spite of all this, however, it is impossible to resist the conviction that we are continually approaching the time when the affairs of this world will be conducted on scientific, that is, on common sense, principles. A good many persons are accustomed to think of scientists as theoretical dreamers, whose labors are of little or no practical importance; but no idea could be farther from the truth. A scientific man is one who is endeavoring to discover Nature's laws, and publish them for the guidance of mankind. The scientists hows us how to make the most of the resources placed at our disposal, how to increase the yield of our land, to reclaim deserts, to harness the physical forces, to avoid disease, to live more comfortably and securely.

In this country, we find ourselves at the present time in the hight of a conflict relating to the currency, and it seems to be entirely overlooked that the elaborate argumenst *pro* and *con* lack even the merit of originality, as they have been uttered scores of times in bygone years, and can be exhumed from the literature and official records of foreign countries. This sort of repetition becomes monotonous, after a while, to say nothing of the disastrous effects of an unsettled policy on the business interests of a country. Now that demagogues have had their say, it is time to call for the views of Science; and we hope the proposition will receive due consideration.

MILK AND ITS ADULTERATION.

When doctors disagree, who shall decide? New York city has been greatly exercised lately by a renewal of the discussion about the methods of detecting the fraudulent adulteration of milk. It was long since settled that water was the only substance employed for adulterating milk, and the question is narrowed down to the determination of the quantity of water added to this popular beverage. Dr. C. F. Chandler has appeared as the champion of the much abused lactometer, and Dr. R. O. Doremus as its chief opponent. The courts lean first one way and then the other, and the public are left as much in the fog as ever.

The question excites much interest, although, aside from its moral and economical aspect, it really does not deserve much attention. Of course such a systematic course of

fraud as that which takes $4,000,000 per annum from honest citizens to pay for water mixed with milk, should not be tolerated. Yet if the milkmen will put clean pure water in their milk, we suffer no injury except to our pockets. In truth the excess of water is the least disagreeable distinction between the milk delivered at our doors and that enjoyed by the rural swain. The hot jolt over stony roads, exposed to the sun's direct rays, as it wends its way to the station, where it waits a few hours for the night milk train, to say nothing of the trip on the rail, enable it to reach us just before it begins to sour, but in a fit state to undergo that change at once on taking it from the ice box. It has spent from 12 to 18 hours in a can none too clean at the start, and soon begins to reproduce for us the well known odor of a dirty milk can. The empty can is returned unwashed on the following day to the honest farmer, whose industrious wife finds it impossible, by careful scalding and scouring, to make it perfectly clean and sweet before it must start off again, and probably consolos herself with the thought that it is "good enough for New Yorkers." To our minds and palates, the filth and stench introduced into it in other ways, including the food of the cow, etc., are far more objectionable and dangerous than the water about which so much stir is being made just now. There is a simple mode of escape from all these by the practice of a little self-denial, by learning to drink black coffee and clear tea. Or, if this task prove too difficult, three or four condensed milk companies stand ready to furnish us and our babies with a pure article of acknowledged healthfulness.

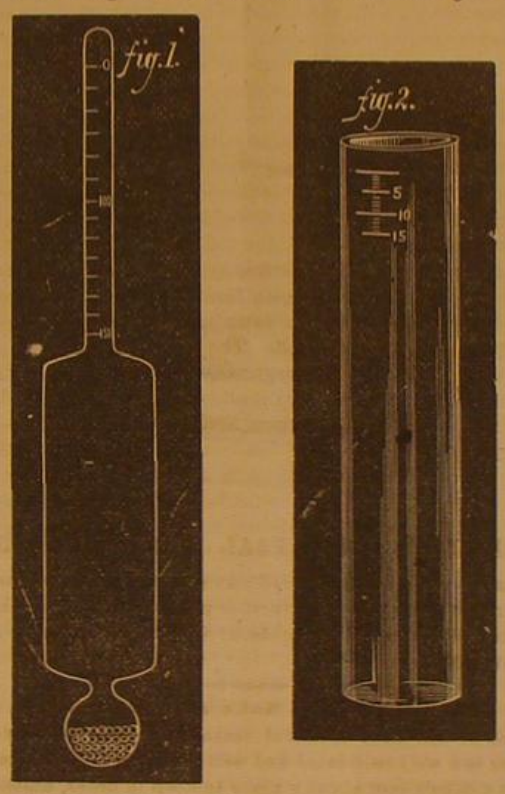
But what are the difficulties in the way of detecting watered milk? Milk is itself a dilute aqueous solution of milk sugar, caseine, and small quantities of mineral salts, and holds in suspension a quantity of fat in a fine state of division. Its composition, when taken from the cow, varies considerably, being richer in the morning than at night, that which is drawn last from the udder, called strippings, being richer than that drawn previously. The same cow yields richer milk when well fed than when poorly fed; and town-fed milk differs from country-fed milk. It is likewise affected by the age of the calf, breed of the cow, etc. The amount of water in unadulterated milk varies from 81·47 to 90·7 per cent, the average according to Letheby being 86·0 per cent. The amount of fat or butter globules varies even more, ranging from 1·79 to 9·88 per cent, both of these figures representing extreme and very uncommon cases. Caseine varies less, from 2·43 to 5·37; sugar, from 3·29 to 6·56; salts, 0·50 to 1·15. Two of the leading English chemists put the average composition of pure milk as follows:

	Letheby.	Wanklyn.	
		Town.	Country.
Water	86·00	85.94	87·55
Fat	3·90	4·00	3·08
Caseine	4·10	5·02	4·04
Milk sugar	5·20	4·31	4·62
Ash	0·80	0·73	0·71
	100·00	100·00	100·00

It will be evident that, if a complete analysis of a given sample of milk be made, it will tell us neither how much water has been added nor how much cream has been removed. The dairyman must have the benefit of the doubt, and the law should permit him to furnish as poor milk as the poorest cows will give on fair food, and hence he is permitted and encouraged to dilute his best milk down to this standard, no matter what method of testing be employed.

A word about testing milk may not be out of place here. The most satisfactory test is, of course, complete chemical analysis; but unfortunately, the time required precludes its use, except to prove a point already indicated by some more rapid method. If it were possible to erect a huge chemical laboratory at every railroad depot, and employ an army of skilled chemists to analyze a specimen from every can of milk, the time required would be such that most of the milk would sour before it reached the consumers' hands. Beside, it is probably not the farmers but the middlemen who dilute it. The course of analysis is briefly this: A weighed quantity of milk is evaporated to dryness on a water bath, dried at 212°, and weighed; the loss represents the water, and should not exceed 88 per cent. This residue is treated with ether (which dissolves out the fat), is filtered, the filtrate evaporated to dryness, and weighed; the result equals the butter. The total residue, *minus* the butter, is a tolerably constant quantity, and should be about 9 per cent. The caseine in cow's milk (not in breast milk) may be coagulated and determined thus, and the salts are determined by burning off the combustible portion of the solid residue after extracting the butter.

The lactometer, about which we hear so much said, is simply a very delicate hydrometer (Fig. 1), so arranged that it floats in pure water at the zero point of the scale. The depth to which it sinks in milk or other liquid having a specific gravity of 1·029 at 60° Fah. is marked 100°. It is not claimed for this instrument that it is able to do more than show the specific gravity of the liquid. This form of instrument was devised by Dinocourt, and was employed for a long time in Paris and London, where its imperfections and careless use brought severe censure upon it. The difficulty in judging of the quality of milk when we know its density consists in this: Milk contains two different kinds of ingredients, salt and sugar, each of which increases its specific gravity; and butter or cream, which lowers its specific gravity. Hence the apparent paradox that you may lower the specific gravity of the milk by adding either water or cream, and increase its density by removing the cream. Although cream is lighter than milk, it is heavier than water; and hence the addition of cream has much less effect than an equal amount of water; so that although this lactometer does not detect skimmed milk, it does detect the admixture of any considerable amount of water. It was necessary to put the standard of pure milk as low as that of the poorest pure milk to avoid injustice to honest dealers; and for this purpose many hundred samples of pure milk, direct from the cow, were tested, and none being found lower than 1·029, this was taken as the 100° mark for pure milk. Milk that has a greater density may have been skimmed or even slightly watered; if the density is less than that, it is due to one of two things, either water or cream has been added; as no man will add the latter, it is a safe supposition that it is due to the former. Granting the possibility of a farmer or dairyman owning one cow, whose milk is so unusually rich that it falls below 100° on account of cream, he is not likely to send her milk to market or if he does, when mixed, as it must be, with other milk, it will be lifted to the standard at least. So that while the lactometer does not decide the absolute value of the milk, it serves to indicate any considerable amount of dilution; and whether followed up by a complete analysis or not, it will not injure the seller, although affording partial protection to the buyer. The fact that its use by the Board of Health has seriously interfered with the dishonest profits of the milkmen is quite evident from their vigorous efforts to prevent its use. It is not, however, true, as many seem to think, that all milk which stands above 100° is allowed to pass by the sanitary police. Should the milk be wanting in cream, as is easily told by the appearance of the lactometer when it is lifted from the milk, a sample is taken and carefully analyzed to determine the amount of cream removed, a point which, as we have seen, the lactometer does not settle. Several other tests have been suggested for determining the relative value of milk. Each of these is open to one of two objections: they either require delicate balances and skilled fingers, or give very rough approximations. A very simple instrument, which may be used in connection with a lactometer, is known as the creamometer, Fig. 2. It is a straight tube, closed at the bottom and graduated



in hundredths, although the graduation need extend but a little way from the top down. The milk is poured in and allowed to stand and throw up its cream; the volume is then read. Pure milk yields about 10 per cent of cream, but is subject to great variation, so that, while this instrument determines the richness of the milk with some accuracy, and would at once detect skimmed milk, it is unable to decide how much water has been added, because unwatered milk may still be poor in cream, and watered milk throws up its cream more rapidly than pure. John Horsley, F.C.S., modifies this test as follows: One tablespoonful or half an ounce of milk is poured into a tube 11 inches long and ⅝ of an inch in diameter, graduated from 10 inches down into hundredths. An equal bulk of ether is next poured in, and the tube closed and shaken for five minutes. An equal measure of alcohol is then added, and again shaken for another five minutes. On placing it upright, the oily matter rises to the surface. Each line of oil corresponds to 4·15 grains of solid butter, and milk with 10 per cent of cream will show two lines of oil, or 8·3 grains for 250 grains of milk.

Sacc's method, which is similar to Horsley's, consists in mixing the milk with an equal volume of alcohol (70° Tr.), and shaking. In good milk the coagulum should occupy the same volume as the milk did. If the coagulum remains suspended in the liquid instead of rising quickly to the surface, it is a proof that water has been added.

Still another method has been devised, depending on the opacity imparted by the butter globules, but space forbids our entering into a minute description of it.

The butter and caseine may best be determined by coagulating the milk with a few drops of acetic acid, boiling, washing the precipitate with water, and finally separating the butter with ether, leaving the caseine pure. On evaporating the ether, the butter extracted by it is left and may also be weighed. No chemist would, of course, attempt to deduce the weight of this coagulum from its bulk, which depends entirely on its compactness, and, although apparently simple, is actually a very fallacious test.

Boussingault has shown (Dingler's *Polytechnisches Journal*, CCV., 65) that the microscope readily distinguishes good milk from skimmed or watered milk; but the microscope, like the balance, is a costly piece of apparatus and reliable only in skilled hands.

TO THE FRIENDS AND PATRONS OF THE SCIENTIFIC AMERICAN.

At no period since the commencement of the publication of this paper—thirty years ago—has its regular weekly circulation been so great as it is at present. This fact is gratifying to us, and not less so, we are sure, to our advertising patrons. Notwithstanding the hard times, scarcity of money, and depression in most kinds of manufacturing business, our old subscribers have never renewed their subscriptions more promptly; and never before have so many new names been enrolled in our subscription books as have come in since the commencement of the new volume. The success of the SCIENTIFIC AMERICAN SUPPLEMENT has exceeded our expectations; and, although but three months old, it has obtained, we believe, a larger circulation than that of any similar publication in this country or Europe, while that of the regular edition of the SCIENTIFIC AMERICAN is undoubtedly greater than the *combined* circulation of all the papers of its kind published both in this country and Europe.

These papers go into most of the manufacturing establishments and machine and workshops of this country, and are on file in the principal libraries and reading rooms in the United States and Europe, thereby affording an unequaled medium for manufacturers of all kinds of machinery, and vendors of any new mechanical articles, new inventions, patents, etc., to advertise their wares. Through no other source can they reach the class of persons most likely to become their patrons.

Every established business firm knows the necessity of advertising; therefore a hint to them is not needed. But upon persons establishing a new business, or having for sale a new article, or wishing to sell a patent, or to find a manufacturer to work it—upon this class we would impress the importance of advertising; and we believe there is no other source from which the advertiser can get as speedy returns as from the columns of the SCIENTIFIC AMERICAN and its SUPPLEMENT.

We do not make these suggestions merely to increase our advertising patronage, but to direct persons how to increase their own business. All who advertise persistently, and through such mediums as have the largest circulation among the class of persons most likely to be interested in the articles offered, advertise judiciously. That the SCIENTIFIC AMERICAN and the SUPPLEMENT go into the manufacturing establishments, and are taken by persons interested in all kinds of engineering and mechanical enterprises, no one will deny; but what the extent of circulation necessary to reach all these classes of persons is, few stop to realize, and none but the publishers and their advertising patrons, we suppose, care much about it. But the latter are interested in this matter; and for their information we would state that 47,500 copies of the SCIENTIFIC AMERICAN and 15,000 of the SCIENTIFIC AMERICAN SUPPLEMENT are printed every week, making a total aggregate on both editions of 62,500 copies of each issue. Of this large edition, in no single week since the 1st of March have we failed to distribute a less quantity than 60,000 copies to our regular subscribers in this country and abroad, through the mails and newsdealers; and we are happy to say that the demand increases each successive week.

We thank our friends and patrons for their liberal encouragement; and we shall strive to render to all classes of them—subscribers, advertisers, and inventors—a full equivalent for their money.

THE FATHER OF WATERS.

Under this head we recently called attention to the remarkable paper of J. B. Eads, C.E., published in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 11, reviewing the labors of the United States Levee Commission, pointing out a number of most serious errors, as he conceives, in the conclusions reached by the Commission. The area of reclamation was given by us at 70,000 square miles, but should have been given at 30,000 square miles. The area of the valley drained by the Mississippi is estimated to contain an aggregate of 1,200,000 square miles, and to be capable of supporting a population of over 300,000,000. In our SUPPLEMENT for the present week (No. 14) Brevet Brigadier General Abbot criticises Engineer Eads' review, giving diagrams of the soundings of the river, showing the accumulation of sediment on the bottom, resulting from increased river volume, with other facts that look difficult of explanation on the theory of Captain Eads. The discussion is one of interest and importance.

Jay Gould Defeated.

About a year ago, the then Commissioner of Patents ordered a patent to issue to T. A. Edison and G. B. Prescott, for quadruplex telegraph instruments, the latter individual being part assignee. Edison sought, by appeal to the Secretary of Interior, Delano, to set aside the Commissioner's decision and prevent Prescott from obtaining his share in the patent, on the pretence that, before selling to Prescott, he had sold the invention to certain other parties, who were known to be in the interest of the notorious Jay Gould. Delano entertained the appeal, held the papers, and refused to decide the case; subsequently he resigned the office. The new Secretary of the Interior, the Honorable Z. Chandler, has recently decided the matter by dismissing the appeal, which he thinks was unauthorized by law; and he sustains the Patent Office in issuing the patent jointly to Messrs. Prescott and Edison,

IMPROVED UNIVERSAL EMERY GRINDER.

The machine herewith illustrated offers an excellent example of the rapid progress which is constantly being made in this country, in perfecting and refining the capabilities and designs of mechanical inventions. The reader, on turning back to the issue of our journal of last year in which we published engravings of this apparatus, will see the difference between the old and the new form, the first, being excellent in its way but falling considerably below the last, both in point of advantages and in adaptation of design and material to the purposes sought. In the present device the standard is of cast metal instead of wood, and is arranged to receive a collar which supports the adjustable table, D. By means of the rack and pawl mechanism shown, said table may be placed at any desired hight.

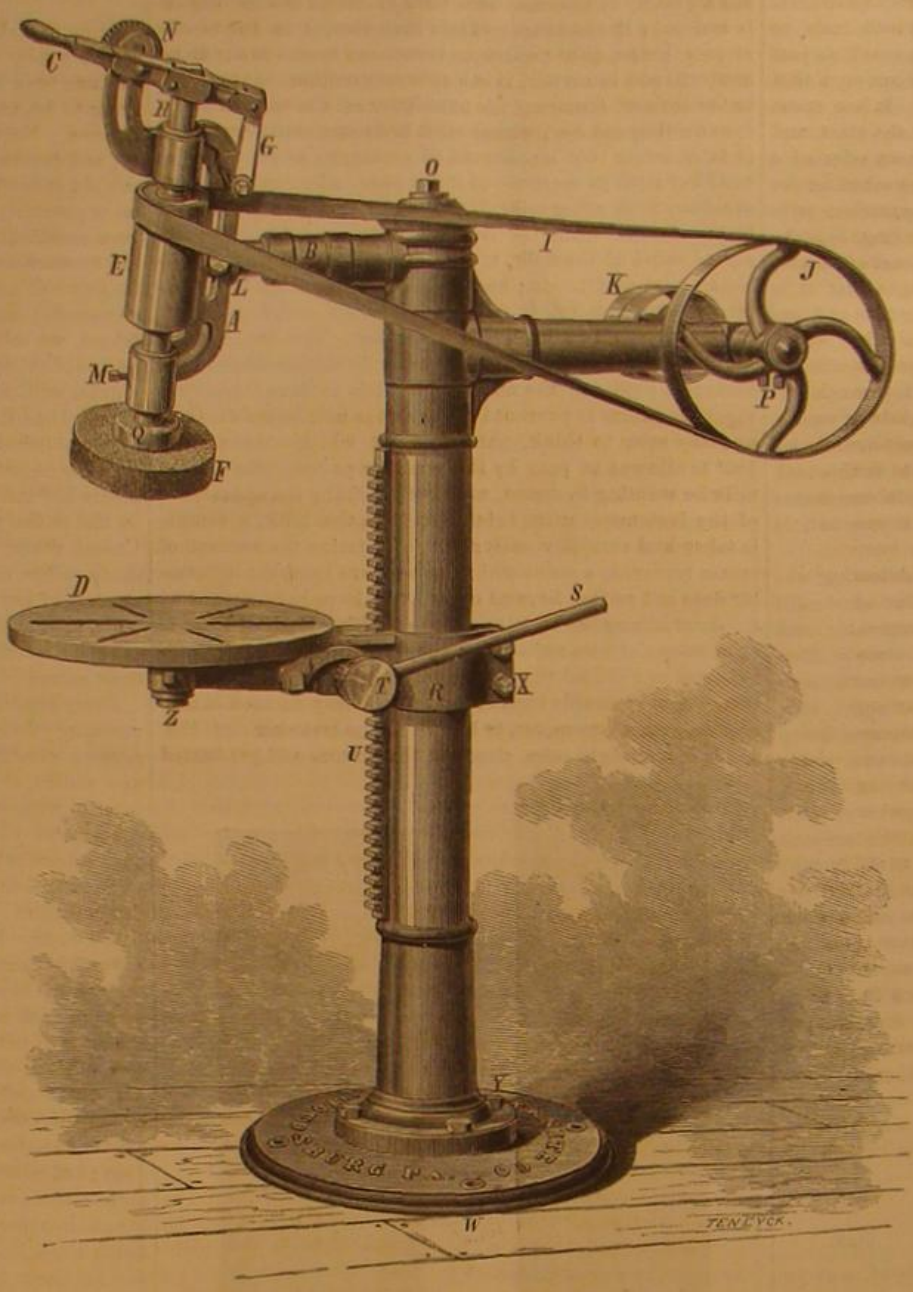
The machine is especially suited to perform a large class of work, done by machinists, stove fitters, and others, which cannot conveniently be performed on horizontal apparatus.

The wheel shaft is mounted in bearings in the frame, A, which, by means of a set screw passing through a slot, is secured to a shank which enters a socket on the standard, B. The shank, by loosening the set screws which confine it in the socket, can be drawn out to tighten the belt which, acting on a pulley on the wheel mandrel, rotates the wheel; or it can be turned in the socket so as to set the latter at any angle. By means of the slot and set screw in the frame, the wheel can be adjusted nearer to or further from the table, as desired. The mandrel has several inches traverse in the frame, so that the pulley can be pressed down or lifted up from the work by means of the simple lever arrangement at C. The lever may be set and held at any position by means of the nut shown, or the former may be counterweighted and operated by a treadle beneath the table.

In order to grind flat surfaces, the wheel is lowered down to them. A conical wheel is used for grinding holes in stove plates, etc., an aperture being made in the table or an auxiliary platform thus provided being secured on top of the latter. For edging plates, the table can be made of sufficient size to sustain the whole weight of the plate, so that the attendant can bring a more even pressure on the wheel with little labor and without danger of injuring it. The wheel can be inclined so as to grind bevel edges with readiness; and by suitably formed grinders, moldings can easily be ground.

The wheel may be adjusted to become an ordinary horizontal grinder; while the substitution of a wooden pulley for the emery wheel turns the machine into a handy contrivance for the use of an emery belt.

The machine is manufactured by the Tanite Company, of Stroudsburg, Pa., who may be addressed for further particulars.



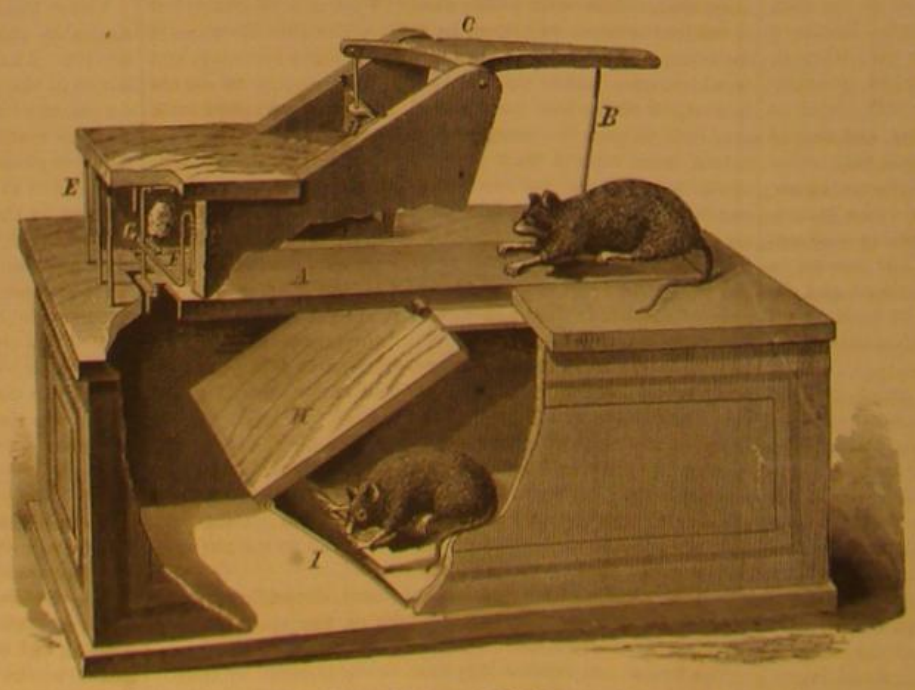
SANFORD'S UNIVERSAL EMERY GRINDER.

IMPROVED ANIMAL TRAP.

In the annexed engraving we illustrate a novel and ingenious self-setting trap, which may be used for catching any kind of small animal that can be lured by bait. It is entirely automatic in its action, and, it is claimed, will continue its operation until the box is filled with its captures. A is a metallic plate, having flanged edges through which it is pivoted by a central pin. At the front end of the plate is a rod, B, which connects with the vibrating lever, C, to which is suspended the gate, D. The inner end of the plate is inclosed in the box, a portion of which supports the lever, C, as shown. The extremity of the box, E, is open and wired, the object being to allow the animal to clearly see the bait and the light beyond, so as not to arouse suspicion. The bait is attached to a curved rod, F, fastened to the side of the box. This rod is bent around a catch rod, G, which engages with the extremity of the plate, A, and supports the same, as shown.

Attracted by the bait, the animal proceeds to the rear end of the plate. The instant the bait is touched, a very slight movement is sufficient to throw the portion of the catch, G, which sustains the plate, into a notch in the latter, so that the end of the plate is free to descend by the weight of the animal. As this descent occurs, the opposite end of the plate, of course rising, so moves the lever, C, as to cause the gate, D, to be lowered, so that any backward escape of the animal is immediately cut off. The animal then slides down the smooth surface of the plate (the inclination of which is limited by the piece, H), and is launched into the rear compartment of the trap. Hence he is free to emerge under the swinging door, I, but of course cannot return. The plate, A, meanwhile regains its normal position, the bait and catch rods slip into place, and the trap is ready for a new victim.

The apparatus is very simple, and can be cheaply and profitably manufactured. The inventor assures us that he has used it with remarkable success, "one trap," as he expresses it, "catching nearly a wash basin full of mice" in a night. It can be made of any desired size and of any material which will resist gnawing. For further particulars address the inventor, Mr. Wm. D. Wrightson, Queenstown, Queen Anne county, Md.



WRIGHTSON'S ANIMAL TRAP.

Lawns---How to Make and Keep Them.

One of the most beautiful features about a country residence is a well cultivated and well kept lawn. It is also the most difficult spot about a place to keep in order, unless one has the facilities for keeping it irrigated; for the very time of the year when it is most desired that it should look the freshest is, in most parts of our northern and western regions, the driest period of the season. We present herewith some suggestions for the laying out, seeding, and care of a lawn, the result of our own experience and that of others, which we believe will be interesting and useful to a great number of our readers.

In preparing ground for lawns, where the expense is not of so much consequence as the good results, a good subsoiling is preferable, because in such soils the roots go down deep, and in this way get moisture when the weather is dry. Very good lawns can, however, be had by ordinary plowing, as for any good crop. It is best, however, to have the ground plowed up and leveled a year before the grass is sown, or it will sink in places, and then the surface becomes uneven. Where the lawn has been made in this way, and inequalities of the surface exist, earth may be brought in the spring, and spread smoothly over the lawn, and rolled down firm. The grass will grow through this, and make a solid, even lawn.

As soon as the frost is gone, and before the ground is hard, the lawn should be rolled. From various causes, there is generally left an inequality of surface after the winter is over, and this the rolling is to remedy. In spite of all the care to keep weeds out of lawns, they will often get in, especially on lawns that are newly made. The best thing is to have the lawn hand-weeded for the first few years. Early in the season the lawn mower should be set going, but experience is against setting the knives too low. Close cutting we have found to be an injury to the grass. It leaves the roots exposed, and the sun is apt to dry and kill the grass.

A lawn requires an occasional top dressing of manure; but there is no necessity of applying it every year, and it should not be used too green. Well rotted stable manure, mixed with soil, makes an excellent dressing, and should be spread over the lawn at least two or three inches in thickness, early in the spring. Some prefer putting it on in the fall, and leaving it to protect the roots through the winter. There is a diversity of opinion as to the use of manure for this purpose, from the fact of its liability to introduce seeds of weeds, which the use of artificial fertilizers obviates; but we have never experienced any ill effect from the use of the former.

The kind of seed to be sown, to make a lawn, depends upon the climate, condition of the land, and composition of the soil. In the Northern States, the English mixed lawn grass seed, with an excess of white clover and red top, are considerably used; and in the Middle States the Kentucky blue grass does well. Red top does the best in clayey, and the others in lighter, soils. Grasses and clovers are gross feeders, and demand good food, else they will not present a good appearance. The white daisy will often show itself in fields and lawns that are too poor to nourish grasses; and to get rid of this pest, it is needful to make the soil richer. The truly practical man, says an agricultural writer, will dress his worn-out grounds with either superphosphate of lime or Peruvian guano, or some other good fertilizer. They will soon show that the grasses can drive out the daisies or mosses, if they are only properly fed. A surface dressing of superphosphate of lime will also cause an abundant growth of clover, and often it will occur where the clover has not before been seen; and even nitrate of soda will give to the new growth a deep richness of color, and thicken the turf rapidly. The constant cutting and carrying away of the grass produces exhaustion of the soil, until at length it becomes so poor that the grasses die out in a great degree; and the daisies and mosses take their places, until fresh plant food is given, and their growth strengthened. There are some strong, deep soils upon which time seems to make little impression, and no manure is required; but they are only the exceptions.

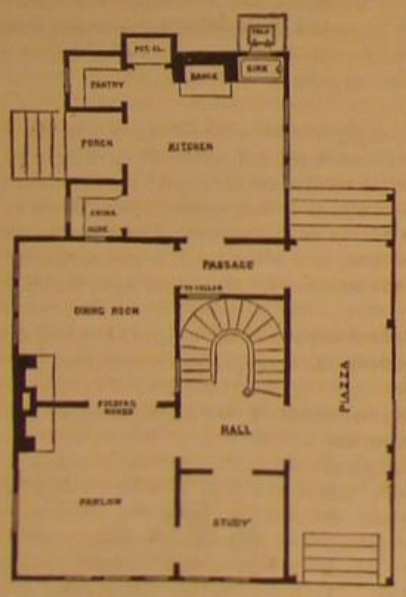
Boxwood Edgings.

In the spring, move back the soil and gravel, roll the walks nicely, and they look as clean and fresh as if new. Before finishing the walks, clip the edgings so as to have them only six or eight inches high. Treated in this way, the top of the edging is sometimes slightly frosted, but no more is injured than is desirable to cut off in clipping. I have practised this method, says a correspondent in the *Practical Farmer*, and have seen others do the same for two score years, and have never seen a failure with it. For dividing walks from beds, both in the kitchen and flower garden, no other edging is as good or as lasting as this. It should never be allowed to grow more than ten inches high, and six inches high and thick is better. When over a foot high and thick, it looks clumsy, injures the crops near it, takes up too much room, and injures the appearance of both walks and beds.

WAX flowers, if left out in the drizzling rain, will be thoroughly cleaned in a short time

A NEW AND USEFUL ARCHITECTURAL WORK.

We have frequently commented upon the strange lack of taste which has been manifested all over this country in the matter of rural architecture. While villas and other costly residences do, it is true, often exhibit grace, beauty, and originality in design, the same is far from the case in cottages and dwellings of medium pretensions; these, like the ever-recurring brown stone front houses of the city, are but duplicates of a few original types, and one after another is constructed by simple modifications of a few plans made by the builder, without the aid of the architect. With these types, and likewise with their ugliness, every one is familiar. There is the "gothic" cottage, so called mainly because it is irregularly built, and not because gothic style is scrupulously observed; more homely still is the cubical edifice surmounted by a miniature reproduction of itself as a cupola; and ugliest of all is the attempted copy of the Greek Parthenon, with its huge front pillars. For these models, architects are now endeavoring to substitute more tasteful structures, and at the same time are demonstrating successfully that there is room for the exercise of skill and ability in designing a simple cottage as well as in planning an elaborate villa. To produce designs, however, is one matter, and to popularize them is another; the latter involves nothing less than an education of popular taste, and at the same time the demonstration to the public that it is just as cheap and as economical to build a neat, even elegant, house as to construct one that is the reverse. These objects have never been more successfully pursued than through the publication of the many volumes of designs and details by the firm of A. J. Bicknell & Co., of 27 Warren street, in this city. This concern has now hit upon a new way of publishing similar information. Instead of a person employing an architect to produce working plans and specifications according to a selected design, he may procure the original plans and specifications reproduced in accurate facsimile, extending even to shape and quality of paper. The first set of plans just published are of the very neat and pretty Swiss cottage represented in Fig. 1 of the annexed engravings, the lower floor of which is shown in Fig. 2. There are six large sheets of drawings, besides the specifications. It will be observed that the first story is very commodiously arranged. A broad piazza runs nearly the whole length of one side. There is a square hall, about which the parlor, library, and dining room are grouped. The kitchen is in an extension, and thus is separated from the other apartments. It is bountifully supplied with closets and other conveniences. In the second story are four good sized bed rooms, arranged around a central hall, besides a large press or store closet, which might well be turned into



a commodious bath room. Finally, the attic consists of a single large bed room, having windows on all sides.

The exterior of the building is very tastefully ornamented in rustic style, with woodwork trimmings, the whole presenting a neat and handsome appearance. The idea of printing these designs and specifications is a good one, and undoubtedly others will be forthcoming from the same publishers.

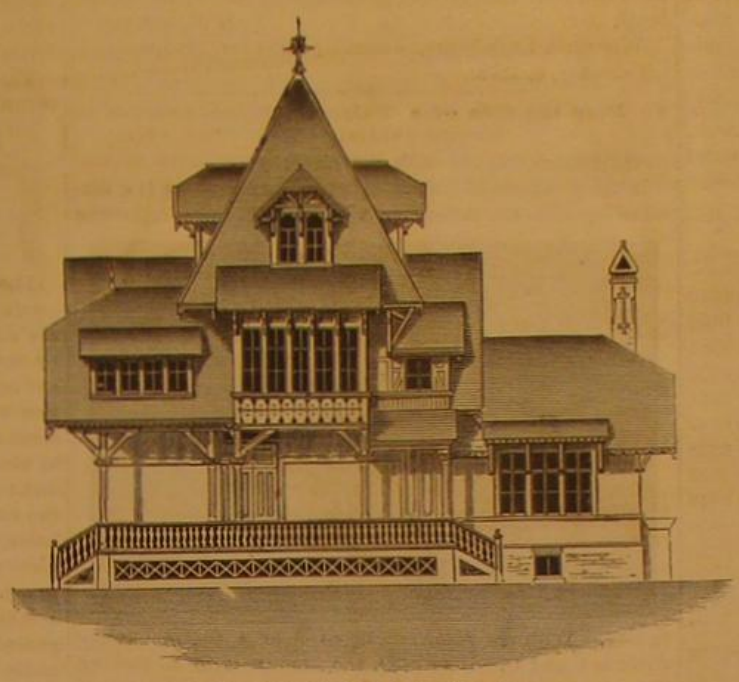
Artificial Ice for Skating Rinks.

Asphalt, pine flooring, patent ice, and all other substitutes for the real thing in skating rinks must give way before the newly invented ice rink of Professor John Gamgee, of London, England, if all be true that is said about it. He is declared to have succeeded in his attempts to manufacture by artificial means a perfect sheet of ice, which can be maintained constantly so as to bear skaters all day and all night long, if necessary. The ice is produced from below by a refrigerating machine, and the members of the London Skating Club who have skated on the rink already formed pronounce it to be the hardest and best they have ever tried. A very extensive rink can be maintained, it is alleged, with a consumption of about 56 lbs. of coal per hour. It is claimed for the ice produced by this method that it has no tendency to produce cold injurious to the feet; but it dries the warm air above, without producing an unpleasant or even an appreciable sensation of cold. We are curious, says the *Building News*, to see how the patentees of the roller skates will welcome Professor Gamgee's invention.

Sold Scientists.

Quite a number of scientific gentlemen in Washington were lately very much exercised over the supposed discovery of a human skull, exhumed from the limestone rock which formed a quarry for building stones in the Osage Indian Reservation in Kansas. The object was firmly imbedded in the stone, many feet below the surface of the ground. Of course such a discovery would be of immense importance, as setting the antiquity of the race still further back than is now believed to be the fact; and when a clergyman from the nearest mission pronounced the round smooth occiput to be a genuine skull, the scientists in Kansas promptly shipped it to another scientist in Washington, and he confirmed the opinion.

After the skull had been viewed and commented upon in the most learned manner by sundry erudite individuals, some one suggested sending it to Professor Meek, of the Smithsonian Institution, Washington. That gentleman quietly pointed out that the sutures visible did not at all resemble those of the human skull, and then shattered all the combined theories advanced by stating that the object was merely a shell, of the genus *goniatites*, a large one of its kind and probably the biggest ever found. It is supposed that thereupon several valuable monographs, "on a human skull from the limestone formation of Kansas," were consigned to various waste baskets.



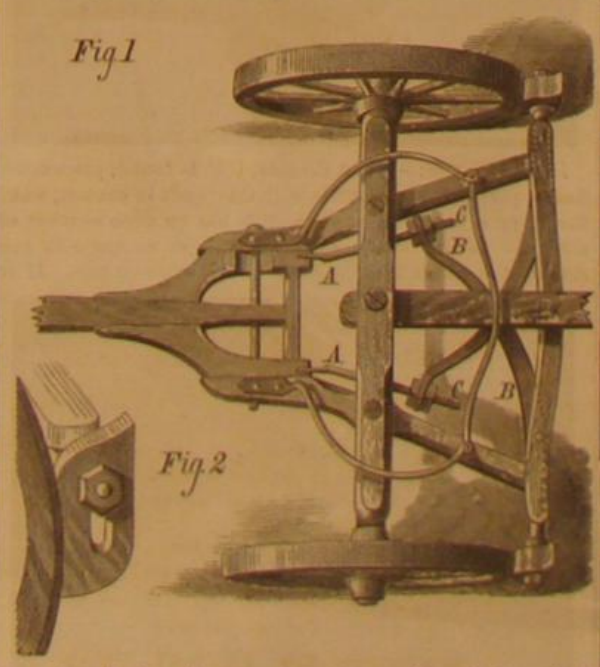
ORNAMENTAL COTTAGE.

MARKRUD'S WAGON BRAKE.

The novel wagon brake illustrated herewith is automatic in its action, and is applied with great force to the wheels through the pushing back of the team upon the pole. Needing no attention from the driver, it is always ready for operation, while the brake shoes are so constructed as to be readily thrown out of use whenever required.

The rear end of the pole is crotched, and in the arms thus formed are long slots, through which passes the fastening pivot. To the extremities of the arms are attached rods, A, which, by screws and nuts, are connected with the curved crossed bars, B. The latter are pivoted, as shown, to the running gear, and carry on their extremities the brake shoes, which are shaped as shown in Fig. 2. The slot through which the pivots of said shoes pass is not symmetrically disposed, but is placed eccentrically, so as to keep the shoe, when reversed, clear of the wheel.

When a strain is brought upon the pole by the pulling resistance of the wagon, the forward ends of the bars, B, are drawn together, and consequently the shoes are held away



from the wheels. As soon, however, as the pole is pushed rearward, then the ends of the bars are spread apart, and the shoes brought in close contact with the tires. It will readily be seen that the shoes only act when their broader portions lie between their connecting pins and the wheels. To throw them out of action, it is only necessary to turn them over, when their narrow portions, being narrower than the distance between the pivot pins and the wheels, cannot come in contact with the latter, even when the pole is pushed inward. The connecting nuts and screws, at C, admit of the accurate adjustment of the various working parts.

Patented November 2, 1875. For further particulars address the inventor, Halvor Markrud, Ettrick, Wis.

THE STOCKWELL SELF-LIGHTING GAS BURNER.

The annexed engraving represents a new and simplified form of a very ingenious little invention, with which the public are already in some degree familiar. Every housekeeper is aware of the predilection on the part of servants to scratch matches on walls or paint, leaving unsightly marks; children playing with matches have set themselves and many a building on fire; and it certainly is annoying fruitlessly to search through a dark room for a match, when a light is needed in a hurry. These, and many other troubles attendant upon the use of matches for lighting the gas, are obviated by the present device, in which the illuminating apparatus is combined with the burner, and the necessary operation of turning the key produces the ignition of the gas.

Cast in a single piece with the lower part of the burner is a circular chamber, provided with a swinging cover, as shown. Within, and fitting against the wall of this compartment, is a disk, rotated by the key; and a prolongation of the spindle of the latter projects into the chamber and supports a coil of paper, upon which, at suitable intervals, are dots of fulminating compound. This paper tape leads up and over the end of a vertical projection of the box in which it is contained.

A is a bent piece of metal, the lower portion of which enters a slot in the rear wall of the chamber, and has a projection below at right angles, which enters a circular hole in the disk, so that the rotating of the latter, in one way or the other, by the key, causes said piece to ascend or descend. The square upper end of the piece presses against the tape, and consequently raises and unwinds the same, as the key is turned vertically. At the same time, the piece, A, pushes back the spring hammer, B, until the bend in the former at C is reached, at which point the hammer is released and carried forward by the spring, strikes one of the dots of fulminate, explodes the same, and so lights the gas. The arrangement of parts is such that the hammer does not fall until just as the key is placed so as to turn the gas fully on, which insures ignition. Each roll of tape contains 135 fulminate dots, and the cost is less than that of matches. There is nothing about the device to get out of order, nor is there any chance of lighting the fulminate save by the operation specified. No skill is required to operate it, as it works



automatically through turning the same key which must be moved to light the gas with a match. The invention, we understand, is meeting with a large sale, and undoubtedly is one of convenience everywhere, especially in manufactories, hotels, churches, etc. It is manufactured in combination with every style of burner, provided with globe holders or otherwise. The patent for latest improvements is dated December 7, 1875. For further particulars, address the Stockwell Self-Lighting Gas Burner Company, 89 Liberty street (P. O. Box 5,065), New York city.

Artificial Snow Crystals.

The difficulty of observing snow crystals except in a freezing air has led M. Dogiel, of St. Petersburgh Academy, to seek for some substance not liable to dissolve at ordinary temperatures, and crystallizing, like snow, in the hexagonal system. He selected iodoform ($C H I_3$), a compound familiar to some of our readers from its medical uses. It crystallizes in a remarkable variety of forms. To show their multiplicity, M. Dogiel dissolves iodoform in boiling (90 per cent) alcohol, and lets the solution cool in water of different temperatures. He gets mostly tabular crystals when a solution containing 15 to 30 per cent of iodoform is kept ten minutes in water of about 57° to 60° Fah.; whereas star-shaped and often very complicated crystals are had at temperatures of 78° to 100°.

FADED writing in ink can be restored by brushing over with a solution of sulphide of ammonium.

Correspondence.

Dividing Circles.

To the Editor of the Scientific American:

From reading the articles by Mr. Joshua Rose, entitled "Practical Mechanism," I know that he is one of the best and most practical mechanics that have seen fit to impart their knowledge to their fellow craftsmen through the medium of any scientific paper; and his articles are the first I turn to upon opening the SCIENTIFIC AMERICAN.

In elucidation of a method of dividing a circle into a given number of parts, spoken of by him on page 84 of your current volume, let me remind your readers that a correct way of doing this is to divide 360° by the requisite number of sides in the polygon, find the chord of the quotient, and multiply by the radius. I have calculated the following table by the above rule, which, upon inspection, will be found to give correct results.

Table of Chords and Angles of Figures Described in a Circle, from Triangles to Polygons with 100 *Sides.—Calculated to* 1 *Minute of the Arc and to* 0·0001 *of Radius.—Radius* =1·0000.

No. of sides.	Angle.	Chord.	No. of sides.	Angle.	Chord.	No. of sides.	Angle.	Chord.
3	120°00'	1·7321	36	10°00'	0·1743	69	5°13'	0·0910
4	90 00	1·4142	37	9 44	0·1697	70	5 09	0 0898
5	72 00	1·1756	38	9 28	0·1651	71	5 04	0·0884
6	60 00	1·0000	39	9 14	0·1610	72	5 00	0 0872
7	51 26	0·8678	40	9 00	0·1569	73	4 56	0 0861
8	45 00	0 7654	41	8 47	0·1531	74	4 52	0 0849
9	40 00	0·6840	42	8 34	0·1495	75	4 48	0·0838
10	36 00	0 6180	43	8 22	0·1460	76	4 44	0·0826
11	32 44	0·5636	44	8 11	0·1427	77	4 41	0 0816
12	30 00	0·5176	45	8 00	0·1395	78	4 37	0·0806
13	27 42	0 4787	46	7 50	0·1365	79	4 33	0·0795
14	25 43	0·4451	47	7 40	0·1336	80	4 30	0·0785
15	24 00	0·4158	48	7 30	0·1308	81	4 27	0·0776
16	22 30	0·3902	49	7 21	0·1282	82	4 23	0·0766
17	21 11	0 3676	50	7 12	0·1256	83	4 20	0·0756
18	20 00	0·3473	51	7 04	0·1232	84	4 17	0·0747
19	18 57	0·3292	52	6 55	0·1207	85	4 14	0·0739
20	18 00	0·3129	53	6 48	0·1185	86	4 11	0·0730
21	17 09	0·2981	54	6 40	0·1163	87	4 08	0 0722
22	16 22	0·2847	55	6 33	0·1142	88	4 05	0·0714
23	15 39	0·2723	56	6 26	0·1121	89	4 03	0 0706
24	15 00	0·2611	57	6 19	0·1102	90	4 00	0·0698
25	14 24	0 2507	58	6 12	0·1083	91	3 57	0·0690
26	13 51	0·2411	59	6 06	0 1064	92	3 55	0·0683
27	13 20	0·2322	60	6 00	0·1047	93	3 52	0 0675
28	12 51	0·2239	61	5 54	0 1029	94	3 50	0·0669
29	12 25	0·2163	62	5 48	0·1013	95	3 47	0 0661
30	12 00	0 2091	63	5 43	0·0997	96	3 45	0·0654
31	11 37	0 2024	64	5 37	0·0981	97	3 43	0·0648
32	11 15	0·1960	65	5 32	0·0966	98	3 40	0 0641
33	10 55	0·1901	66	5 27	0·0952	99	3 38	0 0634
34	10 34	0·1843	67	5 22	0·0937	100	3 36	0·0628
35	10 17	0·1792	68	5 17	0·0922			

Helena, Montana Ter. GEORGE B. FOOTE, C. E.

Sailing Faster than the Wind.

To the Editor of the Scientific American:

If the ice boat question still debatable? Experienced raftsmen tell us that a log sent adrift outruns the stream that carries it, that a single log will outrun a raft of logs, which, in turn, outruns a raft of boards. If these are facts, they indicate the possibility of the ice boats outspeeding the wind. All streams of considerable length have points of slow and rapid flow. Assuming the mean rate to be one mile an hour, the rapids may have a four-mile rate and the slack water a half-mile rate. A log passing each rapid partakes of its speed, and the increased momentum causes it to outrun the more sluggish water below, and thus gain upon the mean rate of the current. A twenty-mile wind may have its thirty-mile gusts, and slack wind to correspond; and an ice boat, by the aid of the former, may gain upon the mean rate. On the other hand, aeronauts in a fifty-mile wind experience a perfect calm, that is, they move no faster nor slower than the wind. A balloon, like the ice boat, has momentum; but it moves without friction, and it is difficult to understand why it should be distanced by an ice boat if both are driven by the same wind.

Rochester, N. Y. E. B. WHITMORE.

The Wisconsin Ten Thousand Dollar Reward.

To the Editor of the Scientific American:

I would like to answer, through the columns of your valuable paper, the numerous letters I am receiving from all parts of the country concerning the bounty of $10,000 offered by this State for a steam wagon that will fill certain requirements. To fill the bill, the machine must travel 200 miles north and south over very poor roads that are often sunk or worn down—in the wheel and horse tracks—six inches to a foot below the common level, but with a ridge in the center, the ridge being impassable for a horse: more so for the wheel of a steamer, when we take into account the stumps and stones, avoided by a double team and left in the center ridge. Our wagon track is about 4 feet 6 inches outside, and that must be the gage of a steamer, which machine should not weigh more than two tuns and must be so arranged that it will climb steep sand hills, cross poor bridges, run easily over bogs, stones, and grubs, and out of ruts, etc., just as a loaded lumber wagon does; and it must travel at the average rate of 5 miles per hour, and, in the language of the law, "be a cheap substitute for horses and other animals on the highway and farm."

On the subject of amending the law so as to admit citizens of other States to compete for the prize, I can say that the law will never be so amended, neither should it be, of right. Rather let the public-spirited men of other States elect to their legislatures one or more mechanics and inventors, who are alive to the importance of the class of inventions and who have the courage and persistance to introduce and to fight a bill similar to ours through, as this was fought. It was the opinion of the originator of the law that no machine has yet been produced that will fill the bill, that *inventors* have failed to bring out a really practical machine; and it was for the especial purpose of encouraging inventors, to persevere until complete success was obtained, that the bounty was offered.

G. M. MARSHALL.

Wisconsin Legislature, Assembly Chamber, Madison.
February, 8, 1876.

To Find the Side of a Polygon of any Number of Sides.

To the Editor of the Scientific American:

In the given circle draw a diameter, and produce it a distance equal to the radius, as A B, in each of the following

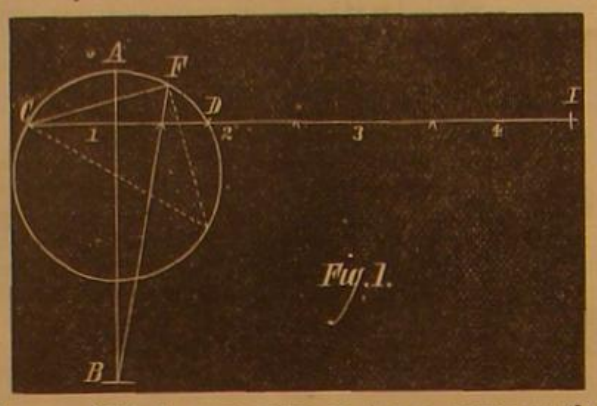


Fig. 1.

figures. With the same radius, on A as a center, cut the circle in C and D. Draw C D, and produce it to E, making C E, equal to three times C D. Divide C E into as many equal

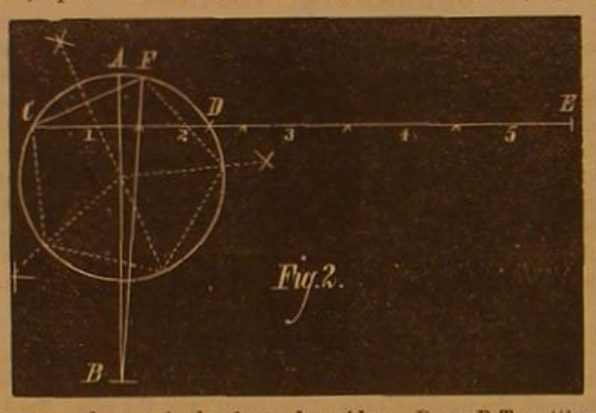


Fig. 2.

parts as the required polygon has sides. Draw B T, cutting C E, in the first point of section and touching the circle in F. Draw C F, which is the side required.

Fig. 1 shows the side of a square; Fig. 2 the side of a pentagon; Fig. 3 a triangle and a hexagon. It will be noted that, in the triangle, C F coincides with C D, and in the hexagon, B F coincides with A B. Fig. 4 shows a heptagon.

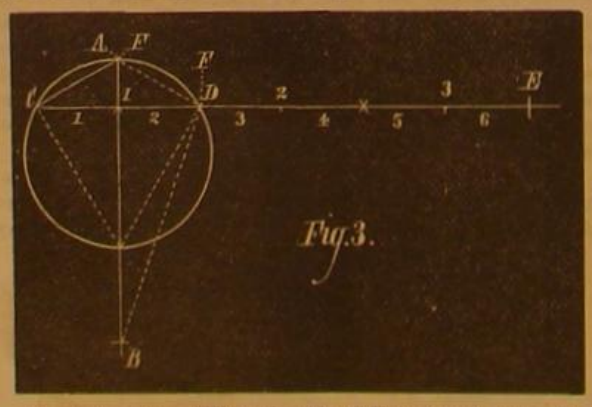


Fig. 3.

Demonstration:—When the side, C F, is found, place other lines equal to it in the circle with their ends in contact, until the polygon is complete; then, if it has an even number of sides, a diameter which bisects a side or an angle on one side of the center does the same on the opposite side. If it

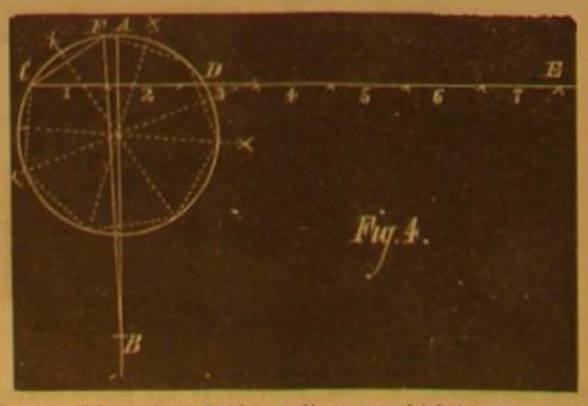


Fig. 4.

has an odd number of sides, a diameter which bisects a side on one side of the center bisects an angle on the opposite side; thus proving that the sides are regular, and consequently equal.

ALBERT BONDELI.

Philadelphia, Mo

The Azoic Period and the Glacial Epoch.

To the Editor of the Scientific American:

In one of his lectures on glaciers, Agassiz said: "If it can be demonstrated that such was the condition of our earth (covered with glaciers), it will follow that the doctrine of transmutation of species and of the descent of animals that live now from those of past days is cut at the root by this winter, which put an end to all living beings on the surface of the globe." Now as glacial action is everywhere visible on the surface of the globe as it now is, it is evident that the glacial period was after the earth had assumed its present form. But if the glacial epoch was before the appearance of animal life upon the earth, then it must have been during the azoic age or before it; and there can be no evidence of a universal glacial epoch in these formations succeeding the azoic, since they would all be covered up by the subsequent formations.

There seems to be a slight confusion here; can any one throw any light on this subject?

Franklin, N. Y. P.

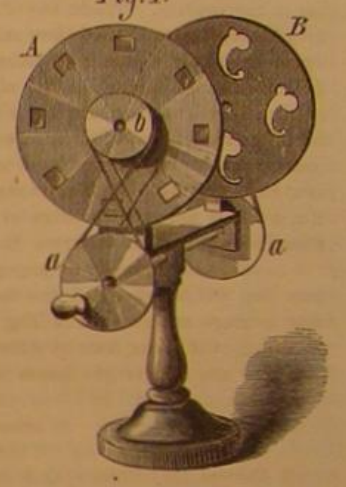
[For the Scientific American.]

THE CHROMOSTROBOSCOPE.

BY PROFESSOR A. RICCO, OF MODENA, ITALY.

The following simple device, which I have invented, is productive of very brilliant results. The two pulleys, *a a*, are made to turn together by means of the crank, and communicate their motion by means of endless cords to the wheels, *b*, to which are attached two disks of cardboard, A, B. In the anterior disk are eight holes, containing little glass windows of different colors. The disk, B, has a white design on black ground. The best way to make the design is to cut it out of the black cardboard and to place oiled white tracing paper behind the latter. On keeping the eye at a point which the apertures successively pass, and looking at the design through them, a colored image will be produced by each one as it passes, and this image will remain on the retina, by persistence of vision, long enough to make the design appear multiplied symmetrically about the center with great brilliancy of colors. If now the figures, of which the design consists, are made to change successively in form and position, as in Plateau's phenakistoscope, the surprising effects of the graceful motions of the images in that apparatus will be combined with a splendid coloration.

Fig. 1.

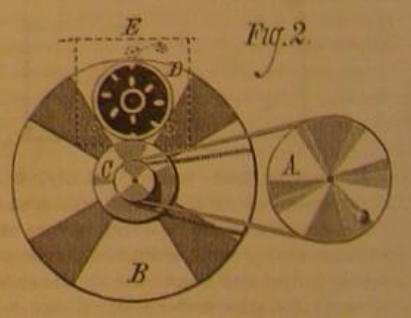


Even by simply putting colored glasses in the apertures of the phenakistoscope, and using white designs on a black ground, similar results are obtained; they are less brilliant, however, because, as is well known, the design in that instrument is placed on the perforated disk itself, and we look through the latter at the reflection of the design in a mirror in front of the apparatus. Of course light is lost by the reflection.

If it is desired to project the images of the chromostroboscope on a screen, the arrangement represented in Fig. 2 may be employed.

By turning the wheel, A, we set in rotation the disk, B, which contains sectors of colored glass. Together with this disk, the wheel, C, turns on the circumference of which rests a disk, D, which may be either perforated or painted black on colorless glass. The wheel, C, and the disk, D, turn together by friction gearing. The pulley, E, which, together with two others, keeps the disk in place, is movable so that the disk can be taken out and replaced by another, like the slides of a magic lantern, while the other parts of the apparatus may remain in undisturbed connection with the lantern.

Fig. 2.



Modena, January, 1876.

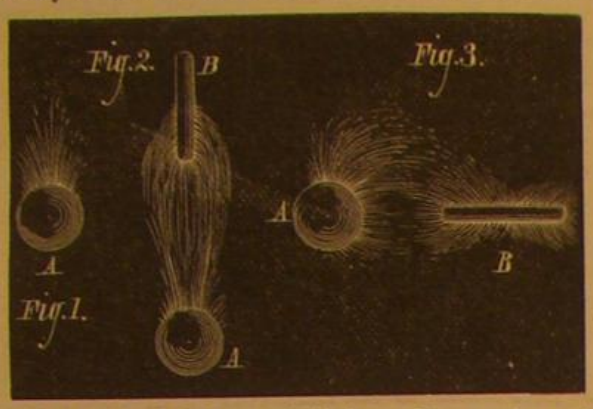
[Evidently this apparatus has a certain analogy to the new chromatrope of Professor Morton, described on page 344, volume XXXIII, of the SCIENTIFIC AMERICAN.—EDS.]

SINGULAR ELECTRICAL EXPERIMENTS.

BY PROFESSOR A. RICCO, OF MODENA, ITALY.

In studying the effects of electricity, it is interesting to note the curves or trajectories passed over by particles of electrified powders. In order to observe them conveniently, they may be illuminated by a ray of sunlight. On putting a little lycopodium or other powder on an insulated conductor, A (Fig. 1), and charging the latter, a jet will be produced which will diffuse a little of the powder in the air; after some time, when the jet has ceased and a non-insulated conductor, B (Fig. 2), is brought near, the jet is reproduced, and

appears formed of an infinity of beautiful similar curves, the extremities of which are almost normal to the surface of the conductors. If now B is electrified and brought near A, in communication with the earth and carrying lycopodium powder, a similar jet will be produced; but if A is then insulated, the jet disappears, and is renewed only when the communication with the earth is restored, by which the electricity of the same kind as that in B is carried off. If a cylindrical, not charged, and not insulated conductor, carrying lycopodium at its extremity, is placed opposite a charged conductor, a jet will arise at that extremity, by which electricity of the same kind will pass off, repelled by the electrified body. And if we sprinkle lycopodium powder on the strongly charged conductor, A (Fig. 3), and on B, containing an induced current, three systems of curves or jets will be formed: one from A to B, another from B to A, and a third from B into the air. Similar, although fainter, curves are observed under the conductors. In all these experiments the particles have a rapid motion to and fro between the two conductors, because the moment they touch one, and are charged with the same electricity, they are repelled. Sometimes a few particles vibrate without touching them (like Franklin's gold fish) and move in the same trajectories.



I have made a great many other experiments with these powders, and I believe they may be useful to the study of that mysterious agent, electricity. The analogy of the curve of Fig. 3 to the magnetic spectrum of a pole of lodestone, A, inducing magnetism in a piece of soft iron, B, is evident.

Modena, January, 1876.

Coal Tar.

Its general properties vary with the coal used as well as with the temperature employed in the distillation of the gas. That obtained at rather high temperature varies from 1·120 to 1·150 in specific gravity. It cannot be burnt in ordinary lamps. If obtained at a lower temperature, it is lighter, and generally is combustible in common lamps. In England the yield is from nine to fifteen gallons per tun of coal.

The distillation is conducted on a large scale in some of our cities. The plan and operations with some are as follows: The liquid is poured into large iron retorts holding several hundred gallons. Heat is then applied. The first portions passing over consist chiefly of ammonia, and a few of the lighter hydrocarbons. As the distillation proceeds, heavier matters pass over, such as water containing a fetid brown oil which collects on its surface. After a little while, the water has all passed over and more oil comes, growing gradually heavier until its specific gravity exceeds that of water. This oil generally amounts to from five to ten per cent of the tar. It is purified by agitation with sulphuric acid and redistillation. The oil before purification contains several easily oxidizable substances, which are converted into a tenacious, dense mass by the action of the acid. The purified oil is called coal naphtha. On continuing the distillation after the naphtha has ceased to come over, a heavy, fetid dark oil, known as dead oil, comes. This usually amounts to about thirty per cent of the tar. In the latter part of the distillation, considerable naphthalin passes over and solidifies in the oil. The operation is usually stopped here, as the mass in the retort will solidify on cooling, and is used to form a black varnish for iron work.

If desired, however, a still higher heat will decompose the matters left in the retort, and a product may be obtained which when cool has the consistence of butter, and is called anthracene. At a still higher temperature, the distilled matters look like resin, and finally the substance passing over at a red heat condenses as a bright orange-colored powder, and is composed principally of chrysene and pyrsene. The residue in the retort is a coke which is very hard and difficult to burn.

The naphtha obtained as above is usually rectified with sulphuric acid again, and is separated into still lighter compounds and heavy oil. The distillate from this is free from naphthalin, does not change color on exposure, and is called "highly rectified." It varies in specific gravity from 0·860 to 0·900, and contains several oils which may be separated from each other by proper caution in distilling.

Mansfield succeeded in separating this into at least five different substances. No. 1 boiled between 140° and 158° and smelt like onions: probably a mixture of alcohol radicals. No. 2 boiled at 176° and consisted of benzol. No. 3 boiled at about 235° and consisted of toluol, mainly. No. 4 boiled between 288° and 293° and resembled cumol. No. 5 boiled between 338° and 342° and resembled cymol.

The dead oil is seldom purified. It consists mainly of carbolic acid, aniline, quinoline and several other bodies, mostly hydrocarbons, which boil 290° and 570°, and usually have considerable anthracene in solution. This oil is valuable for its antiseptic properties, and is used to preserve railroad ties in some places. It has been used in common lamps but is chiefly used to make lampblack. Probably the time is coming when this oil will be used for fuel in steam boiler and allied furnaces.

By a slight change in the order of collecting the products of distillation, a green oil may be obtained after the dead oil. This is used principally as a lubricant for railway engines and cars. In some cities the only use to which this tar is put is for roofing purposes. It is then boiled in the open air in pots holding comparatively but a few gallons. When enough of the more volatile products have passed off, the the whole is run into barrels to cool. When wanted the barrel is knocked apart and the mass remelted.—*Professor H. Poole, in Scientific Commercial.*

The Sun's Atmosphere.

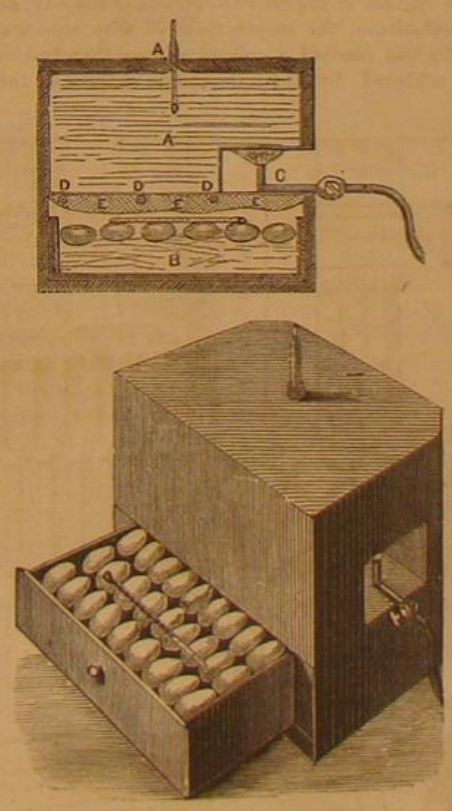
Professor Langley, of Alleghany Observatory, has lately published some results of his steady observations of the solar atmosphere, which, he states, is a thin stratum which cuts off one half the heat which otherwise would reach us. From this it appears that the existence of living beings upon the earth is directly dependent upon the sun's atmosphere, for should that envelope be increased twenty-five per cent in thickness, the mean surface of our globe would, it is estimated, be reduced 100° Fah., in temperature. It has been suggested that the glacial epoch through which the earth passed many ages ago might have been due to a fluctuation in the solar atmosphere.

A Telegraph Cable Pierced by Grass.

At a meeting of the Asiatic Society of Bengal, in Calcutta, says *Chambers' Journal*, a piece of telegraph cable was exhibited, showing that the india rubber covering had been pierced by grass. The piercing was so complete and the contact of the grass with the copper core was so perfect that "dead earth," as it is technically called, was produced, and the efficiency of the cable destroyed. The species of the grass, owing to its dried-up condition, could not be determined. It was suggested as a probable explanation "that the seeds had become attached to the core when under water, and had afterwards germinated when the core was stored."

IMPROVED INCUBATOR.

A correspondent of the *English Mechanic* has recently improved upon the incubator introduced by M. Carbonnier, and we publish herewith an illustration of the apparatus in its present form. "The apparatus," says the writer, "which I used with success, consisted of a box with a zinc case, A, filled with hot water, fixed in the top, and underneath a drawer, B, to put the eggs in, and in which is spread a quantity of hay, so as to line the bottom of the drawer completely C is a small gas burner sufficient to keep the temperature of the water at 110° Fah., for the eggs to become warmed to a temperature of 105° or 104°, to show which a thermometer is laid on the top of the eggs. The upper A is a pipe for supplying the basin with water and to receive the thermometer, which is immersed in the fluid, and shows the temperature. D D

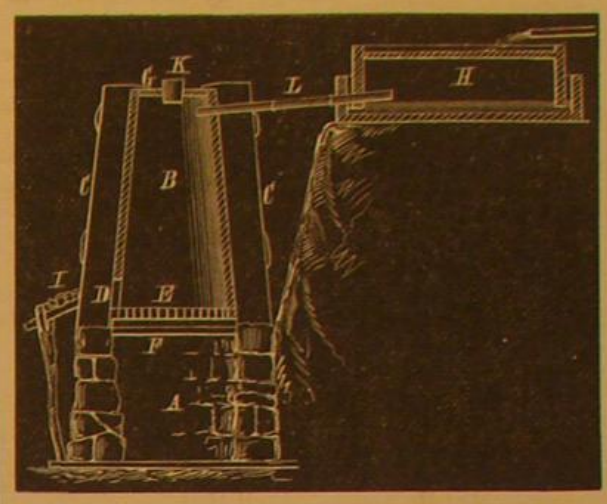


D are three iron rods fixed in from back to front of the box as a support for the zinc case. E is a layer of sawdust, suspended by a piece of muslin (or some such thin material) fastened by a few tacks to the inner side of the box, through which the heat passes, and is at the same temperature and as moist as that which would emanate from the body of a natural mother. The drawer is opened once or twice every day to turn the eggs; and after an incubation of twenty-one days, the chickens will be hatched without any further assistance."

It is stated, upon German authority, that the unpleasant taste imparted to milk and butter by feeding turnips, etc., may be removed by simply throwing into each pan of milk of 4 or 5 quarts as much saltpeter as will lie on the point of a knife, when a gelatinous mass will separate from the milk and settle to the bottom

The Manufacture of Camphor in Japan.

Dr. A. von Roretz, of Otanyama, Japan, states that the only tree which yields the commercial camphor of Japan and Formosa is the *laurus camphoratus*, which the natives call *tsunoki*. It is very widely distributed in Japan, being equally common on the three islands Niphon, Kinshin, and Sikok; but it thrives best in the southern portion of the kingdom, namely, in the provinces of Tosa and Sikok. The sea coast, with its mild, damp air, agrees with it best; and



hence the chief production of camphor is in these provinces.

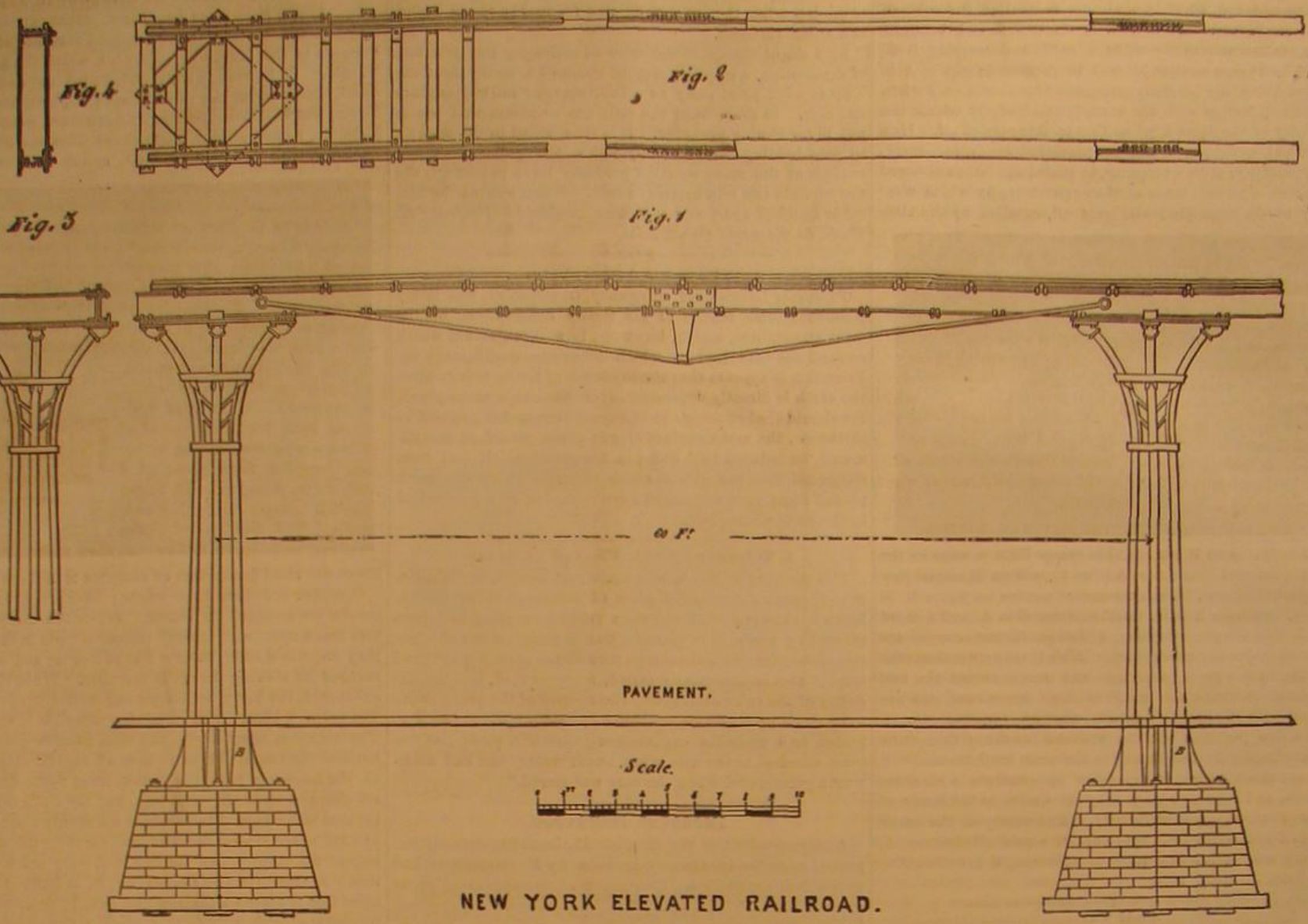
Camphor is collected the whole year through, but the best results are obtained in winter. When the camphor collectors find a spot with several camphor trees in the vicinity, they migrate thither, build a hut to live in, and construct a furnace for making the crude camphor. When that place is exhausted, the hut is torn down and carried to another place. The method observed in obtaining camphor is very simple. The workmen select a tree, and with a hollow-ground, short-handled instrument begin to chop off regular chips. As soon as the huge tree falls, the trunk, large roots, and branches are chopped up in the same way, and the chips carried to the furnace in baskets. The furnaces are mostly built on the side of a hill near a stream of water, and serve for the wet distillation of the chips. The furnace is of very simple construction. A small circular foundation, A, is built of stone, and upon this is placed a shallow iron pan, F, two feet in diameter, covered with a perforated cover, E, luted on with clay. This cover forms the bottom of a cylindrical vessel, B, forty inches high and tapering to eighteen inches at the top. Near the bottom of this vessel is a square opening, D, which can be tightly closed with a board. The whole vessel is covered with a thick coating of clay, C, held in place by strips of bamboo. The cover of this vessel, G, which is also luted on with clay, has an opening, K, closed with a plug. Passing through the side of the vessel near the top is a bamboo tube, L, leading to the condenser, H. This condenser is merely a quadrangular box, open below and divided up by four partitions into five compartments communicating with each other. The open side of this box dips into water and is kept cool by water drizzling over it.

The manipulations in the preparation of the camphor are as follows: The cylindrical vessel, B, is filled, after removing the cover, G, with chips of camphor wood; the lid is then luted on, and a definite quantity of water poured in through the hole, K, which moistens the chips and collects in the pan, F. It is now heated gently for twelve hours, a small fire being kept up as soon as the water in the pan begins to boil. The ascending vapors, passing through the chips, carry off all the camphor and oil in the wood, and both are deposited on the surface of the water in the condenser, H. At the end of twelve hours, the exhausted chips are removed through the square hole, D, and fresh chips and fresh water put in. At the expiration of twenty-four hours the process is interrupted, the whole apparatus cleaned, and the camphor collected in H is packed in barrels. Here it is very lightly pressed; and the oil, which amounts to at least 25 per cent, and is as clear as water, is poured off from the solid camphor, and both products are sent to market. At certain places the crude camphor is again pressed somewhat harder, when quite a good deal more oil runs through the crevices in the vessels. The tolerably dry product is sent mostly to Osaka, the chief export town for this important article of commerce. The camphor oil, called by the Japanese *shono abura*, is used by very poor people only as an illuminating oil; and in spite of its strong smell and smoke, it is burned in open lamps. Perfectly pure camphor is not exported, but the crude country product is first freed from the still adherent oil by further distillation in Europe. The exhausted chips are dried on a scaffold, I, by the side of the furnace, and are then used as fuel.—*Dingler's Polytechnisches Journal.*

The Planing Mill Controversy.

The *Northwestern Lumberman*, of Chicago, says; "Planing mill owners throughout the country will be interested to learn that the National Planing Machine Company, of Boston, Mass, recently negotiated in this city the sale of their substitutes for the Woodbury bar, for nine States of the West and South. The consideration we understand to have been $250,000. The purchasers are capitalists of this city and St. Louis; and they have organized a corporation for the purpose of putting the business of the manufacture and sale of their devices upon a sure and permanent basis."

A little common soap lather mixed with starch gives linen a good gloss.



NEW YORK ELEVATED RAILROAD.

(Continued from front page.)

with the system. The Commissioners' plans, which the court is called upon to confirm, have in view the ultimate erection of over thirty-five miles of iron railway bridges, which are to occupy and cover the central portions of many of our finest streets, including Third avenue and Sixth avenue, the Bowery, Chatham street, Park Row, etc. The property owners along the lines have filed the strongest protests against this occupation of the streets. They allege that the soil and drainage of the city is well suited for the economical construction of underground railways; that the first cost of these roads, if regard is had to relative capacity, is no greater than the bridge system; and that there is no reason or sense in encumbering the streets with the nuisance of bridges and locomotives, when the tracks might just as well be put beneath the ground surface, where their operation disturbs no one. But the elevated people claim that their structures will not encumber the streets, that the running of locomotives and trains on the bridges will not be a nuisance, will not depreciate property: instead of this, property will rise, the bridges will improve the appearance of the streets, and all will be nice and lovely. Many excellent engineers support this view; our valued cotemporary, the *Railroad Gazette*, is an advocate. It says:

"The New York Elevated Railroad is located on the street itself, and such a road could be located on the most crowded thoroughfare without obstructing but rather facilitating the traffic and travel on the street itself. That this system of overhead railroads is destined to be very extensively employed, there can be little doubt, and we think in it may be discerned the remedy which civilization will provide for the evil of crowded populations, which seems to attend its advancement the world over. The effect of this system may be, as we have heretofore pointed out, to change, in a great measure, the whole character of metropolitan life, to concentrate in a small area the places of business, and to scatter the houses of the residents over a larger area, and to cover large sections in the vicinity of cities with suburban residences."



ELEVATED RAILWAY PROPOSED FOR OXFORD STREET, LONDON.

THE NEW YORK ELEVATED RAILWAY.

The New York Elevated Railway, Ninth avenue, New York city, shown on our front page is a single track railway, built on iron posts upon the edge of the sidewalk; it has at present a length of about five miles, extending from the southern extremity of the city, at the Battery, to 61st street on the north, near Central Park. The first or experimental section, consisting of a half mile, was put in operation in 1868, under the auspices of Mr. Charles T. Harvey, the original projector of the enterprise, and first engineer of the work. Mr. Harvey foresaw many serious objections to the running of steam engines in the crowded streets of the city, and sought, as a substitute, the employment of wire rope traction. In this he had reached a greater success than had ever before been achieved; but the unfortunate failure of the company removed him and his coadjutors from all connection with the work, and prevented the consummation of his ingenious and excellent plans. After the expenditure of nearly a million in money towards the extension of the work, the company succumbed, and the property was sold by foreclosure, the original stockholders losing nearly everything. The new purchasers, under the title of the New York Elevated Railway Company, adopted the use of light locomotives, and have from time to time strengthened and extended the track, until it has now reached the length above stated. The line runs from the Battery, along Greenwich street, near the river border, to 12th street, where it enters Ninth avenue, and continues to 61st street. A further extension of the road is proposed, and legal proceedings to that end are now in progress, to which we have alluded. The running time at present is 5 miles in 34 minutes. For the engravings and following particulars, we are indebted to the *Railroad Gazette*.

The portion of the line illustrated is supported on columns, designed by D. W. Wyman, C. E., formed out of four round, solid, wrought iron bars, 4¼ inches in diameter, bent into the shape represented. These are attached to a heavy cast iron foundation plate bolted down to a foundation of masonry. At the top the wrought iron bars are bent outward into four branches, two of which are for lateral support, and two for longitudinal stiffness. The four bars are tied together with wrought iron bands at the neck of the columns, or just below the point from which the bars begin to branch outward, and also at the top. These columns are placed from 30 to 60 feet apart, and the roadway between is supported on two wrought iron girders, each formed of two 12 inch channel bars. These are trussed at the street crossings, as shown in the sectional view, but not in the shorter spans. The perspective view is from a photograph taken above 34th street, looking southward. On a portion of the line near 34th street, the company adopted a form of posts designed by Mr. Charles Macdonald, C. E. In this the support consists of four posts distributed in a similar manner to the round posts designed by Mr. Wyman. Each of Mr. Macdonald's posts consisted of four 3 inch angle irons, riveted back to back, forming a cruciform section.

The stations are usually placed over the street crossings with the stairs leading down the cross street. The equipment of the road consists of six engines and twelve cars. The engines weigh 8,000 lbs. each; the cylinders are 7 by 10 inches, and the four driving wheels 30 inches in diameter. The cars seat 48 passengers and weigh 11,000 lbs. As two cars are usually run to each train, it will be seen that the actual weight of train, including engine, is only 312 lbs. per passenger. The road is laid chiefly with iron rails of 36 lbs. weight per yard, but some new steel rails have been

put down. The hight in the clear above the street crossings is in no case less than 14 feet, but, in order to equalize the grades, is often more. The heaviest grade is 127$\frac{3}{10}$ feet per mile, and the shortest curve of 56 feet radius.

PEN SKETCHES OF RAPID TRANSIT.

The plan shown in the upper section of our engraving, at the left, gives an idea of the appearance of the Gilbert Elevated road, the building of which, on Sixth avenue, was lately begun, but has been temporarily suspended.

The Hanna plan is shown in the two lower sketches, at the left.

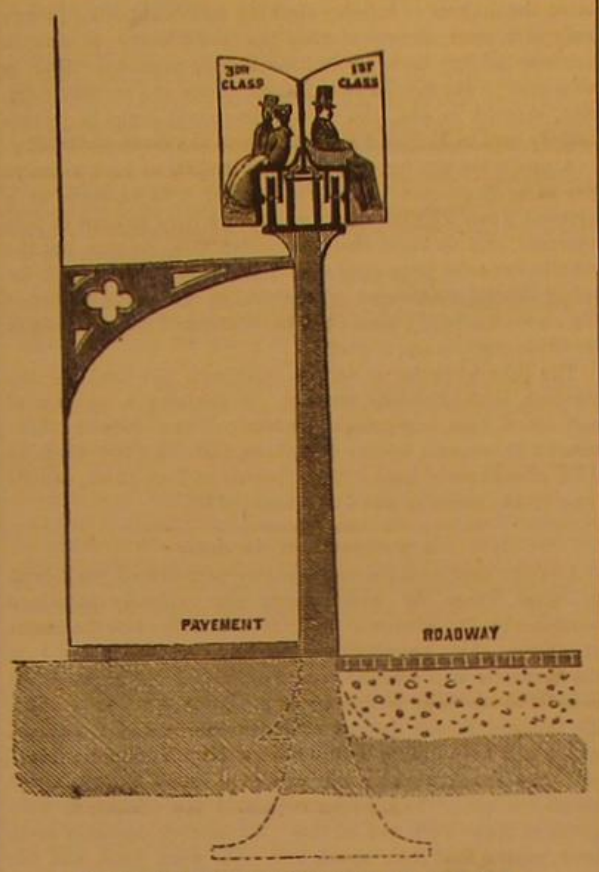
The saddle railway of General Le Roy Stone is represented in the upper and lower sketches at the right. This plan is claimed by the ingenious inventor and his friends to be the cheapest, best, and least objectionable form of elevated street railway that has ever been devised. We gave an account, on page 294, volume XXXIII., SCIENTIFIC AMERICAN, of the practical and highly successful trial of a section of this railway, at Phœnixville, Pa. There is no accounting for tastes, otherwise it might seem strange that some people should be unable to perceive any lines of grace in this structure, while others regard it as a thing of uncommon beauty. Our English cousins are evidently among the latter category; for they have hastened to adopt General Stone's invention, without credit to him, and have added a few modifications which they consider to be an improvement.

THE PROPOSED ELEVATED RAILWAY, LONDON.

We give an engraving of the recent British improvement on General Stone's plan, which we copy from our London cotemporary, *Iron*. The editor says:

"Let a single line be built between the Post Office and Piccadilly or Oxford Circus, *vid* Newgate Street and Holborn, and either Long Acre or Oxford Street, with two intermediate stations. An equally, or even more, favorable route would be that between King William Street and the Elephant and Castle, with one intermediate station. It is remotely possible they might not succeed to the extent anticipated; even then, the money would not have been utterly thrown away. Both lines might be constructed at a cost very much less than that of a single mile of underground railway, and their construction would seem to offer a far more remunerative outlet for our daily accumulating surplus capital than foreign loans or competing lines to Brighton. The present time, when iron and steel are obtainable at moderate prices, and it is barely possible to obtain a return of 4½ per cent on investments, is particularly favorable to such an enterprise.

"The southern line would have the advantage of relieving London Bridge of a great part of the omnibus traffic, which tends so materially to the existing block, besides largely diminishing the crowd of foot passengers, and would postpone the necessity of the much debated widening for some years to come. As an auxiliary to such a plan, a line from Aldgate or Bishopsgate by Fenchurch street to King William street, and so to London Bridge, would complete the much needed link between the Metropolitan, Great Eastern, and Blackwall lines, and the eastern tramways, and the systems of the three great southern railways. Let



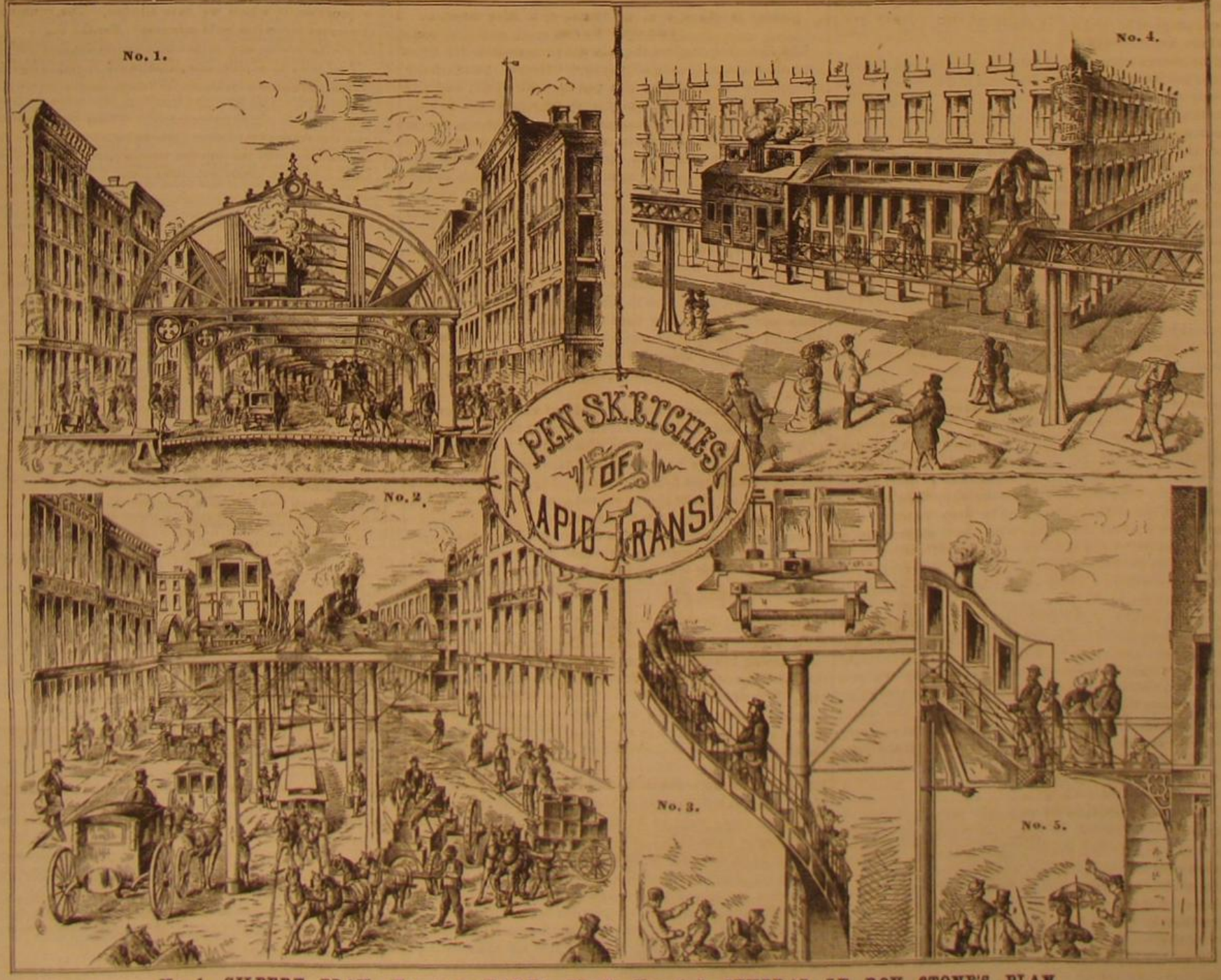
PROPOSED ELEVATED RAILWAY, LONDON.

any one stand for an hour and watch the passing stream of hurrying humanity ever pressing over London Bridge and along the Borough, and he will hardly be long in doubt as to the remunerative character of the traffic which would be offered to any effective system of quick conveyance. The projectors favorite phrase, 'practically inexhaustible,' is here really applicable.

"By adopting a system of air lines, no existing interests, excepting those of the proprietors of inferior conveyances, would be injured' while the proprietors of property adjacent to the routes selected would find the value of their premises largely increased. As to the apparent objections to street railways, it is believed they would be obviated by such a plan as is proposed, and of which we give a sketch outline, rather courting than deprecating criticisms and suggestions, on a subject in which millions are directly interested.

"At intervals of from ten to fifteen yards along the kerb of the selected thoroughfare, wrought iron or steel columns are planted, deep down, into masonry or concrete foundations, but leaving, as we have said, at least 15 feet clear above the pavement level. The construction of these pillars would require great attention, so as to secure a maximum strength with a minimum mass. An elliptical section would probably offer the greatest resistance to the strains to which they would be subjected. In America such pillars have been constructed so as to secure great stability by bolting together four plates of ⅜ inch boiler plate, with the bolted together flanges projecting outwards. Mild steel rolled plates similarly built up, or hollow cast steel pillars, would, however, probably be in the end the most advantageous, considering the necessarily restricted section to which the engineer would be confined. Alternate columns might be strengthened by lateral struts or buttresses of ornamental design, springing from the contiguous buildings. A light double truss girder, with a broad bottom flange, strengthened by an arch as shown in the sketch, rests on the columns, and carries on its base flanges the rails on which the cars run. Cars about 5 feet wide and 20 feet long, in which the passengers would sit back to back, would run on these rails. "straddling" the girder, which, with the car wheels, would occupy the vacant space under the seats. As an additional precaution, the car carries, as a prolongation of its central division, a triangular shaped piece, which runs in a correspondingly recessed groove on the top of the girder, along which it can slide freely, but which effectually prevents the car from diverging from the perpendicular. By this, great stability would be obtained, and an upset be rendered impossible. This might even (to make surety doubly sure) be further provided against by the use of guard rails."





No. 1, GILBERT PLAN.—Nos. 2, 3, HANNA PLAN.—Nos. 4, 5. GENERAL LE ROY STONE'S PLAN.

Remarkable Whirlwind.

A terrible visitation at Hazel Green, Wis., on the 10th of March last, is described in a special despatch to the Chicago *Tribune* as the result of a collision between two sections of a cloud, which had divided and come together again:

The clouds joined, and a long cylindrical shaft shot down. The cylinder was about 120 feet in circumference and 70 feet in hight. It struck the ground a mile southwest of Hazel Green, and, ploughing a furrow 600 feet long, 4 feet wide, and several feet deep, seemed to absorb the earth and the rocks. As it moved along in a northeasterly direction, it looked like a clay-colored column whirling with incredible speed around a central vacuum. It was a solid mass of heavy rubbish. As the cylinder came up the slope, the rush and yell and whirr of the column—sounding like the rush and shrieks of the wind on the sea, and like the thunder of guns—attracted the attention of the people of Hazel Green, and they flocked to their doors and windows. Steadily it came on, sometimes bounding fifty feet into the air, then rushing down again. In two minutes it descended on the little hazel grove just southwest of the town. The trees were snatched up by the roots and whirled ninety feet into the air and supported there.

The cap of the column was a stone 8 feet long, 4 feet wide, and 3 feet thick. This stone was held in its position while the column covered a space of three quarters of a mile. Just between the grove and the town, 250 feet from either, the column halted and spun around over a small space, and then recommenced its march. The air was filled with the yells and lamentations of the people.

Tearing off a corner of a frame house, the column rose some thirty feet into the air, and then, hovering for an instant, fell perpendicularly upon the roof of the Masonic Hall, a stone building. The structure was mashed flat. This was at half past four, and a meeting had been called for five o'clock. Half an hour later seventy persons would have been assembled in the upper portion of the building. The next house was of frame, and occupied by Mrs. Richards and her family. A daughter in law and her two children were saved by the scantlings above them, while the rest of the family were killed outright. A frying pan containing three cakes was on the stove, and the frying pan, still containing the cakes, was found a mile and a half northeast of the village. Twenty-six houses were carried beyond the ken of mortals. Where they went no one can tell. The track of the column is filled with sawdust and bits of wood, as though a sawmill had belched out a half-finished lumber yard. The trees for several miles are filled with chairs, bits of furniture, carpets, clothing, bits of window shades, and household materials. Mrs. Looney was sitting in her kitchen. The house disappeared as if touched by the magician's wand, and the crushed body of Mrs. Looney was found 400 feet off, stripped of clothing and with the skin peeled off her back from her neck down.

Of the rest of those killed nothing can be said, beyond that the bodies were found not less than 200 feet from where they started. A boy and girl were found out on the prairie, wandering about helplessly. They were in a house of which no account has been received. They remembered being lifted into the air, and, when found, were nearly a quarter of a mile from where the house used to be, badly bruised and unable to account for their condition. Probably the most remarkable spectacle was that Dr. Kittoe's horses, which, with barn, buggy, and harness, were lifted 60 feet into the air, and the horses dropped at least 100 rods from the former site of the barn. The column was then a huge mass of *débris*, and a spectator says that the horses went up through the center of the column, whirling around so swiftly that they looked as if torn in pieces. They were found utterly unbruised but stone dead, and not more than 10 or 20 feet apart. The whole affair was over in two minutes, but the devastation was most complete.

Successful Progress of the Galveston Harbor Improvements.

The completion of the survey of Galveston harbor, Texas, by Lieut. Quinn, shows that the western point (where, in June, 1875, there was only five feet of water) has entirely disappeared, and the soundings at that particular spot, in crossing the inner bar, are entirely closed. The deep water of Galveston harbor channel has united with deep water opposite the end of the jetty, and lacks only 750 feet of uniting with the deep water of Bolivia channel. When this connection is made, there will be a depth of over 18 feet on the inner bar. The gabions in the jetty are covered with sand. The old Swash channel is obliterated, and is now connected and forms a continuation of Galveston Island. The depth of water in the shallowest spot at low tide is 14½ feet; at ordinary high tide, 16 feet. Before the city commenced the pile breakwater, there was only 9 feet of water on the inner bar. The recent work by the government has confined the water to a single channel. The results already obtained are very satisfactory; and there appears no doubt but that the jetty system, as being applied, will terminate in giving Galveston 18 to 20 feet of water over the bar.

The Utilization of Tannery Refuse.

Tannery refuse consist of untanned dried pelt or glue pieces, fleshings, hair, lime deposit, and spent tan. The glue pieces are used for two purposes, the principal of which is the manufacture of gelatin and isinglass. For this industry thousands of tuns of the scraps are sold, and few would imagine that the delicately tinted and flavored molds of jelly sold by skillful confectioners ever had their origin in the foul-smelling waste heap of the tan yards. The dry untanned portions find their second utilization in papermaking, and they are also used for the manufacture of peckers or hammers, for knocking to and fro the ever-flying shuttle. Ordinary size is made from the flesh refuse of the hide, and is extensively used by paper hangers, cotton spinners (to give firmness to the thread), and carpet manufacturers. As to the hair, there has been little demand for it since speculative builders have discovered a mode by which ceilings can be made to retain their positions for a time without its use. Unhappily the demand for cheapness (says the *Journal of the Society of Arts*, whence we take the facts here given) has stimulated the makers of inferior clothing and blanketing to mix hair with wool, thus rendering the fabric heavy without in any way adding to its warmth-retaining capacity. Hair is also used in the fabrication of horse cloths and railway rugs, and, strange to add, the cheap (so-called) sealskin jackets largely sold in England are made from the same material.

A profitable use for spent tan, other than as fuel, remains yet to be discovered. Liebig says that it is valuable as a manure when wholly rotten; some have tried to turn it into charcoal, and to light their tanneries with its gas, but the results have not been very satisfactory. A new process for using this refuse instead of charcoal in the manufacture of tin plates has lately been tried in Wales, and seems likely to be advantageous and useful.

The lime grounds or deposit, although not used for the purpose, is an excellent manure. It contains a mixture of salt, blood, lime, and gelatin. Its analysis is as follows: Moisture 54·05, organic matter 6·80, silica 2·55, iron and alumina 0·84, phosphate of lime 1·85, carbonate of lime 12·42, caustic lime 17·44, common salt 4·05; total 100·00.

A Telegraphic Swindle.

A rather neat swindle was recently perpetrated, on a bank in Dallas, Texas, by three scamps who evidently possessed considerable knowledge of telegraphy and likewise the means of carrying their knowledge into practice. Scamp No. 1, in the character of a wealthy New York cotton buyer, presented himself at the bank with a check for $10,000 to be cashed. He brought strong letters of endorsement, and the check, which had been drawn by the bank's New York correspondent, appeared all regular. In order the more thoroughly to assure the bank, the stranger requested the officials to telegraph to New York for advice. An answer speedily came back, saying that both check and man were good, and the cash was paid. Meanwhile scamps Nos. 2 and 3 went a few miles out of town, rigged a battery and the necessary instruments, and tapped the wires of the telegraph line. When the bank's message was sent, they received it, and sent back the false answer, thus assuring the bank officers, and of course victimizing the unfortunate institution.

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

The *Housekeeper* gives the following suggestions for utilizing old tin cans. Take off the top of the can, punch holes on opposite sides near the rim, put in a wire bail; and you have a little bucket, which may serve for a paint pot, to keep nails in, or other handy purposes. Take off the top, cut to the proper shape, and fasten on a handle by means of a screw through a hole in the bottom, and a useful scoop may be made. A saucepan for small messes may be made by cutting down a can, leaving a strip to be bent at right angles, and turned around a stick, to serve as a handle. A coarse grater for crackers, etc., is easily formed from a piece of tin fastened to a board. The holes in the grater should be made with an old three-cornered file.

If the globes on a gas fixture are much stained on the outside by smoke, soak them in tolerably hot water in which a little washing soda has been dissolved. Then put a teaspoonful of powdered ammonia in a pan of lukewarm water, and with a hard brush scrub the globes until the smoke stains disappears. Rinse in clean cold water. They will as white as if new.

Tasteful ornaments may be made of natural leaves and sprays artificially frosted. This is done by means of powered glass, which can easily be obtained by pounding some bits of glass with a heavy hammer, care being taken to protect the eyes against flying splinters. Dip the object in thin gum water and shake the powdered glass over them. When dry, handsome bouquets can be arranged.

Chloride of calcium is such a deliquescent salt that it attracts enough moisture to prevent glue from cracking. Glue thus prepared will adhere to glass, metal, etc., and can be used for putting on labels with danger of their dropping off.

A correspondent of the *English Mechanic* gives the following directions for fixing pencil drawings: "Lay the drawing on a sloping board, and pour boiling water gently over it; this will remove all superfluous particles of lead, and will bring some of the size in the paper to the surface; boil some isinglass or gum arabic in water to make a very thin size; pour it out on a flat dish to cool; run the drawing through the size, taking care that every part is well wetted; then lay it on a board to dry. The size should be so thin as to feel just a little sticky between the finger and thumb when cool. If too thick, it will be seen on the drawing after it is dry. I have tried many ways of fixing drawings, but have never found any to equal this." Another writer says: "The best solution to fix drawings is that made with gum tragacanth. It sizes the paper; it fixes the pencil drawings; it does not chip when wetted; it enables you to continue the drawing afterwards if desired; and it is possible to color over it."

Salicylic acid, until recently not found outside of chemical laboratories, is now coming largely into use as an antiseptic and as an agreeable substitute for carbolic acid. We give a variety of new recipes for its employment, taken from various sources: A very simple and most useful ointment, which answers admirably in some affections of the skin, is formed of ½ drachm to a drachm of the acid to 7 drachms of simple ointment. A liniment of salicylic acid and olive oil (2 drachms of the acid to 8 ozs. of oil) will be found of much effacacy in burns. Soak lint in the liniment and apply to the suppurating surface. Professor Will, of Aberdeen, who has tested this in some severe cases of burns, commends it strongly in the *Lancet*. For cancerous sores, Thiersch recommends dusting with pure acid, or with equal parts of the powder and starch; or powder formed of charcoal and the acid might be employed for the same purpose, or for dusting over poultices applied to sloughing surfaces. Another ointment is made of: Sperm oil, 1½ drachms; oil of theobroma, 2½ drachms; salicylic acid, from ½ to 1 drachm. This forms a thick paste, which should be thickly spread on lint. The heat of the surface acting on the oil of theobroma, a diffusible ointment is formed, which is a suitable application when it is desired to have the discharge thoroughly saturated with the antiseptic. An ointment less easily acted on by the body heat consists of sperm oil and paraffin, of each 1½ drachms; oil of theobroma, 2 drachms; oil of almonds, 1 drachm; salicylic acid, from ½ to 1 drachm.

DECISIONS OF THE COURTS.

United States Circuit Court---Eastern District of Missouri.

PATENT SAFE FILLING.—UNITED STATES AND FOREIGN SALAMANDER FELTING COMPANY *vs.* NATHANIEL A. HAVEN.

[In Equity.—Before Treat, J.:—Decided October 27, 1875.]

A composition having been described in a prior patent, one who applies it to a new use cannot claim the composition as his invention.

The court cannot take notice of what was not set up in answer against plaintiff's patent.

The legal rule is that, *prima facie*, a reissue is for the same invention as that originally patented.

Section 4,916 of the Revised Statutes of the United States prohibits, in a reissue, not only the introduction of new matter, but also the enlargement of the original claim growing out of the subsequent advancement of the art. This rule controls both the Patent Office and the courts.

Every patent, as to novelty or utility, depends on the state of the art at the time of the claim made or patent issued.

By new matter is not meant merely the introduction of a new ingredient in a patented composition, but any change in the original specification and claim, whereby a new and substantially different composition and results are secured.

Treat, J.:

This is a case in equity for an alleged infringement of several patents, of which the Salamander Company is assignee.

The reissued patent, No 4,134, dated September 27, 1870, is in reissue of October 5, 1869, for a composition or cement composed of lime putty, as described, with paper pulp or other suitable fibrous non-conducting material, and with the other ingredients named, or their equivalents, etc.; and claims the employment of lime putty, when combined with paper pulp or any other suitable fibrous non-conducting substance, as a material for preventing radiation from heated surfaces, or as an ingredient in any composition used for such purposes.

It is alleged that this patent was anticipated by French's patents, September 14, 1869, which were for the same purposes as the foregoing. Patent A (94,882) was for a composition of crushed asbestos mixed with an alkaline silicate, and B (94,883) an improvement on A, by adding to the mixture a vegetable substance, as sawdust and other woody matter, to make a lighter and cheaper coating.

The reissue to Johns, No. 5,951, dated June 20, 1874, of original patent dated April 14, 1868, is for crushed asbestos and lime mixed with water to be applied.

The defence is mainly for want of novelty—that the inventions claimed by plaintiffs were anticipated, etc. Whatever there is in plaintiffs' patents for which defendant is to be held as an infringer consists of lime putty mixed with non-conducting fibrous material. The subsequent patents on which they rest are for lime putty and crushed asbestos.

It seems, from the evidence, that plaintiffs are assignees of the French patent also, but it is not set up in the bill, though mentioned in the amended answer as anticipating the Bissell and Riley and also the Riley patents. While some of the Johns patents are set out, the reissue above is not mentioned in the answer.

It seems, from a cursory examination of the case, that if the Johns reissue (not mentioned in the answer), No. 5,951, of June 20, 1874, relates back to April 14, 1868, the plaintiffs' patents as to asbestos and lime putty were anticipated. So, if plaintiffs claim all non-conducting fibrous substances mixed with lime putty, the claim is too broad.

If each reissue relates to the date of the original patents, then the Johns patent anticipated those held by plaintiffs; and, although Johns did not specifically state the use for non-radiation, etc., the plaintiffs cannot, because of the new use to which they apply the composition, claim that they were the first and original inventors of the composition.

The court, however, cannot take notice of what was not set up against plaintiffs' patent.

When this case was before the court previously, it was suggested, that if the reissued Johns patent was valid, plaintiffs' patent was anticipated, and the attention of counsel was also called to the fact that the reissues to Johns had not been set up.

By agreement of counsel, those reissues are now before the court, as if made before this suit was brought, and as if fully set up in defence.

The only additional point, therefore, is as to the validity of the Johns reissue in question, which is for precisely the same compound as that claimed and used by plaintiffs. The legal rule is that, *prima facie*, a reissue is for the same invention as that originally patented.

Section 4,916, of U. S. Revised Statutes, copied from the act of 1870, prescribed for what, and under what, circumstances a reissue may be had.

The repeated decisions by the courts, and especially by the United States Supreme Court, in the 1st, 17th, and 19th Wallace, indicate with sufficient distinctness that not only new matter shall be introduced, but that an enlargement of the original claim growing out of the subsequent advance of the art is not to be tolerated. The reason of the rule is obvious. Every patent as to novelty or utility depends on the art at the time of claim made or patent issued; and therefore, if a party, after learning from a subsequent advance of the art, the worthlessness of his original invention, is to be permitted to claim a reissue incorporating what was not originally in his mind, and what had been afterward suggested to him only by advances in the art made by others, then he could, it may be, even without any new invention, override all the elements which would serve to test the validity of the new application. In other words, having procured a worthless patent, and having subsequently learned from the advancing art how, by changing the terms of his patent, it could be made of value, he would, if a reissue including the new matter were permitted, have the reissue not only relate back to the date of the original patent, but absorb within its privileges all subsequent matters wholly unknown to and unthought of by him originally.

This rule controls both the Patent Office and the courts. New matter must not be introduced. By new matter is not meant merely the introduction of a new ingredient in a patented composition, but any change in the original specification and claim, whereby a new and substantially different composition and results are secured.

Such is the reissue in question. It is not only for a composition essentially different, but for one not within the purpose for which the original invention was designed.

The plaintiff is entitled to a decree.

Subsequently the following decree was entered on record:

This cause coming on to be heard upon the pleadings, exhibits, and proofs herein, was argued by counsel, and thereupon, upon consideration thereof, the court doth order, adjudge, and decree that the said several letters patent mentioned and described in the bill of complaint herein are good and valid in law; that the plaintiffs are entitled to the exclusive use and rights under the same; that the said defendant, by the use, manufacture, and sale of the patented improvement described in said letters patent, has infringed upon the exclusive rights of the plaintiffs under the same

It is further ordered, adjudged, and decreed that the said defendant, his agents, clerks, servants, and workmen, and all and every of them be, and they are hereby, enjoined and restrained from making, selling, using, or in any manner whatsoever disposing of any composition for covering steam boilers, and for other purposes, embracing the patents or improvements of plaintiffs in their said bill of complaint set forth. It is further ordered, adjudged, and decreed that defendant pay the costs herein to be taxed, and that execution issue therefor.

[*Samuel S. Boyd* for complainants.
Kellogg and *Fenton* for respondent.]

United States Circuit Court---District of Massachusetts.

COPYRIGHT CASE.—SAMUEL E. LAWRENCE *vs.* JOSEPH E. CUPPLES *et al*

[In equity.—Before SHEPLEY, J.—Decided October, 1875.]

SHEPLEY, J.:

Complainant is the publisher of a book called "The Advertiser and Collector's Chart," which he has duly copyrighted in accordance with the provisions of the act of Congress, and which he has the exclusive right of publishing.

The publication is a monthly chart, published each month for the purpose of advertising generally, and also contains, in a tabular form, a list of debtors whose bills cannot be collected after due effort, alphabetically arranged, giving the names and address of the debtor and creditor, the amount of the claim, and in some instances the discount at which the claim will be sold for cash.

The bill of complaint alleges that the defendants have published a book entitled "The New England Mercantile Guide," which is a copy of and from the tabular list above described and prepared by Samuel E. Lawrence, the complainant and that it adopts the plan of Lawrence's work in

arranging the names and residences of debtors and creditors, and in stating the amounts, and in the objects and purposes of said arrangement.

The answer denies that the book published by the defendants is a copy, in whole or in part, of "The Advertiser and Collector's chart," and denies that the complainant can have any valid copyright for any arrangement of the names of debtors and creditors, or any other classes of persons, or for stating amounts, or any other purposes of arrangement.

The publication of the complainant is clearly one of that class embracing dictionaries, directories, catalogues, maps, and similar publications where the same sources of information being open to all, the author, by his copyright only, protects himself from a piracy of his own labors by a copy from his publication, but cannot exclude others from publishing similar maps or charts from their own surveys, or similar directories or catalogues, the result of their own labors and compilations, without copying the copyrighted publication or availing themselves of the labors of the author or compiler.

Although the plan or arrangement of a book may be secured to the author, if it be the product of his own genius, there does not seem in this case to be anything in a mere list of debtors and creditors, with their residences, and amounts and value of debts, which possesses any such novelty of plan or arrangement as would preclude any other person from making and publishing from his own independent sources of information similar lists.

The question is correctly stated by the learned counsel for the complainant to be whether the defendants have used the plan, arrangements, and illustrations of the complainant as the model of their own book, with colorable alterations and variations only to disguise the use thereof, or whether the work is the result of their own labor, skill, and use of common materials and common sources of knowledge, and the resemblances are either accidental or arising from the nature of the subject. (Curtis on Copyrights, 258, 260.)

Although many of the same names, residences, and amounts appear in the defendants' as in the complainant's tables, the answer positively denies that they were copied, and the uncontradicted proof is that they were derived from independent sources of information. One of the defendants testifies that the names of debtors are bills placed in defendants' hands for collection, and that a great many of the subscribers (creditors) are persons they were doing business with previously to complainant's publication, and that they were obtained through their canvassing clerk. The list of names marked as identical in the two publications are testified to have been in possession of defendants previous to the publication of complainant's "guide" or of defendant's "chart."

There is no evidence, therefore, of any infringement of any rights secured by his copyright to the complainant.

Bill dismissed with costs.

[*C. D. Moore*, for complainant.
O. S. Knapp and *C. J. Brooks*, for defendant.]

Recent American and Foreign Patents.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

COMBINED LIFE BOAT AND TRUNK.

Wilson E Facer, Toronto, Ont., Can.—The object of this invention is to provide a combined trunk and lifeboat for the use of travelers upon sea-going vessels, which, as a trunk, occupies no more room than the ordinary traveling trunk, and yet, in the event of a disaster, is capable of being unfolded and extended, so as to form, with a suitable covering of rubber canvas, a convenient and effective lifeboat. The invention consists in a rectangular frame and lattice work about the size of a trunk, made lightly of steel and provided with hinged doors, which constitute the trunk or the middle portion of the boat. The stem and stern is constructed alike of a hinged folding frame at each end of the trunk portion, which, together with the said trunk portion, is provided with pivoted folding ribs, which, when the frames are extended and braced, and the ribs opened, form the skeleton of a lifeboat, which is to be covered with heavy duck or canvas, coated with rubber.

IMPROVED CAR AXLE.

Simon Hall and Samuel L. Hall, Ahnepee, Wis.—The object of this invention is to enable the wheels to be adjusted on the axle to conform to different widths of gage which exist on some of our railroads without change of truck. When the wheel is to be adjusted to a narrower width of gage, a sleeve is screwed back, and a sectional washer, made of two semi-sections suitably connected by dovetails, placed between the outer end of hub and collar. The sleeve is then screwed up, so as to force the loose wheel and washer firmly in position, the joints of the hub, washer, and collar being closed by the elastic packing rings to retain the oil.

IMPROVED BALE TIE.

Virgil F. P. Alexander, Greenville, Miss.—This is an improved bale tie for packing cotton and other articles capable of baling; and it consists of a buckle with suitable slots attached to one end of the band, in connection with suitable fastening buttons for attaching the slotted end of the band by passing over the same and through the slot of the buckle.

IMPROVED CROSSCUT SAW HANDLES.

Lewis Shepard, Mace, Ind., assignor to himself and David W. Kennedy, same place.—The object of this invention is to improve the construction of the crosscut saw handles for which letters patent were granted to the same inventor October 5, 1875, so as to enable the handles to be readily detached, to allow the saw to be drawn out of the kerf lengthwise, and to enable the handles to be adjusted in or out upon the saw. The invention consists in the curved and straight handles, secured to each other at their upper ends, and provided with bolts at their lower slotted ends, in combination with the saw blade.

DOOR FRAME AND JAMB PLATE FOR FURNACES.

James C. Longland, Rome, N. Y.—Hitherto door frames and jamb plates for furnaces have been made of cast iron, the door frames having a small pipe cast into them, for the passage of water; but the intense heat of the furnaces acting on the inside of the door frame, and the outer side being kept much cooler by the action of the water, causes an irregular expansion of the cast iron, and, consequently, breakage, after which the water must be stopped, and the door frame soon burns out and must be replaced with a new one. Jamb plates are usually made of cast iron and cooled by the action of blast supplied by a blower. Plates thus constructed and cooled are of short duration. In the present invention the bottom plate is of wrought iron, being forged into one solid piece, having a chamber for a water passage. The cover to said water passage is tongued and grooved to make watertight joints. The side posts are also made of a solid piece of wrought iron, connected with the plate by a screw thread, to make watertight joints. In the top plate, also of solid wrought iron, is cut a water reservoir, which is connected with one of the posts by a passage, thereby causing a constant circulation of water. The jamb plate is also made of solid wrought iron, and is cut out from the bottom up to make a water chamber. The ends of the jamb plate are beveled to fit, the one to the side of the furnace and door frame, and the other to the water bridge bosh, thereby forming a complete water circulation all around the furnace.

IMPROVED MOISTENING DEVICE FOR GRINDING WHEELS.

Andrew A. Hazeltine, New Bedford, Mass.—This consists of a spring-clamped sponge, which is applied to a movable standard, and supplied with moisture from an adjustable fountain arranged above the sponge, said fountain having a spout and elastic cover to discharge, by slight pressure, a quantity of liquid on the sponge. The device forms thus a convenient and readily operated moisture for grinding wheels of all kinds, being easily cleaned and applied to the point where it is required.

ELECTRIC RAILROAD SIGNAL APPARATUS.

Dr. George Whyte, Northview, Scotland.—This invention relates to the establishment of a block system of railroad signals. It consists in apparatus placed upon the train operating in connection with apparatus placed upon the roadway or track, through the instrumentality of line wires, batteries and semaphoric masts, whereby a moving train cannot enter upon the block or section of track before the preceding train has left it without being notified of the fact, both by a stationary signal upon the road and the ringing of a bell on the train, which bell always rings when the signal indicates the presence of a train upon the section in advance, and does not ring when the signal is down and the preceding train has left the section in advance. It also consists in the arrangement of the devices and circuits whereby each train is made to automatically remove its danger signal before going on to the next section, whereby the following train is notified of the fact that the intermediate section is clear.

IMPROVED NUT LOCK.

Samuel A. Brumbaugh, Harrisburg, Pa.—This invention consists of screw bolts with nuts which are set into recesses of washer plates provided at the under side with ratchet teeth. The washers of two adjoining nuts are connected by a key that enters the ratchets by a point and tooth at diagonally opposite ends, and locks thereby the nuts.

IMPROVED MACHINE FOR FORMING PERFORATED LETTERS.

William C. Robertson and Frederick Pearce, New York city.—By forcing down the free end of a lever, the guide and holding plates will be drawn down, forcing pins down through guide and bed plates, and through the strip interposed between said plates. As the lever is released from the pressure, the plates are raised by spiral springs, and by their upward movement draw the pins out so that they may not interfere with the putting in and taking out of the strip to be perforated. By this construction, by removing a detachable plate, the pins may be adjusted to form any desired letter or other device.

IMPROVED ROTARY PUMP.

William T. Doremus, New York city.—In this rotary pump, the fluid is forced through a flexible tube coiled around the face of a cylinder, through the hollow journals of which it enters. The tube is compressed between the faces of the cylinder to which it is attached and of another cylinder. The effect is to force the fluid in front of the point of contact out through the discharge end of the tube and form a vacuum in the rear into which the fluid is forced by atmospheric pressure, so that there will be a continuous discharge.

IMPROVED METHOD FOR TREATING RAILROAD RAILS.

Andrew J. Gustin, St. Albans, Vt.—For the purpose of imparting the proper camber to a heated railroad rail to compensate for unequal shrinkage of the metal while becoming cold, this inventor proposes a combination of three pairs of plain rolls, the middle one being adjustable and placed slightly out of line with the others.

IMPROVED CASK TILTER.

Joseph Barton, Hartford, Conn.—This consists of a cask or barrel supporting stand that is provided at the rear part with a spring bearer that works in a socket hung to the stand, and tilts the barrel when released from the socket by a lever device from the front. When the barrel is emptied to such an extent that the power of the spring equals and gradually overcomes the pressure of the liquor still remaining therein, the rear part of the barrel is slowly and imperceptibly raised, and thus the barrel tilted without causing the least disturbance in the liquor.

IMPROVED GRAPPLING HOOKS.

Gain Beeman and George A. Phifer, Ironton, O.—In this invention the hooks are pivoted to the end of a tube, in which the operating rod is arranged to slide. A spring pawl is fixed on the tube, in connection with notches in the lifting rod, by which to limit the opening of the hooks by the sliding movement of the rod in the tube. The tube may be continuous or sectional, and any form of grappling hooks or scoops may be used.

IMPROVED CAR COUPLING.

Edward A. Goodell, Tecumseh, Kan.—A drawhead is provided at the bottom with a central hook that is curved to guide the entering link and then drop it into a concave rear part. A vertically sliding stirrup is guided in top holes of the drawhead back of the hook, and seated, when dropped, in a bottom recess. When the cars are coupled the stirrup is seated in the bottom recess, so that the link assumes its position above the same. For uncoupling, the stirrup is raised, which carries the link to such hight that it may readily pass out of the drawhead over the central coupling hook. The raised position of the stirrup may be secured by seating the bail in a groove, at the top of the drawhead in front of the stirrup, so that the bail, by its inclined position, supports the stirrups.

IMPROVED PUMP.

John Woodville, Washington, Ind.—With the stirrup of the presser, which produces a suction and force action, is combined a forked detachable lever handle, attached by a forked sliding lock-piece, to retain the handle firmly for pumping, and a fulcrum and stirrup connecting pivot link to give rigidity and stability to the connection of stirrup and handle.

IMPROVED RAILROAD RAIL JOINT.

Henry D. Leishman, Yates City, Ill.—This rail-joint clasp consists of two separate plates fitted to the base and sides of the rail. One extends over the top and along an outer projection of the other, and is bolted thereto, while both plates are bolted through the webs of the rails.

IMPROVED ORE CRUSHER.

Wilson L. Waters, Watertown, Tenn.—This consists in the combination, with two interior movable jaws, of a wheel located between the same, and having diametrical cams, or their equivalents, whereby the strain upon the wheel shaft is neutralized by making the working strain simultaneous upon opposite sides of the wheel.

IMPROVED TREADLE.

George T. D. Barnjum, Boston, Mass., and Wilbur F. Dial, Montreal, Canada.—This invention consists of alternately swinging treadles, connected by belts with an intermediate reciprocating shaft, that operates alternately, by belts in opposite directions, loose sleeves with end eccentrics. The latter engage clutches for imparting, by their alternately reciprocating action, continuous rotary motion to a flanged fly wheel.

IMPROVED CAR STARTER.

Archibald H. Crozier, Carlyle, Ill.—This invention consists of an arrangement of apparatus of novel contrivance, whereby a spring is employed as the brake to stop the car, and as a means of starting it again by the power expended in stopping it, which is stored up in the spring.

IMPROVED FLOUR AND MEAL BOLT.

Edwin Slagle and John M. Graham, Albany, Mo.—This consists of a flat inclined shaking bolt, in which the cloth is arranged in wave-like form, which greatly facilitates the work. The invention also comprises details in the construction and arrangement of the sieve; also knockers for keeping the cloth clean, and also a contrivance of the bolt to cool the meal.

IMPROVED MACHINERY FOR SCREW-THREADING WIRE FOR UNITING THE SOLES AND UPPERS OF BOOTS AND SHOES

Edouard Fromentin, Paris, France, assignor to Joseph M. V. Durand and Joseph Duborget, same place.—This invention relates to certain improvements in that class of machines which cut a thread upon a continuous length of wire, insert the screw into the sole of the shoe, and cut it off, so as to form a secure fastening in one and the same operation. It consists in the means employed for tilting the upper pivoted portion of the machine, so as to bring the devices down upon the sole, in the means for applying the power to effect and definitely control the intermittent rotary movement and in the construction of the feed for the wire.

IMPROVED PIPE WRENCH.

Edward G. Clinch, St. John, N. B., Canada.—The rear parts of the jaws are connected by two bars, the ends of which are pivoted to the said two jaws to keep them always parallel with each other. With this construction, as the wrench is turned, the jaws will grasp the object with greater force as more power is applied.

IMPROVED WINDMILL

Samuel Shannon, Shellsburg Iowa.—This invention consists of a shield on the sliding hub that shifts the vanes to prevent the lodgment of snow and ice on the shaft, which obstructs the working of the hub. There is also a detachable and adjustable contrivance of the eccentric which works the pump rod, to vary the length of the stroke; a wearing plate, to sustain and take up the wear of the wheel shaft at the end; and a contrivance of the coupling by which the vanes that regulate the opening and closing of the wheel vanes are mounted on the machine and connected with the sliding hub.

IMPROVED GRINDING MILL.

James M. Collier, Gadsden, Ala.—This consists of a novel and ingenious contrivance for adjusting, holding, and regulating a concave bed stone to a revolving cylinder. It combines a large number of new contrivances, to explain which, clearly, drawings would be necessary.

IMPROVED CENTERING DEVICE FOR GAGE LATHES.

James E. F. Leland, Bowling Green, Ky.—This device enables blank handles and other pieces of wood to be quickly and accurately centered, so as to prevent imperfect work and loss of stock from inaccurate centering, and to increase the working capacity of the lathe. The invention consists in the combination of a disk, adjustable guides, and a spring with the mandrel of the lathe.

IMPROVED HYDRAULIC AIR COMPRESSOR.

Frank Laurence, Washington, Kan.—This improved air compressor is operated by the direct hydraulic pressure of a limited quantity of water, so that a uniform power may be stored up for various working purposes. There are two cylinders, to which water is alternately supplied from the supply pipe, so as to work the pistons, which are connected by a walking beam that operates the supply valve. A compressing cylinder is arranged above each of the lower cylinders, and operated by valves and pistons at the upper ends of the piston rods. The cylinders are connected, by pipes, with a receiver into which the air is compressed.

NEW CHEMICAL AND MISCELLANEOUS INVENTIONS.

IMPROVED TOY CAP EXPLODER.

Charles Coester, Jr., Bridgeport, Conn.—This consists of two pieces of metal attached to a string, and so constructed and arranged that, on being projected from the hand, they may be caused to strike together by coming in contact with another object, or by having their motion suddenly arrested by the strings, and so explode a fulminating powder placed between them.

IMPROVED PAPER BOX.

Terence Devine, Jr., Newark, N. J.—This box may be readily and securely closed without requiring pasting. It is made from a blank of one continuous piece, with central closing tongues and folding side flaps symmetrically thereto. The top of the box is made of double sections to be locked by the tongues. The box may be printed in any suitable manner on the face and side parts, forming a neat and secure inclosure for letter paper, candles, and other articles.

IMPROVED SNOW SHOVEL.

Eugene Campbell, South Westerlo, N. Y.—The invention consists in the combination of runners with the blade of a shovel. The former prevent the edge of the blade from catching upon the seams of a metal roof, or upon inequalities in a cement roof, and thus portect the roof from being injured.

IMPROVED GLOVE FASTENING.

Frank G. Farnham, Hawley, Pa.—A plate having a rack is secured to one side of the wrist of the glove. A second plate, attached to the other side, is provided with vertical lugs that are connected by a pin. On this pin slides a lever, having a spur, and folded so as to form a loop to receive said pin. The operation is as follows: In order to fasten the glove, the lever is slid forward until the fold strikes the pin, and then raised into a vertical position, so as to be passed through the eye of the rack plate. The lever is then slid in a horizontal direction over the pin, until the spur catches in a tooth of the rack.

IMPROVED INKSTAND.

Jerome Kidder, New York city.—This portable inkstand is composed of a tube or elongated ink reservoir, having a filling and delivery orifice in its upper side, at or near one end. It is adapted for carrying in the pocket.

IMPROVED ROWLOCK.

Frederic A. Gower, Providence, R. I.—The invention is intended to increase the speed and improve the convenience of racing boats with outriggers, by providing them with rowlocks that prevent wabbling, crabs, and other interruptions. It consists of a rowlock of novel shape, that is mounted by ball and socket joint on the supporting shaft, which connects and binds directly the four rods of the outrigging, in connection with one screw nut.

IMPROVED GAS REGULATOR AND PURIFIER.

Eli T. Booth and Daniel J. Esser, Mauch Chunk, Pa.—The invention consists in using gasoline and charcoal in the purification of gas by arranging it between perforated plates, one of which is over the space wherein the gas enters, and the other just under the space wherein the purified gas is collected before use.

IMPROVED SIGNAL HEAD LIGHT FOR LOCOMOTIVES.

John V. Slusser, Louisville, Ky.—This inventor proposes to combine the signal lights with the head lamp of the locomotive, so that they receive their light from the burner of the head lamp. The invention consists in the arrangement of one or more short tubes applied to the head light of a locomotive, said tubes to be fitted with movable caps with colored glass for signals. The engineer can thus at any time, on receiving orders on the road, change without delay the solid caps which cover the lamps to transparent glass ones, which give the signals without having the trouble to light the signal lamps now in use.

IMPROVED FUR-CUTTING KNIFE.

William F. Hoffman, Brooklyn, N. Y.—This consists of a gang of knife blades, fixed at suitable distance apart in a frame, to which they are pivoted at the end of the shank. Between pivots they are fixed adjustably on a clamp screw, so that the blades can be readily adjusted to set the points all in the same plane from time to time, as they wear away irregularly. The cutter is designed for cutting the fur into narrow strips for trimming and the like, which is now done with one blade only.

IMPROVED METHOD OF MANUFACTURING FLOATS.

Linn B. Benton, Milwaukee, Wis.—This is a float made of spun hemispheres forced on a beveled connecting band, and soldered at the joint with a galvanic copper solution.

Business and Personal.

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

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Notes & Queries

C. M. will find a recipe for filling for wood on p. 315, vol. 30.—J. E. M. will find a recipe for chicken cholera medicine on p. 395, vol. 30.—A. G. will find a good recipe for mucilage on p. 196, vol. 34.—H. C. S. can bronze castings by the method described on p. 11, vol. 34.—A. B. R.'s discovery of an electric phenomenon is similar to A. S. G.'s, explained on p. 186, vol. 34.—W. L. D. will find directions for repairing the silvering of his mirror on p. 267, vol. 31.—R. S. can coat cellular substances with silver by the process described on p. 203, vol. 34.—P. & L. cannot use the electricity from a belt economically. See p. 10, vol. 34.—J. C. C. will find on p. 203, vol. 34, particulars as to molding wax for electrotyper's use.—T. E. L. will find directions for staining wood in imitation of mahogany on p. 170, vol. 34.—C. W. K. will find a full description of Dr. Crookes' torsion balance on p. 149, vol. 34.—E. B. and others will find full directions for making an æolian harp on p. 315, vol. 33.—A. A. H. will find directions for making a battery for medical purposes on p. 196, vol. 27.—T. H. H. can utilize mica scraps by the method described on p. 42, vol. 25.—W. F. S. will find a description of an incubator in a forthcoming number.—J. L. R. Jr., will find on p. 42, vol. 26, directions for fastening leather covers to iron pulleys.—W. W. N. will find on p. 202, vol. 30, directions for painting tin roofs.—R. J. O'C. can fasten rubber covers to wooden spindles with good glue.—O. B. F. will find directions for amalgamating zincs for batteries on p. 27, vol. 30.—J. M. will find that timber will bend more easily if kept for some time in boiling water.—J. T. S. will find a description of malleable cast iron on p. 138, vol. 29.—H. E. will find directions for making artificial stone on p. 113, vol. 24.—J. P. will find directions for making citrate of magnesia on p. 203, vol. 34.—E. C. B. will find a practical recipe for tinning iron castings on p. 362, vol. 31.—R. C. M. will find directions for soldering gold on p. 251, vol. 28.—T. P. F. will find formulas for calculating the strength of boilers on p. 186, vol. 32.—W. T. D. will find directions for bluing steel on p. 123, vol. 31.—J. E. M. will find directions for preserving natural flowers on p. 204, vol. 28.—J. J. will find directions for putting a white enameled surface on iron vessels on p. 362, vol. 32.—C. H. R. will find directions for melting rubber on p. 119, vol. 28.—J. W. B. will find directions for browning gun barrels on p. 11, vol. 32.—H. C. S. will find directions for electro-silvering on p. 362, vol. 31.—E. D. will find a description of the sand blast process, which is patented, on p. 195, vol. 27.—L. L. F. will find a description of the gyroscope, on which the toy which he describes is founded, on p. 91, vol. 31.—C. R. will find directions for utilizing leather shavings on p. 105, vol. 25.—A. P. will find directions for varnishing violins on p. 281, vol. 26.—A. L. S. can run solder into thin bars by the method described on p. 282, vol. 31.—W. C. W. will find a description of testing lubricating oils on p. 360, vol. 33.—J. W. V. will find directions for lighting gas by electricity on p. 4, vol. 29.—J. A. will find a good recipe for stove polish on p. 169, vol. 33.—F. G. P. will find an explanation of the theory of color on p. 180, vol. 33.—A. B. can blacken the inside of brass telescope tubes by the method described on p. 362, vol. 25.—J. O. will find on p. 27, vol. 34, directions for making mucilage for postage stamps.—J. P. J. will find directions for making battery carbons on p. 187, vol. 32.—T. H. R. can ascertain the amount of moisture in the air by using a hygrometer. See p. 409, vol. 32.—W. S. can season his wooden hubs by the process described on p. 58, vol. 32.—G. W. S. will find a recipe for cement for rubber on p. 119, vol. 28.—H. E. J. must use Indian and Chinese ink for Patent Office drawings.—W. W. will find, on reference, that the absolute zero of temperature, and the shrinkage of gases when cooled, are discussed on p. 170, vol. 32.—J, W. J. will find a recipe for stencil ink on p. 273, vol. 28.—C. H. C. will find directions for calculating the speed of pulleys, etc., on pp. 26, 73, vol. 25.—G. B. F., C. E. C., K. Q. X., and J. A. have sent correct answers to W. C. S.'s problem published on p. 107, vol. 34. The replies sent by S. R., M. A. C., and C. F. E. are erroneous.

(1) G. D. T. asks: 1. What is the actual horse power of a steam engine 10 x 14 inches, running at 215 revolutions per minute, with a boiler pressure of 60 lbs., cutting off at ⅛? A. A test would be necessary before this question could be answered. 2. Can the exhaust steam pipe on an engine be turned into the smoke stack without injury to either? A. Introduce the exhaust pipe so that it discharges upward, in the middle of the smoke stack.

(2) F. E. H. says: Please give me a recipe for making Pharoah's serpents. A. The genuine ones are simply sulpho-cyanide of mercury made up by means of gum water into the form of cones, pills, or cylinders. They are still made and sold, on a small scale, in this city. We are not aware of any law specifically referring to them. Several substitutes for the dangerous mercury preparation have been proposed, but the snakes they produce are not so life-like nor so big. The following is said to be the best imitation: Take white sugar 3 parts, bichromate of potash 2 parts, saltpeter 1 part. Pulverize separately and mix intimately; finally press the mixture into small paper cones.

(3) E. L. S. asks: What diameter and pitch of propeller would you advise for a boat 58 feet long, 7½ feet beam, with 3½ feet draft of water, engines having 6 x 8 inches cylinders? A. Diameter 3½ feet, pitch 4½ to 5 feet.

(4) R. S. B. asks: I have some liquid which is neither good old hard cider, for it has a vinous taste, nor yet is it good vinegar. How can I convert it into good marketable vinegar? A. Prepare a large barrel, with a false bottom having a number of holes bored through it. Place this in the barrel about six inches above the real bottom, and fill in above the false bottom to the top of the barrel with good, well burnt charcoal, in coarse powder. Moisten the charcoal thoroughly with some of the cider, cover the barrel with a piece of felt or woolen goods, and allow to remain until there is a perceptible rise in the temperature; then add the cider in such a manner as to keep up a constant percolation of the fluid through the charcoal until the process is complete. The vinegar may be drawn off from a spigot at the bottom.

(5) R. J. C. asks: How much power is there in an overshot wheel propelled by a spout of water 12 inches wide by 3 inches deep? A. A good overshot wheel may give ¾ of the whole effect of the water.

(6) F. O. says: P. is testing a boiler with water from a pipe showing a pressure of 60 lbs. The boiler being filled, the gage shows 5 lbs. The gage is half way from top of boiler: now, if the pressure be added from the pipe, should the gage on the boiler show 60 or 65 lbs.? I claim the cause of the 5 lbs. pressure is due to the weight of water above the gage, and must be added to the 60 lbs., and make the gage say 65. P. says the 6 lbs. has nothing to do with it; the pressure must be 60 lbs. Who is right? A. If the pipe enters the boiler at the lowest point, according to the data furnished, the pressure at the highest point of the boiler would be 60 lbs., and the gage would show a pressure of 65 lbs.

(7) C. G. N. asks: How large a boat will a 3 horse power engine propel, with side wheels? A. Make her from 20 to 25 feet long. Good friction gearing is preferable to ordinary toothed wheels. Side wheels give very satisfactory results in smooth water.

(8) R. B. H. L. asks: 1. What kind of cannon is used for chain shot? A. Chain shot have ordinarily been fired from a smooth-bored gun; but we believe that occasionally a peculiar form of gun has been employed, consisting of two barrels, slightly diverging at the muzzles and having a common vent. 2. How many kinds of cannon have ever been used? A. Cannons are generally classed as muzzle and breech loaders, with smooth bore or rifled barrels. 3. If a cannon 1 inch bore, 70 feet from a target, be loaded with 100 No. 1 shot, to what width would the shot spread? A. It is impossible to give a definite answer to this question, since, as you must be aware, the difference in the performance of different guns, in this respect, is very marked.

(9) T. D. and others.—There is no work on taking the buckle out of saws. It is an art known only to saw makers, and attainable only by long practice and a thorough knowledge of the principle upon which saw plates are worked in order to impart that strain upon different parts so as to overcome the expansion by centrifugal force caused by the velocity of the saws in use.—J. E. E., of Pa.

(10) D. W. W. asks: 1. Is it possible for boiler tubes to get heated to the point of producing a spheroidal state when the proper supply of water is kept up in the boiler? A. Experiments seem to show that, in order that water may assume the spheroidal state, a small quantity must be dropped upon a plate which is heated to a higher temperature than the boiling point of the water. 2. What is the lowest temperature at which the spheroidal state can exist in the case of iron and water, and how is it affected by pressure? A. Under atmospheric pressure, the temperature required is about 290° Fah. In a boiler properly designed, the temperature necessary for the spheroidal state could not be produced, if the ordinary water level was maintained. We have, however, occasionally seen boilers in which the circulation was so poor that tubes were burned out when apparently covered with water.

(11) W. C. B. asks: 1. Is it practicable to pump water through a pipe 150 feet long, it being level from the pump to the well, which is 18 feet deep? Yes. 2. Is it better to have the pipe higher at the well than the pump? A. Lay the pipe as straight as possible, with the highest point at the pump. 3. Should there be a check valve at the well? Yes. Put it at the bottom. 4. What sized pipe should we use? A. A 2 inch pipe.

(12) S. H. S. asks: What is the matter with our stove? When the damper was closed, the draft went around under the bottom of the stove; when the draft is all closed, the smoke or something else will condense into liquid and run through the chimney, through the upper floors, and into the room below. A. This may be owing to some peculiar kind of fuel you are burning, which you do not specify. When the draft is closed the flue soon becomes cold, and the air carrying the smoke precipitates its latent moisture upon the sides of the flue; the moisture naturally carries the particles of unburnt fuel with it. If this is the cause, a more free draft would abate the difficulty.

(13) M. B. says: I have a boat 50 feet long and 10 feet wide. The engine is 8 x 9 inches. What size and pitch of wheel should I use? A. You can use a wheel 3½ feet in diameter, with 5 feet pitch. In general, a wheel that is properly proportioned for speed is likewise suitable for towing.

(14) J. J. says: It is claimed that the outside horse, in plowing a circle, commencing in the center, gains only so much as he gains in the first round and no more, as the inside horse follows all the time after. Others assert that the outside horse gains each round plowed, and will gain in each round so long as they continue plowing in a circle, and that each and every day the outside horse has traveled the farthest. Which is right? A. This is a very pretty question, of little or no practical importance; and we therefore forego the satisfaction of answering it, and throw it open to the competition of those who may be interested in finding a solution.

(15) M. J. asks: What is the method of testing hydraulic cement for water? A. It consists in gaging a small quantity of the dry powder with water, and immediately immersing it in water. If the sharper edges crack or break away after a short time, the cement is too hot or fresh, or is inferior in quality.

(16) J. H. D. asks: What weight can an average horse raise, if hitched to a rope, the rope to pass over a pulley, and the weight attached below? A. The following table, given by Mr. Trautwine, furnishes a fair statement of average results, the speed of horse being miles per hour, and the traction in lbs.:

Speed.	Traction.	Speed.	Traction.
¾	333	2¼	111
1	250	2½	100
1¼	200	2¾	91
1½	167	3	83
1¾	143	3½	71
2	125	4	63

(17) J. A. K. asks: What causes an explosion when water is pumped into a hot boiler? Is it the sudden generation of steam, or does the boiler crack? A. When an explosion takes place under such circumstances, steam is formed rapidly; and the iron, weakened by overheating, cannot resist the pressure.

(18) J. W. A. McC. asks: By what rule can I find out what quantity of water will be supplied by a wooden pipe, with a 3 inch bore, having a head of water of 250 feet, the length of said pipe being about 10 miles? A. If we knew all the particulars of the case, we could only give you approximate rules; and it would be useless to attempt to furnish information from the meagre data you have sent. We hope to treat of matters of this kind, in special articles, before long.

(19) R. E. B. says: If I take out a water wheel 10 feet in diameter, and replace it with one 2 feet in diameter, using the same quantity of water, do I gain any power? A. Not from the fact of its being larger. If the new wheel is a better one than the other, *per se*, there will, of course, be a gain.

(20) T. A. B. asks: Should the balance wheel of a gig saw or vertical re-sawing machine and the gate and connecting rod of the same form a perfect balance, to prevent thump or jar? A. Vertical resawing or other rapidly operating machinery should be balanced so as not only to counteract the weight of the gate or frame and connecting rod, but also the momentous force, and this latter depends upon the velocity at which it is run I know of no established rule for accomplishing this. About the only way that I know of to get a perfect counteraction is to construct the balance wheel with more counteracting weight than is really required. Then remove the surplus little by little until the machine moves properly.—J. E. E., of Pa

(21) W. M. K. asks: To what extent, if any, will air in an open inverted vessel, mingle and pass off with a current of water when deeply immersed and under a pressure of 500 lbs. to the square foot? Would hydrogen or some other gas remain longer unchanged in bulk than atmospheric air? A. Either the air or hydrogen will be absorbed much more readily by the water, under these circumstances, than under ordinary pressure.

(22) G. H. says: I have in my cellar a horizontal single flue boiler for the generation of steam for heating purposes. Trouble seems to be caused by a sluggish combustion. It does not smoke nor emit gas; but no matter how much coal is put in at one time, the fire burns dull, and it is difficult to raise 3 lbs. of steam and hold it. The flue fills with soot quickly, which hangs in festoons, indicating that there is no draft. A. Your description will not enable us to help you very intelligently; but we would recommend that you see whether the chimney, *per se*, is in good working order.

(23) H. F. J.—We cannot estimate the performance of your engine and boiler accurately from the data sent. If you will put a check valve on the end of your pipe, we think you will have no more trouble.

(24) O. K. and others ask: 1. How is the focal length of a microscope lens calculated? A. Focal length is reckoned from the center of the combination. 2. How can I test lenses for chromatic faults? A. The only test for achromatism is the color; if there is no color, the lens is achromatic. The best lenses are made of two kinds of glass cemented together and burnished in the cell, there being no necessity for removing them. 3. How can I ascertain and compare the powers of microscopes? A. In comparing the magnifying power of microscopes, opticians generally have agreed to consider 10 inches as the distance of distinct vision; then by comparing the real size of the object with the apparent size of the image at a distance of 10 inches, the magnifying power is easily determined. See p. 25, vol. 33.

(25) G. W. S. asks: What should I put on a wooden plug joint to harden the wood (poplar, bass, or lime) and at the same time to keep the joint from moving when fastened in by a screw at right angles to the plug? A. Powdered resin might answer your purpose.

(26) G. W. J. says: 1. I am running a pair of high pressure engines, 15 x 28 inches, with 100 lbs. steam, at 150 revolutions per minute. These engines are both connected to the same shaft, with a fly wheel only 3 feet in diameter but very heavy. On the crank shaft is a cog wheel 2 feet in diameter, geared in another wheel on a countershaft, 5 feet in diameter, or 2½ to one. Connected to this countershaft is a screw 10 inches in diameter, with square thread of 1¼ inch pitch, or 9½ threads to the foot, running through a cast iron nut. How much thrusting pressure do we apply to that nut?

A. The greatest pressure on the nut will be between 9 and 10 times the maximum pressure on the crank pins. 2. Would a cast steel nut work better and cooler than a cast iron or gun metal one? A. With sufficient bearing surface, we think you will find cast iron a satisfactory material for the nut.

(27) W. H. asks: Is there any rule for the weight of green pine timber? What is the difference in weight between green timber and dry timber? A. It would be impossible to answer these questions very exactly, without experimenting in each special case. Dry white pine weighs about 25 lbs. per cubic foot, and green pine from 30 to 37.

(28) J. B. K. asks: 1. Which is the best for a base to plate on (for such articles as spoons and forks), nickel silver, white metal, or albata? A. All these alloys are good for the purpose. 2. Of what metals are these different bases composed? A. Nickel silver is a variety of German silver, of which many kinds are in use. The following is a good one for plating on: Copper 55, nickel 24, zinc 10, tin 3, and iron 2 parts. White metal consists of: Tin 82, lead 18, antimony 5, zinc 1, and copper 4 parts. Albata is another name for German silver.

(29) W. H. E. asks: What should be the number of revolutions per minute of a screw propeller in a model 3 feet 6 inches long, to gain the maximum speed? A. The question is too indefinite. Probably you could not get a correct solution in any way but by experiment.

(30) W. G. M. says: 1. I have become nearsighted, my eyes being in different degrees affected. I can see to read well at the common reading distance, which does not seem to be the case with others I have noticed similarly afflicted. What has caused it, lamplight or too constantly looking at near objects? A. The natural eye has the power to cause the front of the crystalline lens to become more or less convex as objects looked at are nearer or farther from it. In your case that power appears to be lost by over exertion in looking at near objects. 2. Can my sight be restored? A. Probably it can, with proper care and rest. 3. In looking at distant objects I am compelled to partly close my eyes, when the objects become far more distinct. Why is this? A. In closing the eye, the light passes only through the central portion of the lens, and this part is of longer focus. 4. Will the use of glasses strengthen the eyes, or cause a growing necessity for them? A. If used constantly they will not be likely to remedy the defect. 5. Would their use have a tendency to make both eyes alike? A. Probably not. 6. Should they be worn continually? A. No.

(31) G. C. asks: Is the steamer Great Eastern constructed so as to be divided in any number of parts, each part to sail independently on entering a small harbor or in case of a rough sea? A. If it ever was constructed in this manner, the matter was kept a profound secret.

(32) J. P. W. says: In *Science Record* for 1874, on p. 574, are directions for making a portable field camera obscura. I have followed the directions, but it will not work, as the lens will not throw the image downward. A. The difficulty probably is that the lens is not long enough in focus. The distance from the center of the lens to the mirror and thence to the paper should be the focal length of the lens. It will not be practicable to use a lens of a shorter focus than 2 feet.

(33) C. K. asks: 1. Will a good achromatic object glass of 2 inches diameter and 3 inches focus, with an eye lens of ½ inch focus, make a telescope strong enough to see the phases of the planets Venus and Mercury? A. Yes. 2. Will it show the globular form of Jupiter and the ring of Saturn? A. Yes; with a steady atmosphere you should see the belts on Jupiter also.

(34) J. M. T. asks: 1. I wish to make a telescope. Which will be the cheapest, a reflecting or refracting telescope? A. In small telescopes there is not much difference. 2. What will an object glass, 2½ inches diameter, of 44 inches focus, cost me? A. About $20. 3. What power would it stand? A. A power of 150.

(35) C. R. says: It is desired to surround upright cylindrical stoves by shields to protect woodwork, etc., from the intense heat radiated. Can you suggest some simple and efficient form and material? There should be a door to permit the introduction of coal. A. Sheets of zinc will be the best, unless you require an ornamental effect. In the latter case, use Russian iron.

(36) J. M. G. says: A steamboat boiler is filled to top of steam chimney with water, and shows 5 lbs. pressure on the steam gage from weight of water in pipe connecting the gage with boiler. In testing the boiler to 60 lbs. water pressure, will it be necessary to show 65 lbs. on the gage in order to have 60 lbs. on the boiler? Will the gage show 5 lbs. more than a gage placed at the pressure pump? A. When there is a pressure of 60 lbs.; at the highest point of the boiler, under the circumstances stated, the gage will indicate 65 lbs., and the gage in pressure pump will indicate a still higher pressure, if, as is generally the case, it is subjected to the action of a still higher column of water.

(37) A. N. asks: How can I write or draw on smooth plates of zinc, and afterwards etch the marks in with acid? A. Mix 1 part strong nitric acid and 100 parts water: pour over the plate, and let it run to and fro. Wash with water, and pour weak gum water over the plate.

(38) X. X. X. asks: How can I make a good oleate of soda? A. Oleic acid forms two classes of salts, normal and acid. The normal salts of the alkalies are the only soluble ones. They form soaps, and by the evaporation of their aqueous solution may be obtained in the condition of an amorphous mass. The isolation of oleic acid in a state of purity is a matter of some difficulty, owing to its tendency to combine with oxygen. To obtain pure oleic acid, olive or almond oil is saponified with potash; the soap is decomposed by tartaric acid, and the separated fatty acid, after being washed, is heated for some hours in the water bath, with half its weight of lead oxide, previously reduced to a fine powder. The mixture is then well shaken up with about twice its bulk of ether, which dissolves the oleate of lead and leaves the stearate; the liquid after standing for some time is decanted and mixed with hydrochloric acid; the oleic acid thereby eliminated dissolves in the ether, and the etherial solution, which rises to the surface of the water, is decanted, mixed with water, and freed from ether by heat. The acid may now be converted into soap by the addition of pure caustic soda, which is afterwards separated from its aqueous solution by the addition of chloride of sodium, and pressed to remove excess of moisture. Owing to the strong affinity of the liquid acid for oxygen, as prepared by the above method, it has a brownish color and a slight odor. See answer to A. B. C., below.

(39) A. B. C. asks: Can oleate of soda be made chemically pure? A. If absolute purity be requisite, try the following: Redissolve the oleate of soda, as obtained by the above method, in water that has been boiled for some time to expel all the air, and again decompose with tartaric acid in vessels filled with carbonic acid gas. Allow the acid to settle, decant the supernatant liquid, and wash with water free from air. Then add a large excess of strong ammonia, and, when solution is complete, precipitate with chloride of barium. The oleate of baryta thus formed is dried and boiled with alcohol. During this operation the salt melts and forms a viscous liquid, but a portion of it is dissolved, and is deposited in crystalline plates as the liquid cools; these are again crystallized from alcohol, and on decomposing them with tartaric acid pure oleic acid is obtained.

(40) W. S. D. says: 1. A church is being heated by a hot air furnace, but there is a fault in the ventilation, which is effected by one large pane in each window hanging on a swivel. When the church cools, there is a cold damp air, and the furnace draws cold air from the inside of the church. A. The supply of fresh air to the furnace should be taken from the exterior of the building, by means of an enclosed shaft, which may be constructed of matched boards for the most part, being of brick near the furnace. Place a valve, or shutter on pivots, within the shaft, to close it when required. Additional openings for ventilation should be provided at the ceiling.

(41) J. F. B. asks: 1. Is it necessary that the wires of a galvanic battery be copper, or will iron wire do? A. Not absolutely necessary; but as the conductivity of copper is about seven times greater than that of iron, it is better to use copper. 2. Is the vapor of a battery, consisting of copper zinc plates, poisonous? A. No.

(42) X. Y. Z. asks: 1. How is an ohm, in electricity, measured? A. An ohm, the unit of electrical resistance, is roughly equivalent to 1 foot 1·9 inches in length of German silver wire of No. 29 British Association gage. It would not do, however, to place much dependence on its accuracy as thus determined, as the resistances of various samples of wire vary considerably. Standard copies of the ohm are supplied by various foreign manufacturers of telegraph apparatus, and possibly, also, by some American houses. 2. How are the connections made in the open circuit system of telegraphy? A. The key is provided with both front and back contact points. At terminal stations the line is connected to the key lever; one pole of the battery and the back contact point are connected to earth, and the opposite pole of the battery to the front contact of the key. Except when the station is transmitting, the lever is allowed to remain constantly on the back contact.

(43) B. S. S. asks: 1. How long will a silver solution hold its strength? A. The cyanide solution should last for months if kept, as much as possible, from the action of air. 2. Ought it be bottled when not in use? A. Yes.

(44) C. R. asks: The quality of the magnet is destroyed by fire. Does this magnetic property of the iron impart itself to the fire? If not, what becomes of the magnetic property? A. The attractive property of a magnet is supposed to depend upon a peculiar arrangement of the molecules of which it is composed. Bodies capable of becoming magnetic offer more or less resistance to an arrangement of this kind. We may, therefore, assume that the molecules of a magnetic substance are in a state of strain. Heat reduces the conditions of restraint by imparting motion to the molecules, and thus allows them to resume their former position.

(45) C. A. H. asks: How can I make an electrical machine capable of giving the same power as a Bunsen battery? A. The ordinary electrical machine is not capable of producing a current equal to that from a Bunsen battery. A stick of shellac rubbed with flannel, however, will produce a greater tension, but the current from such a source is infinitesimal. A magneto-electric machine would cost more than the battery.

(46) W. R. asks: 1. What are the best width and thickness of single steel horseshoe magnets that will do to form a compound one? A. Make the width about $\frac{1}{10}$ of the length, and the thickness ¼ the width. 2. Of what size should single electro-magnets be to form a compound one? A. An electro-magnet, such as used for the sounders or registers in telegraph offices, will be found sufficient. 3. How shall I temper the magnets? A. For permanent magnets use the best, fine grained steel; temper as high as possible, and then draw, by heat, to a violet straw color. 4. How many feet of wire are required to saturate single bar magnets to form a compound 10 or 12 inches long? A. An electro-magnet, charged by two or three Daniell cells, will answer the purpose.

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

L. L.—It is possible that the mineral was eucairite, with which it agrees in physical character; but the amount did not suffice to determine its chemical constitution. Will you send about 8 grains of the mineral, free from the gangue?—H. M. W.—The scale consists chiefly of carbonate of lime and sesquioxide of iron. The color does not indicate anything injurious.—L. C. T.—Send us a specimen of your mineral, and we will tell you what it is.

COMMUNICATIONS RECEIVED.

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

On a Car Brake. By M. M. S.
On Problems in Gunnery, etc. By R. H.
On a Cannon Musical Instrument. By H. M. B.
On Belting. By E. H. D.
On a Geometrical Problem. By J. D. L.
On the Mississippi Improvements. By B. J. B., and by O. P. S.
On the Moon. By J. A. S.
On Employers and Employees. By O. O. T. E.
On a Solar Phenomenon. By J. C.
On Another Explosion. By H. I. F.
On Transplanting Trees. By C. E. H.

Also inquiries and answers from the following:

C. A. W.—R. F. F.—D. L. W.—J. L. R. B.—F. W.—W. R.—C. D.—S. H.—A. F.—W. C. I.—E. W.

HINTS TO CORRESPONDENTS.

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

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

Hundreds of inquiries analogous to the following are sent: "Who sells machines for recutting hand saws? Who sells pure bred poultry? Who makes brass castings? Who makes cider mills that grind and press at one operation? Whose is the best boiler for generating steam to heat water in a tank? Who sells platinum, and what is its cost? Who sells machinery for working small screw propellers by hand power?" 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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9,111.—CHAIRS.—C. A. Perley, Baldwinsville, Mass.
9,112.—DOOR PLATES.—J. S. Shaddnck, Huron, Ohio.
9,113.—URINAL.—W. Tweedale, Brooklyn, N. Y.
9,114.—GLASS PEDESTAL.—T. Atterbury, Pittsburgh, Pa.
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9,116.—BUTTONS.—W. W. Knight, Brooklyn, N. Y.
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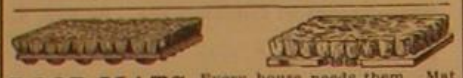
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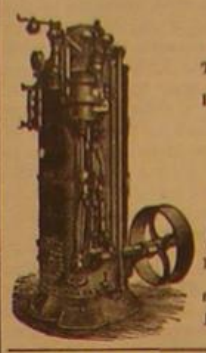
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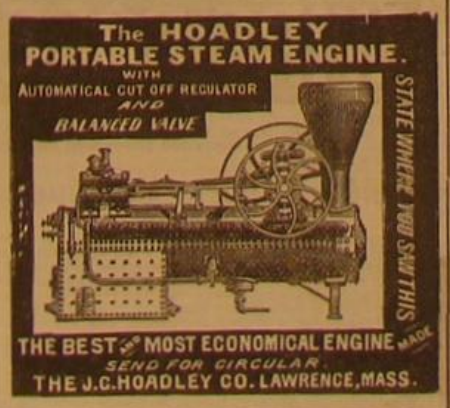
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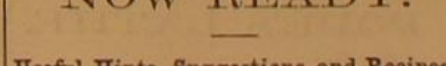
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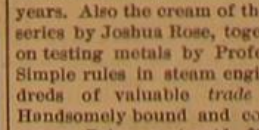
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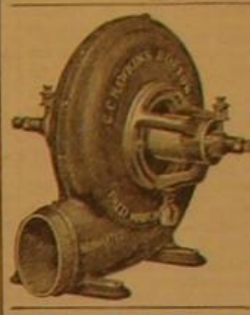
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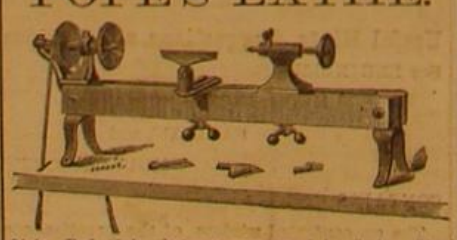
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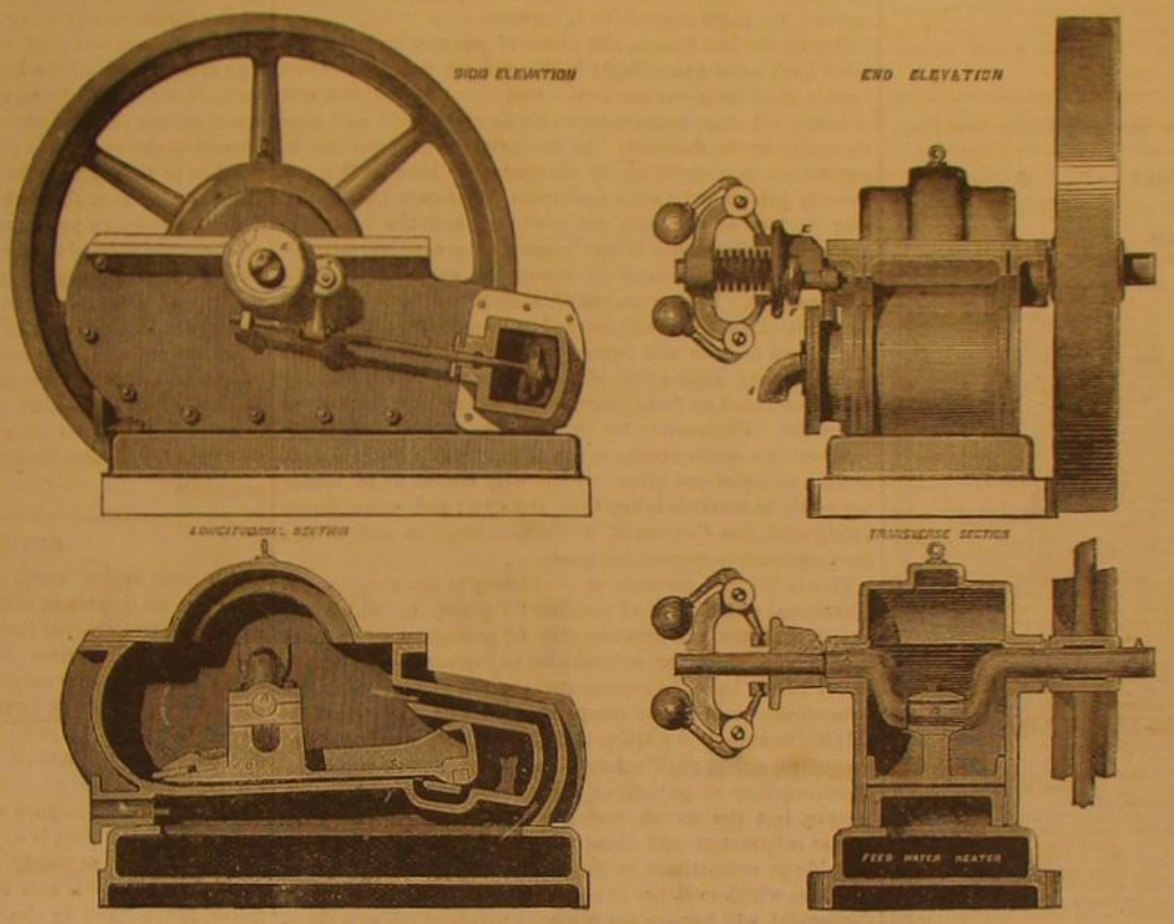
Vol. XXXIV.—No. 15. [NEW SERIES.] NEW YORK, APRIL 8, 1876. [$3.20 per Annum. [POSTAGE PREPAID.]

A SEMI-ROTARY ENGINE.

If anybody should ever apply the development theory of creation to steam engines, the apparatus represented in the engraving herewith annexed would doubtless be hailed as the connecting link between rotative and rotary machines. It certainly is a curious hybrid; it is a reciprocating machine, and yet it is not wholly so, nor is it exactly a rotary; perhaps the inventor's name for it, as above stated, is the best, after all, that could be devised. Its construction and operation will be easily understood from the illustrations, which we take from the *Engineer*.

A is the crank shaft, B the crank pin, C the piston, D the valve, E the cam, F the cam wheel, G the valve spindle, and H the supply pipe. The steam is admitted on the face of the piston, through the valve, which, as shown in the side elevation, is worked by the cam, E. The piston then travels in the direction of the arrow, first ahead, then up, down, and back. The governor is so arranged that full boiler pressure is always admitted.

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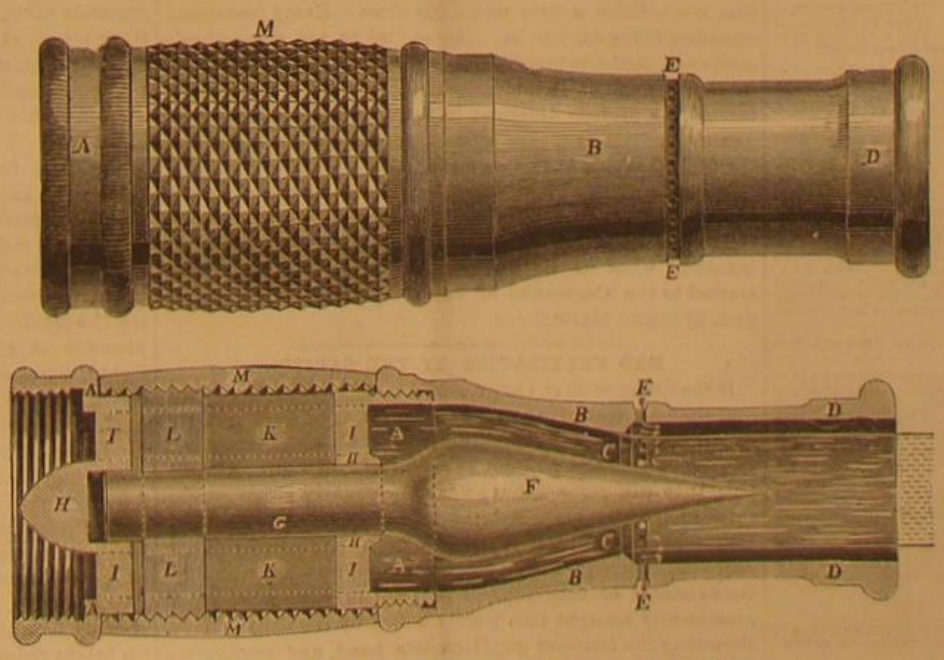
We illustrate herewith an improved nozzle, adapted to fire extinguishing apparatus and for other purposes, whereby the size of the stream, and consequently the volume of water projected, may be easily controlled, or the jet be altogether shut off. There are many advantages attending this arrangement, which will suggest themselves to all conversant with the demerits of the ordinary nozzles. Perhaps the most important advantage (and the one that will especially commend itself to insurance companies) is that the device is calculated to prevent the indiscriminate flooding of warehouses, and the consequent large damage, by water, to buildings and to valuable stock. The reduced stream suffers no diminution of force, and can be thrown as far as, if not farther than, a jet projected from a common plain or ring nozzle. Consequently, in small fires, the quantity of water necessary for their extinguishment can be applied, and any surplus drenching avoided. The controlling mechanism opens and closes the nozzle very uniformly and gradually, so as to avoid the shock due to sudden starts or stoppages of the water. The hose is thus prevented from bursting, while the apparatus is rendered safe for use on hose or hydrants carrying high pressures, and on hose connected to fire engines equipped with relief valves. Greater facility is also afforded in handling hose, by closing down the nozzle and reducing or cutting off the back thrust of the stream.

An exterior and a sectional view of the invention are given in the annexed engravings. The nozzle barrel, A, is screwed into an end piece, B, which has its discharge orifice, C, opening into a valve guard tube, D, in which are air inlet holes, E. A long pointed cone valve, F, placed concentrically with the nozzle, has its stem, G, accurately fitted, but free to move in a small tube, H, which is supported by two thin feather-edged wings, I, fixed transversely in the barrel. A long narrow slot, K, is formed through the wings and barrel, in which slot traverses a flat bar, L, which is fixed to the valve stem. Said bar has rack teeth on its ends, which engage the screw threads of a milled sleeve, M, which revolves freely on the barrel, A, and which moves the cone valve out and in from its seat at the discharge orifice, to regulate the size of the stream or to shut off the same. The water forms on the cone a solid round jet, which does not fill or touch the tube, D. A spraying attachment (not shown in the engravings) is made by placing in the outer end of the tube, D, a disk perforated with divergent holes, which is secured in place by a suitable cap. When this disk is placed in one position it throws a spray, and when it is turned over it throws a solid stream, in both cases backing the water up in the tube, D, and making a rear spray from the holes, E, which protects the pipeman from smoke and heat.

The nozzles are made in three sizes, respectively of capacity to throw a stream of 1¼ inches, 1 inch, and ¾ inch in diameter. These are adapted to all requirements, including those of hotels, warehouses, factories, steamships, etc., up to the largest pumping engines, and are likewise capable of throwing jets as small as ¼ inch.

The inventor, Mr. Melville Clemens, of Worcester, Mass., submits a large number of testimonials from the chiefs of the Fire Departments of New York, Philadelphia, Worcester, Holyoke, Mass., and other cities, pump manufacturers, and others, all of which indicate that the device is both useful and efficient.

Patented March 14, 1876. Patents applied for abroad and in Canada. For further information and circulars, address the manufacturers, the Eaton, Cole, and Burnham Company, 58 John street, New York city.



THE CLEMENS CONTROLLING NOZZLE

Cinnamon and Cloves.

The cinnamon of commerce is the inner bark of a tree closely resembling the laurel, or sweet bay, a native originally of Ceylon, but which is now grown in the other parts of the East Indies, and also in Jamaica and other West India islands. The trees are left to grow unmolested until they are nine years old, at which time the young shoots or branches that are about three years old are lopped off. The bark is then slit on one side and removed from the branch, tied up in bundles until the next day, when it is loosened, and the skin or outer bark scraped off. It is then dried or rolled up into quills or pipes, about three feet long, which have a slit down one side, where the bark was cut. The smallest quills are rolled up inside the larger; the whole then tied up in bundles of 80 or 90 lbs. weight, and wrapped up in cloths, when they are ready for exportation. It has an astringent and highly aromatic and warm flavor, and yields by distillation an extremely fragrant and pungent volatile oil, kept for pharmaceutical use under the name of oil of cinnamon.

The articles known in commerce as cloves are the unopened flowers of a small evergreen that resembles in appearance the laurel or the bay. It is a native of the Molucca or Spice Islands, but has been carried to all the warmer parts of the world, and is largely cultivated in the tropical regions of America. The flowers are small in size, and grow in large numbers in clusters at the very ends of the branches. The cloves we use are the flowers gathered before they are opened, and while they are still green. After being gathered, they are smoked by a wood fire, and then dried in the sun. Each clove consists of two parts, a round head (which is the four petals or leaves of the flower rolled up, inclosing a number of small stalks or filaments), the other part of the clove being terminated with four points; it is, in fact, the flower cup and the unripe seed vessel. All these parts may be distinctly shown if a few cloves are soaked for a short time in hot water, when the leaves of the flowers soften and readily unroll. The smell of cloves is very strong and aromatic. Their taste is pungent, acrid, and lasting. Both the taste and smell depend on the quality of oil they contain. Sometimes the oil is separated from the cloves before they are sold, and the color and taste in consequence are much weakened by this proceeding.

A SIMPLE way of cutting glass is to crack it with a very fine needle-like gas flame. Start the crack with a file, and then apply the flame, which may be produced through a minute perforation in a glass connected with some rubber piping so as to allow of the flame being conveniently carried from point to point. The crack will run before the flame in any desired direction.

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NEW YORK, SATURDAY, APRIL 8, 1876

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THE CENTENNIAL EXPOSITION AS AN ELEMENT IN THE DEVELOPMENT OF OUR MANUFACTURING INTERESTS

There can be reasonable doubt that the United States is about to assume a new and important position as a manufacturing nation. But a few short years ago, we were known as an agricultural country, having vast mineral resources lying idle and unproductive. Our imports of the various metals and of manufactured goods were something enormous; we have just emerged from a war unsurpassed in its expenditure of human life, money, and national substance, a war in which the whole losses of both sides fell upon one nation and people; and yet since the close of that conflict, we have made our *debût* as a manufacturing people and maintained a rate of progress hitherto unparalleled in the history of nations. To this fact more than to any other will the Centennial Exposition point. Of the 60 acres of ground covered by the exhibition buildings, only about 12 acres are devoted to agricultural and horticultural pursuits, while there are 14 acres devoted to the products of machinery alone. Time will probably show that the markets of the world will be opened to American manufacturers, and the Centennial Exposition will do much to bring the demand for our mineral and manufactured products in direct contact with the supply. The more we examine into this view of our subject, the more impressive it becomes.

During the last decade, the prices of our raw material and labor have ruled exceedingly high; and yet we have driven foreign steel from our markets. Our imports of cotton and of nearly all other manufactured goods are largely and continuously on the decrease. At the present time, our cost of production is diminishing by cheapness of labor. We are steadily grasping the edge tool trade. Our cast iron is forcing its way as the best yet produced, and the inventive power and intelligence of our mechanics are universally recognized. We are about to repeat the experience of the older nations. During an era of high prices, we developed our mineral resources and learned to manufacture high class goods, and to spin and weave our own products; but the comparatively high price of our labor and other similar causes excluded us from entering the competitive markets of the world. Fortunately for us, there has set in, with every prospect of a continuance, an era of diminution of the values of both material and labor, which will enable us to tender our goods in markets other than our own; and more fortunately still, the Centennial Exposition steps in and brings the purchaser to inspect our goods.

This is the first instance, in the history of the six great international exhibitions of the last 25 years, in which the question of the comparative cost of productions has been largely considered or mooted in an international sense. Never before have the representatives of national industries debated the questions of comparative cost of production, of affixing to exhibited articles their prices, of the propriety of competing unless such prices were affixed, and of the questionable policy of putting on exhibition products of manufacture, lest the nation mainly interested in such should gather information and ideas rendering them still more formidable as competitors in the world's markets. These are the facts which evidence the existence of a feeling that the Centennial will become the means through which new channels of trade are to be opened up, and long established markets are to be closed: and through which, while new customers are to be found, old ones are to be certainly lost.

Among the branches of American trade to be the most largely benefited, we may doubtless mention the iron, steel, machine, edge tool, saw, agricultural implement, woodworking machinery, general and special tool, timber, and cotton manufacturing industries. Nor will the intelligent foreign visitor fail to perceive that our remarkable progress in manufactures is largely due to the comparative liberality of our patent laws, and the encouragement given to inventors through the progressive character of our people. That the number of visitors to the exhibition will be large, the traveling propensities of Americans are probably a sufficient guarantee: that the attendance of the business community will be proportionately larger than at any previous international exhibition, there is every reason to presume, for the reason that competition is here unusually close. Every tradesman considers it his duty to be "posted" as to his competitor's goods and facilities to carry on his business; the "drummer," as our genus of the commercial traveler is facetiously termed, is a profuse American institution; while an American housewife scarcely makes a purchase without having priced the desired article at two or more stores.

We are convinced that the honors in the shape of awards will be eagerly sought, and that their possession will largely influence many branches of trade; while the benefits to be bestowed upon us by this peaceful industrial monument, erected to the Centennial of our national existence, are at present almost incalculable.

BAD VENTILATION AT THE CAPITOL

If the dozen or so of Congressmen now sick with throat disease shall serve, even in a moderate degree, to impress upon the people the evils of bad ventilation and of vitiated air, our afflicted legislators will not have suffered in vain. As martyrs, they will perhaps have done the country better service than as law makers. But the wretched ventilation of the House of Representatives is no new thing; neither is the foul atmosphere in the public schools of New York, though the existence of both sources of peril is once more being prominently brought into public notice by the daily papers. Poisoning the innocent pupil on one hand, and smothering the statesman on the other, are standing national abuses which, it might be argued, are only to be remedied by the slow alteration of public sentiment; but as abuses, they are superfluously glaring, and, by such examples as the present being brought into daylight, it is to be hoped that the full extent of their dangers can be rendered so apparent as to show the folly and culpability of neglecting the precautions necessary to avoid them. Carbonic acid is the product of perfect combustion and of the breathing of animals, the oxygen in the latter case uniting with carbon in the system; and the air expired contains about 4½ per cent of carbonic acid gas. This, if confined, contaminates the pure air in the room to such an extent that, if an atmosphere, containing one two-hundredth of it be breathed, headache and lassitude result. This, however, is not fatal, as air mixed with 5 or 6 per cent of the deadly gas may be safely breathed; but an atmosphere of 25 per cent carbonic acid is deadly. Children breathe about 14 cubic feet of air per hour, and this, when exhaled, contains 430 times the normal amount of carbonic acid; and so swift a poison does the air then become that if 100 persons were confined in a room, 18 feet square by 11 feet high, in which there was no ventilation, within two and a half hours every individual would be dead. Therefore, when people of sedentary occupations become afflicted with headaches and sore throats, and it is known that they habitually exist in a foul atmosphere, it is as safe to assert that they are being slowly poisoned as it would be had they contracted the opium or any other injurious habit. But to this source of danger must be added another: It appears that the ventilating arrangement of the House of Representatives is such that the cold air sweeps down upon the floor, and thus forces upon the members the foul atmosphere, generated by the gas burners and by the occupants of the galleries. The fresh air supply is taken in through the basement into the cellar, and is then forced up by fans through iron pipes, which, it is said, are "coated by many years accumulation of rust and particles of decaying animal and vegetable matter." From these the current goes through a series of horizontal air ducts, and finally, at a temperature of 100° or thereabouts, is driven into the chamber through registers, which for years have filled the office of spittoons. It is further reported that the mouth of the sewer which drains the Capitol is submerged, so that from every sink there is an escape of sewer gas into the building. Under this condition of affairs, there is no cause for wonder that those who occupy the House should complain.

AFRICAN RUBBER.

The coast region north and south of the Congo is becoming quite an important source of caoutchouc. It is produced by a giant tree creeper (*landolphia*), which grows principally along the water courses. It covers the highest trees, and frequently considerable extents of forest are festooned down to the ground, from tree to tree, in all directions with its thick stems, like great hawsers. Sometimes its stem is as thick as a man's thigh. Above, the trees are nearly hidden with its large glossy leaves of dark green hue, and studded with beautiful bunches of pure white star-like flowers, most sweetly scented. Its fruit is of the size of a large orange, yellow when ripe, and perfectly round, with a hard brittle shell; inside it is full of a soft reddish pulp of an agreeable acid flavor, much liked by the natives. It is not easy to obtain ripe seeds, as the creeper is a favorite resort of a villanous, semi-transparent, long-legged red ant—with a stinging bite, like the prick of a red hot needle—which is very fond of the pulp and the seeds distributed through it.

Every part of the creeper yields a milky juice when wounded; but, unlike the juice of the American rubber tree this milky sap will not run into a vessel placed to receive it It dries so quickly that a ridge is soon formed over a cut, and the flow arrested. When collecting it, the natives make long cuts in the bark with a knife, and as the sap gushes out they wipe it off continually with their fingers and smear it on their arms, shoulders, and breasts, until a thick covering is formed. Then they peel it off and cut it into small squares for transportation.

A COPPER-BEARING BIRD.

One of the most interesting of the West African birds is the plaintain eater, *corythaix paulina*, found abundantly in the thick forests of Angola. By the natives these birds are regarded with superstitious reverence, due apparently to their loud, hoarse, unbirdlike cry, which is of such evil omen that, if uttered within the limits of a town, the place is immediately abandoned. They are sometimes brought from the interior to the coast for sale, but the carriers are not permitted to bring them into towns along the road.

It is a remarkable characteristic of this bird that the gorgeous blood-red color of its wing feathers is soluble, especially in a weak solution of ammonia, and that the soluble coloring matter contains a notable quantity of copper. By burning the smallest portion of a feather in a Bunsen burner, the presence of copper is clearly manifested. By transmitted light, the ammoniacal solution is of a magnificent ruby red color. From a bunch of 300 feathers brought from Sierra Leone by J. J. Monteiro, about 16 grains of turacin was obtained by Mr. Henry Bassett, who reports that two copper determinations gave quantities of oxide of copper corresponding to 7·6 and 8·0 per cent of metallic copper. From an earlier investigation, Professor Church found 6 per cent of copper. Mr. Monteiro reports that the copper is derived from particles of malachite, so universally distributed over Angola, the habits of the birds seeming to favor this, as they are extremely inquisitive in their wild state, and given to picking up bright objects. On the other hand, he has known them to moult regularly and reproduce their splendidly colored feathers when kept in confinement where copper could by no means enter into their diet, except what might be con-

tained in fruit, rice, bread, biscuits, and vegetables, their customary food in the absence of their favorite bananas.

A specimen of an allied species, *c. Livingstonii*, was brought to England by Mr. Monteiro, who describes it as beautifully tame and gentle. It was most amusing in its habits and in the notice it took of everything around it. A change of dress, or even a new ribbon, excited its attention greatly. It would utter a loud cry and open out its lovely wings in astonishment, and, coming close to the bars of its cage, examine the new decoration with the liveliest curiosity. It was very fond of looking at pictures, especially brightly colored prints. At night it roosted in a little flat basket, in which it showed a child-like reluctance to nestle until it was sung to for a few minutes, when it would utter a satisfied sort of low rumbling noise, squat down, and go quietly to sleep.

The wild birds display their observing and extremely inquisitive disposition by running along the large branches of the trees in an excited and fussy manner, with outstretched neck and expanded wings, peering down on any intruder with every expression of interest. The natives believe that these demonstrations are intended to give travelers warning of danger from wild beasts and robbers.

THE COST OF MOTHS AND MILDEW.

A very striking illustration of the value which often attaches to a patent for a comparatively small invention, especially when the introduction of the same is skilfully managed, may be found in the large sums paid by our government for the use of a process for preventing moth and mildew in army clothing. The aggregate amount made thus far by the fortunate inventors, we do not exactly know; but in the Quartermaster General's report for 1874, the following passage occurs: "The expenditures on account of the moth and mildew proof process of Cowles & Co., during the fiscal year, have been $350,000. This includes $200,000 appropriated for the current fiscal year, but made available for expenditure during the last fiscal year." To prepare srticles not yet treated, an additional appropriation of $100,000 is asked; but this subsequently was cut down in Congress to $50,000. The patent was granted, September 20, 1864, to George A. Cowles, Jesse P. Case, and Victor Vieron, of New York city, and is based on the preservative action of sulphate of copper on vegetable fibers. By the addition of alum, the preserving qualities of the mixture are, it is claimed, greatly enhanced; and when gelatin is also combined, the fibers are said to be not only proof against decay, but also impervious to water. The ingredients are: Alum, 2 lbs., dissolved in 60 lbs. of water; blue vitriol, 2 lbs., dissolved in 8 lbs. of water; to which is added gelatin, 1 lb., in 30 lbs. of water. A still further improvement is said to be effected by acetate of lead, ½ lb., dissolved in 30 lbs. of water. The solutions are all hot, and separately mixed, with the exception of the vitriol, which is added cold.

The circumstances attending the adoption of, and the continued royalty paid for, this process, are soon, we learn, to be made the subject of Congressional investigation, it being alleged that the compound is valueless as a preservative, and that some officials have acted fraudulently with regard to it. Whether these charges are substantiated or not, the fact nevertheless remains that the government is out of pocket some $400,000, and that the patentees or managers of patents are the gainers of a very large sum of money. The actual value of a process which will effectually destroy moth and prevent mildew in cotton or woolen goods would be great, even if the particular process now in question proved worthless. The simple fact of such large amounts having been paid for the use of the patented process in a single article conveys some idea of what may be realized by the inventor of any other process for like purposes which can be proved to be really efficient, especially if he be lucky enough to find in the government so liberal a patron.

THE POWER OF BOILERS.

Our readers must have observed the many questions on this subject that occur in our correspondence columns; and it may have seemed curious to them that, while nearly every manufacturer talks of the horse power of his boilers, we have invariably replied that we were unable to define the term, or furnish any standard rules relating to it. We think, however, that we can give good reasons for the position that we have assumed. It is evident that, if we wish to measure anything, we must have some unit of comparison in which the measurement may be expressed. It is easy to determine the length of a piece of cloth in inches or yards, because these are standard units, fixed by law. But if every manufacturer of cloth used a measure of his own which he called at pleasure a yard or an inch, without regard to its actual length, it is clear that a general expression like two yards of cloth would not have any definite meaning; and if we wished to speak of yards, it would be necessary to specify what particular yards were meant: so that it might be said, for instance, that 5 of Mr. A's. yards of cloth were the same as 10 of Mr. B's. We shall show directly that this is about the way in which we have to compare boilers rated by different makers. Any one who has looked over the catalogues of steam engine builders has doubtless noticed that different makers *do not* have the same idea about horse power; so that an engine may be rated in one list as 5 horse power, while another maker may rate one of the same size at 10 horse power. Fortunately, the term horse power, as applied to a steam engine, has an arbitrary meaning; and if an engine is sold under the guarantee that it shall develope a certain amount of useful horse power, all engineers will agree upon the meaning of the guarantee. When there was little difference in the details of engines, it usually happened that a boiler large enough to furnish one engine with steam would answer for any engine of the same dimensions; and as each of these engines would develope about the same amount of power, it was usual to speak of a boiler as being of such a horse power, meaning thereby that it would furnish steam for an engine of that horse power. Having found by experiment the proper size of boilers for engines of different dimensions, the builders were enabled to construct empirical rules, and to say that, for each horse power that the engine was to develope, a certain weight or volume of water must be evaporated by the boiler per hour, requiring a definite amount of heating and grate surface. In those days, a boiler of 10 horse power, for instance, was one that would furnish steam for a 10 horse engine; and as the performance of such engines varied but little, the term had a tolerably definite meaning. In the course of time, as improvements were introduced, it was found that the size of a boiler was not always a measure of its efficiency, and that different engines were operated with widely varying measures of economy. It became common, also, to employ boilers for such purposes as heating, in which it was difficult to estimate the effect in horse power. Another disturbing cause arose from the fact that, as the demand for machinery extended and new manufactories were started, under the competition of the trade it was not uncommon for makers to change the old rating, so as to induce their customers to believe that they were getting more for their money. Now if Mr. Smith, who keeps a dry goods store, were to assume that a yard was only 2 feet, and offer to sell 12 yards of calico for the same price that Mr. Jones, who uses a standard yard stick, asks for 8 yards, very few people would be imposed upon, and probably an inspector would make things unpleasant for Mr. Smith. But it is very common for Mr. Robinson, who is a boiler maker, to decide that 10 feet of heating surface per horse power is a good proportion for a boiler, and offer a 15 horse power boiler for the same price as Mr. Brown's 10 horse boiler, which has 15 feet of heating surface per horse power. If any one will compare a few price lists of boilers, he will find just such anomalies as this; and will probably conclude that the size of a boiler will not enable him to express its power, for the reason that he has no standard by which to measure it. If he extend his inquiries a little farther, he will find engines developing precisely the same power, but requiring boilers of very different size and efficiency, for the reason that one engine may be much more economical than another. Experience shows, for instance, that there are some engines which require the evaporation of more than 100 lbs. of water per hour for each horse power, while others need less than 20, which sufficiently demonstrates the impossibility of rating the standard power of a boiler by connecting it to any engine, taken at pleasure, and measuring the horse power developed. It is evidently unfair to make a good boiler suffer for the faults of a wasteful engine—and the number of engineers supporting our view of the matter is daily on the increase—this view, briefly expressed, being that the proper method of estimating the power of a boiler is to measure the quantity of water which it can evaporate in a given time, as, for instance, an hour. Now if feed water is supplied to one boiler at a temperature of 60°, and the steam pressure is 100 lbs. per square inch, while the feed water of another boiler is 120°, and the steam pressure only 50 lbs., a pound of water evaporated in the first boiler must have more heat imparted to it than a pound in the second boiler. In a third boiler it may be still different; and in order to make a fair comparison between different boilers under various circumstances, it is necessary to reduce the evaporation of each to a common standard, the standard usually chosen being the equivalent evaporation that would have taken place if the temperature of the feed had been 212°, and the pressure of the steam the same as that of the atmosphere. A simple manner of making this reduction was explained a short time ago in the SCIENTIFIC AMERICAN (page 225, volume XXXIII). In measuring the evaporation of any given boiler, it is to be remembered that in some boilers water is carried over with the steam; and unless its amount is determined, the evaporation will be overestimated. A purchaser who buys a boiler measured on the basis of its actual performance knows exactly what he is getting for his money; but it seems desirable to many that some unit should be fixed upon, so that the performance can be expressed in horse power. Such a rating would undoubtedly be convenient in many respects; and the value of the unit does not appear to be a matter of much importance, but it seems difficult for engineers to come to an agreement in this respect. A few years ago a committee was appointed by the Franklin Institute to fix upon a standard for the horse power of a boiler. After long deliberation, they presented two reports. All the members of the committee agreed that the true measure of a boiler's power was its actual performance, or its equivalent evaporation of dry steam, from and at 212°. A portion of the committee considered that the proper measure of a horse power was the equivalent evaporation of one cubic foot of water per hour, while the remainder stated that they were unable to agree upon any standard. The report of this committee contains much valuable information in regard to the practice of different makers in proportioning boilers.

The most recent publication upon the horse power of boilers is a little pamphlet by Mr. Nystrom, which has already been briefly noticed in our columns. Mr. Nystrom claims to have established the legal definition of the horse power of a boiler, because his explanation is in accordance with the law of dynamics, and is not contrary to the law of the land. Without discussing this point, it is sufficient to say that Mr. Nystrom's definition, however legal it may be from his point of view, is certainly not legalized, and consequently only adds one more to the assumed standards, which are already too numerous and confusing. His method may be briefly illustrated as follows:

A cubic foot of water, when evaporated, forms a definite volume of steam, corresponding to the pressure; and if we take the product of: 1. The number of cubic feet of water evaporated per hour. 2. The increase of volume of each cubic foot of water, by its conversion into steam. 3. The pressure of the steam, in lbs. per square foot: and divide this product by 1,980,000, the quotient, which is the greatest power this steam can develope in a non-condensing engine, without expansion, is the horse power of the boiler. Suppose, for example, that a boiler evaporates 25 cubic feet of water per hour, and that the pressure of the steam above the atmosphere is 130 lbs. per square inch, or 18,720 lbs. per square foot. The relative volume of steam of this pressure is 192·83, so that the increase of volume for each cubic foot of water, on its conversion into steam, is 191·83 cubic feet, and the horse power of the boiler is the product of 25,191·83, and 18,720 divided by 1,980,000, or 45·3+.

Mr. Nystrom gives a formula for reducing the observed evaporation to equivalent evaporation from feed water at 32°. He states, as we understand him, that the correct determination of the quality of the steam is impossible in the present state of our knowledge, and consequently his rule is defective, basing the rating of a boiler upon its apparent evaporation, uncorrected for priming or superheating. Of course engineers who think that they are able to make these corrections can readily introduce them into Mr. Nystrom's formulas; but they will probably find that the method previously stated, of basing estimates of power upon the equivalent evaporation from and at 212°, is preferable, on many accounts.

THE PAY OF THE PATENT BUREAU.

The policy of reducing the salary of office holders, generally, which has occupied considerable attention in our present Congress, we do not intend to discuss; but we agree with the sentiments of a Washington correspondent of the New York *Tribune* in the opinion that a generous policy should be pursued by Congress toward the Patent Office, which not only is self-supporting, but has acquired a large surplus fund. The inventors pay all the expenses of this department; it costs the government nothing to run it; and it would be poor policy to reduce the expenses attending its management if inferior talent is to take the place of the present efficient Commissioner and his force of assistants, which will be the natural result. Inventors were never more active than now; and it would be a bad commentary on our Centennial year if any steps should be taken to lessen the enthusiasm of our great body of inventors, to whom is due so much of our nation's progress.

R. H. Duell, Commissioner of Patents, thinks, states the same correspondent, that it will be very unwise to cut down the expenses of a self-sustaining bureau like his. He says that the United States Patent Office has long had a large annual surplus, that its business is increasing, and that there is no reason apparent for reducing either the number or pay of its officers. "The work of the office requires special training; even with the present pay, it is not possible long to keep in government employ many of those best fitted by talent and experience for the duty; the credit of the office and the interest of inventors, whose money supports the office, and of manufacturers, whose capital to the extent of many millions is involved in patents, are imperiled by inefficient work; and the increased number of patents and the general progress of the arts render the proper examination of applications each year more difficult. The erroneous issue of a single patent may easily involve the loss of ten times the amount of the yearly pay of an examiner. These examiners are not only to grant patents, but to see that none are improperly granted. Inventors pay to the government more than enough to afford the small pay now allowed. To take possession of this fund, and then furnish half paid (and consequently poor) service, seems like a fraud on inventors. Should the proposed reduction be made, it will be impossible to keep up the business of the Office." The receipts from applications for patents have run up from $703,191.77 in 1873 to $743,453.36 in 1875, and the surplus last year was $21,795.65. The appropriation for 1875 6 was $436,400; the House bill proposes to cut down the appropriation to $370,220, and the working force from 351 to 294.

Black Varnish for Iron.

A durable black and shining varnish for iron is made by adding to oil of turpentine strong sulphuric acid, drop by drop, stirring until a sirupy precipitate is formed, and no more of it is produced on further addition of a drop of acid. The liquid is now repeatedly washed with water, until the water exhibits no more acid reaction. The precipitate is next brought upon a cloth filter, and after all the water has run off, the sirupy mass is fit for use. This is painted over the iron with a brush, being previously diluted with oil of turpentine, in case it does not flow well. Immediately afterward, the paint is burnt in by a gentle heat, and, after cooling, the black surface is rubbed with a piece of woollen stuff dipped in linseed oil. This varnish is said to combine chemically with the metal, and does not wear or peel off.

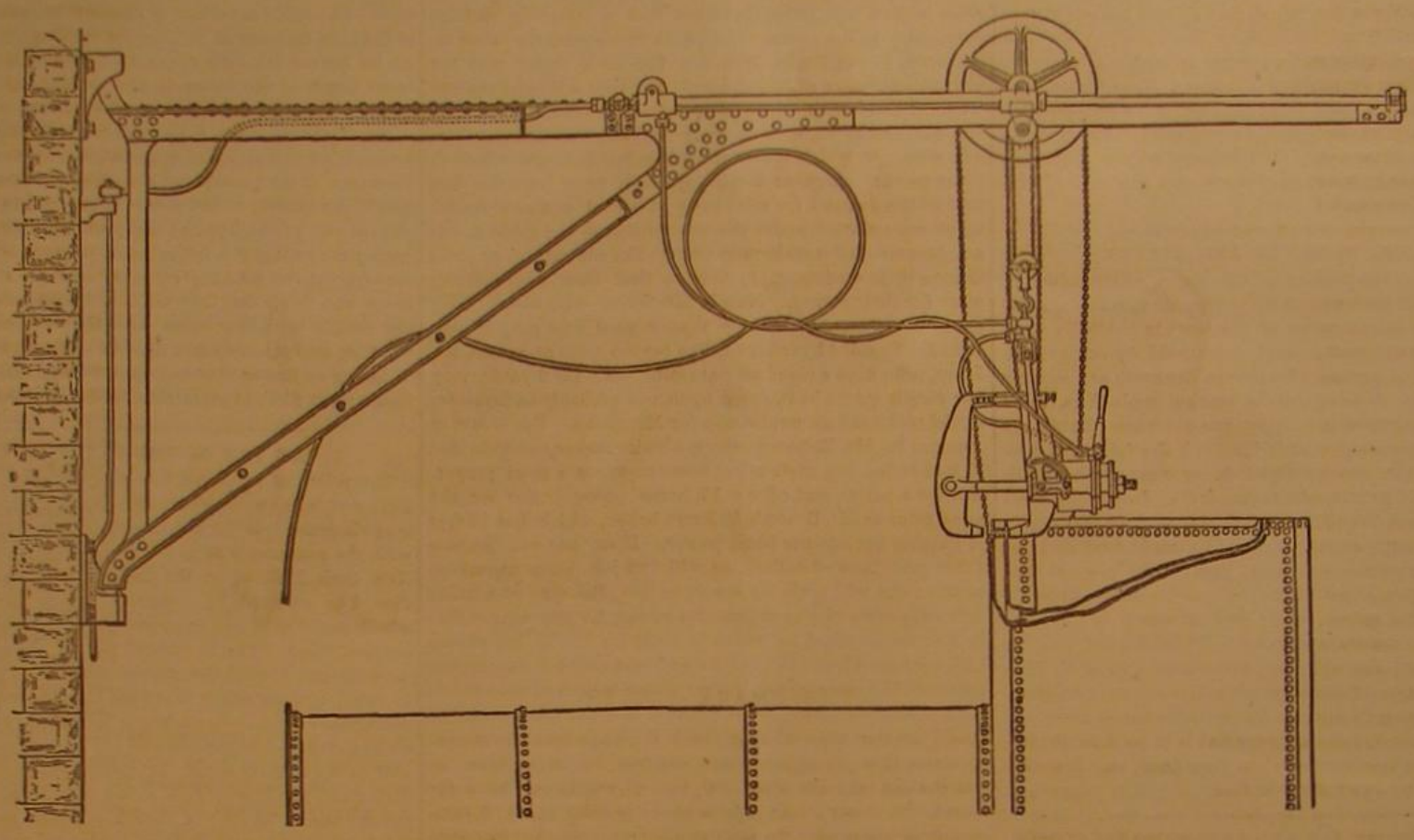
SOME idea of the immense slaughter of buffaloes which yearly takes place on the plains and which is rapidly leading to the total extinction of that animal, may be gleaned from the fact that seven cars freighted with buffalo bones recently arrived in this city. The material will be worked up into buttons, knife handles, etc.

A PORTABLE HYDRAULIC RIVETING MACHINE.

Mr. Tweddell, a well known English mechanical engineer, has recently designed apparatus for riveting locomotive boilers without removing them from the engines. The machine has been erected and is now in use at the Crewe Locomotive Works of the London and Northwestern Railway, where it has been found very useful for doing such work as could not conveniently be brought to the fixed riveting machines.

The arrangement, says *Engineering*, is so simple that not much description is needed. An ordinary swing crane has attached to it an hydraulic sleeve or outer cylinder, which is moved along a fixed tube or pipe by means of a pinion worked by a sprocket wheel, this pinion gearing into a rack attached to the crane. The water, which is supplied under a pressure of 1,500 lbs. per square inch from one of Tweddell's differential accumulators, is taken from the main laid along the shop wall, and thence up the center on which the crane radiates. Thus any motion caused by swinging the crane is reduced to a minimum, and a swivel joint, almost frictionless, causes no twisting strain to be imparted to the pipe. After leaving this joint the pipe is led along the jib, as shown. There is communication between this fixed pipe and the larger one which slides on it, and this sleeve or sliding tube is balanced.

The riveter is hung from one end of the sliding sleeve, and the pipe conveying water to it from the other. The water is then, by means of a simple frictionless universal joint, led into the machine, which is free to turn completely round in a horizontal plane. The raising or lowering is done by blocks, and the angle of the machine jaws can be altered from vertical, as shown, to horizontal, by the quadrant in the suspending gear. It will be seen that there is no strain on any of the pipes, and the great difficulty in transmitting the pressure to a riveter or other machine in a portable form is overcome. We understand that the saving in cost of riveting by this method over the present mode is about four fifths, and the quality of the work is, like all that done by hydraulic pressure, excellent.



TWEDDELL'S HYDRAULIC RIVETER AND CRANE.

THE MANUFACTURE OF ANTHRACENE.

We illustrate herewith an improved method of obtaining anthracene, one of the most valuable products from coal tar, which has been invented by Messrs. Fenner and Versmann, of England, and patented in this country. The inventors claim that they have succeeded in obtaining anthracene from coal tar pitch, all previous attempts to do which have been failures. The anthracene is obtained in a comparatively pure state, with only a small proportion of other hydrocarbons, such as naphthaline or chrysene, mixed with it. Progressively increasing temperatures are employed in the distillation till finally a heat as high as 600° or 800° Fah. is reached. As the heat rises, the more solid constituents of the pitch become volatilized, till anthracene comes over; this occurs at a temperature of 600° or 800°.

Fig. 1 represents a plan view, and Fig. 2 a side view, partly in section, of the apparatus. *a* is a cast iron vessel, in which the coal tar pitch is placed for distillation by the furnace, *b*. *c c* are flue spaces by which the heat may be retained in contact with the surface of the vessel, *a*. *d* is a pipe with a stop cock, *d'*, by which pitch may be supplied to this vessel, *a*, and *e* is a pipe by which the anthracene and matters combined therewith, obtained in the distillation, are conducted in the form or vapor from the vessel, *a*, to a condensing chamber, *f*; but in the passage of the vapors along the pipe, *e*, they become cooled by the surrounding atmosphere, and the products of condensation flow by one or other of the branch pipes, e^1 e^2 e^3, to the receiving tank, *g*. The oil collected in the vessels or tanks, *f* and *g*, is drawn off therefrom through suitable taps. When the product distilled at about 400° begins to issue from *a*, it passes along *e* and at first reaches to and (part being principally non-condensed vapor or gas) enters *f*, as the temperature is raised, and anthracene begins to pass over. The richer oily product containing anthracene passes along e^1 into the chamber, *g*. The temperature being still further raised, or continued at a high standard, such as from 600° to 700°, the oily product distilled becomes more charged with anthracene. The tap in the branch pipe, e^2, is then opened, and if necessary, owing to the increasing density of the oil, the tap in the tube, e^3, is opened, so as to provide a short and ready passage for the distilled product into the receiving vessel, *g*.

Fig 1

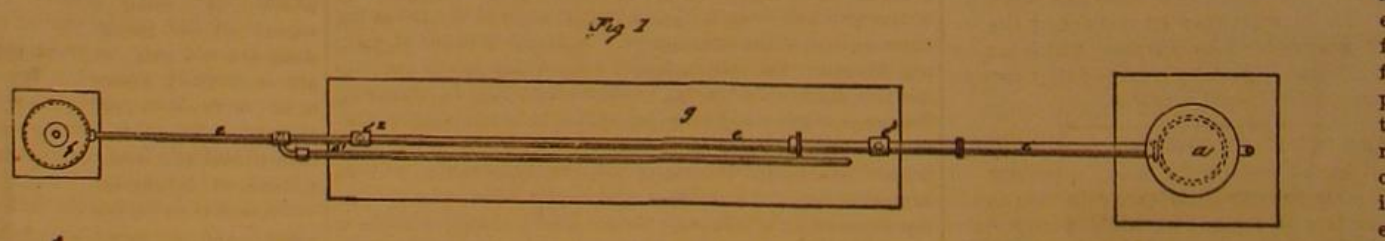
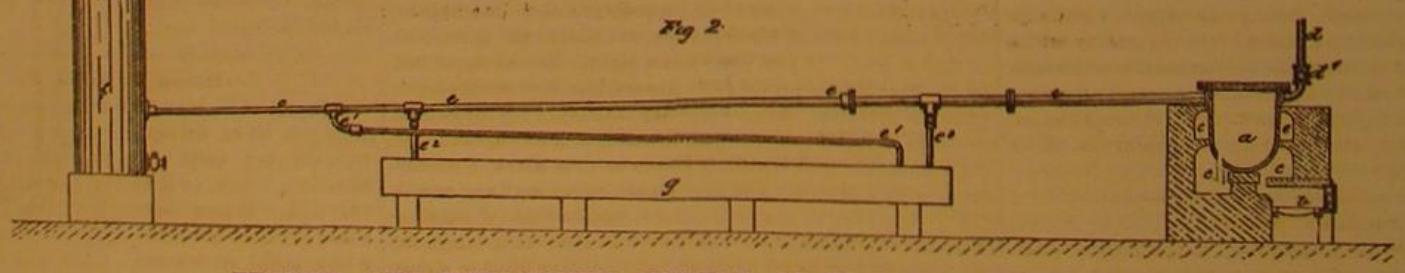
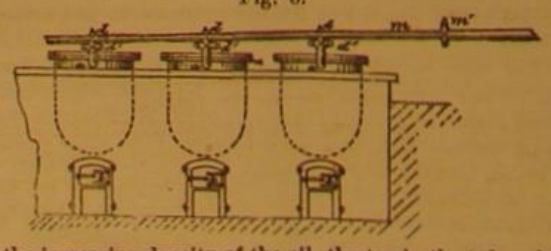


Fig 2.



FENNER AND VERSMANN'S METHOD OF MAKING ANTHRACENE.

Fig. 3.



The production of anthracene can herein be combined with the distillation of heavy oils from coal tar (thus making one continuous process of the two operations) by distilling the heavy oils from coal tar in a wrought iron boiler, *n*, connected with a set of cast iron retorts, *a*, taking care, however, that they are capable of withstanding the high heat. As soon as the heavy oils have been worked off, a residuum of pitch is left; and without allowing to cool, it is at once run off into a set of vessels, *a*, which have been previously heated, and in which the distillation is proceeded with until the liquid or gaseous products have passed over to the condenser, aided in some cases by the use of a partial vacuum. Fig 3 represents a sectional view of the apparatus arranged to operate according to this method of working. *m* is a pipe by which liquid pitch may be conducted from the boiler, which is not shown in the engraving, to branches, *d*, with taps, *d'*, by which to supply vessels, *a*, such as already referred to. *m'* is a tap in the pipe, *m*, to regulate or to stop the supply, as required.

An Ostrich Egg Incubator.

We have pointed out in previous articles that the raising of ostriches in this country, for their feathers, might prove a profitable industry. It would further seem that the simplest way of obtaining the birds would be to procure the ostrich eggs, and pack them according to the well known recipes for preserving hens' eggs. On their arrival in this country, hatching might be accomplished by an incubator similar to that now in successful use in South Africa. The apparatus is a wooden box about three feet square, open from above and capable of containing twenty-five eggs. It rests upon a copper or zinc pan three inches deep and equal in size to the box. The warm temperature of the water is maintained by a paraffin lamp kept burning outside, underneath an extension of the pan which is carried through the wall of the box. The heat can be regulated as necessary, thermometers being constantly in use. The temperature of the box where the eggs are placed is 102° Fah. when they are first put in. After two weeks it is gradually reduced to 100°, and in two weeks more to 98°. The period of incubation is forty-two days. The eggs are turned and aired by opening the box and blanket covering once or twice a day. A fortnight before the time they are held up against the light to examine their condition, and a week after are slightly punctured near the top, to enable the chicks more readily to break the shell. When hatched they are turned, kept warm, and fed with cut lucerne, and allowed to run about their inclosures like ordinary fowls. It is stated that in natural hatching the average number of birds raised is sixteen out of twenty eggs; in artificial, when properly managed, not more than one out of twelve eggs fails.

THE CATTLE OF THELEMARK, NORWAY.

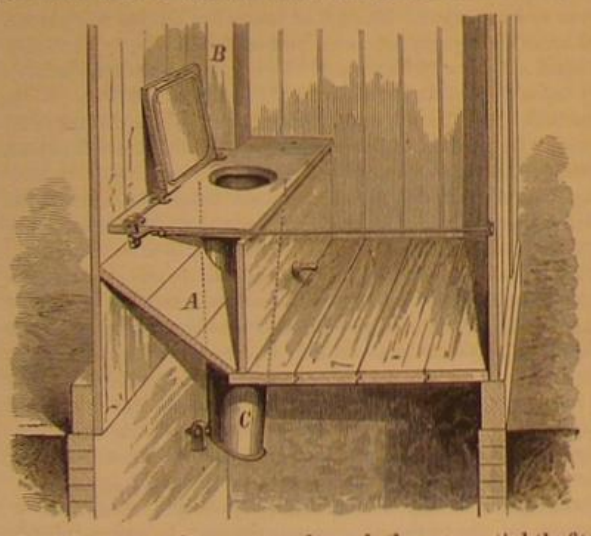
We find in an interesting report by Mr. H. M. Jenkins, on the agriculture of Sweden and Norway, a description of a remarkable breed of cattle indigenous to Norway, which, even in these days of cross breeding and improvement, is still found in its original purity. We select the engraving from the *Journal of the Royal Agricultural Society of England*, Mr. Jenkins being commissioned by the Society to make the report. The cattle, as will be seen, are small, full grown cows seldom attaining a greater weight than 700 or 800 lbs.; they are a mountain race, and their diminutive size may be fairly attributed to the poverty of their food and the rough weather and long winters of their habitat. They are good milkers, the best in this particular of many breeds kept at the royal farm at Ladegaardsoen having been of this race. Moreover, the care and good living bestowed on the race at the farm have somewhat increased the stature and weight of the animals. One cow milked, in 1868, 646¼ gallons, in 1869, 720 gallons, in 1870, 689¼ gallons, or on an average of three years, 685¼ gallons, with a living weight of about 790 lbs.; that is nearly 9 lbs. of milk for each 1 lb. living weight annually, a result which bears comparison with the best milking breeds. Usually the Thelemark cows do not milk highly immediately after calving, seldom more than 3½ gallons daily, but they maintain the yield evenly, and do not remain long dry. Like every other good milking breed, the Thelemark cows are very liable to milk fever; for which reason it is very important to keep them on a low diet for some time before and after calving.



THELEMARK CATTLE.

SELF-CLOSING CLOSET LID AND ANTI-NUISANCE CLOSET.

The invention represented herewith aims to exclude sewer or vault gases from yard closets, and to offer protection against the very injurious cold draft in these as well as in railroad car accommodations. The lid is provided with a self-closing device and elastic packing, which exclude the gases from all sorts of closets. The closet door is suitably connected with the lid, so that, when the former is opened for the exit of the user, the lid is shut invariably. A board apron, A, below the seat closes the vault, compelling the gases to pass out by the ventilator flue, B. A tube, C, attached to the lower side of the seat board and provided below by a



balanced valve or flap, passes through the apron, tightly fitted by packing. Anybody cognizant of the present unwholesome yard closets and railroad car accommodation, throughout the country, will readily appreciate the improvement.

Patented December 14, 1875. For further information, relative to sale of rights, etc., address R. d'Heureuse, P. O. box 395, New York city.

Packing Butter.

A well known dairy authority gives the following directions for packing butter so that it will keep sweet for 8 or 9 months: "Make a brine with a saturated solution of the purest salt you can get, using 1 lb. of saltpeter to about 20 lbs. of salt. Scald the brine by bringing it to a boiling heat, skim, and apply when sufficiently cool. The casks should be carefully prepared as well as the brine. If the gum and sap in the wood are not removed before the casks are used, they will work out into the brine and affect the butter. To remove the woody flavor from the casks, a thorough steaming with a high pressure is the quickest and best means. If soaked before the steam is applied, hot steam will cut the gum and woody flavor all out in a short time. If steam is not convenient, soak in brine a week or so, and then fill with boiling hot brine, and let it stand till it gets cool. By keeping the butter under the brine and the casks full and in a cool place, the butter can be kept safely. Some of the tin-lined packages which have recently been introduced, and which are easily hermetically sealed, would be much more convenient and probably fully as cheap as the oak casks and brine, and are claimed to be equally efficient in preserving."

Straightening and Bending Pipes.

In order to straighten lead pipe, if the bore of the pipe is 1 inch or more in diameter, dress out a wooden rod small enough to enter a hole the size of the bore; then point one end, grease the surface thoroughly, and work and drive the rod into the pipe Draw the rod back and turn it a trifle at every blow. If the pipe is small, less than one inch in diameter, drive in a pointed iron rod, turning it at every blow, so that the rod may not stick so tightly that it cannot be withdrawn. To bend a lead pipe without forming kinks, fill the bore with dry sand. To bend an iron pipe, fill the bore with dry sand, stop the ends with stiff clay, heat the pipe where it is desirable to have the curve, and the pipe will bend readily without making kinks. If the dry sand will not run out, water will wash it out.

Annual Report of the Chief Signal Officer.

We are indebted to Brigadier-General Albert J. Myer, Chief Signal Officer, U. S. A., for a copy of his annual report, being for the year 1875. This book, of 475 pages, exhibits annual reports from the United States Signal Stations in every part of the United States, in the West Indies, Canada, and Alaska, showing the work done, the number of disasters averted, the improvements made, and the wide favor in which the signal service is held. It contains monthly weather reports for the year for all parts of the country, illustrating by numerous charts, the temperatures, barometric pressures, rainfall, humidity, and direction and force of winds. It is a record of all important electrical and optical phenomena, all general storms, and all marine disasters. It contains several large international weather maps, which illustrate the great meteorological changes in North America and Europe. The oscillations or variations of the tides, of the principal rivers in the United States, are recorded by diagrams. The records of miscellaneous phenomena are interesting and extensive, covering natural history, forests, polar lands, meteors, zodaical light, earthquakes, etc. The extensive, varied, and exact information contained in this report makes it a document of unusual scientific value. It is published at the government printing office, Washington, D. C.

Toning of Photo Transparencies on Glass.

This operation is scarcely necessary if the transparency should have been reinforced with acid silver, and is only required to be viewed by transmitted light. But silver as well as alkali-intensified films have generally a very disagreeable color by reflected light, and many amateurs object to this. The use of a weak solution of chloride of gold obviates this difficulty, but, unfortunately, the color thus given is too cold to suit many tastes. The best toning agent we have used is chloride of copper, followed by an application of alkaline pyro.; any tone by transmitted light is attainable, while the color of the deposit by reflected light is either black or a deep warm brown. On no account resort to any of the formerly recommended methods of toning by mercury; the colors, though beautiful to the eye, are evanescent, and sooner or later the picture becomes one shapeless blotch.—*British Journal of Photography.*

Fast Ocean Steaming.

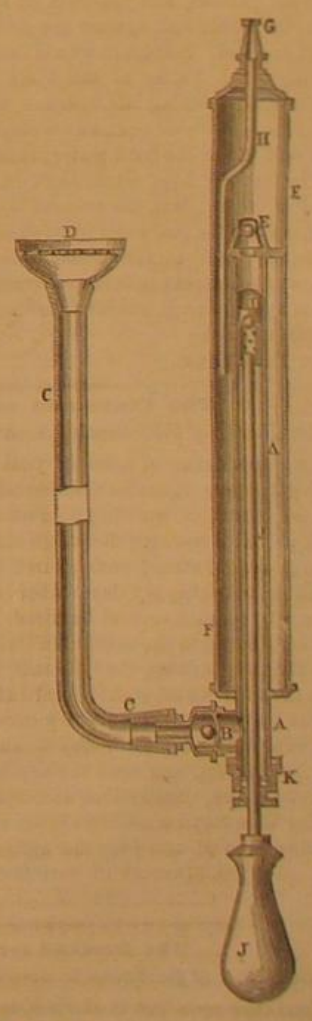
The Germanic, mean displacement 8,525 tuns, recently made the trip from New York to Queenstown, Ireland, 2,894 national miles or knots, in 7 days, 15 hours, 17 minutes, being an average of 15·8 knots per hour. This is the fastest time on record. The mean boiler pressure throughout the voyage was 63 lbs., mean vacuum pressure (condensers) 27 inches, revolutions of engine 55·57 per minute, indicated horse power, 5,434.

The Coming Fiber.

It is well known that with proper methods a certain percentage of fiber suitable for felting into a sheet which may be called paper can be produced from any plant that grows. This fact shuts the door in the face of the inventor in this line. It is possible to obtain letters patent in this country for a certain plant as a material for papermaking, but the value of such a patent is questionable. All who are interested in seeking new papermaking materials among the products of the vegetable kingdom must bear in mind the several absolutely essential elements which are necessary to any successful operation. A vegetable fiber, to compete rags or other leading material, must be such as will admit of yearly production either from its own root or from seed sown and cultivated, like jute or straw; it must grow in large quantities, and must not present great obstacles to ready and cheap harvesting; it must be grown in easy connection with cheap transportation lines; it should yield at least fifty per cent good fiber; and should not offer difficulties which the present improved systems of treating other vegetable fibers will not readily overcome. Failing to possess any or all of these attributes, any new candidate to the favor of the trade would undoubtedly meet with disfavor. As stated above, the vast majority of the so-called new fibers fail in one or more of these essential points, and people who are experimenting to-day with such materials will only have their labor for their pains. It may be truly said that this diligent search for new vegetable fibers is to-day unnecessary. Esparto, straw, and wood are the great substitutes for rags in foreign mills. In this country wood and straw have the field to themselves With the present processes wood can only be made into the better grades of paper by chemical auxiliaries, which are expensive and can be worked profitably only by recovering the alkalies. Ground wood is the great cheapening element in paper manufacture at present, and it can only be used in the lower grades of paper. Straw therefore comes to the point as fulfilling more completely than any fiber the wants of the trade. If worked to better advantage, it alone, in addition to rags, would furnish all the papermaking material required.—*Paper Trade Journal.*

A NEW GARDEN PUMP.

M. Reynier, of Paris, France, is the inventor of a new garden pump, easily operated, and which gives a continuous, spray-like stream which may be accurately directed to the plants which it is desired to water, without necessitating the wetting of others. Water is drawn in at the flared orifice, D (which is provided with a sieve to prevent entrance of impurities), and passes through the tube, C, and ball valve, B, to the interior pipe, in which works the perforated and valved piston, I. When this piston is drawn back, the water, already in its rear, passes through it, the valve, I, opening. On being driven forward, the valve, I, shutting, and the valve, E, opening, the water is forced into the pump body, A, where it compresses the air, which, in turn, forces it out through the tube, H, and nozzle, G. At the same time, a fresh supply of water is drawn in through valve, B. The annexed engraving is extracted from the French *Bulletin du Société de l'Encouragement de l'Industrie.*



THE mucilage used by the government for postage stamps is composed of dextrin 2 ozs., acetic acid 1 oz., water 5 ozs., alcohol 1 oz.

Correspondence.

Multiplication of Minus Quantities.

To the Editor of the Scientific American:

As some of your readers are puzzling over the question why *minus* multiplied by *minus* gives *plus*, and *plus* multiplied by *minus* gives *minus*, I wish to explain thus:

In multiplication, it is all the same which of the factors you call the multiplicand and which the multiplicator: $2\times3=3\times2$ and also $3\times-2=-2\times3$. Now multiplication means to take one factor as many times as there are units in the other factor: -2×3 is therefore *minus* 2 taken 3 times, thus: —2
—2
—2
—6, and by the above 3 multiplied by *minus* 2 must be the same. This shows how *plus* multiplied by *minus* gives *minus*.

Again: -2×3 being $=-6$, -2×2 being $=-4$, -2×1 being $=-2$, -2×0 being $=0$, we see that the product increases by $+2$ for every unit of decrease in the multiplicator. If we then decrease the multiplicator still farther by single units, the product must continue to increase by *plus* twos, namely: $-2\times-1=+2$, $-2\times-2=+4$, $-2\times-3=+6$. Nothing seems simpler or clearer.

But if there is any one who yet fails to see how the product of multiplication can increase in proportion to the decrease of the multiplicator, let him look at it in this way: It is a negative quantity (—2) which we multiply. The negative product decreases with the multiplicator.

Three times *minus* 2 = *minus* 6, twice *minus* 2 = *minus* 4, once *minus* 2 = *minus* 2, no times (0) *minus* 2 = nothing (0).

We have here the products of —2 multiplied by $+3$; $+2$; $+1$; 0; each multiplicator being one less than the preceding one; each product is —2 less than the preceding one. Minus one (—1) is one less than nothing (0). The product of -2×-1 must therefore be one *minus* two less than nothing (0), that is, $+2$. But how does —2, taken away from nothing, leave $+2$?

To make this clear you have only to substitute $+2-2$ for 0. Of course if I have two less two, I have nothing. But ir from this nothing thus expressed, $+2-2$, you take away the —2, does it not leave you $+2$?

C. F. ERHARD.

The Alluvial Lands of the Mississippi.

To the Editor of the Scientific American:

The reclamation of the alluvial lands of the Mississippi river can be accomplished simply by allowing sufficient breadth between the levees or banks on each side of the river for the water to escape through at flood hight. This can be done by straightening the levees, running from bend to bend, and allowing a breadth of from four to six miles from levee to levee, which will allow a flow of water across the neck of points in the case of extreme high water, which gives a more direct and regular current than is attainable with the present levee system, from the fact that the current across the neck meets and counteracts the force of the channel current, and prevents its rolling with so much force into the bends and against the portion of the levee that is most exposed. Besides, it would facilitate the escape of water through the Valley to the Gulf. Straightening the false banks and widening the distance between them will allow of closing the side channels without danger to the levees, and will lower the flood water mark one or two feet.

The levees, once established on this basis, will seldom need repairs. But the present system of leveling in the points confines the water at flood hight within the limits of its banks; and as the water rolls away from the point, it throws the current into the succeeding bend with its undivided weight, until the levee is forced in, and crevasse and overflow ensue.

HORATIO F. HICKS.

St. Paul, Minn.

The Centennial on Sunday.

To the Editor of the Scientific American:

Correspondents of some of your cotemporaries are advocating keeping open the Centennial Exhibition on Sundays, for the benefit of working men who may be poor or too occupied to lose a working day to go and see the show. Americans generally attend some church or pass the day with their families, believing six days' labor in the week to be sufficient. Now why should several hundreds be compelled to work all day on Sunday at the exhibition buildings, in attending upon the visitors, running the railroads, etc., for the accommodation of a throng of sight-seers? It seems to me it would be better for the limited class of persons that are unable to visit the exhibition on a week day to subscribe for the SCIENTIFIC AMERICAN, and read the accounts of what is exhibited, and study the illustrations accompanying the descriptions, rather than impose needless labor upon those who prefer and need one day of rest from the arduous labors of the week.

A MEMBER OF THE SOCIETY OF MECHANICS AND TRADESMEN.

The Demand for Labor.

To the Editor of the Scientific American:

Your correspondent in Harlem, in speaking of the troubles of a tool maker, seems to overlook the fact that at the present time the supply of labor is in excess of the demand, which, of course, puts the workman or the seller of labor in the power of the purchaser or employer of labor. The remedy which he suggests, that each man should have a certificate of his skill, is right enough for some purposes; but what is the use of a certificate when there is no situation? If two men with certificates of equal merit apply for work from the same employer, who requires but one, and stern necessity compels one man to accept any terms, he that will work for the lowest wages will of course get the preference. These men should say to each other: "There is not work for us both, but, by each working half time until there is more demand for men, we shall each not only have a fair share of what wages there are earned, but prevent the employer from pitting one against the other in the struggle to live." This remedy, I believe, should be applied at all times when the supply of labor is in excess of the demand. Of course, to those at present fully employed, it would create a slight stringency in the money market; but it would drive absolute want from many a fireside.

Toronto, Canada. ONE OF THE EMPLOYED.

How Strikes may be Prevented--Free Trade the Remedy.

To the Editor of the Scientific American:

In the edition of your paper for March 18, a correspondent complains of the fact that certain parties, after advertising for tool makers, were unwilling to pay more than $2.50 *per diem* for competent men. He thinks that the state of affairs which enables an employer to hire a skilled man for that sum is not right, and he proposes to rectify matters by having the trade "legally recognized, so as to have a complete and perfect registry kept of all men who pretend to be skilled workmen," the wages being regulated by a mixed board of employers and employees. The first thought that occurs to me on reading such letters is to wonder that a man of sufficient ability to write a letter at all, or make tools requiring intelligence in their construction, should have so little acquaintance with the laws which control wages and kindred matters, as is exhibited by D. In expressing his disbelief in the efficacy of strikes to smooth the way of the working man, D. shows that his is not as hopeless a case as others; but he has a longing for governmental interference between employer and employed that savors too much of communism to be acceptable to working men of self-dependent power. He condemns strikes, but attributes the prevalence of those organized acts of folly to the fact that employers get men to work for the lowest wages they will take. Why will not D. and men who argue in his train of thought consult their own action, and learn the true explanation of the labor troubles? Does D. ever pay $10 for a pair of boots when he can get as good ones for $5? If he does not, how can he expect an employer to act on different principles, and pay $4 a day to workmen when other men of equal skill ask to be employed at $2.50? "But," says D., "they are not of equal skill, and the employer does not get as profitable return from the $2.50 as he would from the $4.00 one." Will not D. see that the employer, in the majority of cases, knows his own business best, and that it is better that he and the workman should make terms on which to exchange money and labor rather than call in the assistance of outside parties to settle it for them? Would D. maintain that it would be better to make him give A $10 for the boots than get them of B. for $5, or exchange four days' labor for what can be had for two days'?

Men will be better off when they learn to look facts in the face, and not delude themselves with sentimental longings for a Utopian state where "everything is lovely." This wages and labor question is simply a continuation of the fight for existence which Science shows to have gone on in the past among all living things, and still goes on.

The present writer is a working man, and as anxious as anybody to get the best price for his labor; but he has had the good fortune to have read works by the working man's best friends, the writers on political economy, and he has become convinced that the truth, as established by Nature and confirmed by experience, is what should guide working men in their efforts to improve their general condition. It is unfortunate in the extreme that elementary works on political economy are not studied in the public schools. From the halls of Congress to the humblest workshop in the land, profound ignorance reigns on subjects of vital importance to the public welfare. When grave and reverend senators eloquently advocate excluding the products of foreign countries, so as to reduce competition with the interests they represent, there can be no consistency in the bosses of those factories condemning the principle of strikes. But both are wrong. The striker is wrong, not in refusing to work if he does not like the wages, but in obliging others to desist from working for the wages he refused. The protectionist is worse than the striker; for while looking solely to his own interest, he pretends to have the welfare of his working men at heart, and besides uses the public money and officials to secure himself against competition, that is, he can sell dear where but for them he would be obliged to sell cheap. The labor problem is so complicated that no one can, in newspaper articles, explain and make clear every point of the subject; but a vast deal of good can be accomplished by directing the attention, of those most interested, to sources where the subject is discussed in full. If every working man, and every employer too, in the country would read Bastiat's little book on political economy, I think that it would do much to put an end to strikes and disagreements among employed and employers. It would show both parties how dependent on each other they are, and teach them the folly of quarreling. It would also open the eyes of working men to the mistake they make on the whole, when they sustain the doctrine of protection and monopoly. Capital is simply preserved labor, pickled down for future use. The workman's capital is his skill and strength; he ought to be allowed to exchange it at will, and where he can do it to the best advantage; but the striker and protectionist deprive him of that right. When justice comes to rule the world, protectionist and striker will have no advocates. In that day it will be admitted that perfect freedom is the condition most conducive to general and individual prosperity, and that, although competition and the introduction of machinery may occasion temporary suffering, the cause of virtue, happiness, and progress is best promoted by free trade.

Rochester, N. Y. E. R.

The Great Engineer for President.

To the Editor of the Scientific American:

Your nomination of James B. Eads for President was a happy thought, whether it will amount to any thing or not. There are many, who now never go to elections, who would go if there were any hope of electing a man of his intellect, who could not be corrupted. "But," says one, "what evidence have the people at large of his great intellect, or of his incorruptibility?"

By his works we know him to be a man of great intellect; and by his dealings with men, as well as with Science, we know that he is not liable to be led astray. The choice of his education in the exact sciences shows that he was born a lover of truth; and his success in mastering and applying them indicates an intellect which will not easily turned into uncertain ways.

What could produce a happier Centennial event than to elect such a man President, one who has never been soiled by politics, whose great intellect has always been on the track of truth, with such universal success?

Lyons Falls, N. Y. D. S. HOWARD

[For the Scientific American.]

ARTIFICIAL ICE.

BY P. H. VANDER WEYDE.

It has been explained in the previous article, published on page 177, current volume, that when, without the aid of heat, water is evaporated by means of a vacuum, aided by the absorbent action of sulphuric acid on watery vapor, the latent heat needed for the formation of this vapor will cause the abstraction of so much heat as to freeze five eighths of the remaining water. In a liquid more volatile than water, this evaporation takes place more readily; and hence many attempts have been made to produce cold by the evaporation of very volatile substances, such as alcohol, various ethers, carbon bisulphide, liquid ammonia, and even nitrous oxide and carbonic acid. Among the partially successful attempts, I may mention those made some 15 years ago by Professor Twining, of New Haven, and Siebe, in England; they used common ethylic or so-called sulphuric ether. More recently, about 10 years ago, Tellier, in France, used methylic ether, of which the effectiveness was supposed to surpass that of the ethylic ether in proportion to the lowness of its boiling point, which is at about 0° Fah., while the common ether boils at 90° Fah. It was, however, soon found out that there is no advantage in using liquids of such very low boiling points, as part of the power used has to be employed for working powerful compression pumps to reduce the obtained vapors to the liquid condition, as of course economy of the process absolutely requires the use of the same liquid over and over again. The use of two other liquids was patented some eight years ago: one, carbon bisulphide, by Professor Paersh, of New Orleans, and chymogene (petroleum ether), by myself. The first of these liquids boils at 112° Fah., while the latter has the advantage of being cheap and abundant, being a by-product of petroleum distillation, where it can be obtained in various degrees of volatility, varying in its boiling points from 20° to 50° or more Fah. It ought to be stated that the vapor of the substance is quite dense, being 4 times heavier than atmospheric air, while in its fluid condition it is decidedly the lightest of all liquids, its specific gravity being 0 6. So that while water, when evaporating, expands to 1,728 times its volume, forming a vapor of which the specific gravity is about half that of the atmosphere, the expansion of the liquid, when assuming the state of vapor, is only equal to $1,728\div2\times4=216$ times. As the amount of expansion which various liquids undergo, when evaporating, bears a close relation to the amount of latent heat absorbed by the vapors, this small expansion may appear disadvantageous to the use of light liquids producing heavy vapors, for the purposes of refrigeration; however this ise especially in the case of chymogene, compensated for by the fact that, in displacing vapors by the air pump, we have only to do with volumes; and as the figures representing tht latent heat of vapors have only relation to equal weights, ir is evident that a heavier gas will, for the same bulk, contain an amount of latent heat proportional to its specific gravity, and will therefore withdraw, during its formation, a proportionately large amount of heat from the material to be cooled. As an offset to this, the latent heat of gases is almost in inverse proportion to their specific gravity; so that after all, the amounts of latent heat for equal bulks do not diffe, widely, but vary only slightly from just under 400 to a little over 600 Fahrenheit units of heat.

Chymogene possesses one special advantage in its boiling point, which is not so high as to require so great a degree of exhaustion to evolve the vapors as is the case with water, and even alcohol, carbon bisulphide, and ether, nor so low as to require extraordinary pressure to recondense the vapors to the liquid condition, as is the case with ammonia, methylic ether, and especially nitrous acid and carbonic acid.

In regard to the two last named substances, they were thoroughly tried, in their liquefied condition, as to their adaptability to produce cold and refrigeration. The first, nitrous acid, boiling at 130° below 0° Fah., was tried by me; and in 1864 I applied for a patent for the invention, but soon

withdrew and abandoned the same, becoming convinced of the serious disadvantage of having to employ machinery calculated to withstand pressures of 700 or more lbs. to the square inch, which this liquefied gas exerts at the common temperature of 65° Fah. Professor Lowe, of balloon fame, in attempting to use the pressure of carbonic acid gas (when liquefied by powerful pumping machinery, under a pressure of 600 lbs. to the square inch) as a source of power for flying machines, was struck by the evolution of great cold during the evaporation of this liquefied gas; and he obtained patents for its use for making ice, and for refrigeration in general. Notwithstanding that he spent many thousands of dollars to put this scheme in practical operation, and kept to its pursuit for several years, it finally utterly failed; and all attempts in this line were given up, the stumbling block being the same as was found in using liquefied nitrous acid, namely, the difficulty of keeping the joints tight under the enormous pressure required; for even the solid metals themselves showed, under the extreme pressure, such porosity that the gases passed through as through a sieve.

The process of Professor Paersh, of New Orleans, using carbon bisulphide, was abandoned for a contrary reason. Its boiling point being 112° Fah., more than 22° above that of ether, it was even less successful than the common ether, the process for which has never been quite satisfactory, as fully proved by the results of the labors of Siebe, in England, Twining, in New Haven, and others afterward.

Liquefied sulphurous acid boils at 14° Fah., and at the increased temperature exerts a pressure of 60 lbs. per square inch, or 4 atmospheres; and thus it appears well adapted for the purpose, and some years ago it was proposed to use it, and, if I am not mistaken, its employment was patented by Professor Seely, of New York city; but its corrosive effect on the metals of which the machine was made forbade its practical application.

The methylic ether machine of Tellier, in France, was at first said to be a great success; and about 10 years ago one of the apparatus was imported from France and exhibited in operation at the Morgan Iron Works in this city. There appears, however, to have been great difficulty in procuring the pure methylic ether required, notwithstanding that its preparation had been minutely described in Tellier's patent. The ignorant persons who had charge of the machine became possessed of the idea of cutting short all trouble, by using ammonia, which was easily procured; and, as any well informed person could have warned them, within 24 hours the whole beautiful machine, a credit to the Parisian workshops whence it came, was utterly ruined, the ammonia having destroyed all the brass parts. Machines using ammonia are therefore always built entirely of iron.

PRACTICAL MECHANISM.

BY JOSHUA ROSE.

NUMBER XLV.

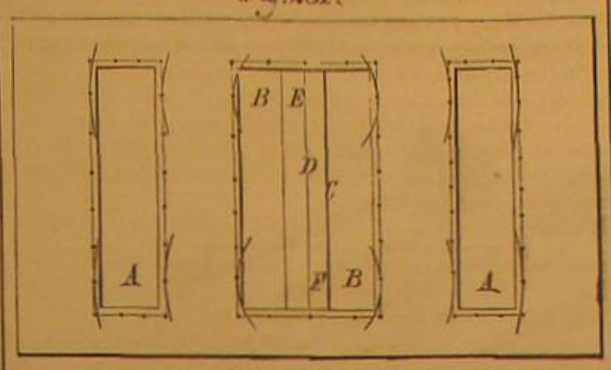
MARKING OFF SLIDE VALVES AND CYLINDER PORTS.

If, in marking off a set of cylinder ports and a slide valve for the same, we are provided with a detail drawing, we have no option, of course, as to their proportions; but if, on the other hand, we have liberty to proportion the same, we have to consider the following: If we make the slide valve to cover the ports without having any steam lap, the exhaust will not be sufficiently free, and there will be a back pressure upon the engine. The amount of steam lap necessary to prevent back pressure will be an amount equal to one quarter of the width of the steam port in a slowly running engine, and equal to about three quarters of the width of the steam port in a fast running engine. If it is incumbent that the valve have no steam lap, or an amount of such lap equal to or less than one quarter of the width of the steam port, we may make the cylinder exhaust port about one and three quarters as wide as the steam port, which will be sufficient to maintain, at all parts of the stroke, an exhaust opening in the cylinder exhaust port equal to that obtaining in the steam port acting (at the same point of the stroke) as an exhaust port: the object of narrowing the cylinder exhaust port in this case being to keep the valve narrow, so that its friction upon its seat may be kept as small as possible, in consequence of its reduced area for the steam to act on, pressing it to its seat. The best results are obtained from a slide valve by giving it sufficient steam lap to cut off the steam supply when the piston has traveled about three quarters of the length of the stroke; if more than such an amount of steam lap be given to the valve, its action becomes distorted, that is, unequal at and during one stroke as compared to the ther

The area of the steam ports should be proportioned by the following rule, which is given by Mr. John Bourne in his "Catechism of the Steam Engine:" "Multiply the area of the cylinder in square inches by the speed of the piston in feet per minute, and divide the product by 4,000. The quotient will be the area of each cylinder port in square inches." This rule is a much better one than any which gives a definite and fixed proportion between the area of the cylinder and of the steam port, because it takes into consideration the quantity of steam required to pass through the port in a given time, and increases the area of the port in proportion as the speed of the engine is increased.

Having determined the dimensions and proportions of our ports and valve, we proceed as follows: Beginning with the cylinder, we place in the exhaust port a center piece, as shown in Fig. 231, in which A represents the steam port, B B the cylinder exhaust port, and C the center piece wedged or fastened therein. In the center of the position intended for the ports, we mark upon the center piece the center line, D, and from the points, E, F, we mark with the compasses the segments of circles from which the width of the steam ports, exhaust port, and bridges are marked, the lines being drawn by the aid of a straight edge. We mark the ends of the ports by the aid of a straight edge and square. To mark off the valve, we may either plane up two of the edges and

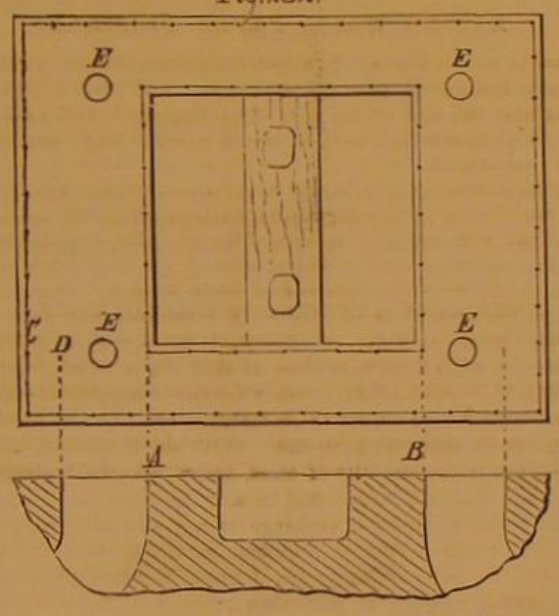
Fig. 231.



mark the lines by the aid of a square, allowing an equal amount to be taken off each side of the exhaust port, or we may place a centerpiece in the exhaust port of the valve, and perform all the marking-off before any of the planing is done, the operation being shown in Fig. 232. From A to B is the width of the exhaust port of the valve, and from C to D on each side is the lap of the valve.

It is found that valve seats (the cylinder faces on which the valves slide) will have, when they become worn, a groove cut across the bridges between the ports and extending along the face beyond on each side, running close to the edge of

Fig. 232.



the ports, and at right angles to the lengths of the ports. To prevent the formation of this groove, it is found necessary to drill in the face of the valve the four small holes (say of ¼ inch diameter) shown in Fig. 232, at E, E, E, E, their depth being about half the thickness of the valve.

To mark off the back of the valve where the slide spindle frame fits, we must stand it on the marking table, with the face standing perpendicularly and at a right angle to the face of the table, and draw a center line on the back of the valve, from which line we may mark off the back of the valve to the necessary conformation.

PROGRESS OF THE CENTENNIAL EXHIBITION.

The exhibition buildings and grounds are fast approaching completion.

THE MAIN BUILDING

is completed internally, the painting and gas pipe connections having just been finished. Show cases are rapidly appearing, that of Devlin, the clothier, being especially notable, both for its style and size. The floor is strewn with packages, prominent among which, on account of their size, are those sent by J. D. Burchall and Co., woolen manufacturers, of Leeds, England, containing woolen goods, and cases of terra cotta from Messrs. Doulton, of England, who are erecting four elegant show cases in which to exhibit pottery and porcelain. Among the exhibits forwarded by the Secretary of State for India, London, England, is a fine muslin, into which threads of gold are interwoven. This material is made exclusively for the rajahs in India, and is so fine in its texture that 50 yards of it can be doubled up and passed through a lady's finger ring.

INDIAN COURT.

The exhibits for the Indian court are nearly all in the building, having been transported from the Indian Museum, London, England.

The Egyptian, Norwegian, Chilian, Spanish, and other courts are all graceful and nationally characteristic edifices, and are fast approaching completion. They promise to be among the most attractive parts of the exhibition. The Norwegian goods are mostly on the ground.

MACHINERY HALL.

In the Machinery Hall, the workmen are busy erecting the shafting and laying steam pipes for the Corliss engine, all the parts of which are on the spot, and most of them erected.

Messrs. Mirrelees, Tait, & Watson, of Glasgow, Scotland, are erecting an engine and sugar mill, the total weight of which is 180 English tuns. It is a compound beam engine, of the parallel motion order, with Corliss valves, the high pressure cylinder being of 24 inches bore and 56 inches stroke. The top roller of the mill weighs 24,780 lbs. The entries of the above firm also include 26 and 36 inch centrifugals and two smaller engines, one driving a small mill and one driving a centrifugal. One of these engines is a valveless engine, which takes steam through the head of the piston, which is a very long one, having in it ports arranged to operate with ports in the bore of the cylinder, and not at the ends thereof.

Messrs. Wm. Sellers & Co., of Philadelphia, have their slotting, planing, vertical, and horizontal boring, drilling, and punching and shearing machines, as well as several large and small engine lathes, in position. J. Mitchell, of Philadelphia, is erecting a column composed of English, French, German, American, and Austrian grindstones, of various grades. J. P. Morris, of Port Richmond Iron Works is erecting a vertical column compound engine of the following description: High pressure cylinder, 50 inches in diameter, of 84 inches stroke; the low pressure cylinder is in line with it, so that both piston heads are fast upon one rod. The valves are constructed under Wanock's patent, and are balanced. The (two) fly wheels are each 24 feet in diameter, and of 21 tons weight, the whole engine weighing 110 tuns. This engine will drive a blower (for blast furnaces) of the following description: The cylinder is like an ordinary steam cylinder, and is provided with a similar piston, save that the piston rings are composed of maple wood, and are cut in segments to accommodate their being set out. The blower valves are of the griddle order. The size of the blower cylinder is 90 inches in diameter by 7 feet in stroke.

The floor spaces are all marked off, and many foundations for the various entries are being laid. Some few of the exhibitors who have their entries all ready are delaying the placing of them in position in the hopes of being able to obtain space in more prominent locations, provided the owners of such latter space shall be dilatory enough to warrant the commissioners in disposing of the space now allowed to them. The fears of the latter are, however, having the effect of hastening the forwarding of entries; hence it is improbable that any reallotment of space will take place, save in the case of those who are very much behindhand.

THE GROUNDS.

Swarms of workmen are busy leveling roadways, removing *débris*, and laying out the grounds and planting additional shrubs, evergreens, etc., notwithstanding the unpropitious weather. The railroad men, both steam and horse car, are at work in full force, giving promise that their preparations will be completed in ample time.

AGRICULTURAL HALL.

The above hall is the most backward of all the buildings but the rate of progress is proportionally rapid, every day making a noticeable difference in its appearance. The working force is here exceptionally strong; and there is evidence that it will soon be ready for the reception of entries

THE FOREIGN EXHIBITORS.

As a rule, the foreign exhibitors have more goods upon the ground than is the case with the American entries, a fact to which their representatives point with a feeling of pride. There is no doubt, however, that the arrival of American goods will, during the coming week, be very large. Representatives of foreign governments who were present at the Paris and Vienna Expositions give it as their opinion that the vista of the main building at Philadelphia excels, in general design, lightness, and airiness, that of any previous international exhibition.

A Metric Treaty.

The President has recently sent to the Senate for ratification a treaty, the object of which is to establish an international uniformity and precision in the standard of weights and measures. The treaty is between the United States and the governments of Austria, Argentine Republic, Belgium, Brazil, Denmark, Spain, France, Italy, Peru, Portugal, Russia, Sweden and Norway, Switzerland, Turkey, and Venezuela. It contains an agreement between all the parties to maintain in Paris, at the common expense, a permanent bureau of weights and measures, to be under the control of an international committee. The bureau is to be charged with the following duties:

1. All comparisons and verifications of the new prototype of the meter and kilogramme. 2. The custody of the international prototypes. 3. The periodical comparison of the international standard with the international prototypes and of test copies, as well as comparison of the standard thermometers. 4. The comparison of the prototypes with the fundamental standards of non-metrical weights and measures used in different countries for scientific purposes. 5. The standarding and comparison of geodesic measuring bars. 6. The comparison of standards and scales of precision, the verification of which may be requested by governments, scientific societies, or even by constructors or men of science.

We are indebted to Mr. R. O. Morris, Secretary of the Rod and Gun Club, Springfield, Mass., for a very attractive pamphlet containing a list of premiums and rules to govern the dog show which takes place on April 26, under the auspices of the abovenamed club. Many very handsome premiums are offered, and it is expected that the exhibition of pointers and setters from all parts of the country will be especially large and fine.

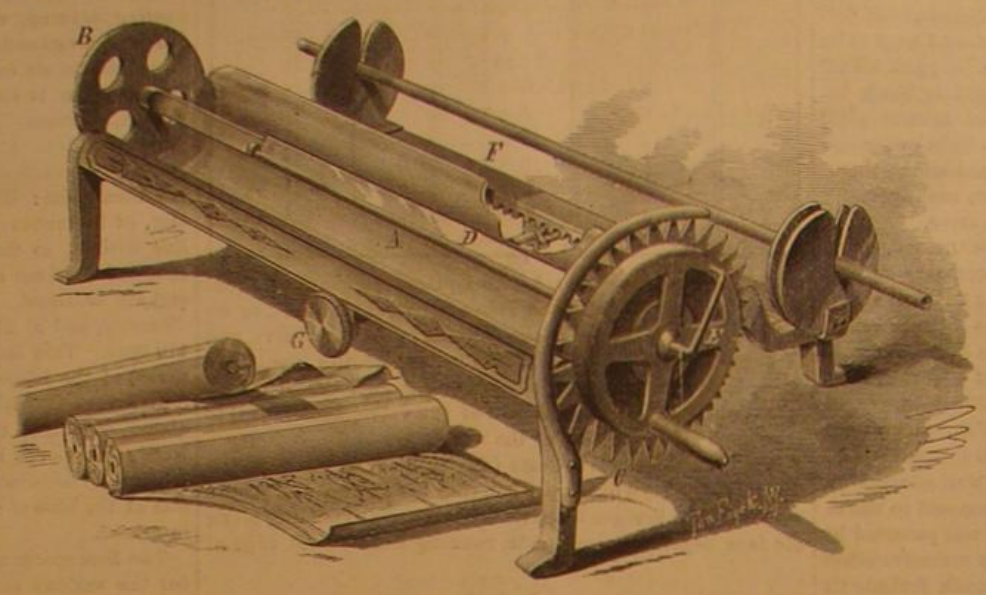
IMPROVED WALL PAPER TRIMMER.

We illustrate herewith a new and simple apparatus for trimming the edges of wall paper up to the printed line thereon. The cutting device is a small circular saw, and to its shaft an end of the paper is attached so, that the single operation of rotating said shaft drives the saw and feeds the paper to it. The cut, as we find by practical trials, is perfectly smooth, and as neat as if made by shears, while it is done with great rapidity, hardly a minute being required to trim a large double roll.

The frame is made of cast iron, and supported upon legs. One end of the roller, A, has its bearing in a fixed standard, while the other end bears in the standard, B, which is hinged to the frame, and can be turned down for the purpose of removing the roll of paper from the roller, A, after the trimming is accomplished. The journal of the roller in the stationary standard projects through the same, and a wheel is firmly secured thereon. This wheel is made dish shaped or flanged and surrounds the standard within. Upon the inner edge of the flange is secured the cutter, C, which is made in the form of a circular saw. One side of the roller, A, is made concave, and at one edge of such concavity is hinged a plate, D, by means of a rod which extends out through the journal of the roller to the outer side of wheel, where the rod is bent to form the handle, E. The plate, D, forms a clamp for fastening the end of the paper to be trimmed. It will thus be seen that the roller is the spindle on which the paper is rolled, and is also the shaft of the cutting device, whereby the machine is greatly simplified. The roll of paper to be trimmed is placed upon the shaft laid in two standards upon a movable carriage, F, sliding in guides on the rear part of the frame. The one standard is stationary on the carriage while the other is movable thereon, so as to be adjusted to the width of the paper placed on the shaft. On the under side of the carriage is a rack bar, into which gears a pinion on the end of a shaft, under the frame, extending to the front part thereof, and provided on its front end with a handle wheel, G, whereby the carriage may be moved to the right or left as required. After the roll of paper has been placed upon the shaft, its loose end is trimmed for two or three inches, either by the machine or hand shears, so as to enable it to pass the cutting device. The end is then inserted in the clamp and secured. By revolving the shaft or roller, A, the paper passes under and between the cutting device, and is trimmed and rolled upon the roller. The only care required while trimming the paper is to see that it is so fed as not to leave a white line or cut into the figure. This can be regulated by means of the wheel operating upon the carriage, as already described. By turning down the hinged standard, the trimmed roll is easily removed.

The machine is compact, while at the same time it is heavy enough not to need fastening down, so that it can be placed in any convenient position.

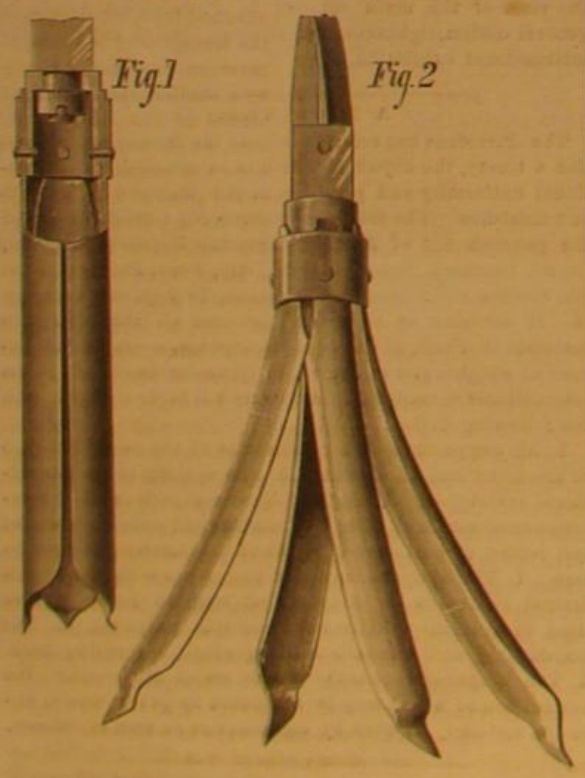
Patented December 7, 1875. For further information address Mr. Charles Boust, Northumberland, Pa.



BOUST'S WALL PAPER TRIMMER.

WESTON'S LIGHTNING ROD DISCHARGING POINT.

In order to render lightning rods of any efficacy as a protection to a building, it is absolutely necessary that the ground terminals shall be large, and sufficiently so to discharge all the electricity from the rod. The object of the device illustrated herewith is to secure an extensive metallic surface in contact with the earth, with comparatively little cost and trouble.

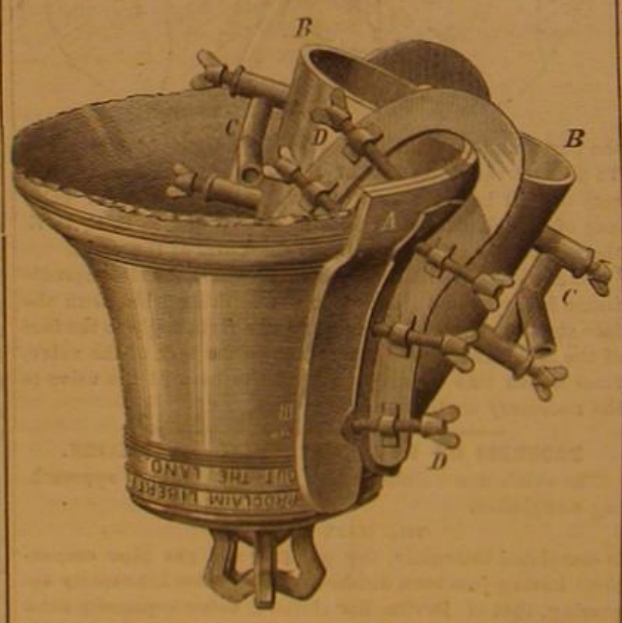


The device consists of four metallic arms, formed as shown and riveted about a central socket. When closed, the point appears as in Fig. 1. To attach it to the lower end of the ground rod, the pivot of the latter is inserted in the socket and the nut screwed on from the inside, as represented in the broken away portion in Fig. 1. A hole is then made in the earth with a crowbar, and the point, with the section of rod attached, inserted. When at the bottom, by forcing the rod down, the sheets or arms of the point will spread out as in Fig. 2, thus giving a large discharge area. The nut which connects the lower section of the rod with the point is left loose, so that the former is allowed to turn when screwing it into the section above. To attach the point to cables a zinc ring is first put on, then the discharger, and then another ring near the end of the rod. The discharger and upper ring are slipped back to their proper position and fastened with set screws.

Patented through the Scientific American Patent Agency, March 7, 1876. For further information address the inventor, Mr. J. H. Weston, 29 West Sixth street, Cincinnati, Ohio.

RIGGS' METHOD OF MENDING CRACKED BELLS.

Mr. Daniel L. Riggs, of Salem, Oregon, has patented (June 16, 1874) a new method of mending cracked bells, which, if we may judge from the testimonials submitted, has proved highly successful in many trials. The inventor proposes its application to repairing the Independence Bell at Philadelphia, and claims that he can render that historical object as good as new, and that its tones will ring out as clearly on July 4, 1876, as they did a hundred years before. The idea is simply to melt the metal at the crack so that the latter becomes closed by the fusion; and this is carried out by the novel arrangement of two furnaces and a mold, shown in the annexed engraving applied to the bell.



The apparatus is made in two portions, secured, one without and the other within the bell, so as to encompass the cracked part. Each section consists of a mold, A, of plumbago or fire clay, which exactly corresponds to the contour of the bell. On these molds are added walls, B, so as to form chambers or furnaces, to each of which air blasts are admitted and controlled by the system of tubes and check valves, C. At D are the clamps and hand screws by which the whole is held tightly in place. In the upper edge of the molds and just above the crack is a gate for adding molten metal. The furnace chambers being supplied with fuel and ignited, a blast is thrown into them until the edges of the crack are fused and united. Molten metal is then poured in in sufficient quantity to fill any deficiency which may be found to exist.

The Centennial Committee and others can, for further particulars, address the inventor as above.

SEVERAL years ago the Berlin Museum paid $24,000 for what were supposed to be Moabite antiquities. It has been discovered that they are not genuine

Success in Milling.

John Griffith, a miller, gives his secret of successful flour grinding as follows, in *Leffel's Illustrated Milling and Mechanical News*:

"My burr is 26 inches in diameter, and has 15 leading furrows, with one short furrow to each leading one; the short ones one inch wide and very shallow. The chief secret is in the shape and condition of the furrows and draft. The stone being in face, running balance, and tram, the draft should be 1 inch to the foot in diameter of the stone; the width of the furrows should not be less than 2 inches for a 3 foot stone, pretty deep at the eye and taper out to the skirt to half an inch deep; it is then worked as smooth as possible with a pick and rubstone or emery wheel to a feather edge at the face. A stone dressed in this way will grind one third or one half more with the same power; and the same cloth will bolt it, and leave no clammy flour to clog the cloth. It bolts freely and the cloth is clean. I run about four bushels through the No. 9 cloth (6 feet in length and 29 inches in diameter), and return from 2 to 4 feet No. 10 in an hour. Grain does not want to be ground; what it needs is to be mashed and rubbed between the two smooth surfaces. Where the furrows are deep and rough, they will grind some too fine and some not fine enough, and throw out unground grain or unmashed particles. A grain of wheat is a bundle of fine particles; and if the bran or shell is broken and rubbed, it will be flour. I have ground 4 000 bushels of wheat since there was a pick on my burrs, and they run nicely yet."

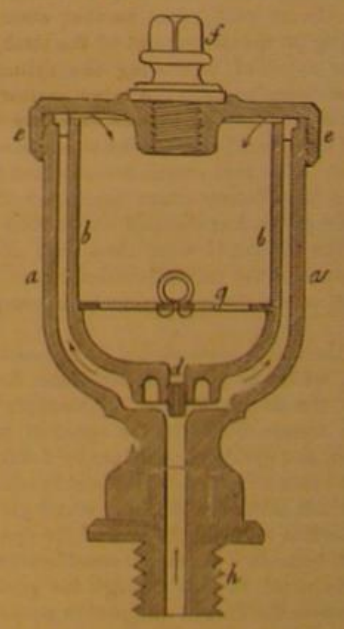
Foul Smells from Drains.

There is but one simple way, says a writer in the *Journal of Chemistry*, to prevent noxious emanations from cellar drains; and that is to start the drain pipes at the outer wall, and hang all the waste pipes from the cellar ceiling in plain sight, where the slightest leakage can at once be detected. These pipes had best be of iron, and in any ordinary building can be arranged to have a sufficient pitch towards the drain, without coming below the cellar ceiling enough to interfere with headway, and at the wall can be carried down perpendicularly into the mouth of the drain pipe, where the junction should be made tight with cement, and should be in plain sight. The best kind of drain pipes are of glazed stoneware with socket joints, and they be should laid in a bed of cement, and the joints made tight with the same. For common drains, a pitch or fall of one half inch in a foot is sufficient.

NEW AUTOMATIC GREASE CUP.

A sectional view of a new automatic grease cup, adapted to the lubrication of valve chests and cylinders, is represented in the annexed engraving, which we extract from the *Bulletin du Musée*. It consists of an exterior box, *a*, which terminates below in a screw shank, by which the apparatus is secured in place. Within the box is suspended a small receptacle, *b*, at the lower part of which is a small capillary tube, *d*, and above this a fine sieve, *g*. The top is hermetically sealed by the cover, *e*, a central orifice in which serves for the introduction of the lubricant (melted tallow), being closed by the screw, *f*. The receptacle, *b*, is filled with tallow until the grease begins to enter the screw aperture above. The object of the sieve, *g*, is to retain any impurities; and it may easily be cleaned by removing the core, *e*.

In operation steam enters the cup in the direction of the arrows, passes up above the receptacle, *b*, and presses upon the grease therein. At each momentary diminution of pressure, which takes place in the cylinder or in the valve chest at each change of stroke, a drop of tallow escapes at *d*, being forced down by the steam above. The apparatus is thus entirely automatic, giving a quick supply when the engine runs rapidly, and *vice versâ*, while the delivery stops altogether when the motion of the machine is arrested. This device is now in use on many locomotives on railroads in Saxony.



ANIMAL FEROCITY.

The tiger has so long been deemed a beast that can only be feared and avoided, except by large parties of well armed men, that there is some sort of satisfaction in contemplating the masterly engraving which accompanies this article; and the dread grip which has seized the most terrible of marauders appeals strongly to our sense of justice. Mr. Joseph Wolf (whose genius may fairly be classed with the master spirits of animal painting, Landseer and Rosa Bonheur, although it is devoted to the comparatively humble work of drawing on wood for book illustration) has here given us a picture very characteristic of the wild animal life in the pathless jungles of the East Indies; and the powerful brute is shown in the remorseless hold of perhaps the only creature who can equal him in strength and ferocity. The elephant certainly now and then gores and tramples to death a tiger who may venture to attack him; but frequently the tiger is the master, and the bones of the "huge, earth-shaking beast,"

that hath between his eyes
A serpent for a hand,

are soon left to bleach in he sun. The crocodile of the East, however, is covered with an almost impenetrable armor of shell-like scales, the head being protected by a seamless horny integument; and its hold is not easily relaxed by the struggles, however powerful, of its prey. That it will ultimately tire out, drown, and devour the tiger) seems probable, and although crocodiles are little likely to elicit much sympathy from the human race, it is well to know that victory will not belong to the man-eating monster.

The engraving is the work of Messrs. J. W. and E. Whymper, and is published in "The Life and Habits of Wild Animals," issued by Messrs. Alexander Macmillan & Co., London.



A BENGAL TIGER ATTACKED BY A CROCODILE.

Diving for Drink.

One of the hottest regions of the earth is along the Persian Gulf, where little or no rain falls. At Bahrein the arid shore has no fresh water: yet a comparatively numerous population contrives to exist there, thanks to copious springs which burst forth from the bottom of the sea. The fresh water is got by diving. The diver, sitting in his boat, winds a great goatskin bag around his left arm, the hand grasping its mouth; then he takes in his right hand a heavy stone, to which is attached a strong line, and thus equipped he plunges in and quickly reaches the bottom. Instantly opening the bag over the strong jet of fresh water, he springs up in the ascending current, at the same time closing the bag, and is helped aboard. The stone is then hauled up, and the diver, after taking breath, plunges again. The source of these copious submarine springs is thought to be in the green hills of Omân, some five or six hundred miles distant.

The Richest Silver Mine in the World.

The Consolidated Virginia Mine is the most profitable in the world. During 1875 it yielded 169,307 tuns of ore worth $98 per tun, average, the total yield in bullion being $16,731,653.43. Since December 13, last, about 600 tuns of ore have been hoisted daily. As soon, however, as the connections with another shaft are complete, it is computed that this hoisting capacity will be increased to 2,000 tuns per day, or ore equivalent in value to $200,000. The superintendent of the mine says that, even under this great drain, there is enough ore in sight to last for many years. The almost fabulous amount of wealth which still lies buried, and which the drills of the miners have not yet exposed, cannot be conjectured.

Comparative Richness of Human Milk.

Mr. H. A. Mott, Jr., E.M., Ph. B., has recently read a paper before the New York Academy of Sciences, entitled "Comparison between the Milk of the African Race and that of the Caucasian." The author has conducted considerable research and has made numerous analyses, the result of which goes to show that the milk of colored women is richer in milk solids than that of white females. An average of 12 analyses of negro milk give water 86·34, milk solids, 3·66; this is compared (among others) with an average of 89 analyses by Vernois and Becquérel, of white woman's milk, which shows water 88 90, milk solids 11·09. The milk of the negro appears especially rich in milk sugar, fat, and inorganic salts. Microscopically examined, the two milks are similar with the exception that the negro milk contains a larger number of globules.

A White Light for Dark Room Windows.

At the last meeting of the Ghent section of the Belgian Society, Dr. Von Monckhoven communicated a very interesting and curious fact. Having to darken a room in which to dry carbon tissue, and having nothing on hand but red and green glass, and not enough of either to cover the window entirely, he used half of each, alternating it. The result was that at a certain distance from the window the red and green lights blended together and formed a white light. This white light has no action on the sensitized carbon tissue. If it should have no action on the sensitized collodion plate, it would be excellent to illuminate our dark rooms. If there should be no difficulty in procuring red and green glass which would transmit no rays having a chemical action, a window might be fitted alternately with red and green panes of small size.—*Photographic News.*

A New India Rubber Cement.

A good cement, that will render india rubber in any form adherent to glass or metal, is oft-times a desideratum with photographers, and in the *Polytechnisches Journal* for last month there is a simple recipe given for the preparation of such a compound. Some shellac is pulverized, and then softened in ten times its weight of strong ammonia, whereby a transparent mass is obtained, which becomes fluid after keeping some little time, without the use of hot water. In three or four weeks the mixture is perfectly liquid, and, when applied, it will be found to soften the rubber. We are told that the rubber hardens as soon as the ammonia has evaporated again, and thus becomes impervious both to gases and to liquids. For cementing the rubber sheet, or the material in any shape, to metal, glass, and other such surfaces, the cement is strongly recommended.

The Depth of the Sea.

At the last meeting of the Royal Society, Mr. Siemens, D.C.L., F.R.S., exhibited the instrument he has devised to ascertain the depth of the sea by a new means, without a sounding line. He has worked out the requirements, starting with the proposition that the total gravitation of the earth, as measured on its normal surface, is composed of the separate attractions of all its parts, and that the attractive influence of each volume varies directly as its density and inversely as the square of its distance from the point of measurement. The density of sea water being about 1 026, and that of the solid constituents composing the crust of the earth about 2 763 (this being the mean density of mountain limestone, granite, basalt, slate, and sandstone), it follows that an intervening depth of sea water must exercise a sensible influence upon total gravitation if measured on the surface of the sea. Mr. Siemens showed how this influence can be proved mathematically, in considering, in the first place, the attractive value of any thin slice of substance in a plane perpendicular to the earth's radius, supposing that the earth is regarded as a perfect sphere, of uniform density, and not affected by centrifugal force. It was in 1859 that Mr. Siemens first attempted to construct an instrument based on these principles. The difficulties he then encountered he has since overcome, and the present instrument is the result of his latest work. He proposes to call it a bathometer, and it consists essentially of a vertical column of mercury, contained in a steel tube having cup-like extensions at both extremities, so as to increase the terminal area of the mercury. The lower cup is closed by means of a corrugated diaphragm of thin steel plate, and the weight of the column of mercury is balanced in the center of the diaphragm by the elastic force derived from two carefully tempered spiral steel springs of the same length as the column of mercury. One of the peculiarities of this mechanical arrangement is that it is parathermal, the diminishing elastic force of the springs with rise of temperature being compensated by a similar decrease of potential of the mercury column, which decrease depends upon the proportions given to the areas of the steel tube and its cup-like extensions. The instrument is suspended a short distance above its center of gravity in a universal joint, in order to cause it to retain its vertical position, notwithstanding the motion of the vessel; and vertical oscillations of the mercury are almost entirely prevented by a local contraction of the mercury column to a very small orifice. The reading of the instrument is effected by means of electrical contact, which is established between the end of a micrometer screw and the center of the elastic diaphragm. The pitch of the screw and the divisions upon the rim are so proportioned that each division represents the diminution of gravity due to one fathom of depth. Variations in atmospheric pressure have no effect on the reading of the instrument, but corrections have to be made for latitude. The instrument has been actually tested in voyages across the Atlantic in the Faraday, and the comparisons with Sir W. Thompson's steel wire sounding apparatus showed it was very reliable. The paper concluded with pointing out many ways in which the instrument might be of use; among others, was that of indicating approaching danger, if contour lines were first efficiently mapped.—*London Times.*

A SIMPLE brown dye for cloth is made of japonica, ¼ lb.; bichromate of potash, 2 ozs.; alum, 1 oz.; and water, 5 gallons. Put the ingredients in a vessel, dissolve, immerse the goods, previously wet with warm water, and simmer for three hours.

ASTRONOMICAL NOTES.

OBSERVATORY OF VASSAR COLLEGE.

The computations and some of the observations in the following notes are from students in the astronomical department. The times of risings and settings of planets are approximate, but sufficiently accurate to enable an ordinary observer to find the objects mentioned. M. M.

Position of the Planets for April, 1875.

Mercury.

On the 1st of April Mercury rises at 5h. 14m. A. M., setting at 4h. 39m. P. M. On the 30th, Mercury rises at 5h. 23m. A. M., setting at 7h. 44m. P. M. Mercury is very unfavorably situated all through the month, as it is far from the earth, and its time of meridian passage is nearly the same as that of the sun

Venus.

On the 1st of April Venus sets at 10h. 07m. in the evening, and on the 30th at 10h. 52m. The motions of Venus can be very easily followed during the month, as its course lies among the bright stars of *Taurus*. Its change of position at setting should be watched from night to night; it is farther and farther north all through the month.

Mars.

Mars rises on the 1st at 7h. 29m. A. M., and sets at 9h. 54m. P. M. On the 30th, Mars rises at 6h. 40m. A. M., and sets at 9h. 40m. P. M. Mars is small, but can be known by its ruddy light, and on the 1st of April it is very near Venus, and sets earlier than Venus.

Jupiter.

Jupiter rises on the 1st at 10h. 28m. P. M., and rises earlier and earlier every night, coming up on the 30th at about 8h. 21m. P. M., the star β^1 *Scorpii* rising at nearly the same time. On the 4th, this star and Jupiter are almost near-y together, but at any time during the first week of April the planet, its moons, and the star can all be seen at once in the field of a telescope of low power

Saturn.

Saturn rises on the 1st of April at 4h. 25m. A. M., and sets at 3h. 01m. P. M. On the 30th, Saturn rises at 2h. 37m. A. M., and sets at 1h. 20m. P. M. It will be seen that Saturn is above the horizon mostly in the daytime, and therefore is not well situated for observation.

Uranus.

Uranus rises on the 1st at 1h. 30m. P. M., and sets at 3h. 34m. the next morning. On the 30th, Uranus rises at 11h. 35m. A. M., and sets at 1h. 39m. the next morning.

Neptune.

Neptune, which can never be seen without the aid of a telescope, is at present very unfavorably situated, even for the best instruments.

Sun Spots.

The report is from February 22 to March 18, inclusive. In the photograph of February 22 was seen, on the edge, the last of the chain of spots mentioned in the last report. The pictures of February 25 and February 18 showed two small spots coming on. From February 26 to March 7 photographing and observations were interrupted by clouds; but the picture of March 7 showed faculæ, without any visible spot, on the edge, going off. On March 9 a small spot appeared on the eastern limb, and it was still visible, March 18, on the western limb. The picture of this date shows also a small group coming on, surrounded by faculæ, and two small groups near the center of the disk.

FIRE APPARATUS FOG ALARMS AND CORK MACHINERY.

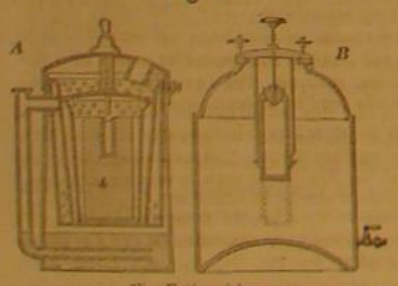
Mechanisms of the above named descriptions constitute our extracts from Knight's "New Mechanical Dictionary*" for the present week.

There are perhaps sixty patents for various forms of the fire annihilator. The devices particularly refer to the modes of construction, the acid and alkali chamber, and the method of mingling the gas-generating chemicals.

THE PHILLIPS FIRE ANNIHILATOR.

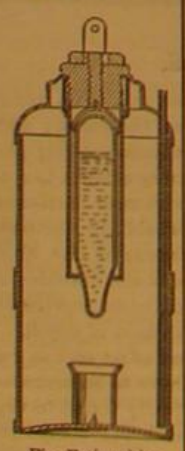
This invention was introduced into this country by P. T. Barnum, the enterprising showman, some twenty years ago. At that time the newspapers of the day were full of its praise. A number of experimental exhibitions were given in this and other cities, and for a time, through Barnum's management, the Phillips fire annihilator was the great sensation of the day. But we believe the great showman, after expending considerably more than his receipts in this venture, concluded that the introducing of new inventions from abroad into our country, which is so much in advance of all others in respect of novel devices, was not his forte; and he finally abandoned the annihilator enterprise and returned to the exhibition business, in which he has acquired both renown and profit.

Fig. 1



Fire-Extinguishers.

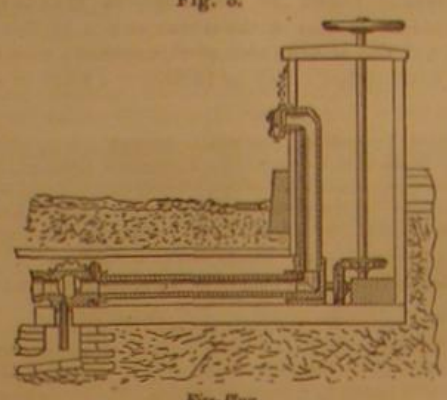
Fig. 2.



Fire-Extinguisher.

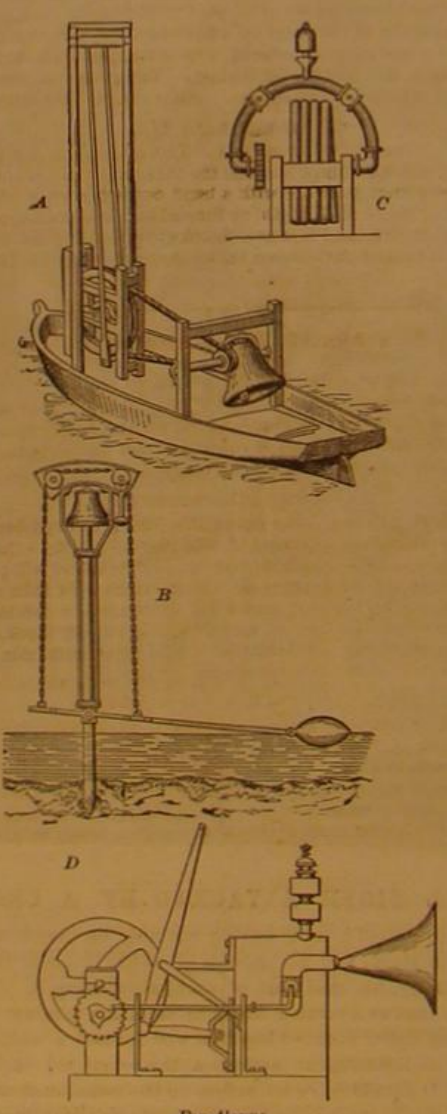
The annihilator is shown at A, Fig. 1; it was one of the earliest of these inventions. A compound of sugar and chlorate of potash is so placed as to receive the contents of a bottle of sulphuric acid, which is broken by striking a plug, on the top of the can, when a fire occurs. Around the perforate case which contains the mixture of sugar and chlorate is another case, and this is in a third envelope, between which last and the outer shell is a water space. The carbonic acid produced by combustion passes out of the top of the machine, meeting on its passage out the water, which is raised in the side pipe by the pressure and heat of the chemical action, and which thus becomes saturated with the gas. A well known apparatus, now in the market, is represented at B. In this the sulphuric acid is in a leaden bucket hung upon trunnions below its center, so that, if set free, the bucket immediately turns upside down. It is kept rigidly upright, however, by a stopper attached to a rod passing through the cap of the apparatus. When the extinguisher is to be used, the stopper is pulled up by an exterior handle, when the bucket turns over and the acid and alkali are mingled, the reaction generating carbonic acid gas. The machine shown in Fig. 2 contains acid in a glass bottle, which

Fig. 3.



Fire-Plug.

Fig. 4.



Fog-Alarms.

is shattered by dropping upon a stud, when forced below the fianges of the tin cylinder which holds it. An improved form of

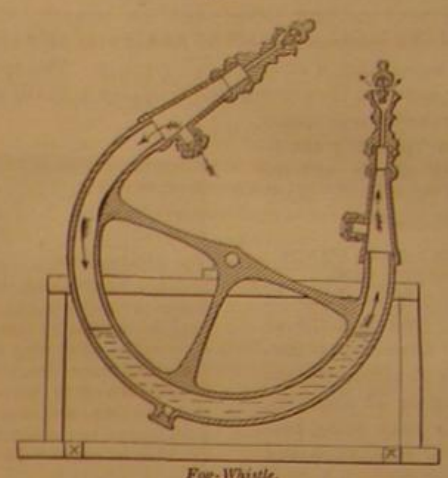
FIRE PLUG

is represented in Fig. 3. At the point where the branch pipe is coupled to the main, the stopcock is placed, and it is operated by gearing and connecting shafts from a hand wheel in the vicinity of the plug.

FOG ALARMS

are various in their kinds, their operation, and their construction. As shown at A, Fig. 4, the apparatus is erected on the deck of a moored boat, and a pendulous frame is arranged to be swung to and fro by the motion of the vessel. A bar on this frame actuates a wheel, which, by means of a pulley and belt, rings the bell. In B, the clapper is moved by a cam wheel actuated by chains, which run over pulleys as the float arm rises and falls on the waves. C has a spiral coil of tubing oscillating with the vessel. Each end of the spiral has a whistle and valve opening inward. The coil contains a quantity of water, which, in changing its position, forces the air out through the whistles, with a prolonged sound. In D the air is mechanically condensed and stored in a reservoir. The cam on the rotary shaft actuates the valve for the purpose of varying the sounds, to give a series of signals, more intelligible than single sounds repeated. A trumpet and whistle are attached to connecting pipes proceeding from the reservoir. The valve governs the air aperture in the

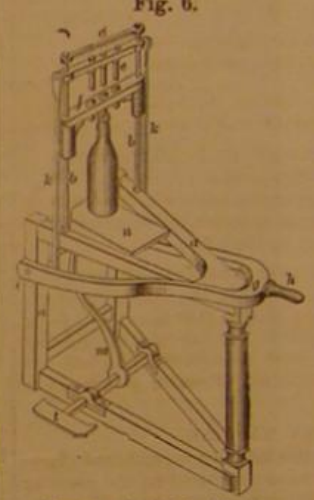
Fig. 5.



Fog-Whistle.

pipe leading to the trumpet. The fog whistle, Fig. 5, is similar in operation to the device, C, above. The vessel is tubular and semicircular; and as it is oscillated, air is forced out by whistles at its ends.

Fig. 6.



Masterman's Corking-Machine.

Fig. 6 is a

CORKING MACHINE,

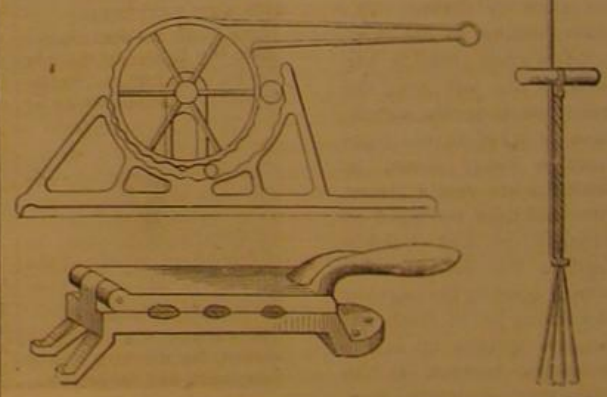
for inserting corks in bottles. The workman seats himself with one foot on the treadle, and the handle, *h*, in his right hand. He places a bottle on the wedge, *n*, with its neck beneath such one of the three tubes as will contain a cork of suitable size. Such a cork being placed in the tube, a motion of the treadle raises the bottle, and the depression of the lever, *h g*, drives the cork into the neck. Reverse motions of lever and treadle release the bottle. Two forms of

CORK PRESSES

are exhibited in Fig. 7. In the first, the cork is placed between the serrated surfaces of the concave and eccentric cam, and pressed to a less or greater extent by a partial rota

Fig. 8.

Fig. 7.



Cork-Presses. *Cork-Pull.*

tion of the latter. The second form is simply a lever press with jaws. Fig. 8 is a

CORK PULL.

The jaws, while collapsed by the slide, are passed through the neck of the bottle, and, being opened, are then clasped around the cork, which is then easily withdrawn.

DECISIONS OF THE COURTS.

United States Circuit Court---Northern District of Illinois.

TRADE MARK CASE.—THE TUCKER MANUFACTURING COMPANY *vs.* LEVI C. BOYINGTON.

[In equity.—Before Blodgett, J.—Decided October, 1875.]

BLODGETT, J.:

This is an application for an injunction to restrain the defendant from the use of the trade mark which has been registered by the complainant in the manner required by the Act of Congress. As the record now stands, I don't think this injunction ought to issue. It is a matter of discretion always with the court to issue an injunction or not, upon a case made in a trade mark suit. I cannot say but that the complainant may make a case upon final hearing that would entitle the complainant to an injunction; but it seems to me that it is not made as the record now stands. I have serious doubts whether the defendant infringes the complainant's trade mark. The words "Tucker spring-bed" were certainly common property from the date of the expiration of the Tucker patent in 1869. In January, 1875, the complainant, being the Tucker Manufacturing Company, and the party who had owned the patent during the lifetime of the patent, obtained the trade mark, which consists of a perspective of the Tucker bed bottom, with the letters "T. M. Co.," in monogram, in the center of the picture, and over it are the words "Tucker spring-bed." It strikes me very forcibly that this trade mark is for the combination, and the defendant does not infringe unless he uses the whole combination. The defendant, Boyington, had the right to use a diagram of the spring-bed as common property, and it has been such since the expiration of the Tucker patent.

It seems to me that while this may be a valid trade mark, when all used together, yet, when the defendant manufactures the spring-bed, he has the right to designate it as the "Tucker spring-bed," indicating that it is manufactured under the Tucker patent, and that he has, also, the right to

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put any colored label upon it that he chooses, so long as he does not, by his label, indicate that it is the manufacture of the Tucker Manufacturing Company. Now, the only semblance between the label used by the defendant and the plaintiff's label is that the defendant uses at the same time a perspective of the bed-bottom, and the words "Tucker spring-bed." He does not use the monogram, and uses nothing but what is common property. It is true that he uses the same colored label as the complainant uses. There is no patent trade mark upon the color. Either party has the liberty to adopt any color, green, blue, or all the colors of the rainbow; so that, as the record now stands, I think this injunction must be denied.

In passing upon a motion of this kind, which involves to a certain extent the merits of the case, I have, as far as possible, refrained from expressing any opinion that would prejudice the ultimate decision of the court. I think it is right that I should indicate the doubt I have, in order that counsel may determine for themselves whether the case shall go on any further or not.

Recent American and Foreign Patents.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED GAS REGULATOR.

Joseph Desha Patton, Trevorton, Pa.—This consists of a hinged or pivoted and weighted gate resting on or against the current of passing gas, for the purpose of reducing the pressure and flow thereof. The device is claimed to be capable of nice adjustment so as to form a very efficient and sensitive regulator.

IMPROVED FLOUR MILL AND STAFFING DEVICE FOR MILL-STONES.

David Leib, Rich Hill, O.—In the mill, the novel feature is the combination of the bedstone with an adjustable flanged ring, having delivery spout and top casing to discharge at any desired point. The ring simply fits around the stone and is attached by fastening screws. The same inventor has devised an improved staffing device for millstones. This consists of a supporting plate, that may be attached to runner or bedstone, and provided with horizontal spring standards, that carry at their mortised front ends the bearers of the red staff, that is adjusted by set screws to the surface of the stone. The device is equally applicable to runners and bedstones, and is readily adjustable.

IMPROVED CAR STARTER.

Louis Funke, Champion Mills, New Mexico Ter.—This invention consists of a brake drum geared with the axle by a reversing train, and contrived with a spring for storing up the power exerted by the brake in stopping, so that, by shifting the gears after stopping the car, the spring will assist in starting.

IMPROVED TRUSS BRIDGE.

Joseph M. McDonald, Tomlinson, Ark.—This consists, mainly, in the construction of an arch made of laterally braced and bolted pieces of alternately interlocking timber, in combination with braced and longitudinally connected side and intermediate trusses.

IMPROVED DEVICE FOR RUNNING BELTS ON TO MACHINERY.

Eddy T. Thomas, Boston, Mass.—This consists of a spring hook or button that slides in a socket at the circumference of the driving wheel, and swings over the belt, so as to retain the same until run on the wheel, being then thrown off by the belt.

IMPROVED ARCH PLATE FOR STEAM BOILERS.

George Fox and George Fox, Jr., New York city.—In place of the solid cast iron arch plate of steam boilers, that is exposed to be burned through by the action of heat in the fire box, the present inventors propose a hollow arch plate connected to the boiler in such a maner that a constant circulation of water is kept up in the same.

IMPROVED BRICK MACHINE.

David Manley, Franklin, Pa.—In this machine is combined a large amount of new and ingenious mechanism for molding and pressing brick. It is so constructed that the three operations of filling the mold, pressing the brick, and removing the pressed brick may all be performed at the same time.

IMPROVED SAW MILL DOG.

Luke Buzzell, St. Johnsbury, Vt.—This is a dog for holding the log on the head block. It is mounted on a vertical screw having a quick pitch, so that it can be partly or wholly forced into the log thereby, and can be kept in so as not to work loose by the jarring and shaking of the mill. It is specially applicable to the dogging of frozing logs, in which the ordinary dogs will not hold at all.

IMPROVED COMBINED BOLT AND KEY FASTENER.

Edward H. Schnell, South Norwalk, Conn.—This is a contrivance of ingenious mechanism within the lock for fastening the key inside of the lock after it has thrown the bolt out, and also to fasten the bolt so that the key cannot be turned from the outside by nippers nor the bolt drawn back.

IMPROVED METHOD OF PROPELLING CANAL BOATS, ETC.

Louis F. A. Legouge, Wheatland, Cal.—A pair of push bars are here caused to push on each side at the same time, and without intermission, and through a reciprocating revolving motion the poles regain their working position with little or no friction. In order to prevent slip, the push bars are curved at the end on the front side.

IMPROVED MACHINE FOR BENDING SCYTHE SNATHS.

John H. Russell and George Birner, Milwaukee, Wis.—In using the machine, the wood to be bent is steamed, the movable part of the form is secured in upon the stationary part, and the cross bar is run back to the proper distance from the form. The timbers to be bent are then arranged with their larger ends in the cavity of the cross bar, and their smaller ends in the cavity of the form. The cross bar is then forced forward by turning a screw, pressing the timbers into the form and giving them the desired shape. The cross bar is then run back, pins are withdrawn, the moving part of the form is detached, taking the timbers with it, and the said part and the timbers are taken to the drying room.

IMPROVED CAR COUPLING.

Duncan MacDougald Campbell, Holly, Mich.—This invention consists in a spring attached to truck and bottom of car, in the rear of the buffer frame, to take up the strain of back pressure, and thus prevent injury to the king bolt; also, in a check attached to the truck and stiffening bar of the buffer frame.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED HARNESS HAME.

Benjamin F. Haviland, Danville, Vt.—This is a contrivance of the rein guides of hames, whereby the rein can be shifted higher or lower, and inward or outward, to meet the requirements of different horses. It is simply an arrangement of one or more upper and lower and outwardly projecting rein guides, additional to the ordinary rein guide.

IMPROVED MACHINE FOR TENONING SPOKES.

John G. Peace, Salem, Mo.—This spoke-tenoning machine may be applied to the ends of the spokes after they have been driven into the hub, so that the wheel may be finished without moving it from place to place. It consists of a spring auger, that is guided in a suitable supporting piece, which is rigidly clamped to the spoke, producing the exact tenoning of the spoke end by turning the auger.

IMPROVED SASH HOLDER.

Charles E. Steller, Milwaukee, Wis.—This consists of a circular grooved disk encircled by an elastic band, and pivoted eccentrically to the sash, so as to act as a wedge to hold the latter against the casing, and so sustain the sash at any desired point. This invention was described and illustrated on page 166, current volume.

IMPROVED DIE FOR MAKING CARRIAGE BODY LOOPS

John Garvin, West Meriden, Conn.—This invention consists in two sets of dies, consisting of the forming dies, made with recesses to form the lug, head, and prong. The finishing dies are made with recesses, and there is a projection to finish the loops and form the countersink for the bolt head.

IMPROVED HARNESS TUG.

Charles Franklin Towsley, Brinkley, Ark.—This invention consists of a metal loop for suspending the thill of a buggy from the back strap. Said loop has a latch piece to open for admitting the thill and closing it in; and also a lining of soft material in the bottom, to avoid wearing the thill. Suitable connections are added for suspending it from the back strap and connecting the girth.

IMPROVED WHIP SOCKET.

William Hughes and Joseph K. Alexander, Minerva, O.—This whip socket is so constructed as to enable the whip to be locked in it when desired. It is a combination of a coiled spring and a lock with a whip socket made in two parts, turning upon each other.

NEW CHEMICAL AND MISCELLANEOUS INVENTIONS.

IMPROVED CARTRIDGE.

Albert Hall, New York city.—This consists in securing the anvil by projecting points in recesses of the shell of a shot gun cartridge, and holding the same by a sheet metal cap piece at the base of the shell.

IMPROVED BOTTLE STOPPER.

Charles de Quillfeldt, New York city.—This consists of an elastic stopper applied to a solid cap piece, and hung by a curved slot to a yoke pivoted at the neck band. A lever ball, pivoted to the cap piece below the slot, acts on the yoke, and raises it to the uppermost part of the slotted cap piece, to secure thereby the stopper to the neck.

IMPROVED RAILROAD RAIL JOINT.

George N. Hodgdon, Enfield, N. H.—This inventor proposes, as an improvement in rail joints, the combination of the rails, which are laterally braced at their meeting ends, with longitudinal sleepers, that extend on both sides of the joint, and are bound by the cross ties at both ends to provide a steady, continuous bearing for the rails.

IMPROVED SUSPENDER STRAP.

Francis E. Johnson, New York city.—This inventor makes the button straps on suspenders of woven webbing; and instead of carrying them directly through a ring on the braces, he attaches them to a piece of leather looped through the ring. The straps may be either in two pieces or in one; in the latter case, they are folded diagonally at the point of attachment to the ring connection. Said connection is covered with satin jean, which obviates the staining of the shirt by the leather. The device is simple and strong, and is both convenient and comfortable for the wearer.

IMPROVED BALE TIE.

Stephen Callanan, Castleton, N. Y.—This consists of a ring bent on one end of a wire, and a hook on the other, such as are employed in a weaver's knot, together with a bend on each wire at the point where the ring and hook begin, or thereabout, in such manner that the hook may be passed through the ring, hooked around the wire above the ring, and then drawn back into it, forming a substantial knot.

NEW AGRICULTURAL INVENTIONS.

IMPROVED FLAIL.

Theodore F. Drake, Great Valley, N. Y.—This inventor proposes a light bundle of wires as a substitute for the heavy metal shod flail beater ordinarily used. He considers this device to be just as effective as the latter and much less costly.

IMPROVED SEED DROPPER.

Hermann H. Koeller, Camp Point, Ill.—This improved device for dropping seed is so constructed that it may be readily adjusted to drop larger or smaller seeds, as may be required, and will prevent the dropping slide from carrying out any more seed than enough to fill the dropping holes of said slide. It consists in combining a centrally pivoted two armed spring with a cut-off block, and in making the cut-off of a side-slotted box, a block with side pins, a spring, a bolt, and certain angle plates.

IMPROVED SPRING LOCK FOR PLOWS.

Milton K. Wheat, Paris, Ky.—The object of this invention is to hold the plow plate of cultivators, drills, and shovel plows in place when at work, in such a way that, should the plow plate strike an obstruction, it will swing back and thus prevent it from being broken. The device consists in spring lock bars, provided with shoulders at their upper ends, pivoted to the plow beam or the plow standard, and having the plow plate attached to their lower ends.

IMPROVED STRAW CUTTER.

William H. Harrison, Clay Village, Ky.—This consists of a cam contrivance combined with a curved cutter having a rocker-shaped end, and a roller at each end of the rocker to work in the cam as a substitute for the ordinary pivot. The object is to contrive a connection of the cutter that will not be subject to the lateral play of the cutter common to the ordinary pivots, and which will give a shear cut throughout the whole swing of the cutter.

IMPROVED REAPER AND MOWER.

Marvin W. Freeman, Beatrice, Neb.—The invention consists in sickles concaved upon their inner sides, and provided with sickle teeth, and in the combination of the stationary adjustable sickles and their bar with the vibrating sickles and their bar, and with dividing fingers and the cutter bar. By using two sickles, serrated, matched, and concave, right and left oblique edges are made to work in close proximity with each other; while by making the upper sickle section longer than the lower one, the whole weight of the former is made to bear on the heel thereof, the main bar and bevel edges of lower sections thus retaining the edges close together until worn out.

IMPROVED HOG SCRAPER.

Peter Johnson, Wauconda, Ill.—This hog-scraping tool is formed of a handle, with circular and elliptical concavo-convex scrapers secured to its respective extremities. The conformation of the blades admits of all portions of the body being equally reached, and hence of the scraping being more effectively performed.

IMPROVED SELF-RAKES FOR REAPERS.

Abner S. Smith, Hannibal, Mo.—This is an improved rake for attachment to harvesters and reapers to remove the cut grain from the platform, and deposit it in gavels upon the ground. The novelties are mainly improvements in construction, requiring the aid of drawings for their proper description.

IMPROVED PORTABLE FENCE.

Levi Chipman, Vermont, Ill.—This is mainly an improved fence post, which may be quickly set up and taken down, and which requires neither nails, keys, wedges, pins, nor bolts for connecting the panels thereto. It is formed of inclined bars, a notched sill and crossbar, made in two parts, and an upright bar. With this are combined the projecting ends of the horizontal bars of two adjacent panels, placed at an angle with each other.

IMPROVED SCRAPER ATTACHMENT FOR PLOWS.

Eugene Slosson, Morris, Ill.—The scraper plates have arms which are pivoted to the standards. The ends of the arms are fastened by wooden pins strong enough to withstand the draft strain under ordinary circumstances, but which, should the scrapers strike an obstruction, will break and allow the scrapers to swing back. The pitch of the scrapers is adjusted by wedges, and there are other useful and novel improvements in construction.

IMPROVED CULTIVATOR.

Thomas J. Montgomery and George W. Montgomery, Winchester, Tenn.—The standards are curved outward to bring the plows at the proper distance apart, and then downward, and their lower parts are curved forward to form seats for the plows. There is a new arrangement of braces attached to the standard for sustaining the draft strain, and a bar is provided which acts as a guard to keep the machine erect and cause it to run steady and smooth, and as a gage to regulate the depth to which the plows may enter the ground.

IMPROVED CHURN.

John T. Brown, Morrisville, and J. W. Colbert, Fredricksburg, Va.—The invention consists of a churn wherein there are two dashers revolved in opposite directions, to produce conflicting currents; also a bearing plate between the cover and an inner shoulder of the churn body, the same being arranged so as to form both a bearing for the dasher shafts and a guard against the exudation of the milk or cream: also a collocation of mechanism with cover, so as to make a single detachable piece.

IMPROVED PLOW.

Henry D. Straight, Denmark, Iowa.—This plow is so constructed that the depth at which it works in the ground may be controlled entirely by the handles. The landside part of the mold board is bent forward to serve as a colter to cut the soil, instead of tearing the same, as is ordinarily the case.

IMPROVED PORTABLE FENCE.

Tilmon A. H. Cameron, Petra, Mo.—The panels of the picke fence are formed by inserting and securing the pickets in holes in the top and bottom rails. The adjacent ends of the top and bottom rails of the contiguous panels are overlapped, and through them are passed round pickets, which have heads formed upon their upper ends to prevent them from dropping through the said rails. The panels are supported away from the ground by the device, in which a notched sill receives the bottom rail of the panel, and the ends of which are secured to braces. The fence is easily leveled upon inclined or uneven ground.

IMPROVED CHURN.

Robert M. Neal, Belle Plaine, Kan.—The object here is to throw the milk into violent agitation, so as to bring the butter in a very short time. This is effected by using both a dasher moving up and down, and beaters revolving in opposite directions, the whole operated by novel and simple mechanism.

NEW HOUSEHOLD ARTICLES.

IMPROVED NURSERY CHAIR.

Lewis P. Lawrence, Port Morris, N. J.—This is an ingenious article of furniture, so constructed that it may be arranged for use as a child's high chair, as a low chair and table, as a low rocking chair and as a low stationary chair.

IMPROVED WASH TUB STAND, CLOTHES HOLDER, AND IRONING BOARD.

John J. White, Norfolk, Va.—This invention consists in constructing a hollow stand so that it may receive the soiled clothes, hold the wash tubs, and support the ironing board; also in providing opposite inwardly inclined ledges to receive the wash tubs as well as bottom sections, and to sustain the ironing board; also in novel means for holding the bottom sections of the stand in a secure and stable position.

IMPROVED TABLE LEAF SUPPORT.

Eli J. Wolfrom, Washington, Ohio.—The invention relates to modes of supporting hinged table leaves, and consists in so doing it that the support will be automatically thrown into true bracing position by the act of raising the leaf, and, at the same time, effectively locked against the possibility of displacement.

IMPROVED WASHING MACHINE.

Thomas H. Peavey, Epworth, Iowa.—The essential feature here is a contrivance of the apparatus for working a swinging washer in a box-shaped tub, so that the projecting portions may be readily detached and stowed away. A table top may be put on the top of the tub, and thus the machine may be utilized for a table when not required for washing.

IMPROVED KNOB LATCH.

William W. Gardiner, New York city.—This lock is so constructed that the key may be inserted through the knob and spindle that operate the catch bolt.

IMPROVED HEAT RADIATOR.

Emerson C. Angell, New York city.—This is a combination of tubes, rising from a continuously open draft flue, that has a valve near each end, provided with valves just above said flue, and above these valves connected by cross pipes, so that all the flues will empty into a continuous tube, being thus easily cleaned, and a direct or indirect draft being secured. The invention presents a large radiating surface, while tending to economize fuel.

IMPROVED FOOT-WARMING STOVE.

Edwards A. Reed, Oliver Springs, Tenn.—The invention relates to providing the outer box of the foot stove with braces for supporting the chimney, and forming a handle by which to carry the same. The furnace may be withdrawn by a handle from the casing, and used in detached state for cooking purposes, which may be of considerable advantage in traveling.

IMPROVED CANDLESTICK.

Philipp Schauble and Louis Dohm, Elizabethport, N. J.—This consists of a coiled wire fixed upon a suitable base to serve for the tube of the ordinary candlestick. The upper end terminates in a hook for hanging it up readily, and there is a cup for the bottom of the candle, with a stem projecting out from it through the space between the coils, to raise and lower the cup by screwing it up and down, and to serve for a handle for carrying the candlestick about.

IMPROVED IRONING TABLE.

Jacob Closs, Decatur, Ind.—This is a new ironing board, so constructed that it may be readily attached to an ordinary table, and provided with a small board, which may be swung over the large board and secured for use, and swung back out of the way when not required.

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$1,000 for any hand sawmill equal to A. B. Conu's, 197 Water St., New York.

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Responsible parties who will make, on royalty, a Pat'd Corn Planter, address A.C. Burgner, Charleston, Ill.

Castings for low pressure beam Engine, about 2 in. bore of cylinder, address P.O. Box 347, Albany, N.Y.

Canadian Patent on a Life-Preserving Stool, for sale cheap. H.H. Nash, 223 So. Eutaw St., Baltimore, Md.

Companies engaged in casting "cast steel" may secure a desirable contract by sending their catalogues of prices to Post Office Key Box E E, Macon, Ga.

Traveling Crane at half price—8 tuns lift with 2 men—12 feet high, 25 feet tread, $425, f. o. b. cars. Mitchell, 310 York Ave., Philadelphia, Pa.

Wanted—The address of parties who manufacture machinery for making paper pulp from wood. H. H. Frary, Jonesville, Vt.

Split-Pulleys and Split-Collars of same price, strength, and appearance as Whole-Pulleys and Whole-Collars. Yocom & Son, Drinker St., below 147 North Second St., Philadelphia, Pa.

For Best Band and Scroll Saws, Universal Wood Workers, Planing and Matching Machines, address Bentel, Margedant & Co., Hamilton, Ohio.

Patent for Sale, on royalty—Road Engine. A valuable Machine for hill grading as well as on level. Address J. Henry Bange, Edwardsville, Ill.

Family Knitting Machines—Alfred L. Lincoln, Knox P.O., Pa., wishes the best kind made.

Best Speed Indicator. Mail $2. Write for discount to Agents. Samuel Harris, Lind Block, Chicago.

For Sale or to Let on Royalty—Patent Oiler. Address George F. Dutton, Farmington Falls, Maine.

Sure Cure for Slipping Belts—Sutton's Patent Pulley Cover is warranted to double the power of any pulley. Circulars Free. Agents Wanted. John W. Sutton, 96 Liberty St., New York.

Patent for Sale—A Water Wheel two inches in diameter, in a case three (3) by five (5) inches, for running Sewing Machines, &c., using very little water. Larger sizes can be built. Address C. H. Sturges, Saratoga Springs, N. Y.

For Sale—36 in. x 16½ ft. Lathe, $400; 31 in. x 10 ft. Lathe, $300; 18½ in. x 12 ft. Lathe, $250; 15 in. x 8 ft. Lathe & Chuck, $175; 9 ft. Planer, $425; 6 ft. Planer, $350; Profiling Machine, $350. Shearman, 45 Cortlandt St., N. Y.

Small Launch Engine, 3 in. x 3½ in. Link Motion, cheap for cash. H.R. Silliman, 160 Smith St., Brookl'n, N.Y.

M'f'rs of Shafting, Pulleys and Hangers, address, with lowest price list, the Dueber Watch Case Manufacturing Co., Cincinnati, O.

Walrus Leather and Walrus Leather Wheels for polishing. Greene, Tweed & Co., 18 Park Place, N. Y.

Wanted—A good 2d hand Steam Engine, Cylinder 18 in. x 36 in.; Band Wheel, 12 or 13 ft. x 36 in. face. Address, with full particulars, N. W. Robinson, P. O. Box 775, Burlington, Vt.

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

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

Temples and Oilcans. Draper, Hopedale, Mass.

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

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

Notes & Queries

E. J. T. will find directions for painting tin roofs on p. 202, vol. 30.—G. D. can remove colored writing ink from paper by the process given on p. 410, vol. 32. Water may be purified by the process given on p. 387, vol. 33.—S. H. will find a description of a process for canning green corn on p. 234, vol. 33.—G. G. M. P. will find a description of a tracing machine (pantagraph) on p. 179, vol. 28.—W. R. will find directions for using the lactometer on p. 208, vol. 34.—C. O. R.'s device for improving a vertical boiler is not new.—W. E. S. should address Seth Green, Esq., Rochester, N. Y., as to trout culture.—J. A. G. can ebonize wood by the process described on p. 50, vol. 33. Shirts may be highly finished by the method described on p. 213, vol. 34.—H. P. S. will find directions for silver-plating without a battery on p. 399, vol. 31.—W. F. R. is informed that the sparks from a leather belt in motion are electricity. See p. 10, vol. 34.—C. M. will find a recipe for filling for wood on p. 315, vol. 30.—P. B. T., G. M. G., S. H. W. J. K., B. L., and H. T., 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) J. L. W. says: If we use a plain iron pipe in drive wells, in some localities, it will run into holes in about one year; in others it will last a little longer. Why does the pipe not wear out sooner than the pipe 8 or 10 years ago? A. The new pipe may be driven through dissimilar strata of earth, and thus subjected to different conditions from the old; or the old may have holes in it also, but the rust and compact earth around it close them so that they do not show. Rubber coated pipe is now used for gas when laid in the ground, and might be serviceable for drive pipe.

(2) J. E. M. asks: Will it do to cement on soft sand walls in a cistern? A. Dig your cistern in a circular form and cut the sides as true and smooth as you can: put on the cement all in one coat about one inch thick, and float it down to a very smooth surface.

(3) E. A. V. says: A refrigerator is built of brick. It is 4 feet square, and 5 feet 6 inches high inside. The wall is 10 inches thick, having a hollow space of 2 inches wide in the wall. It is cemented on the inside. The room has no ventilation, and the ice melts very fast. How can it be made to work? A. The heat is most probably derived from the earth at the bottom of the refrigerator, and through the brick wall, where the isolation is not perfect. A wooden lining set off from the wall 2 or 3 inches, and up from the bottom the same, and a little ventilation, would most likely improve it.

(4) S. & P. M. Co. says: In the manufacture of artificial stone from Portland cement, we use wooden molds and coat them with shellac varnish; but it becomes soft in a short time. Is there anything that we can coat them with that will become hard and resist the action of the cement? A. Glycerin is sometimes used for plaster molds, but more usually a mixture of lard and oil.

(5) F. N. R. says: Please tell me how I can make a good galvanic battery without many cups. A. Get a glass jar, and at the bottom of it place a circular piece of copper to which a gutta-percha-covered wire has previously been attached. Let the wire be long enough to extend five or six inches out of the jar. Fill the latter, about two thirds full, with water, in which a quarter of a pound of zinc sulphate may be dissolved. Then suspend a piece of zinc in the jar so that its upper surface is just below the level of the water. When this has been done, drop crystals of copper sulphate (blue vitriol) in the jar, taking care that none remains on the zinc. About half a pound will be enough to start the battery; more may be added from time to time as needed, but care must be taken that the blue does not extend quite up to the zinc. A wire leading from the zinc and the one from the copper form the poles. The number of cells required for any given case, as well as their arrangement, will depend upon the work to be done.

(6) J. B. asks: Can shellac be dissolved in sulphuric ether by heat? A. No. It can be dissolved by the alkalies and by aqueous solutions of borax.

(7) H. S. J. says: 1. Please give me the value of paraffin as an insulator, counting shellac as 1,000. A. We do not recollect ever having seen a statement of the relative values, but believe that paraffin stands a very little below shellac as an insulator. 2. In the chloride of silver battery described on p. 390, vol. 33, do you mean that each cell is equal to 1·03 of Daniell's? A. Yes. 3. How many cells of this battery would be necessary to produce a powerful electric light? A. That depends upon the resistance of the battery, which, we believe, is high; consequently the number of cells would be considerable. We have, however, never experimented with it.

(8) E. W. asks: Is there an equal amount of fertilizing material in old dry bones and in green ones? A. The difference is in the loss of nitrogenous compounds arising in the decomposition of the fatty and other matters. The percentage of phosphate of lime in the two cases is the same.

(9) T. K. asks: Do wire hair brushes make the hair stiff and harsh? A. The excessive use of a stiff brush should be avoided, as it irritates the scalp and promotes the formation of dandruff. We have found that thorough cleansing of the hair with tepid water and pure white Castile soap (the soap being completely removed by rinsing with pure water) once in two or three weeks, and thoroughly rubbing the scalp and roots of the hair with hair oil, will keep the head clean and the hair soft and free from dandruff.

(10) J. A. G. says: What can I use to prevent the disintegration of rubber hose? A. Try the following: Flow the interior of the tube with a solution of strong glue in water, and immediately afterwards with a strong solution of tannic acid in water. India rubber is partially dissolved by kerosene oil.

(11) A. B. asks: What is the reason of the heat produced when lime and water are mixed? A. When two liquids or a solid and a liquid combine to form a solid body, the action is always accompanied by a considerable evolution of heat. As might be expected, the contrary is the case when a solid passes into the liquid form, as in the case of ice and salt. When caustic lime is mixed with about one half its weight of cold water, the lime and the water combine to form a white dry powder (which is the hydrate of lime), and the heat that is evolved by the chemical combination is often sufficient to ignite gunpowder.

(12) C. P. says: In November last I was traveling in the west, and the prairie fires had spread over hundreds of square miles, and the ground was black. During the bright daylight, the ground was continuously spread over with a gossamer covering of spiders' webs for miles and miles. Whence came the multitude of insects that spun the webs? A. The fire had been superficial and would not have destroyed the germs of vegetable and animal life concealed beneath the surface.

(13) F. W. G. asks: What is the best method of polishing hard rubber? A. Use pumice-stone and rottenstone. Some varieties of hard rubber goods are given a natural polish by the presence in their composition of bodies similar to asphaltum.

How can I stain pearl to an color? A. We have never heard of this having been done.

(14) W. W. B. asks: How many lbs. of marble does it take to make 100 cubic inches of carbonic acid gas? A. About 200 grains.

(15) B. G. asks: 1. Please tell me the amount of correction to be applied to an aneroid barometer for an altitude 6,000 feet above sea level. We have a mercurial barometer from which to make the adjustment. A. The adjustment is best made directly from the mercurial barometer itself. Graduate your aneroid according to the readings of the mercurial, or (by observation) make a table of comparative values. 2. Water boils here at some 11° below the temperature required at sea level. By the same rule, should water freeze at a different temperature than at sea level? A. The freezing point is not displaced in any appreciable quantity.

(16) A. B. says: Galvanized iron nails throw the putty when the latter is made of lead. Would a putty made of zinc do better? A. Yes, try it.

With what, oetter than with white lead paint, can wood be coated to render it impregnable to water? A. Fill the pores of the wood with a good covering of shellac varnish.

(17) B. V. P. asks: Is there any way to avoid the use of sulphuric or other acid in wire drawing? A. The acid pickle may be omitted, but if so the tool is in danger of being rapidly corroded by the scale of oxide formed on the surface of the wire during the operation of annealing. Wash your wire immediately as it comes out of the pickle in alum water, and dry as quickly as possible. This method, if the acid used is free from copper, will, in most cases, be all that is required. Another method is that of neutralizing any of the acid liquor that adheres to the wire after removal from the pickle by means of a weak lye, washing with water, and drying quickly. The wire should not be allowed to remain, while moist, in contact with the air any longer than possible. Sawdust may be used for absorbing the moisture, but in some cases it will be found advisable to employ good lime instead.

(18) J. W. L. asks: What cheap stuff can I use to dye hemp or feathers to a deep red or scarlet color? A. Use aniline red.

(19) T. W. A. asks: Can you give me any information in regard to the manufacture of illuminating gas from fine sawdust? A. Very rich illuminating gas may be obtained from wood by subjecting it to destructive distillation in retorts similar to those employed in the production of coal gas. It has been found necessary, however, in order to convert the empyreumatic vapor that first passes over into a permanent gas, to pass the vapor through tubes heated to redness. The gas thus obtained contains a larger proportion of carbonic acid than coal gas, and consequently requires a larger percentage of quicklime for the elimination of this impurity. It is, however, free from sulphur and ammonia compounds. Wood gas requires larger burners than coal gas because of its greater specific gravity. If this precaution is not taken, the luminosity of the gas flame will be greatly reduced.

(20) J. M. N. asks: What is the best way of protecting the iron bottom of an aquarium from rust? A. Mastic varnish will answer the purpose very well.

(21) S. W. N. asks: What is a good stove polish? A. The best stove polish is the purest graphite, ground very fine and mixed with a little alcohol or vinegar; the addition of other carbonaceous substances only injures its polish and refractory qualities. The plumbago now employed is in many cases adulterated with finely pulverized gas carbon, which, although it resists high temperatures, detracts greatly from the polish.

(22) P. A. says: If I have an inverted siphon, one end being larger than the other, filled with water and closed at each extremity with a closely fitting piston, and a weight or pressure of 100 lbs. be applied to the larger end, what will be the amount of pressure at the smaller end? If applied at the smaller end, what will be the pressure at the larger end? A. The pressure per square inch will be the same at each end of the tube, so that the total pressure will be in proportion to the area.

(23) H. B. asks: How can I make the mixture of clay that is used in the place of fire brick for stoves? A. Fire clay is a common article of trade. When required for use, it is mixed with with a little water, kneaded into a thick dough, and used at once. The clay is sometimes mixed with a little plaster of Paris, and alum water is occasionally employed in place of clear water.

(24) J. M. asks: Is there not a method by which rock can be blasted by electricity? A. Not by electricity alone. Gunpowder and gun cotton can be fired by electricity, and dynamite and nitro-glycerin by a suitable percussion cap ignited by an electric current.

(25) J. D. G. says: 1. I wish to warm several chambers and a bath room. Is it practicable to do it with 1 inch iron pipes of water, passing through 2 stoves with constant fire, water being supplied from a barrel on the second floor, passing down to stoves on first floor, thence up to the chambers, and back to the barrel? A. It can be made to work if properly set. The pipe in the stove should be in a spiral coil, the water from the reservoir entering at the bottom and the warm water passing out at the top; set the coil against the lining of the fire chamber, and let the coal lie in against it. The reservoir should be 4 or 5 feet higher than the highest part of the pipe, and the pipe so set that the water will all drain back to the lowest point at the stove, where a faucet should be provided to discharge it when required. A coil from the same pipe could be placed in a second stove, providing regard is had to discharging the same as above. The water in the reservoir will become heated, and with proper pipes could be supplied to the bath tub, etc. 2. What surface of pipe would be needed in each 100 cubic feet of space in the rooms? A. One foot of radiating surface to every 50 to 100 cubic feet of air, according to the conditions of exposure to winds, etc.

(26) L. P. L. asks: What is best to prevent sourness in mucilage made of gum arabic and water? A. Try a few drops of oil of cloves.

(27) A. O. W. asks: 1. Does wind affect a thermometer? A. If the glass bulb of the thermometer be perfectly dry, its indications will be the same whether the surrounding air is in motion or at rest. The truth of this is very easily demonstrated by experiment. If we moisten the bulb of the thermometer, however, we shall find that the temperature indicated will be decidedly lower when the air is in motion than when at rest. The difference in the indications is dependent upon the rapidity with which the water on the exterior of the bulb is evaporated. The analogy between the human body and the wet bulb thermometer in this respect is obvious. 2. How much colder is it at the surface of the earth than 5 feet above, in the shade? A. Practically the difference is very slight, and the difference is by no means uniform. 3. How can I make a rain gage? A. The cheapest form of rain gage we know of is that composed of a graduated bottle, having a narrow neck with a perforated stopper, through which passes the leg of a glass funnel, the mouth of which is of known area. For one of the best forms of pluviometer, see p. 150, vol. 34.

(28) A. L. S. asks: How can I make a good liquid acid for soldering iron? A. Dissolve zinc in hydrochloric acid until it will hold no more.

(29) B. asks: Is it possible for a lady to attain proficiency in the arts of engraving, etching, and carving without a master? A. There are many artists of both sexes who, having natural ability, have made great progress in these arts with little or no instruction except what is gained from books and diligent practice. The demand for art workers is increasing, and is likely, in the future, to be great enough to insure remunerative employment for really capable persons.

(30) W. X. C. asks: How can I wash printer's rollers? A. When printing ink was made with burnt linseed oil, as it should be, a little pearlash lye would clean any roller fresh from the press, and dried ink could be removed with a little turpentine. But the inks of the present day are many of them, made with mineral oil: and caustic lyes and petroleum benzine, with much labor are required to clean rollers or type.

(31) F. E. H. asks: What size of wire is best for a magnet (¾ inch core) to ring a small bell? A. No. 18 copper wire will be found about right.

(32) W. P. D. says: 1. What should the power of the telescope of an ordinary spectroscope be? A. That depends upon the class of work required. 2. What should be the length of the collimator tube? A. It should be the focal length of the lens for parallel light. 3. What should be the length of the slit? A. About $\frac{3}{10}$ of an inch. 4. Should the lens in the collimator tube be achromatic? A. It is not essential: but the lens must be free from spherical aberration.

(33) A. W. asks: Of what size and how far from an objective, consisting of 3 plano-convex lenses of $\frac{3}{10}$ inch focal length, should a diaphragm be? A. That can only be determined by trial. Some objectives do not require any diaphragm.

(34) B. C. says: 1. I wish to make a magic lantern. Can you tell me the best size of lenses to use, both condensing and objective, to throw a picture on a screen from 10 to 30 feet away? A. Use 4½ inch condensers with objective of 1¼ inch aperture and 6 inches focal length. 2. What change is made in the lenses to throw the picture farther away? A. Only a change of focus. The farther away, the larger the picture. 3. Do the burner and the centers of the lenses require to be in line? A. Certainly.

(35) J. C. W. asks: What has become of the Keely motor? I hoped that there was something in it, as, allowing for large exaggerations, I did not think it possible that lawyers or men of standing in society could or would suffer their names to go forth to the world in connection with a humbug of such magnitude. What has become of it? A. Echo answers: What?

(36) E. asks: Is it possible by the use of prisms to so decompose or separate the prismatic rays of light as to enable the photographer to take pictures in colors? Chromos were first made by adding one color at a time. Why may not the rays of the camera be tinged by passing through media of prismatic colors superimposed on each other? Experiments in this direction will, I believe, yet solve the problem which has so long baffled photographers. A. The difficulty in photographing colors is not in the manner of lighting the subject, but in the fact that the photographic chemicals are insensitive to all colors except the blue and violet.

(37) M. J. M. says: I have a small stream of water carrying about 20 cubic feet per minute, in which I can obtain a head of not over 2 feet. Can I raise with such a head water enough for family use, with an hydraulic ram, to the hight of about 20 feet, say about 10 or 15 gallons per hour? A. This should be done without difficulty.

What is the rule for setting thimble skeins on axles? A. Perhaps some of our readers will give this correspondent the benefit of their experience.

(38) F. G. asks: 1. Is there any work in the English language that gives formulæ for grinding and arranging the lenses in modern compound microscopes? A. "The Microscope and its Revelations," by Dr. W. B. Carpenter. They are ground like all other lenses. 2. Can I get optical glass, both crown and flint, of uniform refractive power, whose index of refraction has already been ascertained with sufficient accuracy on which to calculate the curves of lenses without testing each piece separately? A. We do not think you can; but you can get glass of known specific gravity, which will enable you to form some idea of its quality.

(39) E. L. H. says: We differ on ventilation under the roof. One wants to ventilate directly through from the gable ends. I want ventilators in the ceiling, constructed so that they can be closed when desired, with an escape out through the steeple. Which will be the best? A. Your plan is the best; but it is also necessary to have openings near the floor as a part of a good system of ventilation. These should be arranged so as to prevent drafts as much as possible.

(40) E. L. H. asks: Are we to understand that you are opposed to arched ceilings for churches? We are building a church which is to be 50 x 76 feet x 35 feet, ceiling to be arched, having a spring of 9 feet, and paneled, commencing at the spring of the arch. The ribs forming the panel will be 24 inches deep. It will require some 5 or 6 of these ribs to give the desired finish, forming continuous panels from spring to spring of the arch. We desire your opinion. A. It is true that arched ceilings have proved to be subject to echoes more than those of other forms, but this seems to be governed somewhat by the hight of ceiling, low ceilings being apparently more subject to them than high ones. An arched ceiling is more objectionable still, on account of its tendency to thrust out the side walls and thus to cause a settlement. This has occurred in many cases where the buttresses were insufficient or entirely wanting, and where no tie rod or beam extended across the church at the eaves.

(41) H. C. D. asks: In making malleable cast iron it is melted in an air furnace. When it is put in, it is a gray cold blast charcoal iron. It remains there until it changes from gray to white. Does it contain more carbon when it is white than when it is gray? I think it does, for if it remains in a little too long it becomes steel, which we can take to the blacksmith's fire, and draw and temper. A. The white contains the least carbon.

(42) G. L. P. Jr. asks: 1. Where can I get information as to making models and patterns for casting small steam cylinders and other articles? A. Consult our advertising columns. 2. What should be the length and breadth of ports, measuring on the cylinder face, of a cylinder, the bore of which is 2¼ inches and the stroke 4½ inches? A. Make your cylinder steam ports ¾ long and ⅛ inch wide, the exhaust port ¼ wide, and the bridges between the ports ⅛ wide. 3. What should be the size of the slide valve for same cylinder? A. Valve ⅜ wide, with an exhaust port barely ⅛ inch wide.

(43) R. C. asks: At how many revolutions per minute can we run a grindstone 6 feet in diameter with 8 inches face, with perfect safety? A. You may run it safely at 300 revolutions per minute.

(44) M. R. asks: 1. How old is the earth according to geology and astronomy? A. The age of the earth cannot be fixed, as its proved antiquity is so great that many cycles of ages, more or less, are of little consequence. 2. How long has it been since man made his first appearance on the earth? A. No one knows. The answer to the previous question applies to this one also.

If on a solid wheel, 4 feet in diameter, the point half the way (or 1 foot) from the center travels through only half the space in the same time that a point furthermost from the center does, is there not good reason to believe that there is a point in the center that does not move at all? A. There is in every rotating body, theoretically, a point of no rotatory motion. But it is a point, "without parts or any magnitude."

(45) H. H. A. says: I have a pump with 1¼ inch suction and 1 inch discharge pipe. At a very low speed it works well; but with full head of steam, it does not half fill the pump, and thumps badly. Is the suction pipe large enough? A. No. Make it 2 inches in diameter.

(46) W. F. S. asks: 1. Of what alloy shall I make a lead wheel on which to polish cut flint glass stoppers? A. Use old type metal. 2. How will I prepare the rottenstone to use with it? A. You had better purchase it already prepared. The back numbers you ask for are out of print.

(47) A. asks: Please inform me of the rule for determining the diameter of a wheel when number of teeth and pitch are given. A. Multiply the number of teeth by the pitch on the pitch line, and divide by 3·1416. The quotient is the diameter at the pitch line.

(48) J. E. H. asks: How is it that telegrams can be sent two ways over one wire at the same time? A. The instruments are so arranged that the current sent does not affect the receiving instrument of the station sending. This is effected in various ways. One of these consists in winding the magnets with double coils, the convolutions of which are put on oppositely; or the connections are so made that the result amounts to the same thing. One end of one coil is connected to the line wire: one end of the opposite coil, to the ground, through a resistance equivalent to that of the line; and the other ends of the coils are joined together. The junction is then connected to the transmitting apparatus. When a current is sent out it divides where the two coils meet, half passing through one coil to the line, the other half, through the opposite coil and resistance, to ground. As the half currents are oppositely directed in the two coils, the action of one neutralizes that of the other, and the iron cores remain unpolarized. The half current which goes to line passes on to the receiving instrument at the distant station, and, if the key at that point is open, goes through one coil of the instrument, thus producing a signal. There may also be a time, in simultaneous transmission, when the received half current passes through both coils of the home instrument. It will be observed, however, that, for such a case, the convolutions of the coils supplement each other; but at the same time, the current must pass through the extra resistance, so that while the number of convolutions is doubled, the current is reduced one half by this added resistance, and thus the effect remains as before.

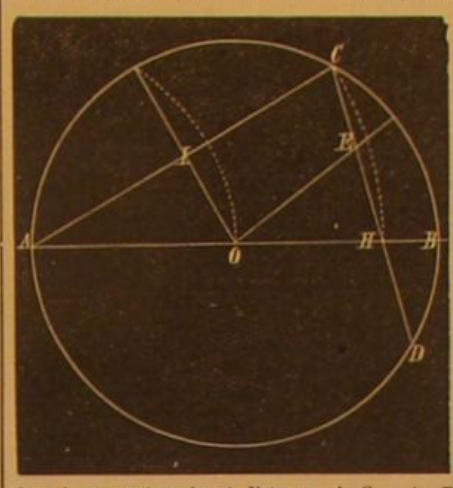
(49) A. I. says: Please give me a recipe for making the black composition that picture frame moldings are coated with. It is afterwards easily polished with a rubber to a jet black. A. Make your frames of plaster of Paris mixed with thin glue water. When dry, cover them with size and lampblack, and varnish with the following composition: Boil turpentine until it becomes black, and sprinkle on it 3 parts amber in fine powder to 1 turpentine. When the amber is melted, add some sarcocolla and more spirit of turpentine, and stir the whole. Strain the mixture, mix with ivory black, apply in a hot room to the plaster frames, and place in a heated oven. Two or three coats will be necessary.

(50) G. P. S. says: I have a zinc and carbon battery, the carbon plates of which are supported by copper connections. I find that the acid creeps up on these connections and corrodes them. What can I use to prevent the corrosion? A. The best plan is to deposit copper on the end of the carbon and then solder a wire to the deposit. First heat the end of the carbon and touch the part just beyond where the copper is to extend (about half an inch from the end) with a piece of paraffin, taking care it does not run up the part to be deposited on; should it do so, however, it may be driven off by a strong heat. When cold, cut a few scores in the surface to give a hold to the copper, and drill a hole through, in which fix firmly a copper wire projecting on each side. With a warm iron, spread a good film of paraffin from the line of intended coppering as far down the carbon as the part to be immersed in the liquid of the battery when working. Connect a wire to the carbon, by a screw clamp, and insert in a copper solution, arranging at first for a quick deposit. When a good deposit is made, drill a few holes right through copper and carbon, soak in water to remove any absorbed copper salt, and dry it thoroughly. Now tin the part to which the connecting wire is to be soldered and stand the carbon with its coppered end in melted paraffin till its upper part is well saturated. When the connection is soldered, a coating of paraffin may be spread with an iron over the copper and all parts of the carbon not intended to be acted on by the liquid.

(51) J. M. W. says: 1. It is universally accepted that a current of electricity on a wire is only complete when the metallic circuit is complete, and that a wire of 400 miles in length in reality is 400 miles of electricity. What becomes of the charge when the circuit is broken? Does it return to the battery and replace itself as before starting out upon its journey? This does not seem possible when we consider the amount of surface in both battery and wire. For instance, the surface of 400 miles of wire exceeds many times that of a battery consisting of 200 cells of gravity. What becomes of all this amount of force? A. The current circulates only when the circuit is complete; but it is not essential that the latter should be metallic. If the circuit is interrupted, when insulation is perfect, the conductor on each side of the break assumes a charge proportionate in magnitude to its surface, and its potential is equal to that of the battery.

(52) S. asks: Is there in existence a white cement for outside building purposes capable of standing the weather? A. Portland cement is probably the lightest: it is advertised in our columns. Ordinary hydraulic cement will make a light stucco by using white sand or a good lime paste with it. The lime paste may equal in volume the cement paste.

(53) H. C. N. says: I send you the following simple method of ascertaining the sides of some inscribed figures. Its simplicity will recommend it to your readers. Set off the radius, B C;



then from center, A, at distance, A C, cut off A H, equal to A C. Draw C D through H. The rest explains itself. A C is the side of an inscribed trigon, C D is the side of a square, D E the side of a hexagon, A I the side of a heptagon, O E the side of an octagon, D B the side of a dodecagon.

(54) J. M. W. says: 1. There are 9 or 10 wires feeding from two Callaud batteries; both take earth from same ground wire. If we adjust closely, we get a cross from either of the 9 wires. We did not have this trouble on same wire with an acid battery. Is this a feature of the Callaud, or is the defect at the point of junction with the ground wire, or is it in the ground wire wholly? A. No. The ground wire may be faulty: but it is more probable that defective insulation is the cause of the phenomenon. 2. Working a wire 400 miles in length, will it improve its working condition to use condensers at each terminus? A. No.

(55) J. M. W. asks: 1. Is the conductivity of a wire altered by expansion and contraction other than by tightening the connections at time of contracting? A. As the temperature rises, the conductivity becomes less. 2. In speaking of low and high resistance, is the term low used to designate resistance from 1 upwards, and high resistance the amount of interference it is capable of overcoming? A. Low and high resistance are relative terms; 1,000 ohms would be called exceedingly low resistance if it referred to the insulation of a mile of telegraph wire. 3. Common line relays are measured and marked like this: 75 ohms, 100 ohms, 130 ohms, etc. Is the one of 130 preferable to the others for intensity of attraction, and more suitable for general use? A. It would be more suitable for average telegraph lines; but these matters depend altogether upon the circuit in which the instruments are to be used. 4. I have a battery constructed as follows: The glass cell is 3 inches in diameter and about 4 or 5 inches high. In the bottom of this, I place a piece of cast iron, and suspend a disk of copper, both connected with insulated wire. I then fill up the cell with a strong solution of lye from wood and coal ashes. I get a pretty good current from it. Is it of any value? A. Very little.

(56) G. C. N. asks: Please tell me of some harmless substance by which light brown hair can be changed to a golden color. A. A dilute solution of chlor-nitric acid (*aqua regia*) applied as a hair wash will effect this. A similar preparation of peroxide of hydrogen may also be employed. But we cannot recommend the use of either. Any one who knows of a better recipe will please send it to box 773, New York city.

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

L. B. D.—The explosion was most probably caused by marsh gas or light carburetted hydrogen. This gas likewise forms the chief part of fire damp.—C. W. G.—It consists of oxide of iron, alumina, and silex. For anti-incrustators, see our advertising columns.—S. F. S.—It is yellow and blue clay. You might, with profit, see how it will stand heat.—D. T. G.—No. 1 consists mostly of silex, silicate of alumina, and carbonate of lime, nothing to render it more valuable than any common earth. No. 2 is a fine white clay, remarkable for its small percentage of combined water. Try its capabilities in the way of absorbing grease stains, drying up and disinfecting foul places, and similar uses. No. 3 is inspissated bitumen. You ought to be able to make use of it in manner proposed. No. 4 is rather doubtful. It contains a small percentage of oxide of iron. No. 5. The magnetite will all be swept out by a magnet, and the rest are quartz grains and hyacinths.—The spider from Jacksonville, Fla., has been handed to a distinguished entomologist for examination.—M. P. C.—It is celluloid. See p. 23, vol. 33.

W. A. F. asks: Will some one give a plan for straightening wire, from No. 16 to No. 8?—F. A. R. asks: How can I calculate the number of bushels of shelled corn contained in a crib of any certain size, the corn being on the cob?—G. M. Jr. asks: How can I make Cologne spirit?—J. W. B. asks: How can I put a fine black finish on gun work?—J. C. W. asks: How large a cube can be cut out of a ball 12 inches in diameter?—W. J. says: I am about to construct a flouring mill. Will some one tell me the size and length of reel, and number of cloth, which will make the most merchantable flour?—L. M. H. asks: Would lin wood do for building a boat 20 feet long?

COMMUNICATIONS RECEIVED.

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

On Cheap Postage. By C. E. H.
On Superseding Steam. By H. C. D.
On the Post Office Department. By J.
On Explosives. By J. N. K.
On Frost and Waste Heat. By T. P.
On Creeping Rails. By L. D. W.
On a Blowpipe. By C. H. H.
On Bone Black. By F. L. B.
On Steam Domes. By T. H.
On the Years of the Planets. By J. H.
On Electric Organs. By T. G.

Also inquiries and answers from the following:

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

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

Hundreds of inquiries analogous to the following are sent: "Who sells machinery for making flour sacks, and paper bag machines? Who sells meteorological instruments? Who makes large weight power machines? Who makes an artificial hand, which a disabled man can attach to the stump of his fore arm, so as to carry pails, etc.?" 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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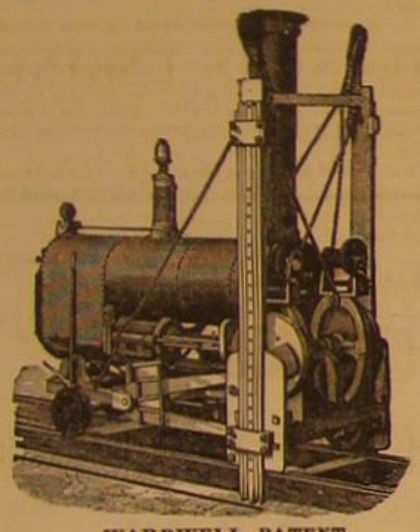
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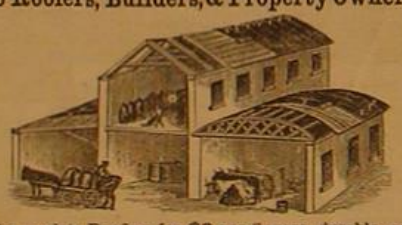
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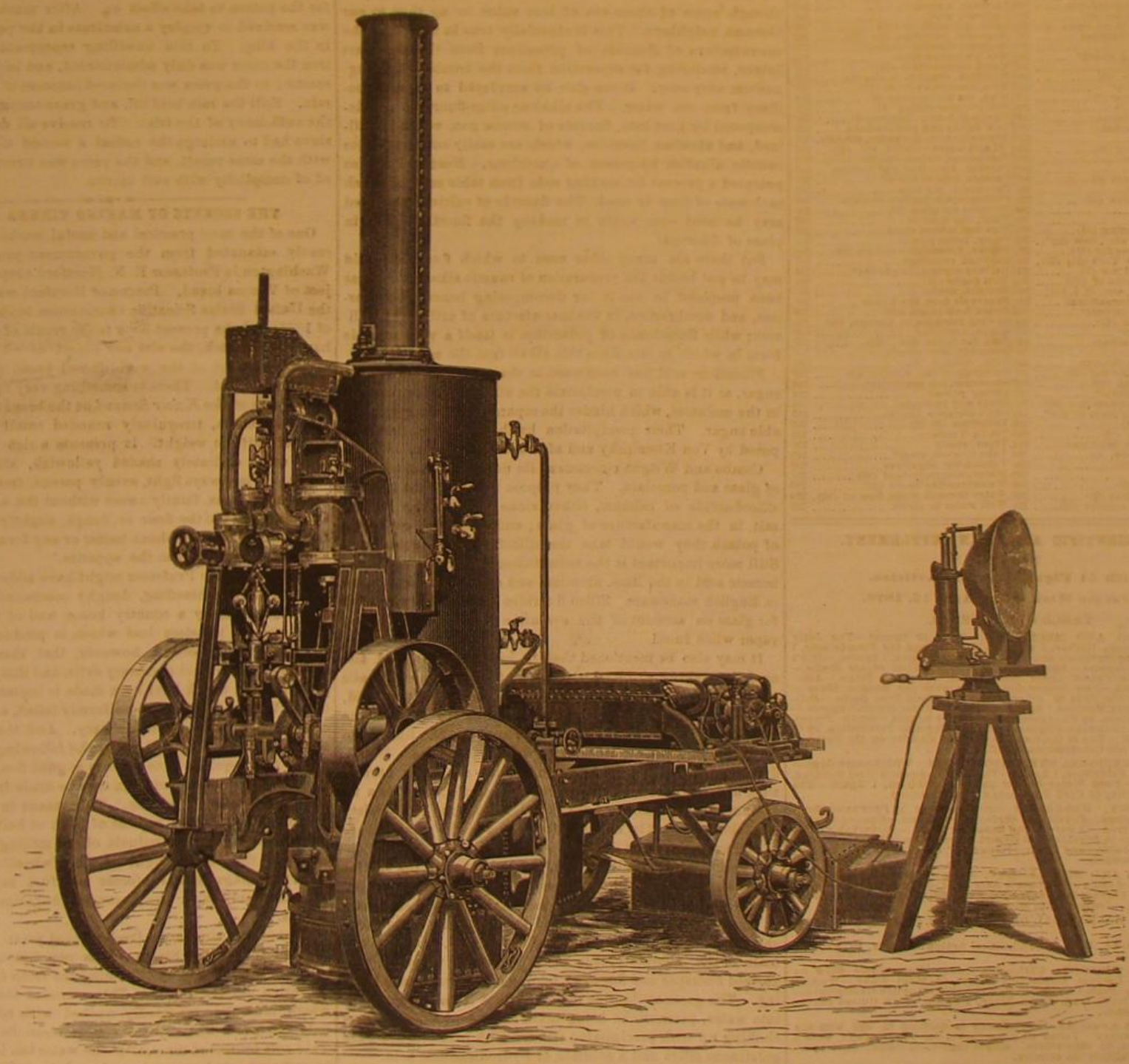
Vol. XXXIV.—No. 16. [NEW SERIES.] NEW YORK, APRIL 15, 1876. [$3.20 per Annum. [POSTAGE PREPAID.]

A LOCOMOTIVE MAGNETO-ELECTRIC INDUCTION ENGINE.

We recently published Professor G. F. Barker's excellent lecture on magneto-electric machines, in the course of which a description was given of the Siemens armature. One of the most recent applications of this important apparatus for converting magnetism into electricity is represented in the accompanying engraving, which we take from the *Practical Magazine*. The machine is a locomotive magneto-electric induction engine, in other words a very powerful electrical battery, mounted on a carriage, to which horses may be harnessed in order to transport it from place to place. The fore part of the vehicle is occupied by the magneto-electric apparatus, which is driven by a small vertical steam engine located in the rear. The machine was built at the Siemens-Halske telegraph works, in Berlin, and is mainly intended for the production of the electric light.

Currents of electricity are induced in coils of insulated wire wound upon a metal drum, by causing the latter to rotate rapidly around an iron core placed between powerful magnets The electric current can be conducted, either continuously or intermittently, to any desired point, by means of conductors connected with the magnetic poles. When used for illuminating and signaling purposes, the conductors are led to an electric lamp, which is provided with a special arrangement for regulating the intensity of the current. The steam boiler is vertical, made of steel plate, with a fire box suspended below; there are twin cylinders, which set in motion a couple of driving wheels, connected, by means of belting (omitted in the figure), with the drum of the induction apparatus

The engine works up to 200 revolutions per minute, producing 450 revolutions per minute of the drum of the induction apparatus. The latter is of thin German silver plate, covered with eight separate coils of copper wire of 0·28 inch gage, and rotates between two very powerful horseshoe magnets. At full speed, the current induced is sufficiently intense to heat a copper wire, 0·04 inch in diameter and 38 feet long, to redness, and, photometrically, is equal to 14,000 wax candles. The draft of the apparatus is about 2¼ tuns.



PORTABLE MAGNETO-ELECTRIC MACHINE

The Use of Well Water in the Cities.

The State Geologist of New Jersey, in his recent report, calls attention to the habit, still in use in some of the older cities of New Jersey, of people drawing their supplies of water from old wells. In an analysis of the water coming from some nine wells in Princeton, five of them were found to contain free ammonia, albuminous matter, and chlorides in excess. In tracing the effects of these waters, it was found in almost all cases that diarrhœa and typhoidal fevers accompanied their use. It is almost impossible to be sure of the good quality of any well which is surrounded by houses, where drains and sinks empty into the surrounding soil. It would be well if the proprietors of large country hotels and summer resorts would not only look more closely to their sources of water, but eschew well water entirely. For the health of their guests, it is better, in all cases where running water does not exist, to seek their source of water from cisterns which are fed from the rainfall on the roofs. Wherever such rain water is used, it may be safely stated that there is an entire exemption from the diseases which always attend the use of water contaminated with putrefying organic matter

An Incendiary Machine.

The Hartford Phœnix Insurance Company lately unearthed the latest incendiary device in connection with an $1,800 barn loss in Schoharie county, New York. It is to be hoped that the machine will form a part of the underwriters' Centennial exhibit. The apparatus consists of a board covered with sand paper that faces another board filled with matches, set so that the sulphur of the matches can rub against the sand. These were set against a hay mow, and with the match-filled board attached to a ten foot lever with its bearing in the middle. At the end of the lever is a tin milk pail, and set above the pail was an ordinary funnel supplying the bottom to a bushel box filled with fine sand. This sand was allowed to run into the pan; and when the pressure was sufficient to move the lever, a string unloosed the funnel, and the balance of the sand, dropping suddenly into the pan, moved the lever, and so the board ignited the matches, thus firing the barn. A belated traveler passing discovered the thing in working order, rushed in, and saved it, and presented it to the insurance adjuster as an evidence of the ingenuity of man.

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NEW YORK, SATURDAY, APRIL 15, 1876.

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FLUOSILICIC ACID IN THE ARTS.

One of the compounds of silicon with hydrogen and fluorine, known as hydrofluosilicic acid, $H_2 Si F_6$, seems likely to become at some future time as useful and well known as it is now rare and untalked-of. It is not a new substance, but has long been used in analytical laboratories for precipitating potassium, one of the most difficult salts to precipitate; and also it is used for separating barium from calcium and strontium. About eight years ago, Tessié du Motay and E. Karcher attempted its manufacture on a commercial scale at Grossblittersdorf; but the Franco-Prussian war interrupted the business, which has never been revived. Their process consisted in smelting together in a shaft furnace, by means of a cold blast, a dry mixture of sand, clay, fluorspar, and fine coke. The gases evolved, consisting chiefly of nitrogen, carbonic oxide, carbonic acid, and fluoride of silicon, were passed through water in a condensing apparatus, when the fluoride of silicon was decomposed into silicic acid and hydrofluosilicic acid. The acid solution was either introduced into commerce in that form, or employed in preparing silico-fluoride of potassium and sodium. This process was quite imperfect, and, until a better one is devised, the manufacture of fluosilicic acid on a large scale is not likely to be revived. In the first place, not all the fluoride of silicon is decomposed by the water, and this involves a waste; secondly, some hydrofluoric acid is formed, which cannot be expelled, and this interferes with its usefulness in decomposing the chlorides of potassium and sodium. Finally, the silico-fluorides of potassium and sodium, when formed, are not completely decomposed by heat into fluoride of silicon and alkaline fluorides.

That it is highly desirable to devise a cheap and perfect method of manufacturing fluosilicic acid will be seen when we mention some of the uses to which it is applicable, although some of these are of less value to us than to our German neighbors. This is especially true in regard to the manufacture of fluoride of potassium from the Stassfurt brines, rendering its separation from the troublesome magnesium very easy. It can also be employed to separate sodium from sea water. The alkaline silico-fluorides are decomposed by heat into fluoride of silicon gas, which is utilized, and alkaline fluorides, which are easily converted into caustic alkalies by means of quicklime. Kessler has also patented a process for making soda from table salt, in which carbonate of lime is used. The fluoride of calcium produced may be used over again in making the fluosilicic acid, in place of fluorspar.

But there are many other uses to which fluosilicic acid may be put beside the preparation of caustic alkalies. It has been proposed to use it for decomposing bones, phosphorites, and sombrerites, in the manufacture of artificial fertilizers; while fluosilicate of potassium is itself a very suitable form in which to introduce this alkali into the soil.

Fluosilicic acid has been used in the manufacture of beet sugar, as it is able to precipitate the alkaline salts contained in the molasses, which hinder the separation of the crystallizable sugar. Their precipitation by this acid was first proposed by Von Kletzinsky and afterwards by Marix.

Combe and Wright recommend its use in the manufacture of glass and porcelain. They propose to replace the lime by silicofluoride of calcium, either alone or with the barium salt, in the manufacture of glass; and instead of carbonate of potash they would take the silicofluoride of potassium. Still more important is the substitution of fluosilicic acid for boracic acid in the lime, alumina, and other compounds used in English stoneware. Silico-fluorides could scarcely be used for glass on account of the evolution of fluoride of silicon vapor when fused.

It may also be mentioned that it has been proposed and used in making artificial stone, for fixing stereochromatic colors, in making tartaric acid, as a substitute for this acid, as a mordant in dyeing and calico printing (in place of the drug bath), for whitening pins, for removing the lime from beet juice in making sugar, and many other uses. It produces an incomparably beautiful patina on brass, bronze, zinc, and German silver. A French manufacturer uses its sodium salt to make hard alloys rich in silicon. T. Christy has taken a patent in England for its use in the manufacture of ammonia from gas liquor.

It seems as if fluosilicic acid, notwithstanding the service it has already rendered, is not attracting the attention it deserves either from chemists or manufacturers. Let America take hold of the problem and show the old world what she can do with this curious and useful acid. On a small scale in the laboratory, it is made by mixing together pulverized fluorspar and fine sand, adding oil of vitriol, and heating. The gaseous fluoride of silicon thus formed is passed into water, precautions being taken to prevent the tube from choking up with precipitated silica. The products are pure gelatinous silica and a solution of hydrofluosilicic acid.

THE BAOBAB AS A FIBER PLANT.

The baobab (*Adansonia digitata*) has long been known as one of the giants of the vegetable kingdom. It has lately become an important source of fiber for papermaking. The fitness of its inner bark for this purpose was demonstrated some years ago, but it is only within the past decade that it has begun to rank as an important article of commerce. By the natives of Africa the bark is put to various uses: Twisted into string and rope, it is used for all sorts of purposes, and in untwisted strips it serves to secure loads and to bind together the poles employed in making their huts. Finer pieces are pulled out so as to resemble coarse netting; and the edges being sewn together, they make handy bags for cotton, gum, grain, and the like. Coffee and ground nuts are brought down from the interior to the coast in very strong bags woven from thin strips of the bark.

The bark is obtained by first chopping off the softer outer bark of the tree with a hatchet, after which the inner bark is stripped off in large sheets. The pieces are beaten with a stick to soften them, and shaken to get rid of some of the pithy matter which they carry. The sap is then dried out in the sun, and then the fiber is pressed into bales for shipping. The smaller trees produce the finest and softest fibers. The bark is taken off all round the tree, which does not appear to suffer much injury. A fresh layer of bark grows and is thick enough to be taken off in six or eight years. Mr. J. J. Monteiro, who has the credit of adding this valuable fiber to the resources of the paper trade, tells some amusing stories of the difficulty he experienced in developing the business of collecting the fiber. By paying liberally, he induced some of the natives to take hold of the new work at last, and matters went on tolerably smoothly until a season of drouth came on. The fetich men declared that the "big iron"—his hydraulic press—had fetiched the rain and prevented its appearance. The matter was discussed throughout the country; and at a general meeting of the people of the neighboring towns, it was decided to apply the usual tests to the big iron, and, if it proved to be a sorcerer, to destroy the press and throw it into the sea. It is the custom in those parts to try all cases of supposed witchcraft by subjecting the suspected to the ordeal of poison. For this purpose they use *casca*, the bark of a large tree, the *erythrophlæum Guineensis*, which acts either as a violent emetic or as a purgative, innocence or guilt being determined by the manner of its action.

In the case of the press, the application of this simple and, to them, perfectly satisfactory test was seriously interfered with by the absence of any stomach or insides to the big iron, for the poison to take effect on. After much deliberation it was resolved to employ a substitute in the person of a slave to the king. To this unwilling representative of the big iron the *casca* was duly administered, and luckily acted as an emetic; so the press was declared innocent of bewitching the rain. Still the rain held off, and grave suspicions arose as to the sufficiency of the trial. To resolve all doubts, the poor slave had to undergo the ordeal a second time, fortunately with the same result, and the press was never more suspected of complicity with evil spirits.

THE SECRETS OF MAKING VIENNA BREAD.

One of the most practical and useful works which has recently emanated from the government printing office, at Washington, is Professor E. N. Horsford's report on the subject of Vienna bread. Professor Horsford was a member of the United States Scientific Commission to the Vienna Fair of 1873; and the present book is the result of careful and exhaustive research, the aim and object of which was to unearth the secret of the world-famed bread peculiar to the Austrian capital. There is something very appetizing in his description of the *Kaiser Semmel*, as the bread is there termed. It is "a smooth, irregularly rounded small wheaten flour loaf, of uniform weight. It presents a rich reddish brown crust and a delicately shaded yellowish, almost white, interior. It is always light, evenly porous, free from acidity in taste or aroma, faintly sweet without the addition of saccharine matter to the flour or dough, slightly and pleasantly fragrant, palatable without butter or any form of condiment, and never cloying upon the appetite."

The reverse, the Professor might have added, on one hand, of the dyspepsia-breeding, doughy compound which passes for bread in many a country home, and of the attenuated, alum-treated, tasteless loaf which is produced in many a city bakery. It seems, however, that these gastronomic abominations are not necessary evils, and that, despite the repeated efforts which have been made to imitate Vienna bread out of Vienna, which have uniformly failed, a way does exist of producing it in all its delicacy. And that way is very simple, as the reader will see by the following:

The first requisite is to procure as good flour as the Vienna bakers have. Good flour can only be made from pure sound wheat, and by good milling. This means in general flinty wheat reduced by the process of high or half high milling, and a selection of the products of the milling, not to exceed one half the total weight of the wheat ground. Good fresh middlings flour, Professor Horsford says, would compare favorably with the average Hungarian flour used in Vienna.

The next requirement is fresh pressed yeast. This is already made in the United States. It is not difficult to manufacture, since it is made by skimming the froth from beer mash in active fermentation. This contains the upper yeast, which must be repeatedly washed with cold water until only the pure white yeast settles clear from the water. This soft tenacious mass, after the water has been drawn off, is gathered into bags, and subjected to hydraulic pressure until there remains a semi-solid, somewhat brittle, dough-like substance, still containing considerable water. This is the pressed yeast, which will keep for eighty days in summer and for an indefinite time on ice. For use it should be of recent preparation and sweet, so that it will yield only alcohol and carbonic acid as products of fermentation.

Next follows the very important operation of mixing. Into the middle of a zinc-lined trough, about 2½ feet wide and 8 feet long, semicylindrical in form, the Vienna baker empties his flour sacks. Then, into a pail holding about five gallons, equal parts of milk and water are poured, and left to stand until the mixture attains the temperature of the room, between 70° to 80° Fah. It is then poured into one end of the trough and mixed with the bare hand with a small portion of the flour to form a thin emulsion. The press yeast is

next crumbled finely in the hands, and added in the proportion of three and a half ounces to every three quarts of liquid, and then one ounce of salt in same proportion is diffused through the mixture. The trough is now covered and left undisturbed for three quarters of an hour. Then follows the incorporation of the flour from the neighboring heap; and as this is the last of the ingredients, we may write the recipe as a whole, thus: Flour 8 pounds: milk and water 3 quarts: pressed yeast 3½ ozs.: salt 1 oz.

The mass of dough, being left quiet for two hours and a half, becomes a smooth, tenacious, puffed mass, of yellowish color, which yields to indentation without rupture and is elastic. It is now weighed into pound masses, and each lump is then cut by machinery into twelve small pieces, each of three quarters of a inch in thickness. Of each one of these, the corners are brought together in the center and pinched to secure them. Then the lump is reversed and placed on a long dough board for further fermentation, until the whole batch is ready for the oven. Before being introduced into the latter, the rolls are again reversed and restored to their original position, having considerably increased in volume, to be still farther enlarged in the oven to at least twice the volume of the original dough. In the oven they do not touch each other, and the baking occupies about fifteen minutes. To glaze the surface they are touched in the process of baking with a sponge dipped in milk, which, besides imparting to them a smooth surface, increases the brilliancy of the slightly reddish cinnamon color and adds to the grateful aroma of the crust. No peculiar form of oven is required, the only necessary point being that the receptacle shall be capable of maintaining a temperature of about 500° Fah.

THE UTILIZATIONS OF MICA.

A correspondent encloses us a sheet of very clear mica, and asks us for what the material may be employed. Of late, large quantities of mica have been mined in Mitchell and adjoining counties, in North Carolina, which are proving very remunerative. The material is got out in sheets of from two by three to fifteen inches square, according to patterns furnished by dealers, and the best price is given for dark or brandy-colored mica. In obtaining these sheets, of course, immense quantities of scraps and fragments must be made, and it is mainly with regard to these waste bits that the utilizations above to relate. The first employment which suggests itself as worthy of a wider field than it now possesses is the substitution of mica for glass in spectacles worn by workmen, especially stone and metal workers, to protect their eyes from chips and splinters. As already made in Germany, these mica glasses are concaved in the shape of watch glasses, and are about one twenty-fifth of an inch in thickness. They are mounted in simple brass wire frames, and are made sufficiently large to fit closely around the eye sockets. The advantages gained by this utilization are greater than would at first be imagined. Mica spectacles cannot be broken. Pounding with a sledge hammer merely flattens them, nor does molten metal poured on the mica affect it. The shower of pointed iron particles which issues from lathes merely rebounds from the elastic mica glasses. In weight, mica spectacles are about half as heavy as glass ones; and when a pure material is used, the mica, with the exception of a slight grayish tint, which is rather agreeable to the eye, is fully as transparent as glass.

Another use for mica is its application, when previously colored or metalized, to ornamental purposes. From its unalterable nature, the material preserves gilding, silvering or coloring from deterioration; and from its diaphaneity, the articles so treated will preserve all their brilliancy. The process of treating mica, devised by Murray, of Paris, is as follows: The mineral is first cut to the desired thickness, then coated with a thin layer of fresh isinglass diluted in water, and the gold or other surface applied, after which it is allowed to dry. A copper pattern of the desired design is next placed on the reverse side of the sheet, and any superfluous parts of the gilding are removed by means of a small brush, the design remaining on the parts not brushed. Colors are then laid on as desired, and the whole is coated with a solution of liquid glue, diluted in spirits of wine, which is applied for the purpose of rendering the mica pliable. The sheet is then fastened with glue permanently in position; and where several sheets are to be secured together, the junction can be rendered imperceptible by first gluing with Venetian glue and then going over the joints with a hot iron.

Puscher, of Nuremberg, has also suggested several ways of converting mica sheets into very elegant ornamentation. For one application the thin plates are first purified by treatment with strong sulphuric acid, and then silvered by the ordinary process adopted with looking glass. The mica thus acquires a beautiful silver luster, and it may easily be cut into any shape for inlaying work. The flexibility of the mica will, of course, allow of its being applied to irregular surfaces. When a sheet of mica is heated to full redness for a time, in a clay muffle, it loses most of its flexibility, and is changed considerably in appearance. Under reflected light, it has a dead silver white look; but viewed by transmitted light, it is seen covered with gray spots. This latter appearance is lost when two or three pieces are superposed. The mica, after heating, is also a beautiful material for inlaying work; it should be cut into the desired shapes prior to the heating process. Another very pretty effect is obtained by scattering small fragments of mica on freshly poured clear sheets of gelatin, and varnishing it with a dark-colored solution of gelatin. Finely ground mica, on colored gelatin, also shows handsome effects; and when mixed with a solution of gum arabic, it makes a good silver ink. The gelatin combination is used for inlaying buttons.

Another beautiful application of mica is in the production of bronze-like colors, which bear the names brocades crystal colors, and mica bronzes. The mineral is to this end well crushed, boiled in hydrochloric acid, then washed in water, and assorted according to the size of the laminæ. Mica scales thus obtained exhibit a glass-like luster, combined with a silver white appearance. Among the advantages of these brocades are that they are indifferent to sulphurous exhalations, are very light in weight, and in some colors are even more brilliant than the metal bronzes. They may be fixed upon all kinds of articles of metal, wood, glass, plaster of Paris, and paper board, so that they are well adapted to the preparation of artificial flowers, fancy papers, sealing wax, and for use in tapestry, furniture-making, and painting: in fact, they may be applied to all purposes now filled by ordinary bronze powders. In fixing these brocades, the articles are first painted in bronze color; if silver is to be imitated, a ground of white lead is suitable. Either oil or glue color may be used, the latter fixed with a mixture of 4 parts glue and 1 part glycerin. Upon this coat, when hard, the binding material for the brocade is spread, and after fifteen minutes the latter is sifted over. As a binding material, a paste consisting of 4 parts boiled starch and 1 part glycerin is recommended. If the ground is formed by an oil paint, the binding material for the brocade should be constituted of pale copal varnish, upon which, when only pitchy, the powder is sifted. When finally varnished, articles treated as above assume a very beautiful appearance.

When small particles of mica silver are spread over articles coated with asphalt varnish, the result is a good imitation of granite. The crystal colors are also suitable for calico-printing; and fabrics to which they are applied surpass in brilliancy the heavy bronze and glass dust fancy fabrics of Lyons. Such colors have been used to decorate porcelain and glassware, the articles undergoing a second heating up to the fusing point of their glazing. By suitable dyes, the material is easily colored to a variety of hues.

Mica has been used instead of glass on board war vessels, in localities where glass would be broken by the concussion due to the firing of heavy guns. It is also employed for roofing purposes, and in several patented processes forms a water and fireproof covering for strata of rubber, tar, canvas, felt, and similar materials.

THE INTERNATIONAL EXHIBITION OF 1876---PROGRESS OF THE MACHINERY DEPARTMENT.

The commencement of the period of hustle and tussle, such as has been more than once predicted in these columns, is at hand; and Machinery Hall and its offshoots are now a very pandemonium of iron, wood, brick, stone, and mortar, in every conceivable shape and position. Heaped up in the most indiscriminate manner may now be seen monstrous castings and forgings, belonging to such mighty engines as steam hammers, rolling mills, etc.; and they lie about the floor in a manner as though some Titan, in mockery of all human effort, had carelessly dropped the ponderous objects in this way to thwart the toiling mites who tug at them all the day to bring them into place; and one might pass on in the full conviction that busy man had here overreached himself in his attempt to master these unwieldy masses and bring order out of such a chaos by the 10th of May, if it were not for those modern and veritable titanic aids, the steam cranes, three of which are now constantly at work lifting and moving heavy objects into place. One of these machines picks up a 10 tun piece of iron and whirls about upon its vertical axis with it, to deposit it where wanted, or moves off to the desired spot with the piece of metal hanging from its extended arm, with all the ease imaginable. Much of this kind of material as there now is upon the floor, car load upon car load continues to arrive almost hourly. As an earnest of what may be expected within the next two weeks, it may be stated that eighty car loads of material arrived upon the grounds on Saturday last. In view of such facts, we may well believe that, before the whole is in its destined place, many figurative corns will be trod upon and some peculiarly centennial anathemas be added to the language. Mixed up with such ponderous objects as the foregoing may be seen, here and there, a fancy little show case occupying its half dozen square feet of floor, and others of greater size and pretensions looming up in all their majesty of polish, gilding, and ornate carving; and one is led to wonder how their present high state of finish is to be preserved amid an assemblage which may be described as the furniture of some huge smithy.

Some of the "early birds"—to whom we give all credit—have their exhibits finished, and they can look on at their more tardy *confrères* with all the complacency of a man with an umbrella among his friends caught out in a heavy shower without any. Among these is a rather peculiar exhibit—and one which will become quite a prominent landmark in the hall—made by J. H. Mitchell, of Philadelphia. It consists of a column erected upon an ornamental pedestal of brick, the whole being about thirty feet in hight. The plinth, base, a section of the shaft at about every four inches, and the members of the capital, are each made of a separate grindstone, the whole being proportioned so as to form a very handsome column of the Doric order of architecture, every piece—of which there are thirty-six—being a real grindstone, except the plinth and the upper member of the capital, both of which are, of course, square, and could not therefore well be used for grinding purposes. These stones are of all shades of color, and come from all parts of the world where such material is found; altogether, this column makes a conspicuous and curious object.

Another of the American exhibitors who has taken time by the forelock is the firm of J. P. Morris & Co., of this city, who have now erected, at a short distance westward of the large Corliss engines, an immense vertical blowing engine. With the exception of a very few of the minor details, it is now complete; and from its great hight and massive proportions, it may readily be seen from almost any part of the floor of the great building. The steam cylinder is 50 inches in diameter by 7 feet stroke, and the air cylinder is 90 inches in diameter, with the same stroke. It is of the style generally known as the "steeple," with the air cylinder placed vertically upon the steeple frame. The axes of the cylinders are in one line, and the piston rods are severally connected to a yoke, which encompasses the crosshead, the rod of the air cylinder passing upward, and that of the steam cylinder downward. The whole hight of this machine is 37 feet 6 inches above the floor, and its total weight over 100 tuns. It is a condensing engine, but will be run (without pressure in the air cylinder) during the exhibition as a high pressure or non-condensing engine, at about 16 revolutions per minute, discharging into the upper regions of the building nearly 10,000 cubic feet of air per minute, which ought to render the immediate vicinity of this engine a favorite locality during the heated term, which we are sure of in the months of July and August. Upon either end of the shaft, which is below the bottom cylinder head, is a massive fly wheel of 20 tuns weight, which is, in some respects, quite notable. The hubs or centers of the wheels are somewhat larger than in the ordinary constructions of this kind, sufficiently so as to permit of the crank pin being inserted into them as in the ordinary disk crank. These hubs or centers have holes bored radially in their edges for the reception of the arms of the wheel; and each arm, cast with its own section of the rim, has a corresponding cylindrical projection upon it, which is turned in the lathe to fit the radial holes in the hub. The sections of the rim where they join each other are secured with the usual internal link and driven keys, riveted over on the outside to prevent withdrawal; and the turned ends of the arms are secured in the hub with similar riveted keys through slots, cast in them and the hub for that purpose. This is something of a novelty in the construction of large sectional fly wheels, and has at least the merits of cheapness, precision, and security.

A rather curious feature in this engine is that the connecting rods—as necessarily must be the case with the crank pins inserted in the wheel centers—pass outside of the fly wheels; the crossheads being of sufficient length to permit of the fly wheels revolving between them and the steam cylinder; and the shaft being below the cylinder, the connecting rods are long enough to keep the crosshead clear of the rims of the wheels at the top. The weight of the two pistons, piston rods, and crosshead is balanced by coring out some of the arms and a part of the rims of the wheels, which externally are symmetrical in form. The valve gear very much resembles the old Stevens cut-off with its side pipes, poppet valves, and overhung lifting rods: except that the long toes of that form of valve gear are replaced by friction rollers working in the lower ends of the lifting rods and actuated by peculiar cams upon a rotating shaft which receives its motion by the intervention of spur gearing from the engine shaft. This arrangement is called the Wanock cut-off, and, as an expansion gear, can only be adjusted by hand. This machine seems to be a well conceived design for blowing purposes under pressure, all the strain being received and transmitted in direct lines, except in the case of transverse strains upon the crosshead, which, if the work of the machine requires that the fly wheels should be as heavy as they are made, has the appearance of being entirely light to transmit the momentum of these rotating masses of iron.

The Japanese mechanics have finally entombed themselves in their new abiding place, for any one of them is now rarely to be seen outside of that structure. The clatter going on within, however, gives note that they have by means ceased their labors. They have expressed themselves as considerably astonished—which must, however, have been in the form of words or gestures, for their immobile visages seem incapable of any such expression—at the rapidity with which the "Melican man" erects his large and handsome buildings, and they rather feel themselves in the shade in this respect. At the beginning of their labors, a large and curious throng was always to be found observing and criticising the tools and methods of the "Japs," and no doubt gave the foreigners the impression that they were creating a grand excitement among, and imparting much valuable knowledge in the building line to, the American mechanics and architect. If such has ever been their state of mind on that subject, they have evidently become disabused of it; for not only have they expressed their surprise at the rapidity of our workmen, but they now look upon their own chosen instruments and tools as inferior to ours: as is instanced in the fact that Mr. Henry Disston, saw manufacturer of this city, has received an order from them for 900 hand saws to be sent to Japan. In the operation of such tools as planers and saws, their cutting is done by pulling the tools towards them; but they are evidently coming to the conclusion that a little American "push" is the best.

J. T. H.

Editorial Amenities.

Under the head of "New Industries Wanted," we lately published a paragraph relative to the needs of the people of the Mississippi Valley, which we quoted from and credited to the *Engineering News*, as it appeared in that paper without credit to any other journal, and, we supposed, was original with the *News*. We are now in receipt of a note from the editor of the Indianapolis *Journal of Commerce*, desiring us to inform our readers that the paragraph in question was original with him and first printed in his paper

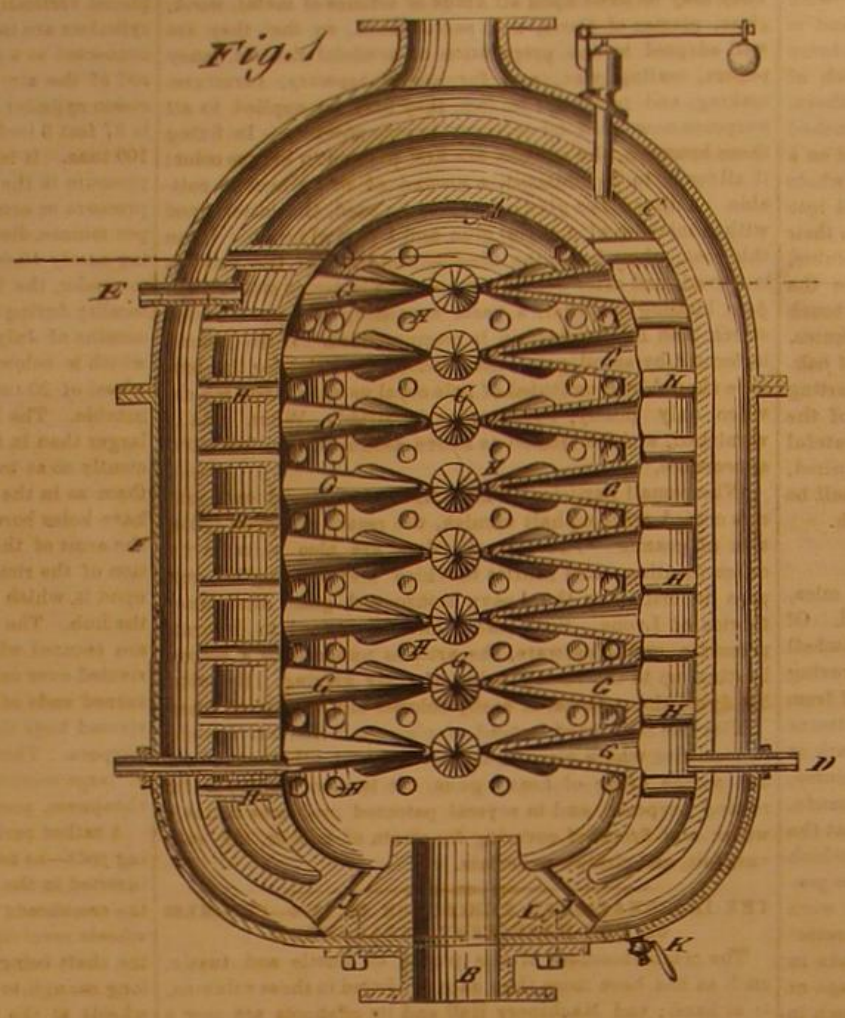
IMPROVED FEED WATER HEATER.

We illustrate herewith a new feed water heater, so constructed as to avoid risk of fracture by contraction or expansion, and also to afford an efficient application of heat without obstructing the escape of steam.

Fig. 1 is a sectional elevation, and Fig. 2 is a horizontal section. A is the inner cylinder into which the steam is discharged from the engine, by the pipe, B. C is the water cylinder, inclosing the cylinder, A, and having inlet and outlet pipes, D, E; and F is the steam jacket surrounding the water cylinder. The hollow conical studs, G, radiate from the shell of cylinder, A, to its center, or nearly so, and conduct the water into the steam space from cylinder, G, so as to distribute the application of the heat very efficiently. The small exit steam pipes radiating outwardly from said cylinder, A, make another efficient distribution. Both the hollow studs and the exit pipes are distributed uniformly, or as nearly so as is necessary for producing uniform effects throughout the heater, and the capacity of the pipes, H, is regulated to that of the exhaust pipe, B. This pipe is prolonged a little above the bottom of the cylinder, A, to make a kind of trap to prevent the water of condensation from flowing back in it, and passages, J, are made for it to flow into the steam jacket, F, from which it may be drawn from a cock, K. Cylinders, A and C, are cast in connection together at L, making a substantial base, to which the jacket, F, is also connected, so as to seat the heater on the top of the pipe, B, or any other suitable support. Conical studs are provided, instead of tubes connected at both ends, with express reference to the changes of temperature to which the heater will necessarily be subjected when in use.

Patented February 22, 1876, through the Scientific American Patent Agency, to Mr. Timothy W. Hayes, of Trenton, N. J.

Fig. 1



HAYES' FEED WATER HEATER.

Tin in Tuscany.

At a meeting of the Paris Society of Civil Engineers, a paper was read on a discovery, said to have been made in Tuscany, of a vein of bioxide of tin. The vein is reported to be situated about a mile and a quarter southwest of the town of Campiglia Marittima, in Tuscany, at a place called Cento Camerelle, upon the western side of the Fumacchio, a spur of the Monti Calvi, a chain celebrated for its mineral deposits. The Cento Camerelle (Hundred Chambers) consists of a series of excavations attributed to the Etruscans, and dug out horizontally in the side of the mountain. The concretions with which they were filled have been removed in the course of ironstone mining. The tin was stumbled upon some yards from the Cento Camerelle in following up a vein of brown hematite. The tin ore is very compact, of a yellowish gray color, and of granular fracture. Specimens yielded from 58 to 72 per cent.

Fargier's Carbon Process.

According to the *Moniteur de la Photographie*, Fargier's new carbon process may be summed up in a few words. A sheet of paper is allowed to float upon a solution of five grains of chloride of iron and a similar amount of citric acid, which are dissolved in one hundred grains of water. This paper is afterwards dried in the dark, and placed under a negative to print, until a weak image is produced. This print is taken and floated upon a bath of colored gelatin solution, when it is found that the gelatin attaches itself to the portions of the surface that have been acted upon by light. There remains nothing but to wash the sheet in water, and the picture is finished. If, instead of a colored solution of gelatin in water, softened tissue were employed, the printed chloride of iron paper being pressed into contact with the same, warm water being used subsequently to separate the two surfaces again, there would perhaps be a step further gained in the simplification of the carbon process, for the pictures would be visible at once during the printing operation, and could therefore be controlled. Dr. Liesegang, writing in the *Archiv*, is of opinion that an improvement in the carbon process may be effected in this direction, and that the Fargier method indicates a branch of the subject which might be investigated with advantage.—*Photographic News.*

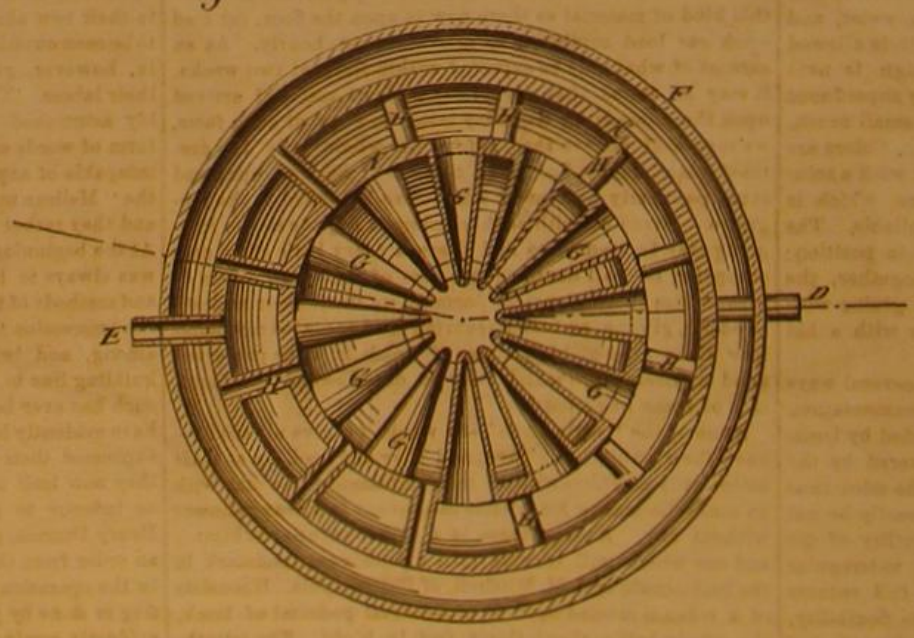
Pig Iron Pavement.

Twenty different kinds of paving have been tried in Paris; wood paving has been judged, gutta percha paving is too dear, in bitumen paving there is room for improvement, and now paving by pig iron is to be tried in a few days. A bed of mortar is first laid down, which is covered by a strong layer of asphalt; it is in this layer that the iron cakes, which are about 1·6 inches thick, are set. These cakes, it appears, preserve the homogeneity of the bitumen, and prevent its depression, and render the asphalt less slippery for horses. This pavement will cost more, assuredly, than the compressed asphalt, but it is estimated that this mode of paving will save 50 per cent upon the repairing expenses, which are very considerable. The end desired is to avoid, by the adoption of a kind of pavement, the depressions in roads over which a great deal of traffic passes. To attain this, it does not suffice to pour bitumen upon a well prepared ground lightly covered with a coat of lime; the resistance of the ground should equal that of an old macadamised bank; and a very thick bed of mortar, which should be very homogeneous, should be laid before the asphalt is laid.

Spectrum of the Electric Arc--A New Experiment.

In general, the electric light refers to the light coming from the incandescent carbon points, as well as from the space between them. Now, in this sense, the spectrum of the electric arc is a very common lecture experiment. But the words electric arc, in the strict sense of that term, belong to the arch of light between the points. This light is but slightly luminous, and is of a pale blue or violet color. Ordinarily, with a battery, the distance between the points is so small that the pure arc itself cannot be had separated from the points, and so its spectrum cannot be separately projected. But, during a recent lecture experiment by Professor G. F. Barker, at the Stevens Institute, with the arc of the Gramme machine, the experiment was successfully performed, the carbon lines being plainly produced on the screen. This, we believe, has never been done before as a distinct experiment; at any rate, we call to mind no record thereof. It should, however, be stated that, in the ordinary use of the spectrum of the electric light, the carbon lines occasionally flash out for an instant from a lateral discharge.

Fig. 2



HAYES' FEED WATER HEATER.

Man's Allotted Span.

The determination of threescore and ten years as the allotted period of human existence is doubtless in a considerable degree owing to that period having been adopted by the royal psalmist; but modern science, while it has postponed somewhat the average termination, has also still more largely prolonged the hypothetical duration of life. Flourens, reasoning from the time required for the full physical development of a human being, as compared with that taken by other animals, fixes the natural limit at 100 years, and this is also the period fixed by Dr. Farr as man's natural death time, although at present he finds, as the result of ten years' approximately accurate and complete registration, that this limit is scarcely reached by one English child in a hundred thousand. In some districts, of which the town of Liverpool is an exceptional example the proportion is much below this. In this, however, as in many other respects, we are far in advance of our ancestors. The early English poets fix the appearance of the signs of approaching senility much earlier than we are now accustomed to notice them, and Dr. Farr shows that, while two hundred years ago the mortality of London was about 8 per cent, and one hundred years afterwards 5 per cent, it is now only 2·4 per cent. And there is good reason to believe, says *Iron*, that it may be still further reduced—very much of the existing mortality depending upon the preventible causes, such as impure air and impure water, negligence on railways, on shipboard, in mines, in street police, and in many other ways. What is also of equal importance is the fact that any decrease in the mortality from these causes will be necessarily accompanied by the absence of disease, and an increase to survivors of that good health without which length of days is scarcely a boon. The economical results will be no less important. Disability from sickness is a source of pecuniary loss not only to the sufferer but to the entire community; while the longer old age, that one incurably malady, can be staved off, so much will be gained, for when the season of effective work is over, the individual, in ceasing to contribute to the general wealth, becomes a pensioner upon it. Thus, according to Dr. Farr, the Norfolk agricultural laborer, worth $25 at his birth and reaching at the age of twenty-five years his maximum value of $1,230, sinks at eighty to $205.

The Time to Plant.

It is useless to put seeds in the ground, *The American Garden* sensibly says, before the soil becomes warm and dry. For this reason no particular time can be specified for planting—everything depends upon the location, soil, and temperature. A very good guide is the taking up of a handful of the loam and closing the fingers tightly upon it. If, on opening the hand, the soil remains in a hard lump, and retains the imprint of the fingers, it is too wet; while if it falls apart in an irregular heap, it may be deemed in a condition for the seeds. Another reminder, and one that will prove a guide in all latitudes, is the forest tree. When trees put forth their young leaves, all nature is ready for active work. Seeds planted then germinate at once, and seldom fail to come up and grow vigorously. Nothing is gained by very early planting. Better be a grain too late than too early.

Save your Soapsuds.

Who would throw away a barrel full of soft soap or a box of hard soap? Were it not otherwise useful, it would be of great value as a fertilizer, if spread, in its raw state, about our fruit trees or berry bushes. But, after being dissolved in water and passing through the wash tub, gleaning the imperceptible elements of the best manure from soiled linen, its fertilizing power is vastly increased. Indeed we may almost say that the average soapsuds from the kitchen and laundry is worth more than the soap which produces it. Do not, then, allow your soapsuds to run away wasted, while you have trees which it might benefit.

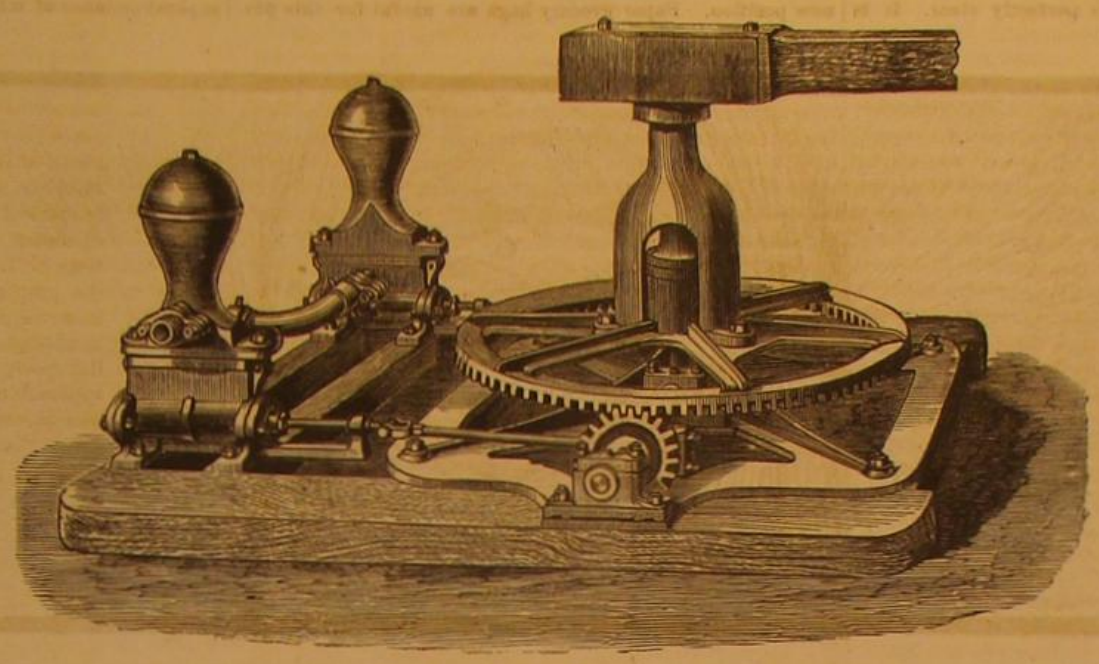
A Good Lacquer.

A preserving lacquer for brass or bronze, which gives a beautiful gilding to the articles, is also mentioned in the same paper. It is prepared simply by dissolving in 332 parts of rectified spirit 16 parts of shellac, 4 parts of dragon's blood, and 1 part turmeric root. The metal to be lacquered is warmed, and the varnish applied means of a sponge. Brasswork becomes beautifully gilded by this application. As the liquid is a spirit solution, it is necessary, of course, to keep it in a well stoppered bottle.—*Photographic News*

HORSE POWER PUMP.

We are constantly receiving inquiries, from farmers and others, as to the easiest and most economical way of bringing water from a moderately distant point into a dwelling or barn. Probably the cheapest plan and one of the most efficacious is to use a windmill to actuate a suitable pump, and some of our correspondents have availed themselves of this means; others, however, have found local objections to the windmill, and, possessing horses, have asked us for a method of devoting the power of their animals to the purpose of raising water.

One of the simplest and most compact machines designed to meet this requirement is illustrated in the annexed engraving. The beam to which the horse is harnessed turns by its vertical shaft an inverted crown wheel, which actuates two smaller pinions, the rotary motion of which, changed by simple means into reciprocating, works the pistons of the two pumps. This apparatus is an English invention, and is manufactured by Messrs. Hayward, Tyler & Co., of London. It is light and portable and easily constructed, while it is capable of raising a large body of water. Such an apparatus would be useful on any large farm for supplying stock with water, or for irrigating purposes. Any of our manufacturers of pumps and horse powers may get an idea from this illustration which they can modify to suit special requirements, by omitting one of the pumps or by substituting some other kind of pump, or by changing the mode of gearing. It would seem as if there would be a good demand for something of the kind which is compact, simple, and not too costly.



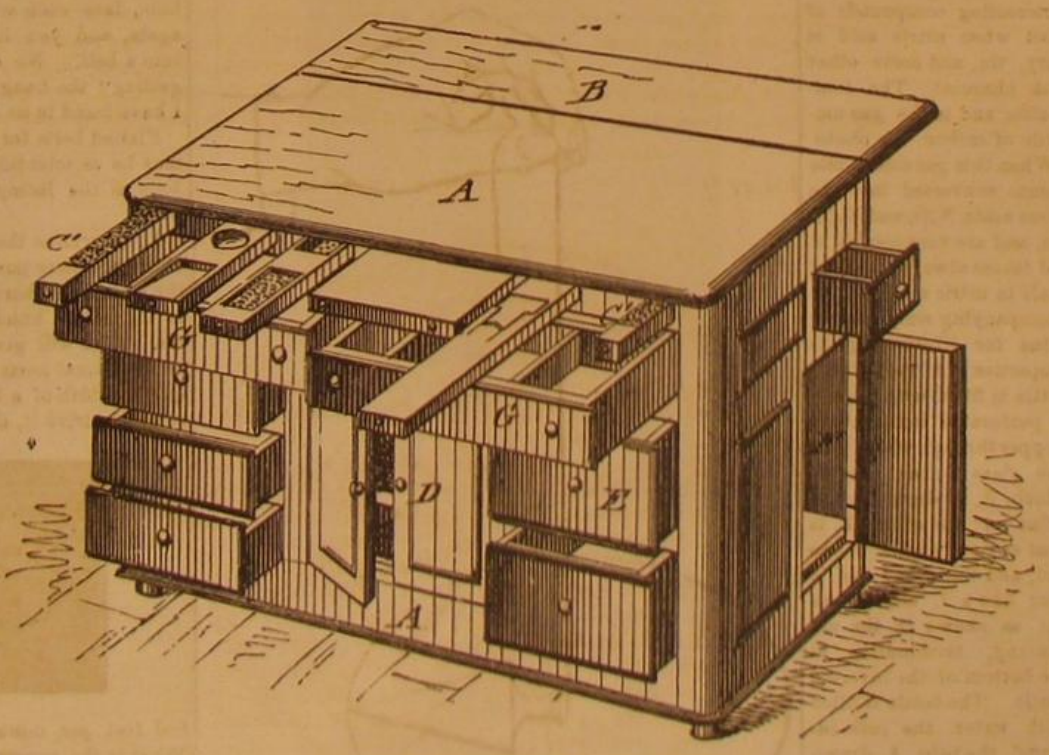
HAYWARD & CO.'S HORSE POWER PUMP.

IMPROVED KITCHEN FURNITURE.

Mr. George Holt, of Minneapolis, Minn., has recently invented an article of kitchen furniture which shows considerable ingenuity in economizing space, and contains places for nearly all the articles required for use in culinary operations, the utensils, etc., all being arranged so as to be ready at hand.

A represents the top or table; B is a hinged leaf at the rear side, supported on suitable slide pieces; and C is an ironing board that is placed in front corner slides, C', which are also made use of for sharpening knives. The central front part of the cabinet is arranged for shelves, D, forming a dish cupboard with hinged doors. At both sides of the shelves, D, are drawers, E, for miscellaneous articles—flour, sugar, meal, towels, etc.; and above the shelves, D, and drawers, E, are two drawers, G, of smaller hight, but with inside partitions, one drawer being for forks, knives, and spoons, the other for spices, etc. Below the top, and between the slides, C', are arranged various sliding devices, as a bread board, a vegetable cutter, a knife scourer, a grater, and others, which are drawn out as required, being pushed in after use. The space at the rear part of the cabinet is divided by a central partition into longitudinal chambers, F, for storing various larger articles of kitchen use, as tinware, potato mashers, etc., while longitudinal drawers, F', occupy the remaining available space.

Patented October 5, 1875. For further particulars address the inventor as above.



HOLT'S KITCHEN CABINET.

Progress of the Sewing Machine in Europe.

At the annual soirée of the employees connected with the extensive works of the Howe Sewing Machine Company, Glasgow, Scotland, recently held, the chairman stated that the British islands alone had taken a third of the machines (61,123) which the company had made in 1875. The little kingdom of Belgium, with her 5,000,000 of industrious people, took twice as many machines in proportion to population as Great Britain; but France, with her 36,000,000 of people, as yet took but half as many as Great Britain, with 33,000,000. Germany, with her 40,000,000 did no better. Italy and Spain, the former with 26,000,000 and the latter with 17,000,000, as yet purchased but a few hundred machines per year. Entire Scandinavia was an explored region; while Russia, with her 85,000,000 of active and rapidly progressive people, as yet received but the tenth part of what were now sold in Great Britain.

A little strong soap lather mixed with the starch will prevent flat irons sticking to linen.

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

To give black walnut a fine polish so as to resemble rich old wood, apply a coat of shellac varnish, and then rub it with a piece of smooth pumicestone until dry. Another coat may be given, and the rubbing repeated. After this, a coat of polish, made of linseed oil, beeswax, and turpentine, may be well rubbed in with a dauber, made of a piece of sponge tightly wrapped in a piece of fine flannel several times folded, and moistened with the polish. If the work is not fine enough, it may be smoothed with the finest sand paper and the rubbing repeated. In the course of time the walnut becomes very dark and rich in color, and in every way is superior to that which has been varnished.

To separate honey from wax, put honeycomb and all in a tin pan upon a moderately warm stove, adding a tablespoonful of water to each pound of honey. Stir occasionally with a piece of wire until the contents of the pan are in a liquid condition. Do not allow boiling to begin. Remove the pan from the fire and set it aside to cool. The cake of wax, to which all impurities will adhere, may then be carefully lifted off with a knife.

A good durable whitewash is made as follows: Take half a bushel of freshly burnt lime, slake it with boiling water; cover it during the process, to keep in the steam. Strain the liquid through a fine sieve, and add to it 7 lbs. of salt previously well dissolved in warm water; 3 lbs. of ground rice boiled to a thin paste and stirred in boiling hot; ½ lb. of powered Spanish whiting; 1 lb. of clean glue, which has been previously dissolved by soaking it well, and then hanging it over a slow fire in a small kettle, within a large one filled with water. Add 5 gallons of hot water to the mixture, stir it well, and let it stand a few days covered from dirt. It must be put on quite hot. For this purpose it can be kept in a kettle on a portable furnace. About a pint of this mixture will cover a square yard.

A process of tinning iron tacks is to triturate chloride of zinc with a large quantity of oil and heat it in an oscillating vessel. As soon as this has reached the proper temperature, throw in the tacks and the necessary quantity of metallic tin, and after a few seconds dip them out with wire gauze and cast them in water.

The removal of sand, etc., adhering from the molds to iron castings, generally accomplished by filing, is said to be effected far better by means of steel brushes. They are made of thin strips of steel, in the form of ordinary scrubbers, and also in that of whitewash brushes, and are reported to remain sharp for a long time, and to be far more convenient in use than the file.

Bronze powders: Bright yellow, copper 83 parts, zinc 17; orange, copper 90 to 95, zinc 5 to 10; copper red, copper 97 to 99, zinc 1 to 3.

A correspondent of the *Country Gentleman* reports excellent results for the following recipe for staining wood: 1. Wash the wood with a solution of sulphuric acid and water, made in the proportion of 1 oz. to a pint of warm water. Mix when wanted; put on warm and wash evenly over every part. 2. Stain the wood thus prepared with tobacco stain, using a piece of flannel or sponge, rubbing it in lightly. To make the stain, take 6 lbs. common shag tobacco, cover with water and boil, letting it simmer slowly away till of the consistence of sirup. Strain for use. 3. When entirely dry, brush it over with the following mixture: ½ lb. beeswax, ½ pint linseed oil, 1 pint boiled linseed oil. This may be omitted, and the wood simply varnished and polished instead. When it is desired to give the tone of light oak or maple, the solution of sulphuric acid should be much weaker and only a light coat of the stain used. When a dark tone is preferred, two coats of the stain should be put on.

Linseed oil has been sold for pharmaceutical use mixed very largely with cod oil. The adulteration is detected by mixing 1½ ozs. of the oil with 0·4 oz. of nitric acid, and agitating. The liquid is then put by till the acid and oil separate; and if the oil has a darker brown color and the acid turns yellow, proof of adulteration with cod oil is manifest.

The following is a method of giving cast iron the appearance of bronze without coating it with any metal or alloy. The article to be so treated is first cleaned, and then coated with a uniform film of some vegetable oil this done, it is exposed in a furnace to the action of a high temperature, which, however, must not be strong enough to carbonize the oil. In this way the cast iron absorbs oxygen at the moment the oil is decomposed, and there is formed at the surface a thin coat of brown oxide, which adheres very strongly to the metal, and will admit of a high polish, giving it quite the appearance of fine bronze.

If wool be dyed black according to the following recipe, the dye, it is said, does not rub off, the fibers remain loose, and the wool has a desirable reddish cast: Boil the thoroughly washed wool well for an hour and a half in a bath composed, for 100 lbs. of wool, of 2½ lbs. of chromate of potash, 2½ lbs. of alum, ½ lb. of blue vitriol, and 2 lbs. of commercial sulphuric acid, and dye it, without rinsing, in fresh water, with 20 lbs. of logwood and 20 lbs. of Brazil wood. It is advantageous for the color to allow the wool to remain in the mordant for 12 hours.

Professor Charles A. Seely has invented a new mode of filtration. At the bottom of an open glass tube, say 1 inch in diameter, he places a piece of felting paper, and over this a piece of India muslin, which is secured around the tube by a rubber ring. The tube is filled with the liquid to be filtered, and is closed at the top with a rubber stopper, through which runs a piece of rubber piping. The tube is connected with the two bottles, so arranged that the water in the upper one flows down into the lower one, forcing out the air, which in turn runs through the rubber pipe, forcing out the liquid through the filtering material.

Washing the face night and morning in ½ pint of water to which the juice of 1 lemon has been added is said to be a good remedy for freckles.

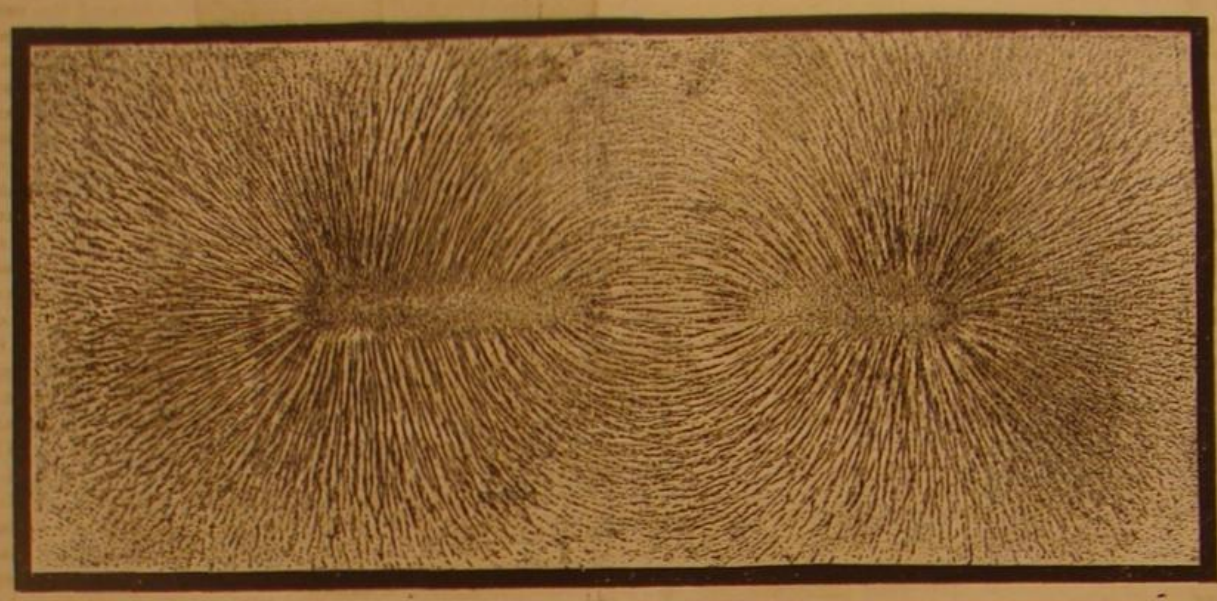
The secret of raising fine quinces, according to a correspondent of *Inter-Ocean*, is to purchase the orange variety, and set the trees from six to eight feet apart in rich soil. Bandage the stem with two or three wrappings of old cloth as far down in the ground as possible, as the roots start from near the surface. Let the bandages run six or eight inches above the ground, then pack the soil a couple of inches around the bandages. This should be renewed every spring.

Waterproof glue may be made by boiling 1 lb. of common glue in 2 quarts of skimmed milk. This withstands the action of the weather.

THE MAGNETIC SPECTRUM.

In a lecture delivered by Professor Barker at the Stevens Institute of Technology, and described in the SCIENTIFIC AMERICAN of March 18, one of the most striking experiments was the exhibition of the magnetic spectrum upon the screen. The name magnetic spectrum has been given by physicists to the arrangement which iron filings assume under the influence of the poles of a magnet; and these spectra afford a convenient means of studying the lines of magnetic force. Professor Mayer's method of rendering magnetic spectra permanent will enable any one to obtain plates like that from which the engraving herewith has been made.

Having dissolved shellac in strong alcohol, it is allowed to stand for a week or more until it is perfectly clear. It is then decanted and flowed over a thin glass plate, just as photographic plates are coated with collodion. After carefully drying for a day or two in a place free from dust, "the plate is placed over the magnet or magnets, with its ends resting on slips of wood, so that the under surface of the plate just touches the magnet. Fine iron filings, produced by drawfiling Norway iron which has been repeatedly annealed, are now sifted uniformly over the film of lac by means of a fine sieve. The spectrum is then produced by vibrating the plate by letting fall vertically upon it, at different points, a light piece of copper wire. The plate is now cautiously lifted vertically off the magnet, and placed on the end of a cylinder of pasteboard, which serves as a support in bringing it quite close to the under surface of a cast iron plate (1 foot diameter and ¼ inch thick), which has been heated over a large Bunsen flame. Thus the shellac is uniformly heated; and the iron filings, absorbing the radiation, sink into the softened film and are fixed."



THE MAGNETIC SPECTRUM.

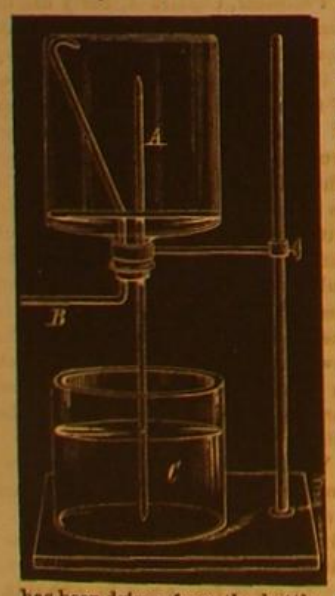
When the plate is to be used for photographic prints, the heat is kept up until the metallic luster of the filings disappears by their complete immersion in the shellac. The photographic prints will exhibit the lines of force in white upon a black ground. When the plates are used for exhibiting them upon the screen, the lines of force will appear black. When prepared with great care, such plates may be used for the most accurate measurements of the magnetic field.

The engraving herewith was made directly from a plate prepared by Professor Mayer. C. F. K.

A NEW LECTURE EXPERIMENT.

One of the most curious and interesting compounds of nitrogen and oxygen is that formed when nitric acid is poured upon copper, silver, mercury, tin, and some other metals, as well as when heated with charcoal. The compound (N_2O_2) is known as nitric oxide, and is the gas employed, in connection with bisulphide of carbon, for photogenic purposes in Sell's new lamp. When this gas comes into contact with free oxygen, it is at once converted into the higher oxides—nitrous and hyponitrous acids, N_2O_3 and N_2O_4. The latter compounds are red vapors, and are very soluble in water. These are the poisonous red fumes always observed on dissolving sugar, starch, or metals in nitric acid.

G. Bruylants has devised the accompanying simple apparatus for illustrating its properties. A very large bottle is fitted with a doubly perforated india rubber stopper through which pass two glass tubes, one of which, A, is drawn out to a fine jet; the other, B, is bent at right angles at one end, and the other end is bent like a J, and drawn out as shown in the engraving, terminating at the bottom of the inverted bottle. The bottle is filled with water, the cork inserted, the tube, A, drawn out so as to project but a little distance above the stopper, and the bottle inverted. Nitric oxide is allowed to enter through B, until nearly all the water has been driven from the bottle. The tube, A, is then pushed in until about four inches from the bottom, as seen in the illustration, and the other end inserted in a vessel of water, C. Oxygen gas is now passed in through B, the aperture at once fills with red fumes, which dissolve in the small quantity of water still in the bottle, producing a species of vacuum. The water then ascends through A, producing a small fountain. If, in admitting the oxygen, excess is carefully avoided, the bottle may be completely filled with water.



The experiment is more instructive if the water be first made blue with litmus; the acid in the vessel then changes it into a fine red.—*Berichte der Deutschen Chemischen Gesellschaft.*

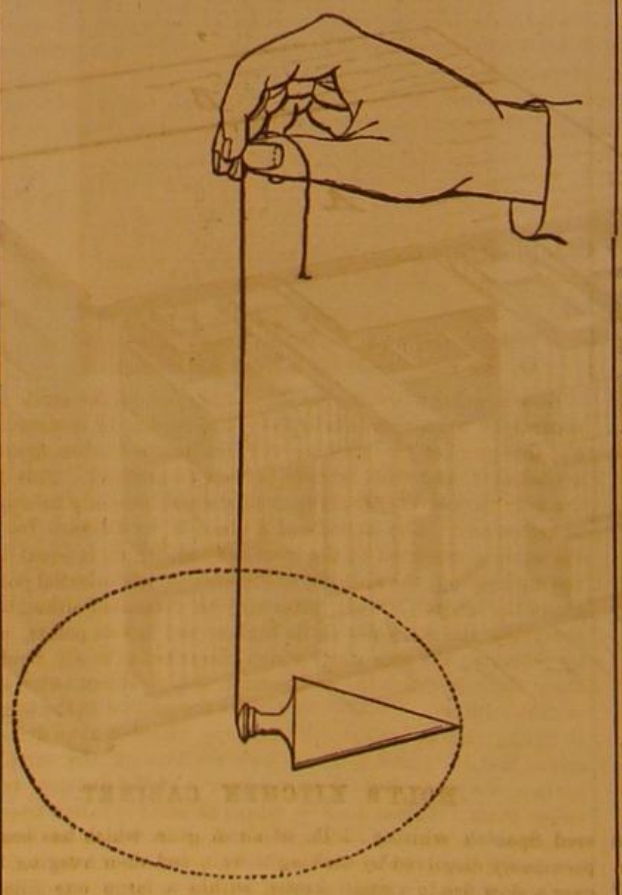
How to Set Out Roses.

Messrs. Dingee & Conard, the great rose raisers, give the following directions for the treatment of their favorite flowers: Make a hole so large that the roots may be spread out nicely. Cover the roots with fine soil, rather deeper than they were grown, and pack down lightly with the hand. It is generally best, though not always necessary, to protect the plants for a few days from the sun and chilling winds, until they become somewhat accustomed to their new position. Paper grocery bags are useful for this purpose, turning the bag completely over the plant, and supporting this with one or more sticks, heaping on a little earth to keep it in place. If the ground is dry, water thoroughly, soaking the earth down to the roots of the plants. Do not water too often. Like persons, rose plants want water only when thirsty. Let them get thirsty before giving them a drink.

SIMPLE FORM OF THE GYROSCOPE.

BY JOHN. C. DEANE.

Take an ordinary plumb bob, with a smooth hole where the cord is attached; wind about three feet of smooth hard cord about the neck of the plumb bob. Hold the end of the cord firmly and let the plumb bob fall; as it descends, and the cord unwinds, it will spin rapidly on its axis like a top, but instead of pointing toward the floor the axis will take a horizontal position at right angles to the cord, as shown in the engraving; and while revolving rapidly on its axis, the



point will slowly describe a circle around the cord, as shown by the dotted line. This form of gyroscope may have been noticed before; but I have never seen it described, and accidentally discovered it only a few days ago.

Indianapolis, Ind.

MESSRS. Frahm and Scharnweber, of Chicago, Ill., request us to state that their spring power, described in our issue of March 11, can be constructed in large as well as small sizes, and that a machine of nearly 3 horse power is now being made.

Correspondence.

Something about Belting.

To the Editor of the Scientific American:

A first class leather belt will do 3½ times the service of the best rubber belt that is found in the market. There is no economy in using a rubber belt at any price, unless it be where there is great heat or dampness.

Leather belts should be thoroughly oiled before using. A good way to apply the oil, where there is much belting to be oiled, is to have the belting run off from one reel to another, through a pot of oil, with suitable rubbers to wipe off the superabundance of oil. Another very good method of applying the oil—and perhaps it would be preferable in a majority of cases—is to put it on with a paint brush. This should be done on both sides, with no sparing hand. A belt thus oiled will not require a second application under ten years, unless there be much dust to absorb the oil, and then it may be put on very sparingly compared with the first application. The advantages that an oiled belt has over a dry one are these: 1. It lasts longer. 2. It requires less power to drive the machinery. 3. It may be run much more slack, which makes the bearings less liable to heat, requiring less oil and less attention.

There are but few people who pay any attention as to how they put on a cross belt, consequently they are just as likely to get it on wrong as right. There are but two ways to put such belts on. The right way is this: Put the belt on in such a manner that the drive pulley will have a tendency to rough up the splices; then when the splices come to the crossing they will smooth each other down instead of catching under each other's corners and tearing open a splice.

A quarter twist belt should never be used where it can be avoided; but when it is used, it should be as narrow as practicable, and the pulleys should be large. Increasing the width of a quarter twist belt does not increase its power in the same ratio as in a straight or cross belt. There is not more than one per cent advantage in using an oiled belt with the grain side next to the pulley, which will hardly compensate for the ugly look which a belt presents when put on in that manner.

In lacing a belt, the lacing should never be crossed on either side. To lace a belt in this manner, there must be one more hole in one end than the other, consequently there will be a hole in the middle of one end, which is the place of beginning. Draw the lacing to its middle through this hole, lace each way to the edge and back to the middle again, and you have by far the nicest joint that can be put into a belt. No one will ever lace the old way after once getting "the hang" of this method. But it is old to me, as I have laced in no other way for twenty-five years.

Plaited belts for engine governors and small machinery may be as scientifically laced, and the fastening will last as long as the lacing of a flat belt, with no more unevenness.

To determine the width of a belt to drive all kinds of machinery, where power and speed are known. Rule: Place the number of horse power for a numerator, and the speed of the belt in hundreds of feet per minute for a denominator. That will give what the width of the belt should be in fractional parts of a foot. Example 1: What is the required width of a belt for a planer which requires six horse power to drive it, the verge of the driving pulley running at



900 feet per minute? Answer: $\frac{6}{8}$=8 inches. Example 2: What is the necessary width of a belt for an engine of 10 horse power, running at 100 strokes per minute, with a band wheel 3½ feet in diameter (11 feet in circumference)? Answer: $\frac{10}{11}$=10 $\frac{10}{11}$ inches. E. H. DAVIES.

Santa Clara, Cal.

Human Remains in Michigan.

A party of scientists have begun the work of excavating and exploring the mounds at Spoonville, Mich., which were supposed to conceal the remains of prehistoric inhabitants of this region. Two mounds were opened. There were found human skulls, pottery, copper utensils, hatchets, needles, etc. It was the unanimous verdict that they were at least two thousand years old. Further explorations will be made. The scientists are of the opinion that this will prove among the richest discoveries of the kind on this continent.

HOW THE EARTH IS WEIGHED AND MEASURED.

LECTURE DELIVERED AT THE STEVENS INSTITUTE OF TECHNOLOGY, BY PROFESSOR C. A. YOUNG, OF DARTMOUTH COLLEGE.

It may seem paradoxical to state that the earth is the least accessible to us of all the heavenly bodies; but the fact is that we possess more accurate information concerning the surface of other bodies, such as the moon, for example, than we do of our own planet. There are six cardinal facts connected with the earth. 1. It hangs freely in space. 2. It is approximately spherical, having a diameter of about 7,912 miles; 3. It weighs about six sextillions of tuns, or would if the operation could be performed on its own surface, by bringing up one basketful after another to the surface and weighing it. 4. Its density is about 5·55 times that of water. 5. It rotates on its axis once a day. 6. It revolves about the sun once in a year.

The spherical form of the earth is proved by the shape of the shadow it casts upon the moon in an eclipse of the latter, and by the fact that we see the masts of a ship before the hull comes in sight. There are several other proofs, which it would take too long to describe; but the above are sufficient. The rotation of the earth is proved in various ways. If the earth did not rotate, a falling body would move in a straight line towards the center of the earth. In fact a body, however dropped, say from the top of a tower, will fall a little to the east of the vertical line. The reason is that the top of the tower moves faster than the bottom because it has a larger circle to describe in the same time, and the body dropped partakes of that motion. At a hight of 500 feet, this easterly deviation amounts to about an inch and a quarter. On the same principle a cannon ball will not preserve its true direction, but will be influenced by the rotation of the earth. The direction of the winds is also influenced in an important manner. Suppose a wind to start with a direction due north and south, and to keep that direction constantly. Then the earth's rotation from west to east will cause the wind to come more and more from the eastward, and it will change to northeast, east, southeast, south, southwest, west, and northwest. All this takes place without any real change in the direction of the wind; the change is only apparent, and because our position has changed. In this way the wind veers around in the direction of the hands of the clock about five or six times a year in the northern hemisphere. When there is any change it is due to a disturbance, and a storm is to be looked for. Storms usually rotate in the opposite direction. The lecturer proceeded to show how the rotation of the earth is demonstrated by means of Foucault's pendulum, which consists of a heavy globe of metal suspended by a wire in a frame, which may be rotated by means of a crank. When the pendulum is set in motion, it is found to swing in the same direction, no matter how much the frame is rotated. Now suppose such a pendulum to oscillate for several hours; it will constantly keep in the same plane, but the earth in the meantime carries the table under the pendulum around from west to east, and the pendulum will appear to have changed its plane in the opposite direction. This change is made apparent by means of a graduated circle on the table under the pendulum. In order to make accurate experiments, an extremely long wire and a heavy ball are used; and to insure a perfectly regular motion in one plane only, without any sideward swing, the ball of the pendulum is pulled back by means of a string, which is then fastened and burnt off. To keep it in motion for hours, an electro-magnetic apparatus is employed. At the pole the plane of oscillation would appear to move all around the circle, while at the equator it would continually coincide with the meridian, notwithstanding the rotation of the earth, and would appear unchanged. In latitudes between the equator and the poles, the apparent motion would be proportional to the sine of the latitude

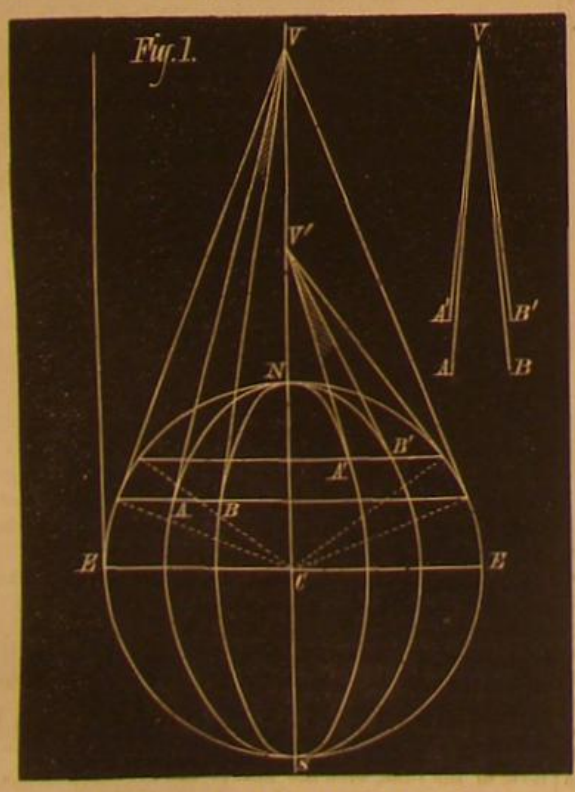
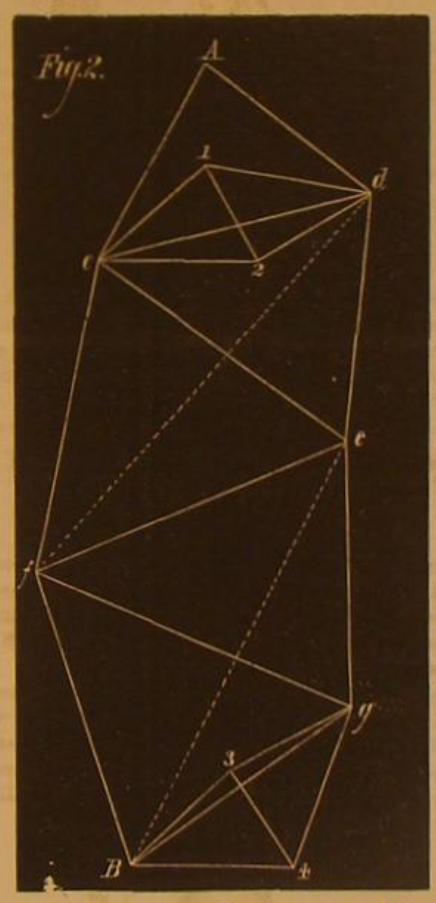


Fig. 1, a drawing by Professor MacCord, neatly illustrates the reason why the amount of deviation in the plane of oscillation of the pendulum diminishes as we pass from the pole to the equator. Suppose a pendulum to be set in motion at A, swinging in the direction of the meridian at that point, which direction is represented by the tangent, A V. It will tend to preserve this direction, when it is carried to B by the rotation of the earth; so that, instead of oscillating in the direction of the meridian at that point, represented by the tangent, B V, it will differ from it by the angle, AVB, included between the two tangents. Now, on taking a parallel of latitude nearer the pole, the angle, A' V' B', formed by the tangents drawn to the two successive positions of a pendulum taken on the same meridians as before, will be greater; or in other words, the displacement of the plane of oscillation of the pendulum will be greater for the same amount of the earth's rotation on the parallel of A' B' than on A B. The angles, A V B and A' B' V', which appear only as projections in the main figure, are shown in their true relation to the right. It will be noticed that the tangents drawn to the different meridians, at their intersections with the parallels of latitude, form the elements of a cone, the apex of which recedes further and further from the center as we approach the equator, and that therefore the angles between these elements become less and less. At the equator, all the tangents, as E I, being perpendicular, they would form a cylinder and not a cone; and as they are of course all parallel, the direction of the pendulum would not be changed in passing from one to the other. Another instrument for showing the rotation of the earth is the gyroscope, consisting of a well poised wheel, which continues to gyrate in one direction, but seems to describe a circle with its axis because the earth moves under it. The size of the earth has been pretty accurately determined. The following are the results obtained respectively by Bessel, Airy, and Clarke:

	Bessel.	Airy.	Clarke.
Polar radius in feet.....	20,853,662	20,853,810	20,853,429
Equatorial radius in feet	20,923,596	20,923,713	20,923,161
Ellipticity.....	$\frac{1}{299 \cdot 15}$	$\frac{1}{299 \cdot 33}$	$\frac{1}{300 \cdot 83}$

According to Charles, the equator is also elliptical, and his measurements of it are as follows: Semi-major axis 20,926,350 feet (longitude 15° 34' E.): semi-minor axis 20,919,972 feet (longitude 105° 34' E.): difference 6,378. Equatorial ellipticity, $\frac{1}{3281 \cdot 5}$.



Now in order to determine the dimensions of the earth so accurately, numerous arcs of meridians had to be measured. For this purpose two stations, say two hundred miles apart, are selected, and their latitude is first determined. This is the only part of the whole operation which properly belongs to astronomy. The latitude of a place is its distance from the equator reckoned on the meridian, or, which is equal to the same thing, the altitude or distance of the celestial pole above the horizon. This latter may be measured either by observing the same star at its highest and lowest points, or by observing the pole star, which describes a small circle about the celestial pole, and crosses the meridian twice in each revolution. These observations are made with the transit instrument and the zenith telescope. Having thus determined the true position of the two stations on the earth's surface, we proceed to the measurement of the distance between them. This is done by means of what is called triangulation. A piece of level ground, four or five miles long, is selected to get a base line, *c d*, Fig. 2, which is very accurately measured. Then a third station, *e*, is selected, and the angles it forms with the two ends of the base line are measured with a theodolite. Then, having one side and the angles, the other sides can be easily calculated. In the same way we compute the distance of the stations, *f* and *g*, and finally B. Usually hill tops are selected for the intermediate stations, and the observation of the angles is facilitated by the reflection of a beam of sunlight by means of a mirror, called a heliotrope, into the measurement. The observations are repeated many times to reduce the errors as much as possible; two feet in two hundred miles is about the limit of error allowed.

The measuring rods used in the United States Coast Survey are made of iron and brass in such proportion as to compensate for the elongation and contraction due to temperature. One is placed on trestles, and the other is carried forward and made to touch the first very accurately. The moment of contact is indicated by a spirit level connected with the rod by means of levers.

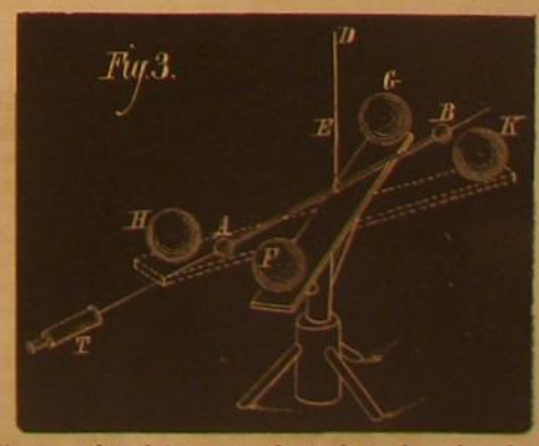
The length of a degree depends of course on the shape of the earth's surface, and the clock furnishes us with a ready means of determining that shape. The vibration of the pendulum is due to the attraction of gravitation, and this becomes greater as we approach the center of the earth. Hence a clock will go faster at the poles than at the equator. It will gain about four minutes, three of which are due to the centrifugal force as has been found by calculation, and one is due to the form of the earth. *Therefore*, in order to determine the form of the earth, or, in other words, the distance of the surface from the center at different points, all that is necessary is to carry the same pendulum to those points and observe the rate of variation. The best instrument for this purpose is Kater's pendulum, based on the principle (of Huyghens) that the point of suspension and the center of oscillation are interchangeable. It is adjusted by means of sliding weights until it keeps the same time, when it is suspended by its ordinary point of suspension, or turned upside down and *suspended* by its center of oscillation, which is also provided with a knife edge. This instrument is hung up in front of an astronomical clock beating seconds, and their rate of variation is ascertained by observing them through a telescope and noting the coincidences. It has been found that the degrees are about one seventh longer at the poles than at the equator. Although the accuracy of these measurements is often extolled, it not unfrequently happens that an error of two or three hundred feet is made in determining the latitude of places. Such errors are not the fault of the methods or of the observers, but are due to the variations of the direction of the plumb line caused by the attraction of mountains or dense rocks at the places in question. In the work of the United States Coast Survey, the average error is one hundred and twenty-five feet.

We are enabled to compute the weight of the earth by first determining its density; and this is done by comparing the attraction of the earth upon some object with the attraction of a body of known mass upon the same object.

Dr. Maskelyne accomplished this by determining how much a plumb line was deflected from its normal direction by Mount Schehallian, in Scotland. This deflection was found to be twelve seconds. If the mountain had been as dense as the interior of the earth, the deflection would have been twenty-one seconds. The mean density of the mountain was ascertained, by numerous borings and actual determinations, to be two and three fourths times that of water. Hence the density of the earth is 12 : 21 :: 2·75 = 4·81.

Cavendish, in 1798, compared the attraction of the earth with two lead balls, F and G, Fig. 3, each a foot in diameter. Two small lead balls, A and B, upon which the attraction was exerted, were attached to a wooden rod six feet long, suspended by a fine wire, D, E. When at rest, the position of the rod was observed by means of a telescope, T; then the large balls were brought near, on opposite sides, so that their attraction should conspire to twist the wire, and the change of position was observed by means of the telescope. The amount of force exerted in producing the torsion of the wire, D E, is the measure of the attraction of the balls. The attraction of the earth on the same balls is, of course, represented by their weight. Then, from the known density of lead and the law of gravitation that bodies attract each other directly as their masses and inversely as the squares of the distances, Cavendish computed the density of the earth to be 5·45 times that of water. More recent experiments with an improved form of the apparatus have proved that the density is 5 56.

Another method is by observing the rate of vibration of a pendulum at the top and bottom of a mine, or of a mountain. At the bottom of a mine a pendulum will be attracted only by the particles of matter below it, the stratum above it exerting no influence upon it whatever. More accurately speaking, a pendulum carried to a depth of 500 feet would



vibrate as though it were on the surface of a sphere having a radius 500 feet shorter than that of the earth. Since the density of the stratum above the pendulum can be found by experiment, we are enabled to deduce that of the earth by a simple calculation.

From the dimensions of the earth already given, its volume is found to be about 260,000,000,000 cubic miles, and its weight six sextillions of tons, which, when written out, will present the formidable appearance of 6,000,000,000,000,000,000,000 tuns.

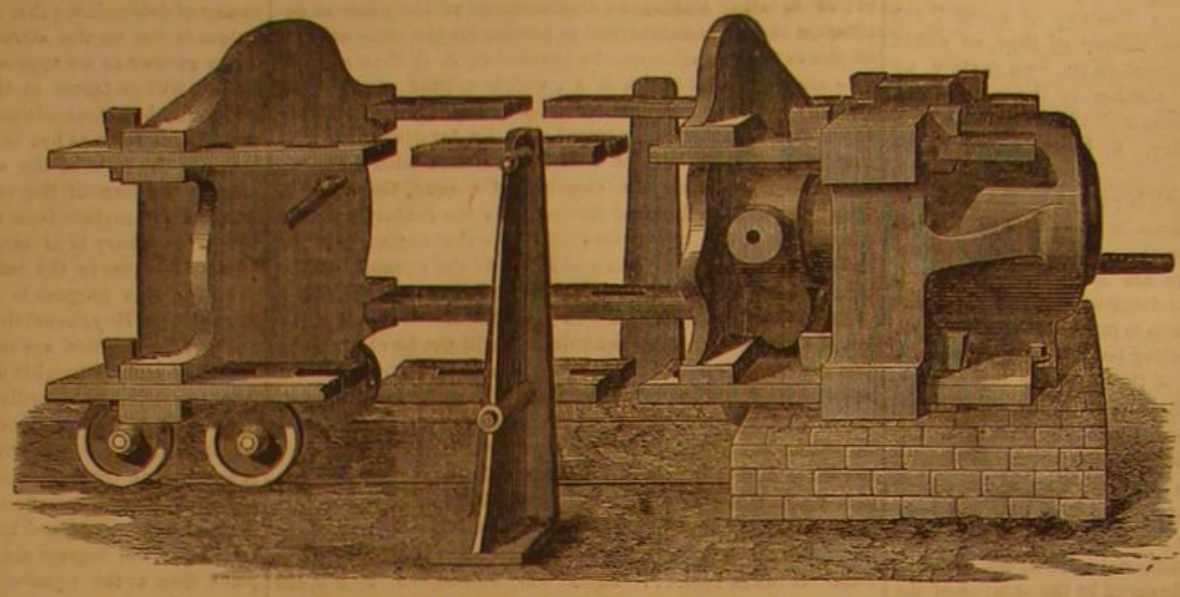
C. F. K.

TESTING BOILERS.

An English firm (Messrs. Howard & Co., of Old Hill, Worcestershire) is now making boiler shells with welded seams, a form of construction involving some difficulty in manufacture, the trouble of which will be amply repaid by the improvement in strength and durability of the boiler. Hydraulic pressure is used for testing the soundness of the welds, and for this purpose Messrs. Tangye Brothers, of Birmingham, have designed and constructed the machine herewith illustrated. It is capable of testing shells up to 4 feet in diameter and 35 feet long, at a pressure of 200 lbs. to the square inch.

The appliance, the engraving of which we select from *The Engineer*, consists of a fixed hydraulic cylinder, 12 inches in diameter and of 12 inches stroke, connected to a traveling head by rectangular wrought iron bars, 5 inches by 2½ inches, pierced with cotter holes of 11 inches pitch; the platen attached to the hydraulic ram slides along the bars. When a boiler shell is to be tested, the traveling head is run out of the way along the line of rails, and the shell is run in on a truck, the head is brought back to its place, and the cotters are inserted in the nearest cotter holes. Pressure is then applied to the cylinder by means of hydraulic pumps; the ram forces the platen against the end of the shell, and the joint is thus made tight, ready for testing. The shell is then filled with water from a tank by means of a flexible hose inserted into a passage in the platen, while the air escapes by the tube, marked B, in the traveling head; this tube is made to slide diagonally, so as to suit any sized shell. The tube is then closed by means of a cock, and the test pressure is applied by the hydraulic pumps.

The boiler seams are welded by means of a gas furnace placed over them; and special machinery has been made for planing the plates, bending them into the form of tubes, and facing the ends of the latter, as well as for testing them by the machine now under notice.



HOWARD & CO.'S BOILER TESTING MACHINE.

ATKINSON'S IMPROVED DESK.

Any person that has spent an hour or two bending over a sitting desk, steadily writing, knows what a wonderful relief is experienced when he can transfer his work to an upright standing desk and straighten the painful stitch out of his back. To afford this relief, and to add many conveniences not heretofore embraced in a single desk, are the objects of the invention illustrated herewith. This desk is readily changeable from a sitting to a standing desk, or *vice versâ*, by simply raising or lowering the table, which can be adjusted to any hight; and besides, it can be placed at any angle desired. The movable table is pivoted to sliding pieces which travel in vertical guides on each side of the frame. Its weight is balanced by metal counterpoises which are secured by chains to the upper part of the slides, which chains pass over pulleys, so that the counterpoises hang inside the desk out of sight. The curved arms, A, which support the outer portion of the table, are also secured to the slide. These arms serve as guides for a third arm, B, which has projections on its inner end which engage in the rack teeth shown in Fig. 1, so as to aid in holding the table in whatever position it may be adjusted. The appearance of the desk with the table closed is shown in Fig. 2.

Fig. 1

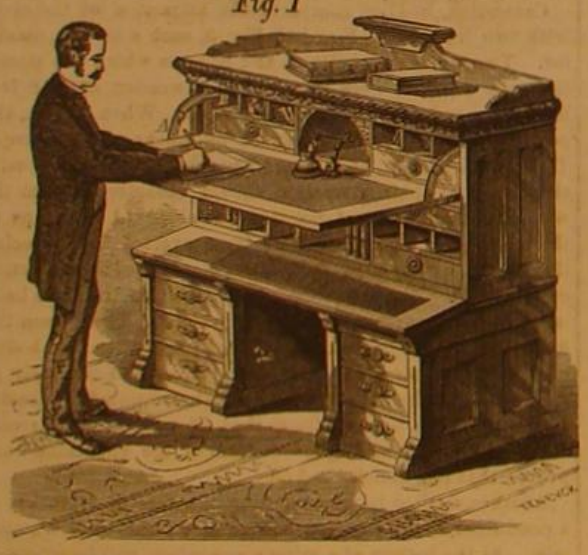


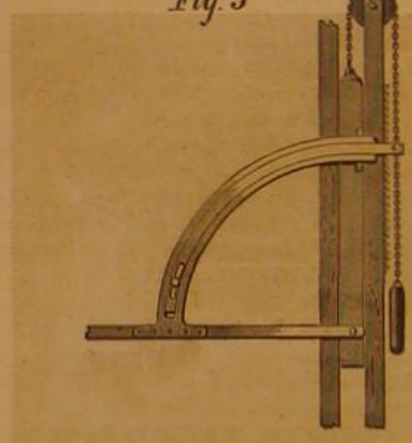
Fig. 2



The invention has a compact and ornamental shape, rendering it a handsome article of furniture for the library.

Patented through the Scientific American Patent Agency, March 7, 1876. For further information relative to rights to manufacture, etc., address Chas. A. Atkinson, 2 Clinton Place, New York city.

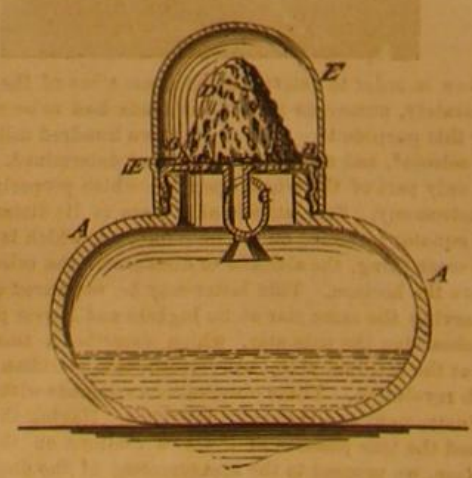
Fig. 3



IMPROVED MUCILAGE BOTTLE.

George R. Wight, of New York city, has recently invented a mucilage bottle, so constructed that the mucilage may be applied without a brush or any detached instrument. The bottle has a metallic cap, provided with an S tube and sponge.

A represents the bottle or cup; and upon the neck of the bottle, A, is formed a screw thread to receive the screw thread formed upon the inner surface of the flange of the metallic cap, B. In the center of the cap, B, is formed a hole, in which is secured the upper end of the small metallic tube, C.



The tube, C, is bent into an S shape, so as to prevent the air from entering the bottle, and to keep the mucilage close to the sponge. D is a sponge cut into a tapering or conical form, the base of which is secured to the cap, B, by sewing, small holes being formed through the cap for convenience in securing the sponge in place. E is a cap, made of such a size as to cover the sponge, D, without touching it, which fits snugly and airtight upon the outer surface of the cap. In using the device, the sponge should be kept moist with water to enable the mucilage to pass through it freely. To apply mucilage, the cap, B, is removed, the bottle is inverted, and the sponge, D, is rubbed over the place to which the mucilage is to be applied, care being taken to replace the cap, E, to prevent the sponge from becoming dry and stiff.

French Railway Signals.

The Paris correspondent of the London *Times* says: "The French Minister of Public Works has addressed a circular to the railway companies, calling their attention to an apparatus designed to prevent the terrible accidents resulting from the inefficiency of danger signals. The question is of immediate interest on account of the lamentable accident at Abbot's Ripton, and the ministerial circular deserves, therefore, the greatest publicity. I wished, before transmitting it, to obtain information personally as to the efficiency of the system patronized by M. Caillaux. The results communicated to the companies by the circular may be considered conclusive, and seem destined to make up for the inadequacy of optical signals, which are naturally thwarted by fog or by a sharp curve, an inconvenience which it has been attempted to remedy by fog signals. In England a mechanical contrivance has been devised putting in motion a rod which, being struck by the engine, produces a whistle; but the recent accident has proved that this device is not infallible. The system indorsed by the Minister of Public Works seems, on the other hand, to meet every objection. It can be placed at any distance, as it acts simply by laying down a wire The board which indicates danger, in moving, excites an electric current which leads to an apparatus placed in contact with the locomotive, and which produces a loud whistle. As soon as the indicator no longer indicates danger, the current is intercepted, and the locomotive may come in contact with the apparatus without causing a whistle. These experiments have been made during snow, and have invariably succeeded, the warning being given at a sufficient distance to allow of a train, running at full speed, being pulled up in time.

NEW FUSIBLE BOILER PLUG.

The annexed engravings, taken from the *English Mechanic*, represent a new fusible plug, which is intended to act as an efficient safeguard against boiler explosions. A bulb of gun metal, C, is provided with a screw shank, whereby it may be screwed into the top of the fire box. Through the bulb passes an inclined tapered tube, D, so that the outer surface of this tube and the inner surface of the bulb are subject to the heat of the fire, while the exterior of the bulb and interior of the tube are surrounded by the water in the boiler, which circulates through the latter The tube, D, is slotted, and the slots, E, are filled with soft metal, which, so long as the tube is full of water, is thereby kept from melting; but should the water in the boiler fall below the level of the tube, then the heat of the fire melts the fusible metal, forming apertures through which the steam rushes, thus relieving the boiler of pressure and at the same time putting out the fire. The device is the invention of Mr. T. J. Smith, of North Bow, England. Fig. 1 is a perspective view, and Fig. 2 is a vertical section

FIG 1.

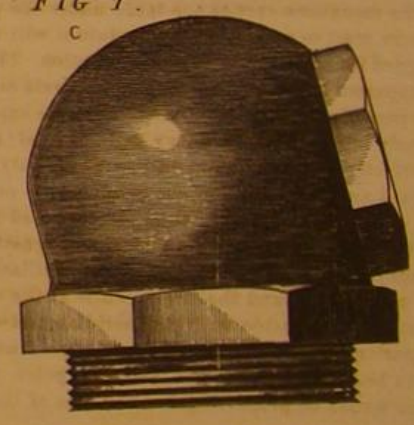
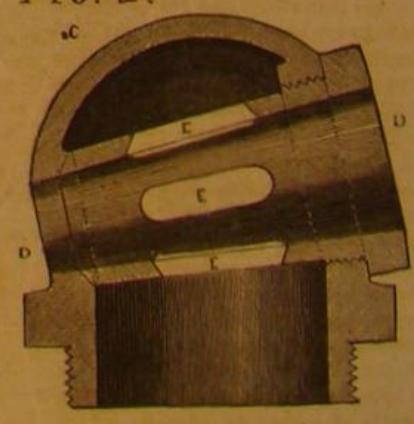


FIG. 2.



AN ORNAMENTAL GOURD.

We have already called attention to the beauty of many of the varieties of gourd, and their value in the flower garden as trellis plants. Their foliage is generally very handsome, and the fruit is frequently interesting on account of its eccentric appearance. Plants suitable for covering walls and arbors are by no means numerous; and the gourds are plants of large growth and rapid development, and are therefore worthy of cultivation. Nearly all members of the genus can be utilized for climbing purposes; and one of the best is the *cucumis metuliferus*, shown in our engraving. The venous structure of the leaf is highly organized, and the curious oblong fruit is studded all over with horny protuberances. The foliage is of a beautiful fresh green color; and if planted in a deep soil, in a sunny place sheltered from high winds, a very ornamental addition will be made to the garden. The gourds require plenty of water in dry weather, and liquid manure is highly beneficial to them.

The Early Discovery of Coal.

Bituminous coal, or sea coal, was known upwards of a thousand years ago, in the year 853, but did not come into general use until the 16th century, and was not used in the manufacture of iron until the 17th century. Anthracite coal came gradually into use so late as the 19th century, and was not used as fuel in the manufacture of iron until about 16 years ago.

So early as 1790 anthracite coal was known to abound in the county of Schuylkill, in the State of Pennsylvania; but it being of a different quality from that known as sea coal or bituminous coal, and being hard of ignition, it was deemed useless until the year 1795, when a Pennsylvania blacksmith, named Whetstone, brought it into notice. His success in burning it induced persons to dig for it: but when found, every person connected with the enterprise had to experiment on its combustion, and vain were the attempts to burn it by the majority of them, and all came to the conclusion that it would not come into general use.

About the year 1800, Mr. Morris, who had a large tract of land in Schuylkill county, Pennsylvania, procured a quantity of coal therefrom, and took it to Philadelphia city, but he was unable with all his heroic exertions to bring it into notice, and abandoned all his plans. From that time until 1806 it was talked about as a humbug; when accidently a bed of coal was found in digging a tail race for a water wheel for a forge, which induced another blacksmith, David Berlin, to make a trial of it. His success was generally made known, which induced others to try to burn Pennsylvania coal.

Study and Business.

In learning, concentrate the energy of the mind principally on one study; the attention divided among several studies is weakened by the division; besides, it is not given to man to excel in many things. But while one study claims your main attention, make occasional excursions into the fields of literature and science, and collect materials for the improvement of your favorite pursuit.

The union of contemplative habits constructs the most useful and perfect character; contemplation gives relief to action; action gives relief to contemplation. A man unaccustomed to speculation is confined to a narrow routine of action; a man of mere speculation constructs visionary theories, which have no practical utility.

Excellence in a profession and success in business are to be obtained only by persevering industry. None who thinks himself above his vocation can succeed in it, for we cannot give our attention to what our self-importance despises. None can be eminent in his vocation who devotes his mental energy to a pursuit foreign to it, for success in what we love is failure in what we neglect.

ACALYPHA MARGINATA.

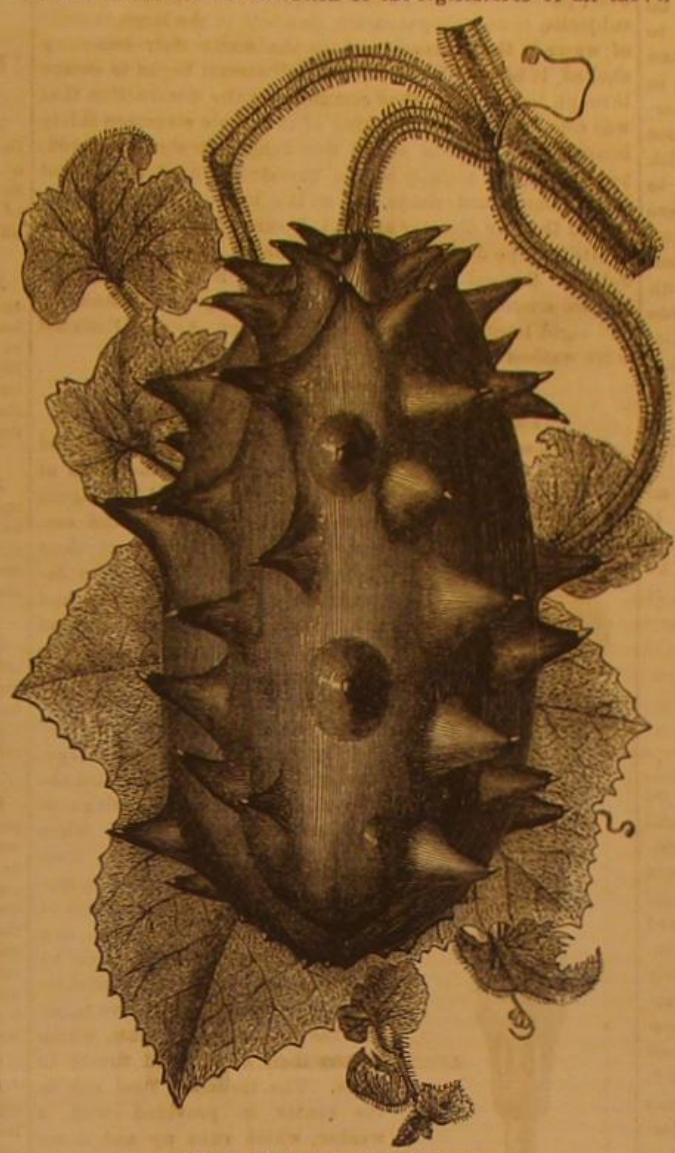
To the myriads of fine foliage plants which have been introduced of late years this is a welcome addition. The leaves, as regards size, resemble those of *acalypha tricolor*, but the markings, in which their chief beauty resides, are of a character wholly different from those of that variety. In the present case, the center of the leaf is brown, around which is a distinct margin of rosy carmine about a quarter of an inch in width; and the surface is entirely covered with little hairs, which add considerably to its beauty. This plant, says the English *Garden*, belongs to the spurgeworts, an order comprising upwards of a hundred species, which are more or less distributed over all tropical and subtropical regions, but the headquarters of which are in South America. A goodly number are annual, but the great mass are perennial plants, having much the appearance of nettles, and readily known from their nettle-like leaves and the disposition of their flowers.

INCOMBUSTIBLE lamp wicks are made in Austria of asbestos

Railroad Crossings.

A bill has lately been passed by the Massachusetts legislature, providing that "no highway or townway shall hereafter be laid out across a railroad at a level therewith, nor shall any railroad be laid out and constructed across a highway or townway at a level therewith, without the consent in writing of the Board of Railroad Commissioners, in addition to the authority of the Court Commissioners, as now required."

This is an excellent and most sensible measure, and one which deserves the attention of the legislatures of all the other States. While we have scores of inventions for the safety of passengers in the cars, there is little attention paid to proper safeguards to keep people out of the way of the trains. As a rule, the railroad companies are only required to put up a sign to "look out for the locomotive when the bell rings" at road crossings, and blow whistles or sound bells when the train approaches the road, and that is all that is thought needful to protect the public from trains rushing at the rate of forty miles an hour. It is no easy matter to estimate the speed of an approaching locomotive, and accidents are constantly occurring simply through people thinking that they can drive across a track before the locomotive can reach the crossing, or on attempting to cross, and failing to observe the coming train until too late to avoid it. By sinking or raising the track, so as to leave a clear passage, these accidents, of course, become impossible. In England, it is of a very unfrequent occurrence for railway and highway to cross on the same plane; and whenever such intersection does exist, guards with signals are kept constantly on the alert.



CUCUMIS METULIFERUS.



ACALYPHA MARGINATA.

The Thickest Armor Plate Ever Made.

Experiment was lately made at the great works of Charles Cammell & Co., Sheffield, Eng., which, it is believed, will have an important influence upon the future of ironclad navies. It was the rolling of the thickest armor plate which has ever been produced. Four and a half inches is the thickness of the plates with which vessels of the Warrior class are covered. Step by step the size has been increased till it has reached 14 inches, which, until the present experiment, was the thickest plate known. Messrs. Cammell & Co have now succeeded in producing one of 22 inches, this being eight inches thicker than any armor plate ever yet rolled. The plates, of which this is a sample, are intended for the Dandolo and Duilio, two war vessels now being built in Italy for the Italian government—one at their dockyard at Castellamare and the other at La Spezzia. These vessels are to be armored at the water line with plates of this thickness, and the representative plate now rolled was ordered for the purpose of ascertaining the relative resistance of plates of this enormous thickness compared with the thickest that has yet been manufactured. The gun to be used in testing this great plate is one of the 100 tun guns now being made by Sir William Armstrong & Co., at Newcastle. The vessels are to have two turrets, and each turret will contain two of these enormous pieces of artillery. The guns will be about 30 feet long, their bore 19 inches in diameter, and they will throw a shot weighing nearly one tun. Several hundred pounds' weight of powder are necessary for each charge. One of the guns is nearly ready, and Sir W. Armstrong has been specially asked to make a crane, capable of lifting 150 tuns, to move it. To give some idea of the enormous mass of metal of which the plate is formed, it may be stated that it had to be in the furnace upwards of twenty-seven hours before it was fit to be placed upon the rolls. It weighs upwards of 35 tuns, and measures 17 feet in length and 5 feet in width. The experiment of rolling such a monster was a bold one. Sir Joseph Whitworth, Sir W. Palliser, and a number of officials and diplomatists were present to witness the operation.

Before the plate was rolled, a luncheon was served at the works, at the conclusion of which a few toasts were given and responded to. Sir Joseph Whitworth's health was proposed in connection with his guns. In giving it, Mr. Cammell stated that if Sir Joseph's guns succeeded in penetrating the plate about to be rolled, he should have no hesitation in rolling one of 30 or even 40 inches in thickness. In reply, Sir Joseph Whitworth kept significant silence with regard to what he believed his guns would do when opposed to a 22 inch plate. Sir William Palliser's health was also given. In replying, he said, that, owing to the success of his projectiles, he at first thought that the days of iron-plated vessels were numbered, and that we should return to unplated ships with heavy guns. Subsequent experiments, however, satisfied him of the enormous resistance which armor plates presented to projectiles, unless they happened to strike exactly at right angles; and it was this enormous resistance that, in his opinion, rendered the retention of ironclad ships necessary to the country. Nobody could yet say whether the gun or the plate would win. If Sir Joseph Whitworth made a gun that would penetrate even a plate 22 inches thick, then a plate must be made that it could not penetrate; in fact, the bigger the guns, the more powerful must be the plates. Nobody could deprecate more than he the idea that, because of the increase in the power of penetration of our guns, iron-plated ships must be abandoned. What they required was that their plates should be more powerful. It was only in direct firing that the greatest penetration had been obtained, and it was but fair to presume that in actual warfare the greatest portion of the shots would be fired obliquely. He was quite aware that Sir Joseph Whitworth had invented a shot which would bite when fired from an oblique position; but even then the penetration was much inferior to that obtained by a direct shot. That being so, he was inclined to think that armor-plated ships would always possess an advantage over guns.

Shortly afterwards an adjournment was made to the armor plate mills. A group of men were standing round the furnace in which the plate was being heated, and at the word of command from a superior they began to pull away the bricks at the mouth of it. Instantly the flames leaped out, and the men, accustomed as they are to stand a great heat, were constrained to retreat until the fury of the flames had subsided. Then one wearing only trousers and a shirt approached the furnace, raised a little doorway, and looked at the huge monster within. The view was doubtless satisfactory, though how any one could look into this furnace unscorched was a marvel. Men were then seen guiding, up to the mouth of the furnace, a huge pair of tongs with which the plate was to be

grasped. A trolly, too, was sent almost up to the mouth of the furnace, and, by and by, it received the plate when the tongs had done their work. Everything was now ready. The doorway of the furnace was lifted up, the flames shot out and lit up the mill, and, while spectators shielded their faces with their hats or handkerchiefs, the workmen, with their backs to the furnace, pushed up the tongs until they grasped the plate within. Balks of wood were then put on each side of the furnace to enable the plate to be drawn out the more readily; but the flames seized upon them and appeared to devour them as if mere shavings. There was no time to lose, the order was given, and machinery began to move, the chain fastened to the tongs slowly tightened, and the huge mass, which had required twenty-seven hours in such a furnace as this before it was done, made its appearance. Fierce as had been the heat before, it was now ten times greater. One could hardly look upon the plate, white with heat, over and around which little blue flames appeared to be lingering. Slowly it fell upon the trelly, the tongs were then removed, and in a moment or two the rolls, which had been revolving for a while, caught the end of the plate; and the huge mass, weighing 35 tuns, passed between them with as much ease as if it were but a 4½ inch plate. Backwards and forwards it came six or seven times, each time the distance between the rolls being decreased, and the operation ended as soon as the required size had been attained. The rolling was most successful, and it is believed the plate is without a flaw. The destination of the plate is Spezzia, where the test is to be carried out.

The experiment shows that there is absolutely almost no limit to the thickness of which armor plate can be made. It was no idle boast on the part of Mr. Cammell when he said that, if Sir Joseph Whitworth's gun penetrated this plate, he would make one 30 inches or 40 inches thick. The result of the test at Spezzia will be watched with great interest.—*Iron.*

SCIENTIFIC AND PRACTICAL INFORMATION.

STRANGE NATURAL CISTERNS.

In the rough granite country back from Mossamedes, on the west coast of Africa, are some very remarkable natural cisterns. The country itself is peculiar, huge single rocks rising out of the nearly level plain in some places, and in others hills of rock, in several of which deposits of water are found at the very top. A recent traveler visited one of these, and describes it as a natural tank with a narrow entrance, containing some three or four hundred gallons of exqusitely clear and cool water. It was covered by vast slabs of granite, from which the rain drained into it during the rainy season, shading the water so that it could not be seen without a torch, and so protecting it that the sun cannot evaporate it during the dry season. Thus a bountiful store of excellent water is preserved while there is not a drop to be had elsewhere for miles.

A still more remarkable cistern of this sort is that of the Pedra Grande, or Big Stone, some thirty miles from Mossamedes, a huge rounded mass of granite rising out of the sandy plain. On the smooth side of this rock, twenty or thirty feet above the plain, is a circular pit about ten feet deep and six feet across. The rainfall on the rock above the pit drains into it, filling it completely every rainy season. The walls of the pit—which is shaped like a crucible, narrowing gently to the bottom—are perfectly smooth and regular, the enclosing granite being of the closest and hardest description. The cistern will hold several thousands gallons of water. Near by are smaller pits of similar character. Their formation is unexplained. The water of this strange well furnishes the natives and travelers with an abundant supply during the dry season; consequently it is a noted halting place.

A SPITTING SNAKE.

There is a dangerous snake, not uncommon about Benjuella, West Africa, called by the natives *naja neje*, and by the Portuguese *cuspedira*. It is small in size and remarkable from its habit of spitting when interfered with. The saliva is ejected to considerable distances, and is said to cause blindness if it touches the eyes. One of the snakes was captured by the natives and brought to where some English miners were at work. It was teased by a miner who was standing over the cage, which was on the ground, and retaliated by a discharge of spittle. Some of the liquid entered one of the miner's eyes; and though the eye was immediately washed out with water, it was very much irritated for several days. The snake was killed before any experiments could be made with it by the scientific superintendent of the mine; he has, however, no doubt of the miner's statement and that of his companions, corroborated as it is by the testimony of the natives and the Portuguese.

A RIVER OF INK.

In Algeria there is a river of genuine ink. It is formed by the union of two streams, one coming from a region of ferruginous soil, the other draining a peat swamp. The water of the former is strongly impregnated with iron, that of the latter with gallic acid. When the two waters mingle the acid of the one unites with the iron of the other, forming a true ink. We are familiar with a stream called Black Brook in the northern part of this State, the inky color of whose water is evidently due to like conditions.

A. RICCO, of Modena, Italy, says: To cure the swellings of chilblains, rub them well at night with petroleum. It will take three or four nights rubbing to cure them.

The Breaking of the Lynde River Reservoir Dam.

A serious disaster, causing a large destruction of valuable mills and other property, occurred in the vicinity of Worcester, Mass., on the 30th of March, through the rupture of the dam of the Lynde river reservoir, whence the water supply of the above city is derived. The reservoir has a capacity of some 670,000,000 gallons, and by the recent heavy rains became filled to its utmost extent. The embankment wall, it is said, was known to be too low for safety, and engineers had recommended its enlargement. These warnings, however, passed unheeded; and consequently, when the dam was subjected to an unusual strain, due both to the large amount of water in the reservoir and to the waste weir becoming choked, it became leaky, and a small stream began to escape through its masonry, thus commencing the destruction that was completed by the breaking of the whole structure thirty hours later. As soon as the first dangerous sign appeared, people in the vicinity of the threatened flood abandoned their houses and shops, and so the loss of life, which attended the like disaster at Mill River a year or so ago, was averted. The damage done is estimated at several million dollars. Several houses, the Bottomly, Smith & Co. Mills, besides a number of smaller manufacturing establishments, and eight hundred feet of the Boston and Albany Railroad were washed away.

THE NATIONAL STEEL TUBE CLEANER.

We show in the accompanying illustration an improved apparatus for cleaning the flues of steam boilers. All intelligent users of steam appreciate the economy of keeping the flues of their boilers clean and free from deposits of unconsumed carbon and ash, which are non-conductors of heat and cause a marked difference in the working of a boiler.



The National Tube Cleaner is a plain, practical, durable tool, and has many points of advantage. Among these may be mentioned the absence of small steel springs or thin bands of metal, which, when thrust into a hot flue, lose their temper and elasticity. The scraping edges, supported on blades of Bessemer steel, are cut from saw plates, and are held in place by doubly riveted braces of malleable iron. The blades are dove-tailed into the malleable iron butt, which insures their being held firmly in place. The threaded steel rod in the center is provided with a washer, which runs up and down upon it, by means of which the spread of the blades is adjusted to the size of the flue. These implements received the silver medal at the American Institute in 1875, the first premium at the last Industrial Exhibition in Pittsburgh, and also at the Providence (R. I.) exhibition. It is manufactured by the National Steel Tube Cleaner Company, and has been introduced through the agency of the Chalmers Spence Company of New York. It is sold by the principal dealers in engineers' and mechanics' supplies throughout the country.

NEW BOOKS AND PUBLICATIONS.

THE FIRST GERMAN READER: a Modification of Marcel's Method. By Charles F. Kroeh, A. M., Professor of Modern Languages, Stevens Institute. 67 pp. New York city: D. Appleton & Co.

This is a concise and admirable instruction book, for English pupils, in German. The entertaining story of Cinderella is presented in German, accompanied by a literal linear translation, which exhibits at one view the peculiar arrangement of the language. Excellent directions, vocabularies, etc., are given, the author's object being to convey a practical knowledge of the subject without burdening the learner with the technicalities of grammar.

PORTRAITS OF CELEBRATED DOGS. Price $2, for Set of Eight Portraits. New York city: "Forest and Stream" Company, 17 Chatham street.

These are well executed wood engravings of celebrated pointers and setters, and they will undoubtedly have a large sale among the shooting fraternity.

THE PHILADELPHIA LEDGER. Philadelphia, Pa.: G. W. Childs.

The enterprising publisher of this old and respectable daily journal inaugurated, on March 27, the forty-first year of its publication, by increasing its size and improving its general appearance. Under the proprietorship and management of Mr. Childs, the *Ledger* has become one of the most profitable newspapers in the country.

REFERENCE BOOK FOR INVENTORS AND MECHANICS. 125 pages. Bound in cloth, gilt edges. Price, by mail, 25 cents. New York city: Munn & Co., Publishers SCIENTIFIC AMERICAN and SCIENTIFIC AMERICAN SUPPLEMENT.

This is a valuable little book for inventors, patentees, mechanics, and others. It contains the patent laws of the United States complete, with directions for obtaining patents, trade marks, caveats, designs, copyrights, and forms for transferring, by assignment and license, interests in patents. It contains the census of the United States, by States and Territories; and contains also engravings of 150 mechanical movements, which will be found convenient for all mechanics and inventors to have at hand for reference. A more valuable compilation of rare and useful information has never been condensed into so small a compass, or sold at so cheap a price.

EVERY MAN HIS OWN LAWYER. By John G. Wells. 612 pages. Price, by mail, $2 25. New York city: John G. Wells, 3 East 4th street.

Mr. Wells has just issued a new edition of his business form book, adapted for all classes of persons. It is a guide in all matters of law and trade, and is adapted for every State in the Union. To those who have occasion to draw conveyances, to frame wills, agreements, and powers of attorney, or to make assignments, this work will be found most convenient. It contains a synopsis of the laws of all the States relating to usury, the rights of married women to hold property, how to obtain pensions and letters patent, and other matters likely to arise in the life and experience of most persons.

THE ALDINE.—Parts 6 and 7 of the new issue of this beautiful art publication are just from the press; and they compare favorably with the five first numbers of this year's issue. Several finely executed wood engravings of American and foreign scenery and copies from celebrated paintings of our best modern artists, executed by our most distinguished designers and engravers, are features in these issues which render the publication of special interest to lovers of art. Published fortnightly by the Aldine Company, 18 and 20 Vesey Street, New York city, and supplied, to regular subscribers only, at 50 cents a number.

Recent American and Foreign Patents.

NEW CHEMICAL AND MISCELLANEOUS INVENTIONS.

IMPROVED TINNED BLANK.

John C. Milligan, South Orange, N. J.—This inventor forms a little extension lip at one part of the edge of a round plate or blank of tin plate, the object of which is to receive the beads of tin that flow to the lower edge, and there solidify on drawing the sheet out of the bath, so that they can be removed from the sheet by cutting off the lip without destroying the symmetry of the blank.

IMPROVED BALE TIE.

Jesse R. Horton, St. Louis, Mo., and Henry A. R. Horton, McKinney, Tex.—This is a simple device whereby the end of the band is held in close contact with the other end by means of a lug, so that the swelling of the bale can never affect the security of the fastening, since the flanges of said lug do not permit it to be pressed out of the slot. The lugs are so arranged that they do not catch in the cotton or wrapping of the bale, either in the act of locking or unlocking.

IMPROVED CORSET SPRING.

Joseph Day, New York city, assignor to himself and Nathan Hyman, same place.—This is a corset clasp composed of a broad stay, having fixed hooks upon it, in combination with an overlapping stay having eyes hinged to fastening bands which pass around the stay, said eye being made with broad base, to allow the easy connecting and separating of the parts.

IMPROVED MICA LIGHT FOR STOVES.

John W. Elliot, Toronto, Canada.—This invention consists in a mica light, provided with a handle at the upper end, a perforation, and a strengthening tip, the same being applied to a window frame having a lip. The plate is sprung into the rim and guard lip of the stove body, and is provided with an eyelet at the lower part to admit the entrance of air.

IMPROVED FILTERING APPARATUS.

Leo Prange, South Brooklyn, N. Y.—In this filter, the liquid is passed through a body of charcoal and a series of bags, formed of woven fabric and suspended vertically from short tubes attached to the bottom of a tank. In order to hold the charcoal necessarily employed as a filtering medium, a strainer supported on a circular flange forms a false bottom to the vessel. The liquor filters through the charcoal and enters the space between the bottoms, whence it escapes as fast as it can ooze through the bags. In order to indicate the hight of liquor a glass tube is attached to the outer side; and in order that the tube may not become choked, the lower end is made to communicate with the space between the false and true bottom, so that only clear or filtered liquor can enter.

IMPROVED LOCK FOR POCKET BOOKS.

Daniel M. Read, New York city.—The device is fastened by pushing a catch into one of the holes in the case of the *lock*, when the inclined end of the said catch strikes against the rounded forward edge of a latch bar, pushes it back, and passes it. To unfasten the lock, the rear edge of the catch plate is slightly raised, which throws the engaging end of the catch back a little, so that its upper incline may readily slip off the rounded edge of the latch bar. With this construction there is no projection upon the outside of the lock to wear the pocket.

IMPROVED METALLIC SEAL.

Alphonse Friedrick, Brooklyn, N. Y.—This invention relates to certain improvements in that class of metallic seals in which a section of wire is employed for forming the loop, the ends of which wire are bent and secured in a soft metal button by compression. It consists in the construction of the soft metal button, which is made with a deep circumferential groove around its edges forming two connected disks, with or without a hole through the central smaller portion or stem connecting the disks. Around this button, in the groove and through the hole, the wire is variously twisted and secured by the compression of the soft metal button which, when stamped, forms the two edges of the disks into a single milled flange, which imparts greater security to the seal.

IMPROVED GUIDE AND REEL BAND FOR FISHING RODS.

Francis Endicott, New York city, assignor to himself and Henry F. Crosby, same place.—This consists of open (expanding and contracting) guide and reel bands for fishing rods, constructed with a loop and binding screws on one end, and a tongue on the other end, passing through the loop for being readily fastened on rods of different sizes. In case a rod is broken, a temporary rod can be easily rigged, and the carrying of a rod may be avoided by taking the rings and reel along and procuring the rod when wanted for use.

PROCESS FOR SEPARATING MIXED COAL TAR PRODUCTS.

Charles Lowe and John Gill, Manchester, England.—The nature of this invention is, first, to submit the partially or wholly dydrated mixtures of tar acids to the prolonged action of temperatures between 15° Fah. and 56° Fah.; secondly, to separate the hydrated carbolic acid crystals, thus formed, from the mother liquors containing the liquid tar acids and a residue of carbolic acid dissolved in them; thirdly, to effect complete purification of the more or less hydrated carbolic acid crystals thus obtained by recrystalization, either by partial fusion or solution in water with subsequent refrigeration; and lastly, to prepare carbolic acid of high or complete degrees of purity by dehydrating the partially or wholly purified more or less hydrated carbolic acid crystals.

IMPROVED COMBINED WATCH CHARM AND KEY.

Patrick Dever, Glen Riddle, Penn.—This consists of a suitable case with a sliding and a spring-acted key, that is retained or released to protrude from the case by suitable catch device.

IMPROVED PRESS FOR FORMING SPRING SHANKS FOR SHOES.

Emil Briner, New York city.—The object here is to improve and perfect the press or dies for forming spring-shanks for shoes, for which letters patent have heretofore been granted to same inventor under date of February 9, 1875. New devices are provided for perforating the shank blanks and carrying off the punchings, for conveying the sheared-off blanks ready for the action of the shaping dies, and for the purpose of shaping, feeding, and dropping foward the shanks.

IMPROVED DOUBLE APRON.

William G. Heaney, Camden, N. J.—This is an improved double apron, designed for use in male diseases.

IMPROVED VARNISH FILTER.

Jerome Rich, Jackson, Mich.—This is a tube, in the bottom of which is a filter suitable for filtering the dust out of carriage varnish. Below the lower end, which is conical, is a conical cup valve, attached to a rod sliding up and down the tube, to close the filter to prevent any gum or skins from entering it as it passes down to the bottom of the can for filling, also to open the filter and let the varnish in from the bottom of the can. It is intended to draw the varnish from the filter by a liquor thief, the filtering tube meanwhile to remain in the can, and to be corked at the top to protect the varnish from the dust of the atmosphere.

IMPROVED ORE CONCENTRATOR.

Charles Crane and David F. McKim, Parley's Park, Utah Ter.—This invention consists of an endless carrier, slightly inclined laterally, along the upper side of which, near the receiving end, are spouts with fan-shaped corrugations, for distributing the slime in thin layers on the carrier as it slowly passes along. Near the other end are spouts for discharging clear water, for washing the matters received from the other spouts while being carried along under stationary brushes arranged above the carrier for stirring the matters on it. Below the carrier is a sluice for receiving the tailings washed off from the lower edge of the carrier, and at the end is a box to receive the ore. The box is divided parallel to the longitudinal axis of the carrier, to separate the ore into two grades. Directly behind where the ore falls into the box is a perforated pipe for discharging jets of water up to the carrier, for washing off any particles that may adhere to it.

IMPROVED APPARATUS FOR PUMPING SHIPS, ETC.

Charles Huxford, Edgartown, Mass.—This consists of a paddle wheel mounted on a float and dragging astern of the ship, so as to be revolved by the water and having an endless rope fitted around it, and around a pulley on the ship, in such a manner that the rope is made to work the pump, and thus save the working of it by hand in ships not having steam power.

IMPROVED CARTRIDGE BOX.

Charles K. Howe, Hallowell, Me.—This box is so constructed as to allow only one cartridge to be taken out at a time. It may be attached to the shoulder rest of a pocket rifle, or carried in the pocket. It is formed of a ring-flanged block, having holes (for the cartridges) in different radial planes, and covered by a slotted centrally pivoted disk, that has a flange overlapping the flange of block. It is a convenient device for carrying revolver or pistol cartridges, as well as those of rifles and larger fire arms.

IMPROVED SYRINGE.

Reinhold Vander Emde, New York city.—This invention consists in improving upon the ordinary syringe caps, made of soft rubber, by using a centrally perforated exterior cap, provided with a flange that fits around the end, and an interior groove that fits over the rim of the barrel. This offers a better guide and stuffing box for the piston rod, and allows of the same being readily removed for refitting.

IMPROVED DUMPING SCOW.

Daniel Dailey, New York city.—This is an improved dumping scow, from which the refuse may be readily and conveniently dropped for submersion. It consists of a scow divided by a longitudinal center bulkhead and lateral brace walls into compartments, which are each closed by hinged bottom gates that are raised or dropped by chains winding on a top shaft.

IMPROVED METHOD OF UNITING PIECES OF LEATHER, ETC.

George V. Sheffield, East New York, N. Y.—This is a new method of uniting pieces of leather, cloth, etc., by looping an under thread through a loop of the needle thread and drawing the under thread loop up to the surface by the needle thread, thus quadrupling the lower thread in the work, and binding the same by the upper thread, and connecting these quadrupled threads from hole to hole by a thread on each side of the work. The method is mainly designed for uniting boot and shoe soles with a waxed thread.

IMPROVED COMPOSITION FOR DENTAL PLATES, ETC.

Cornelius Reagles, Schenectady, N. Y.—This is an improved compound for dental plates, and for the various purposes for which ivory, gutta percha, and hard rubber are used, which may be molded, pressed, sawed, turned, planed, carved, inlaid, polished, etc., shall not be liable to combustion, shall have great tensile strength, and in the liquid form will make a waterproof varnish of great toughness and brilliancy. The ingredients are pyroxylin, compound ethylated camphor, flexible lac, rubber shavings, Canada balsam, and white wax. The important feature is the combination of india rubber and cellulose.

IMPROVED CENSER.

Rev. James J. Dunn, Meadville, Pa.—This invention consists of a reticulated pocket, for holding the charcoal, with a lamp burner arranged under it for igniting the charcoal more conveniently and maintaining the fire longer than can be done in the close fire pot of the ordinary censer, in which the fire often dies out before the service is over for want of air.

IMPROVED ARTIFICIAL LEG.

Joseph B. Warner, North Dighton, Mass.—This invention relates to an improved knee joint, by which it is impossible for the joint to bend while the weight is upon it. The lower section of the artificial leg is suspended by a sliding strap from the upper section, in connection with a slotted guide band of the detached knee piece, supporting the upper section and causing it to bear tightly on the sliding band when the weight rests on the leg.

IMPROVEMENT IN PLATING METALS.

Charles S. Minchew, Taunton, Mass.—This invention consists in a new process of plating Britannia ware with silver, whereby the ware may be made much harder and lighter and the resonance of solid silver ware imparted to the plated goods. The invention extends generally to the plating of all of the baser metals with the more precious metals, and to the process has been given the name of "impulsic plating," to distinguish it from the ordinary methods of plating. The invention consists, first, in the method of cleansing the articles to be plated by nascent hydrogen liberated by the electric current from a hot alkaline solution; and secondly, in depositing a thin coat of the precious metal, then heating the coated article, and afterwards suddenly cooling it, the steps of depositing the metal, heating, and cooling being repeated in succession until a sufficient thickness of plate is obtained. When the coated metal is first heated, the pores of the base metal expand and a partial vacuum is produced. Atmospheric pressure forces the thin coat of the precious metal into the opened cists, and the sudden cooling produces a contraction of the under metal, which seizes and holds the precious metal that is driven in.

IMPROVED PILL MACHINE.

Jacob Dunton, Philadelphia, Pa.—This invention relates to an improved machine for making pills by compression, and it consists in a movable or detachable compression chamber or powder receptacle, in combination with two movable dies having concaved ends, the upper one of which forms the plunger, and the lower one of which is made short and is adapted to be driven through a hole in a base piece together with the pill. The invention also consists in the construction of the base piece, which is provided with a hole terminating in a laterally discharging curved chute, through which the pill and lower die are driven out of the chamber into a convenient position; and it also further consists in the combination with the powder receptacle of the base piece provided with guides, which permit the powder receptacle to be shifted from its position for compressing to its position above the hole for discharging the pill without misplacement and without the delicate adjustment which would be otherwise required.

IMPROVED DEVICE FOR DETACHING HORSES.

Josephus T. Willis, Pushmataha, Ala.—This consists of locking sleeves, sliding at the ends of the whiffletree to lock or release the catches that retain the traces. The bands are moved by lever-rods connected to a fulcrumed center lever, governed by a forked lever and strap from the carriage. A pin strap extends from the main strap to a hole of the whiffletree, to lock the sleeve and allow the detaching of the traces only after withdrawing the pin.

IMPROVED AIR GUN.

Wilhelm Hebler, New York city.—This air gun is designed to reach the range of an ordinary rifle. The essential feature consists in a novel combination and arrangement of valves and other devices, in connection with the air-compressing chamber, whereby a very large amount of air may be compressed, which by its high expansive force throws the ball a long distance.

IMPROVED PHOTOGRAPHIC PRINTING FRAME.

Claude Léon Lambert, Paris, France.—This invention relates to certain improvements in photographic presses for working off positive proofs from the negative; and it consists in a casing having openings covered with glass of the size and shape of the outlines of the picture, upon which glass openings the negative is placed. A hinged leaf, provided with apertures corresponding to the openings, but a trifle smaller, is then fastened down upon the negative; and the sensitized paper being placed in little compartments above these apertures, a set of little doors, lined with felt, are shut down, and held in place by bearing springs on the lid, which, being fastened, holds the press tightly together.

IMPROVED TRUNK.

William J. Large, Brooklyn, N. Y.—This trunk is so constructed that the tray may be conveniently raised to obtain access to the body of the trunk, which may be conveniently moved from place to place. To the tray are connected vertical slides, which traverse ways in the sides of the trunk, and which support it when lifted above the body of the trunk, to allow access with the latter. There are several ingenious devices connected with this general feature.

IMPROVED ORNAMENTAL LINKS FOR NECKLACE CHAINS.

Shubael Cottle, New York city.—This invention consists in long hollow links, having holes at the ends of the slots of a larger diameter than the end parts of said slots, and having a small plate inserted in one end to receive the ends of the open ring. In this way a strong and beautiful necklace is produced from a comparatively small amount of material, while at the same time it has the appearance of being very heavy.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED PUMP.

George Washington Johnson, Yarmouth, Canada.—This invention improves the construction of the pump known as the Sluthour pump, so as to adapt it to be used on shipboard, and in other places where the pump should work continuously without danger of stoppage or delay from choking. A number of useful improvements are added to allow any obstruction to be conveniently removed from the valves or suction pipe, to enable the pump to work smoothly, to be conveniently sounded, and to admit of an even motion of the pump buckets to be produced when worked by a crank and fly wheel.

IMPROVED GRINDING AND HULLING MILL.

Elam Morrison Query, Harrisburgh, N. C.—This invention consists in constructing a grinding and hulling machine with reversible and, therefore, self-sharpening teeth on the cylinder and concave.

IMPROVED AUTOMATIC STOP MOTION.

Augustus A. Hagen, New York city.—This is an improved automatic stop motion for feed wheels in tobacco-cutting and other machines; and it consists of a fulcrumed lever, that operates by contact with a raised part of the feed screw, a transverse slide piece, and, by a connecting swinging slide, the spring pawl of the ratchet feed wheel, so as to throw the same out of gear.

IMPROVED NUT LOCK WASHER.

Isaac Van Kuran, Omaha, Neb.—This is an improved elastic washer for the nuts of rail joints and similar purposes, and consists of the base plate of the washer, with a large central opening, holding by side lips the elastic top plate in a central position. The device is cheaply made, and the drilling of holes and riveting is avoided.

IMPROVED LOCOMOTIVE ROCKER SHAFT AND BOX.

John T. Crowther, Carbondale, and William J. Crowther, Urbana, Ill.—This invention consists in an open bushing, made in one or two pieces, and provided with three sets of oil holes, in combination with the rock shaft and the box: and in the rock shaft made with three key seats in each end, the key seats in the one end being opposite the centers of the spaces between the key seats in the other end, to enable the shaft to be adjusted in six different positions. It is well known that the rocker shafts of locomotive engines soon wear oblong, which causes a loss of motion to the valves, and a corresponding loss of power to the engine. The present device enables the shaft to be repaired easily and quickly, and without disarranging in the least the valve motion.

IMPROVED PUNCHING AND SHEARING MACHINE.

Austin W. Comstock, Mount Pleasant, Iowa.—This machine is adapted for punching and shearing off flat and round iron, plates, bars, and rods. It consists of two levers fulcrumed to supporting standards, and provided with front jaws, having punch and die for perforating the plate, which is held by hooks of the lower jaw. The rear ends of the levers have square recesses for shearing off round and flat bars.

IMPROVED CRIMPING MACHINE FOR LEATHER.

Chas. M. Robinson and John F. Lister, Newton, Iowa.—The purpose of this invention is to provide a machine for shoemakers' use, to facilitate the work of crimping the leather for the uppers, cutting out the soles, and pressing the same into the proper form to fit the last without lap hammering. The invention consists in a table having a lever pivoted thereto at one end by means of links, and operated at the other end in vertical direction, to produce the necessary pressure by means of a secondary lever, to be worked by hand, which lever carries a crosshead, one end of which is pivoted to the first lever, and the other end to a set of links, pivoted at their lower ends to the table, which arrangement gives a compound motion for the operating lever, between which and the table the crimping, stamping, and pressing devices are contained.

IMPROVED COCK AND FAUCET.

Charles K. Dickson, Jr., St. Louis, Mo.—This invention consists in the combination of a three-armed head with the plug of a three-way cock, in such a way that the said arms may be directly over the openings of said plug, to indicate the position of said openings with reference to the three pipes of the cock. This device, we learn, has already been adopted by the Water Commissioners of St. Louis, Mo.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED DOOR CHECK.

Edsell W. Chamberlain, Sullivan, O., assignor to himself and J. W. Spencer, same place.—This invention consists in forming a reversible door check of two pieces, one of which has a pivot, base-plate, and check studs, and the other a latch and check; the whole to be used in connection with a spring. The device is composed of but two castings, ready to receive the spring and to be applied to doorways without drill, file, or other tool, at very small expense. It serves as a right or left check by simply changing sides.

IMPROVED SASH FASTENER.

Lloyd J. Earll, Pittsburgh, Pa.—This invention relates to certain improvements in that class of sash locks which have an arc-shaped head or binding surface, which bears either against the window sash or is pivoted to the window sash, and binds against the window frame, for the purpose of holding the window sash in any desired position; and it consists in means for tightening a continuous band of leather or rubber about the face of the holder to prevent scratching the paint. The invention also consists in a sliding bolt passing through a lug on said holder, so as to enter a socket of the window frame, and having a shoulder upon one side, so that, when the bolt is in the socket and turned, it cannot be withdrawn. The invention also further consists in the particular form of the socket made to receive the bolt, the same being made in the form of a wedge with a hollow head and flat face, which socket is to be driven into the window frame.

NEW AGRICULTURAL INVENTIONS.

IMPROVED GRAIN BINDER.

Joshua A. Kay, Melbourne, Colony of Victoria.—This is an apparatus for tying knots in single or double string, being mainly intended to be used in grain binders for tying knots in strings around sheaves of grain. The invention consists of certain tools, implements, or devices for tying knots together, with the mechanisms for imparting the necessary motion thereto. These devices consist, primarily, of a prolonged looper, a horizontally sliding hook, a rotating hook, and a hooked finger and thumb; and secondarily, of a needle, a knot slipper, a fixed hook, a top, bottom, and middle cord catcher, a holder, and a cutting knife, by the joint working of all of which inside of an oblong casing or knotting box the knots are produced.

IMPROVED PLOW SHOULDER.

Joseph G. Blount and Elias Haiman, Columbus, Ga.—This consists of a shoulder for the upper end of the plow plate to rest against, which may be adjusted as a longer or shorter plow plate is used, or as the plow plate wears away.

IMPROVED CORN PLANTER.

Charles A. Andersson, Mineral Ridge, Iowa.—This is an apparatus which plants the corn accurately without previously marking the land, and can be readily changed from a self-dropper to a hand dropper, as desired. The new features consist in combining, with a seed hopper having perforated walls and false bottom, a spring having points that pass through and hold the bottom; also, in combining seed plates and crank levers, connected by a rod having pairs of arms, with a rotary wheel having two inclines diametrically opposite and on different sides. The two rims and the alternate arms insure the uniform revolution of the wheel, even when the ground is rough.

IMPROVED CULTIVATOR.

Silas Walton, Moorestown, N. J.—This invention relates to an improved cultivator, so constructed as to pulverize the soil and pass clods and rubbish without clogging, having the blades so extended from the frame and so placed that they lift and pass under the vines and lateral parts of plants, thus allowing the earth to be thrown under them, and so adjusted as to be used as a cultivator only, by pulverizing the soil and leaving it flat, or used as a cultivator and plow combined, by both pulverizing and ridging the soil at the same time, either to or from the rows of plants, as desired. It consists in the combination, with the main beam and hinged arms of a cultivator, of certain standards which are in shape and position curved, downward and outward, terminating at the outward end with a vertically inclined stem, made concave on its upper edge, to carry reversible metallic hoes or blades.

NEW HOUSEHOLD ARTICLES.

IMPROVED BROILER.

Frederic Martin, Jr., West Jefferson, O.—This is an improved culinary vessel, that may be employed for broiling and baking, roasting coffee, and other purposes. It consists in a flat-bottomed case, having a lid with a central hole, provided with a pan having central bottom hole, and having a vertical crank shaft with stirrers thereon.

IMPROVED COMBINED TABLE KNIFE AND SPOON.

James Higgins, Detroit, Mich.—This inventor has arranged a spoon bowl-shaped cavity in the blade of a table knife, near the point, but without destroying the integrity of the edge, point, and back of the blade, so that the latter remains in suitable form for its functions.

IMPROVED HEATING STOVE.

Marius C. C. Church, Parkersburg, W. Va.—This invention relates to certain improvements upon the heating stove, for which letters patent No. 167,497 were granted the same inventor September 7, 1875, and it consists in the particular construction and arrangement of the parts in which the smoke pipe is connected with the back part of the fire chamber, instead of the top, and the upper tapered portion of the heating chamber is expanded into a closed drum, surmounted by a water vessel at the point of exit for the hot air through the detachable cover. An extra back plate of brick or metal forms the back of the fire pot, and a perforated partition of the same material rests thereupon and divides the heating chamber from the fire pot.

IMPROVED MATCH SAFE.

William Dawson, Philadelphia, Pa.—The object of this invention is to provide a convenient receptacle for the stubs or burnt ends of matches. After the match has been used, the disposal of the burnt end is always a source of more or less trouble. It either has to be thrown on the floor, producing in consequence a litter and an unsightly appearance, or it has to be thrown into the stove or carried out of the room, either of which involves more trouble than the insignificance of the object justifies. The invention consists in constructing a match safe with two compartments in the same containing case, one of which is provided with a lid and employed for holding the matches, and the other of which presents an opening through which the burnt ends or stubs are inserted, the said latter receptacle having also a door or slide, through which the accumulated stems may be removed.

Business and Personal.

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

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Catechism of the Locomotive: an elementary treatise for mechanics, locomotive engineers, firemen and others. It explains the theory, construction, and working of locomotive engines. 625 pp., 250 engravings.

The Catechism of the Locomotive will be mailed on receipt of price, $2.50. Published by the "Railroad Gazette," 73 Broadway, New York.

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Parties making or dealing in Portable Gas Machines, please send circulars and prices to Seminary, Mt. Carroll, Carroll Co., Illinois.

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Friction Hoisting and Mining Engines.—J. S. Mundy, 7 R.R. Ave., Newark, N. J.

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Gas and Water Pipe, Wrought Iron. Send for prices to Bailey, Farrell & Co., Pittsburgh, Pa.

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Baxter Wrenches fit peculiar Corners where no ther wrench answers. Greene, Tweed & Co., 18 Park Place, New York.

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Hand Fire Engines, Lift and Force Pumps for fire and all other purposes. Address Rumsey & Co., Seneca Falls, N. Y., U. S. A.

Corner Cutting Machine, Chocolate Mill, Bolt Cutter, Letter Press and Stand—all at Bargains. A. B. Cohu, 197 Water St., New York.

Notes & Queries

W. A.'s query as to radiation does not give sufficient data.—E. C. H. should read our answer to S. O. M., as to supposed diamonds.—J. D. G. will find full information as to the ether ice-making process on p. 228, vol. 34.—A. R.'s communication is founded on a misconception. See pp. 195, 228, vol. 33, as to the nature of electricity.—A. J. R. will find on p. 120, vol. 33, directions for making muslin unioflammable.—C. W. and others ought to know that the only way to find buried treasure is to dig for it.—X. Y. Z. can copper his cast iron articles by following the directions given on pp. 90, 139, vol. 31.—E. F. M. will find full directions for plating with nickel on p. 235, vol. 33. For plating with gold, see p 116, vol. 33. For plating with silver, see p. 362, vol. 31.—A. B. can ebonize wood by following the directions given on p. 50, vol. 33.—W. B. J. can gild his clock hands by the process described on p. 116, vol. 33.—A. G. L. should proceed in zincography exactly as in lithography. The specimen sent appears to be a photo-engraving from a pen and ink drawing.—L. M. M. will find full directions for electro-silvering with a battery on p. 361, vol. 31.—E. D. N. can remove the rust from his sword by the method given on p. 56, vol. 33.—W. D. should read our article on p. 241, vol. 33, on constructing a windmill.—J. C. H., F. A. H., J. H. G., L. N. B., M. G., J. L., S. H. W., P. S., G. D., F. G., J. H. M., C. M., G. G., and others, 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) B. V. P. asks: Please inform me of some way to harden light common iron wire in quantities. A. Box harden it, by the process described in No. 5 of "Practical Mechanism," p. 69, vol. 31.

(2) H. J. W. asks: 1. I am running an old-fashioned high pressure engine. The cylinder is 15 by 48 inches stroke, cut off at half stroke. It has a balance wheel of 15 feet diameter, also a pulley attached, 11 feet in diameter. It takes steam through about 15 feet of 3 inch pipe. The governor is an old-fashioned throttle. I have been running 48 turns per minute, and wish to increase it about 8 turns; but I think the latter is rather too much, as the brasses and journals on main shaft are badly worn. Would it be safe to run her so fast? A. You had better not increase the speed if the bearings are worn. 2. Would it use any more steam to speak of? A. If you run your engine faster, you will use more steam in proportion. 3. Would I have to run the governor faster or slower? A. Run it slower.

(3) O. M. B., of San Juan Bautista, Mexico.—If you reduce the speed of your engine you reduce the power, unless, as you propose, you increase the steam pressure. It would probably be better to alter the size of the gearing, thus using the same steam pressure and same piston speed, and to decrease the speed of the rollers; while their power will be proportionately increased.

(4) W. S. says, in reply to the query: How is it that *minus* multiplied by *minus* gives *plus*, and *plus* multiplied by *minus* gives *minus*? By trigonometry, the cosine of any arc divided by its sine is equal to its cotangent. Take the arc of 135°: $\frac{-\sqrt{.5}}{\sqrt{1.5}} = -1$. Clearing of fractions, $-\sqrt{.5} = -1 \times \sqrt{.5}$. That is, a *minus* quantity is equal to a *minus* quantity into a *plus* quantity, which was to be proved. The secant of any arc is equal to 1 divided by the cosine. $\frac{1}{-\sqrt{.5}} = -\sqrt{2}$ Clearing of fractions, $1 = -\sqrt{2} \times -\sqrt{.5}$. That is, a *plus* quantity is equal to a *minus* quantity into a *minus* quantity. A. This is an illustration which might possibly be admissible, if at all, only in the higher analysis, but would be obviously out of place for establishing the fundamental principles of elementary analysis.

How far is the earth from the sun, as estimated recently by the transit of Venus? A. The observers have not got that far, we imagine. Indeed, we noticed that, at the last meeting of the British Association, one of the members stated that he thought they would be doing very well if they worked up the observations in seven years.

(5) R. S. N. says: 1. I have a turning lathe operated by a treadle attached to the shaft of a 36 inch wheel of 4 inches face. The treadle cranks make 6 inches sweep; the bearings are ⅞ x 2¼ inches. The chuck spindle bearings are ⅞ x 2¼. A. Such a lathe will require about ½ horse power. 2. What do you think of this arrangement? A. It is a powerful lathe to be worked by the foot.

(6) S. M. says: 1. A line joins two fixed points on the earth's surface. Presuming that no earthquake or any other convulsion has affected these points, will time produce any change in the direction of this line? Can it point due north today, and 1° or 2° east or west of north a few years hence? A. No. 2. In other words, if two surveyors state its direction differently, an interval of time intervening, can you predicate error of either or both? A. If we knew by what method the surveyors determined the astronomical meridian and applied it to the line above spoken of, we should probably be able to predicate the error of one or both.

(7) B. K. A. asks: Will you let us know what is the difference between a high pressure and a low pressure engine? A. A high pressure engine exhausts the steam when the piston has arrived at the end of the stroke. A low pressure engine condenses the steam, and thus has live steam on one side, and a partial vacuum on the other side, of the piston.

(8) E. R. says: I propose to build a yacht 90 feet long and of 18 feet beam, to draw 12 inches of water when light, and not to exceed 18 inches with all machinery and 6 tuns of coal on board. I intend to use two engines 8 x 10 inches (to work quartering), two upright boilers of 36 inches diameter, with 75 tubes, 1¾ inches in diameter and 4 feet long. Fire grate surface is 2¼ feet x 3½ feet in each boiler. I will use the best propeller I can find, and fully submerge the same under the boat without loading down the boat. What kind of a sea boat will she be? A. We do not think such a boat would stand rough weather very well; and for smooth water it might be advisable to use side wheels.

(9) M. M. C. says: We are putting in a 50 horse power engine which will run at 85 revolutions of the crank per minute. The drive pulley is 4 feet in diameter; distance to main shaft is 15 feet. What should be the width of the leather drive belt? A. About 12 or 14 inches.

(10) A. C. asks: How many times more water will go through a 3 inch pipe than would through a 1 inch pipe? A. The question is too indefinite to admit of a single answer. If the velocity in each pipe is the same, the discharge will be in proportion to the squares of the diameters. If the head is the same for both pipes, and the pipes have the same length, the velocities will be different and the discharge will vary as the products of the velocities by the squares of the diameters. We give below Weissbach's rule for determining the velocity: Let l=length of pipe in feet, d=diameter of pipe in feet, v=velocity of flow in feet per second, and h=head of water in feet. Then

$$v = 8{\cdot}02 \times \sqrt{h} \div \sqrt{1{\cdot}505 + \left(0{\cdot}01439 + \frac{0{\cdot}017155}{\sqrt{v}}\right) \times \frac{l}{d}}$$

(11) J. W. G. asks: What is used in the navy for blacking boilers? A Paint made of common charcoal ground in oil is an excellent article for the purpose.

(12) T. W. R. asks: 1. Will steam after heating a building, return to the boiler, no matter how much pressure you may have in the boiler, that is, will steam return against 20, 40, 60 lbs. of steam? A. It can be made to return, by the use of a suitable trap. 2. Is the pressure equal on all sides of a boiler? A. The pressure is greatest on the bottom, on account of the weight of water in the boiler. 3. In low pressure boilers, could not the return be run half way below the water line as well as at the bottom of the boiler? A. An arrangement of this kind is not uncommon.

(13) R. S. Jr. asks: Will my engine, the cylinder of which is 2¾ inches bore by 5½ inches stroke, drive a back-geared engine lathe of 16 inches swing and 5½ feet bed? A. Your engine and boiler are both rather too small for the purpose.

(14) J. & C. say: We have a stationary engine of 16 inches diameter, 5 feet stroke, using steam from 90 to 100 lbs., and cutting off at 10 to 12 inches on the stroke, as the work requires. The fly wheel is 20 feet in diameter, weighing 18,000 lbs., made in 8 sections and held together at periphery with wrought iron key and links. The center is held by two flanges bolted together through the arms. Would it be safe and economical to run the engine at 35 revolutions per minute? A. Yes, if the bearing surfaces of your engine are sufficiently broad and strong to stand the wear and tear.

(15) W. E. P. says: For extinguishing kerosene flames, I would recommend ashes from the stove. When the flames were 4 feet high, cold ashes from the stove extinguished them immediately.

(16) A. M. T. asks: 1. Has the pump, used on locomotive engines, suction? A. Yes. 2. Are the air pumps, used on ocean steamers, ever made of brass or steel? A. Brass.

(17) W. T. H. asks: Why is it darkest just before dawn? A. The statement to this effect is without foundation.

(18) S. asks: Does cast iron contract or expand when cooled from a liquid state? A. Iron acts very much, in this respect, like water. Solid iron floats upon the molten metal and is consequently lighter. As molten iron cools, within certain limits, it gradually expands; but when it has reached a certain temperature, it begins to contract, and this it continues to do however low the temperatures may be carried. It is for this reason iron copies so accurately the molds into which it is poured while in a molten condition, and allowed to gradually cool.

(19) J. McC. asks: How are pictures produced on white porcelain glass cone shades? A. They are for the most part put on by the decalcomanie process.

What is the coloring principle in ruby-stained window glass? A. Purple of Cassius.

(20) J. A. G. asks: What can I use on or in a rubber hose to prevent kerosene oil from rotting it, or what flexible material can I use in place of rubber to draw kerosene from a large tank? A. There are several methods by which the tube may be protected completely or in part; but we should recommend, as liable to give the best satisfaction, the use of a good tube of leather of sufficient suppleness to avoid the objectionable tendency to close the duct by creasing, when bent at a moderate angle.

What is the best material to use on boots that are exposed in water a great deal? A. Try a solution of india rubber in bisulphide of carbon.

(21) J. W. says: I had occasion to remove a piece of mica from a stove, and noticed that, on being crushed, it gave out flashes similar to those noticed on scooping hard sugar with a metal instrument. Can you give an explanation? A. The flashes of light are due to the electrical disturbance consequent upon the forcible disruption of contiguous laminæ. It is a well known phenomenon.

(22) P. asks: What will prevent the pigment permanent white from scaling off parchment? A. Try the following: Reduce to powder and dissolve quickly in cold water a quantity of gum tragacanth. There must be sufficient water to give to the diluted gum the consistence of a jelly. Mix with this your pigments (sulphate of baryta), and, after finishing the work, spray with a little naphtha in which has been digested for some time a quantity of caoutchouc. The naphtha will soon evaporate, leaving behind the caoutchouc as an extremely thin and adhesive, but perfectly transparent, film.

(23) A. L. E. says: A friend of mine states that, to be able to run an engine in a small building in New York city, the engineer must have a certificate showing that he has the ability to run the engine. I say that he does not need it. Which is right? A. Your friend's statement is correct.

(24) A. C. McK. asks: 1. Is tellurium valuable? A. Yes. 2 Is it difficult to extract? A. Very. 3. Is there any market for the ore or the metal in America? A. The market will have to be made, since, owing to the scarcity of the metal, it has as yet been little employed in the arts. 4. What is the probable cost of extraction per ton? A. The cost will have to be determined by trial.

(25) R. J. P. asks: Can ordinary Indian ink have anything added to it to make it indelible? A. Try the addition of a little nitrate of silver just before using.

(26) A. C. McK. asks: How can I extract tellurium from its ore? A. Professor von Schroetter has lately published the following method of separating tellurium in its free state: The finely crushed ore is first digested with strong hydrochloric acid (in order to decompose or dissolve the sulphides of arsenic, antimony, lead, etc.), and separated from the insoluble residue, which is then treated with *aqua regia*, when gold and tellurium are dissolved, and thus separated from silver. From the solution thus obtained the gold is precipitated by protosulphate of iron, and the tellurium by metallic zinc. The gold is melted in a graphite crucible with borax, and the tellurium in an iron pot, when both metals are obtained in a pure state, the latter being a white metal of from 6·0 to 6·4 specific gravity and of great fusibility. The present value of tellurium (fused) is about $200 per lb. avoirdupois.

(27) W. L. S. asks: Can you tell me of a safe way of preventing mildew in cotton duck sails, etc.? A. We find the following recorded as a good preventive of mildew: Boil the fabric for several hours in a solution consisting of 50 parts common salt, 4 parts lime, and 1 part alum, dissolved in a suitable quantity of clear water.

(28) A. B. O. says: I find the following alloy to answer for repairing the damage to steam chests, valves, etc., which have been eaten out and honeycombed by the use of impure suet, tallow, and other bad oils: First make molds of Russian sheet iron, bent at right angles where surfaces or corners are to be built up, stopped with red molder's clay or plaster. Clean the surfaces: and if there is no hold for the alloy, small holes must be drilled in the iron to secure the casting in place. The alloy consists of 2½ parts copper, 1½ parts antimony, and 6 parts tin. Heat the casting in a common ladle to dull red, and file the mold. The alloy cannot be worked down with anything but file and scraper. I have saved with this alloy a couple of steam chests which would have cost $500 to renew in a short time.

(29) T. H. W. asks: Is there any instrument, similar to a thermometer, for indicating the degree of purity of the air? A. This desirable little instrument has not yet been invented; and from the numerous obstacles to be overcome, it is not probable that anything of practical utility in this line will ever be devised.

(30) M. R. asks: How can I make ink to write blue, and afterwards turn black? A. For blue ink changing to black, take ¾ lb. finely powdered nutgalls, and digest for 2 or 3 days in 1 gallon of cold water; add to this about 6 ozs. each of finely powdered copperas, gum arabic, and sulphate of indigo (chemic or Saxony blue). Heat the whole to the boiling point, and allow to stand with occasional stirring for several days in a warm place. Then filter through a fine linen cloth, add a few cloves, and bottle for use. To make the so-called sulphate of indigo (Saxony blue): Dissolve well sifted indigo in 5 times its weight of strong oil of vitriol, previously heated over a water bath to about 150° Fah. Neutralize the solution by cautious additions of carbonate of potassa in the form of a fine powder. Collect and dry the precipitate.

(31) M. C. asks: How can I dress Arkansas diamonds? A. With copper wheels, and emery or corundum.

(32) C. asks: Which is the best soap for the toilet, and which for washing clothes? A. Use for the toilet a good variety of glycerin soap. The common yellow soap answers well enough for laundry purposes.

1. Is there an alloy that resembles gold, and is as hard as 14 carat gold after it is annealed? A

Try the following: Copper 86·4 parts, zinc 12·2 parts, tin 1·4 parts. Fuse the copper first, and then add the other metals. 2. Is there a brass solder that will fuse as easily as 12 carat gold solder? A. Try 1 part silver and 2 parts brass.

(33) L. L. L. asks: Has the author of articles, which have been published in and paid for by literary periodicals, a right to publish the same in book form? Or does the property in said articles vest in the publishers of the periodicals, making it necessary for the author to obtain permission from them to publish such book? A. The right to republish articles in book form depends on the agreement between the author and the publisher.

(34) C. F. asks: Can common red earthenware be, by any process, glazed white either before or after the lead glazing? A. Fabrics of potter's clay are too fusible to admit of being enameled with porcelain. Try the following: Mastic 10 parts, red lead 60 parts, calcined tin (putty powder) 26 parts, and common salt 10 parts. Mix them, and calcine and powder the composition three or four times. Apply to the ware (after baking) in the manner of a paint, and place again in the oven.

(35) J. M. says: I am using a cast iron pot in galvanizing, and have been told that the zinc in connection with the cast iron pot forms more slag by galvanic action than a wrought iron pot would. Is this so? A. No.

(36) F. P. asks: 1. Can the color of coal tar be changed conveniently to a red or brown, or any other color that would be suitable to paint farm buildings, without changing its nature? A. No. Use red ocher or red lead. 2. How can coal tar be thinned? A. Use naphtha.

(37) E. D. says: I have a pack of playing cards that stick together when affected by the heat of the hand, and seem to get dirty very quickly. Can you inform me of any preparation to prevent their sticking and to give them a gloss? A. The trouble is due to the inferiority of the glazing with which the cards are enameled. We do not think you can overcome the objection without the expenditure of too much time and labor.

(38) J. G. M. & Co. say: In cooking fish for canning, we need a greater heat than 212° Fah. gives us. We have used salt, and then chloride of calcium, heating the water by steam. But the oil from salmon, mixing with the calcium, is hard to clean off the cans after cooking. Can you tell us of some cheap preparation which we can heat (with steam coils) to 240° Fah.? A. It would be better to heat the water to the requisite temperature by means of a very moderate steam pressure. The temperature of the boiling point might thus be arranged to suit your convenience, and by suitable valves caused to remain constant. Saturated saline solutions are objectionable.

(39) J. M. A. and others.—It is a popular idea that the sunflower will prevent disease, but we have no reliable authority for the statement. It is not used in medicine.

(40) H. W. H. asks: Is it possible to blow glass in the shape of a cylinder, with a very small opening along one side? A. Yes; it is readily done. The molten glass, as it is drawn from the pot, adhering to the end of the *punta* tube, is blown into a pear shape, elongated by swinging, rolled on a steel slab into the cylindrical form, and slit through lengthwise, and the cone-shaped bases at both ends removed. It is then placed in the annealing furnace.

(41) M. F., of Gaggenau, Germany, asks: Is there a good gas tight membrane, not affected by heat or water, or by the impurities (acids, etc.) contained in the gas? A. This desirable invention has as yet been very imperfectly realized.

(42) M. W. asks: How are rain gages generally constructed? If a vessel 12 inches in diameter above, and 10 inches at the bottom, and 8 inches deep, should be filled with rain water to depth of 3 inches, would 3 inches really have fallen, or more? A. Less. If the vessel employed as the receiver is not a uniform tube, it should be carefully graduated before using.

What will remove the marks of so-called indelible ink from linen? A. Use a strong solution of cyanide of potassium in water. As the cyanide is very poisonous, it is necessary to avoid contact with sores or cuts in the flesh.

Do the crossheads of a locomotive make a retrograde movement when the engine is going either forward or backward, unless the driving wheels slip? A. No.

(43) H. J. asks: Will oil evaporate into the air and dry away, whether on the surface of water or not? Can water evaporate into the air when its surface is covered with oil? A. The application of a film of any of the fatty non-drying oils to the surface of water will prevent its evaporation. The oil itself is not volatile.

(44) F. N. B. says: I have been trying to make a friction match composition by a formula in which there is a large proportion of niter. The niter spoils the composition; the matches are good when first dried, but an exposure to damp causes them to become sticky, so that, when placed in a cellar they will in 24 hours stick to my fingers like tacks to a magnet. When kept in a dry place, the phosphorus slowly burns off, filling the room with a strong garlic odor, and the matches are worthless. What is the matter? A. After preparing the matches, and while dry, dip the tips into a moderately strong collodion for a moment, and allow to dry. This will form a thin protecting film over the friction composition. This film is not affected by moisture or other atmospheric influences, and does not interfere with the ready ignition of the match when required, as the slight abrading influence of the friction is sufficient to remove the film, while in itself it is a very inflammable substance, and aids, by the heat of its combustion, the ignition of even a common wooden plint.

(45) W. S. H. asks: Is it possible to become sufficiently advanced in architecture without a tutor, to enable one to complete the study in a short time under instruction? A. It is necessary to take an extended course of study in the office of an architect of experience, where you will have access to his library.

(46) S. M. O. and others.—The diamond occurs in the form of rounded pebbles covered with a brownish crust. Its crystals are in the form of the regular octohedron, but their faces are often a little convex. It has the most remarkable refractive and dispersive action upon light, is a nonconductor of electricity, and is not acted upon by acids or alkalies. If the stone is a diamond, it will easily scratch corundum and quartz, and will have a specific gravity of from 3·52 to 3·55. The specific gravity of quartz crystals is from 2·50 to 2·66, while that of corundum, true sapphire, etc., is from 3·9 to 4·16. A diamond dealer alone could give a valuation, based on personal examination.

(47) F. S. & S. ask: What is the best mode of cleansing the feathers of an eagle, which are discolored by fly dirt and dust? A. Use freshly prepared lime water. It may require several applications and an exposure of several days to perfectly cleanse the feathers.

(48) A. H. S. asks: Does nitro-glycerin lose any of its explosive force when combined with earth to form dynamite? A. The nitro-glycerin itself remains unaltered in the mixture, but, as might be expected, the dynamite is a much weaker explosive, volume for volume, than good nitro-glycerin.

(49) A. H. asks: Will it injure the burning properties of kerosene, or make it any more or less explosive, to filter it through cloth or bibulous paper to remove sediment? A. It will alter neither its illuminating nor its explosive qualities.

(50) C. B. F. W. asks: How can I test laundry soaps for adulterations, such as silex, silicate of soda, soapstone, etc.? A. Dissolve a small quantity of the soap completely in a large excess of boiling water, and filter through clean white filtering paper. Observe whether or not any insoluble inorganic residue remains behind on the filter; if so, examine it with a strong magnifying glass, and, if the particles appear to be homogeneous in character and transparent or translucent, the adulterant may safely be presumed to consist of quartz sand. If opaque, and of a pearly or dark color, it is probable that the material consists of talc, chalk, soapstone, barytes, or some of the other numerous and common adulterants. In order to be sure that part, at least, of the residue does not consist of resinous or other organic materials, the residue should be heated to bright redness for some time before examination with the glass. To test for the presence of water glass, add (to the filtrate from the above experiment) a small quantity of muriatic acid, heat to boiling, and allow to stand for some time. If a precipitate forms, wash it several times with clean water, heat it, and examine it as before.

(51) G. J. B. says: What effect on the acoustic qualities of a room would a cove in a ceiling have, the room being 90 x 47 feet, and 27 feet high? The cove is 4 feet out from the side walls. A. It is not likely that so small a cove would affect the acoustic qualities of the room.

(52) F. P. says: I read that Governor Bagley, of Michigan, suggests that all land owners should plant a tree during this our centennial year What kind of tree would be most suitable as a shade and ornament tree, an evergreen being preferred? A. The Norway spruce fir is a good evergreen for this purpose; the scarlet maple or the sugar maple is a good ornamental shade tree among the class not evergreen. The elm is also one of the noblest trees of the latter class.

(53) F. R. asks: How many Bunsen cells are necessary to effect the decomposition of water, with moderate rapidity? A. Two or three cells will evolve has readily from acidulated water.

(54) C. K. M. asks: 1. Will ¼ lb. No. 16 cotton-covered copper wire, for a primary coil, and 1 lb. No. 23 cotton-covered wire for the secondary coil, and 1 cup of Callaud battery, do for giving electric shocks? A. Yes. Stronger shocks would be obtained if smaller wire were used for the secondary. 2. How thick ought the bundle of iron wires to be for such a coil? A. About ⅛ inch.

(55) J. L. W. asks: In taking a gun barrel and holding it perpendicularly, and taking a compass, holding it on the side of the same and lowering it to the breech, the needle will suddenly reverse when lowered about half way; and on raising, it will again reverse at about the same place. What is the cause of this change? A. In such a position the gun barrel is almost in the line of the dip, consequently it will become magnetic from the inductive action of the earth. The lower end will be a south pole, the upper a north pole.

(56) W. H. G. says: I have made an induction coil, 6 inches long by 1¾ inches diameter, with a half inch core of iron wires, using 2 turns of No. 22 cotton insulated cooper wire for the primary, and about 25 turns of No. 32 cotton insulated copper wire for the secondary coil, making the latter about 20 times as long as the primary. The vibrator is attracted by the core, and works well. I have insulated the two coils from each other with 3 sheets of paper varnished with shellac, and put 1 sheet of varnished paper between each two turns of the secondary. With the above I only get feeble shocks on holding the two ends of the secondary wire on my tongue, using 7 cells of the gravity battery in connection with the primary. A. It is quite likely that different convolutions of the secondary touch somewhere, and by this means the greater part of the action is cut off.

(57) J. B. J. says, in answer to several correspondents who ask as to how the variation of the magnetic meridian is reckoned: There is a secular change, increasing or diminishing the declination from 1′ to 7′, annually, according to locality. There is an annual change, affecting the needle about twice as much in summer as in winter. There is a diurnal change, during which the declination attains its maximum or minimum about 2 P. M., according as it is W. or E.; and there are also irregular changes, depending upon the condition of the atmosphere, magnetic storms, etc., as well as local attraction, proximity of iron, ore, steel, etc. It must be evident to any one conversant with the subject that it is practically impossible definitely to locate a line with a given bearing from the meridian, with a surveyor's instrument, unaided by some external object. The only reliable method of determining the angle, if any, between the line in question and a true meridian, would be to set up a surveyor's instrument over, say, the south end of the line, sight to the pole star at its extreme elongation, and drive a stake in the range thus found as far off as can be observed conveniently, and repeat the process for the extreme western elongation: midway between the two stakes is the true meridian from the instrument. The distance from the midway point to the line in dispute, divided by the distance from that point to the instrument, will be the line of the angle between the line and true meridian. As the operation will doubtless be performed after sunset, the sights or crosshairs of the instrument will need to be illuminated by light of lamp reflected upon them from a white object. A lamp or candle may be used to determine points at which to drive stakes.

(58) W. M. R. says, in reply to P. A. K., who asks who invented the first railroad sleeping car: In 1838, when I was chief engineer of the Cumberland Valley Railroad, between Harrisburgh and Chambersburgh, Pa., we had sleeping cars built, which ran for some years. One end of the car was arranged in the ordinary way, with day seats; the other end was fitted up with eighteen sleeping berths, for the night, which were changed, for the day's running, so as to make omnibus seats on each side of the car. There were three lengths of berths and three tiers on each side. The top tier of berths hoisted on a hinge, and was secured by rope supports to the ceiling of the car. The middle tier consisted of the back of the omnibus seat, hinged and supported in the same manner. The lower tier was the day seat along the side of the car. At that period, there were two coach loads of passengers arriving by turnpike road nightly from Pittsburgh; and they were very glad to have the benefit of the sleeper during the four hours then occupied between Chambersburgh and Harrisburgh, on the old plate rail. There was no charge for sleeping accommodations.

(59) A. H. says, in answer to C. E. A.'s query as to a difficulty with his alarm bell: I think it arises principally on account of the brevity of the contact between the hammer and bell. If so, he can ascertain the fact by pressing the hammer against the bell by hand; to this the armature ought to respond. In such case, the remedy would be to place the wire now attached to the bell in contact with a piece of metal, so arranged that the hammer will be in contact with it, at each vibration, a length of time sufficient for the magnet to act.

J. S. J. says: Water is forced into all parts of our building by its own pressure, through iron pipes. Frequently is heard a loud singing noise like air escaping slowly; but after the spigot is opened and the water runs freely, the noise continues about a minute. What is the noise?—E. M. H. asks: I have an open buggy of 5 feet track, front wheels 3 feet 11 inches high, and hind wheels 4 feet 1 inch. What is the necessary under axe?

COMMUNICATIONS RECEIVED.

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

On the Aeroscope. By W. S. H.
On French Apartment Houses. By N. L. D.
On Life and Blood. By J. F. G. M.
On a Telescopic Eye. By ——.
On a Book on Geology. By E. K.
On the Hidden Forces of Nature. By H. F. G.
On Public Works. By J. C. W.
On the Financial Question. By W. H.

Also inquiries and answers from the following:

J. H. H.—S. F. S.—L. S. W.—M.—W. H. H.—J. M. M.—J. S. T.—B. B.—F.—F. W.—R. B. G.—Q.—N. W.—I. J.—E. R. G.—R. McM.—W. L. S.

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 brick-making machine, and what is its price? Who makes coiled springs to order? Who buys sulphate of lead? Who sells wire-straightening machines? Who makes vegetable parchment? Who are the principal lumber dealers in New York city? Who makes bung machines?" 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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Tide power, A. Mallory..... 174,692
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Windmill, Brower and Reed..... 174,774
Windmill, G. A. Swartz (r)..... 6,996
Window screen, C. B. Sheldon..... 174,864
Wood-bending machine, S. R. Bailey..... 174,652
Wrench, W. J. Squire..... 174,745

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9,133.—COFFIN HANDLE SOCKET.—R. H. Burr, W. Meriden, Ct.
9,134.—SHIRT BOSOM.—S. Cohn, New York city.
9,135.—CHILD'S CARRIAGE.—I. Cole, Newark, N. J.
9,136.—TRIMMINGS.—G. H. Prindle, Philadelphia, Pa.
9,137.—FLAG HOLDER.—J. W. Barth Jr., Philadelphia, Pa.
9,138.—FAN.—L. M. Beard, Brooklyn, N. Y.
9,139.—LANTERN.—J. H. De Barry, Philadelphia, Pa.
9,140.—CHAIN LINKS.—V. Draper, North Attleborough, Mass.
9,141.—INKSTANDS, ETC.—O. F. Fogelstrand, Kensington, Conn.
9,142.—PEN RACKS.—O. F. Fogelstrand, Kensington, Ct.
9,143.—INKSTAND.—O. F. Fogelstrand, Kensington, Ct.
9,144.—FAN.—J. A. Lynch, Washington, D. C.

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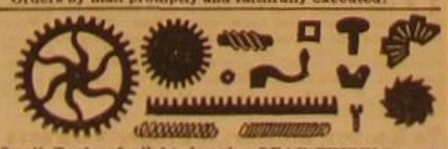
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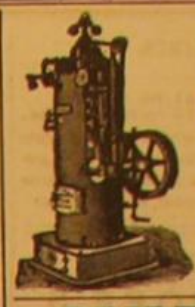
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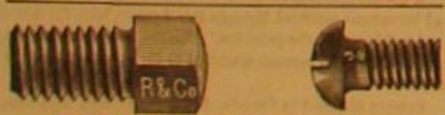
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