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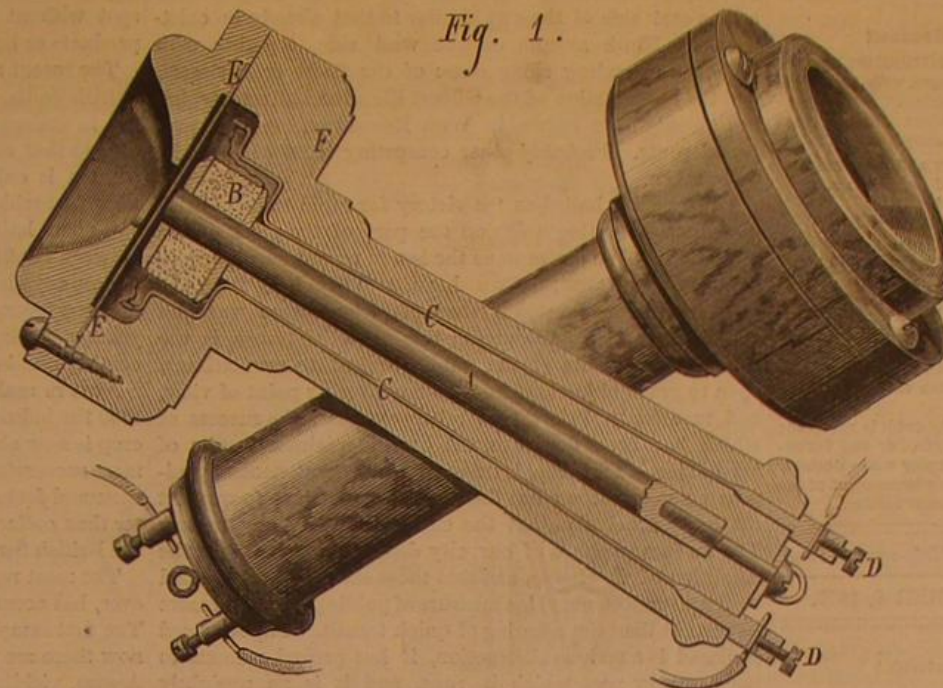
NEW YORK, OCTOBER 6, 1877.

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THE NEW BELL TELEPHONE.

Professor Graham Bell's telephone has of late been somewhat simplified in construction and also arranged in more compact portable form. It consists now of but three metal portions and is contained in a casing of wood or light hard rubber, but five and five eighths inches in length and two and seven eighths inches in diameter at the enlarged end. It will be remembered that this telephone differs from all others in that it involves the use of no battery nor of any extraneous source of electricity whatever. The only current employed is that generated by the voice of the speaker himself.

The simplicity of the construction is clearly shown in Fig. 1 of our engravings, in which both sectional and exterior views of the device are given. Referring to the sectional view, A is a permanent magnet, held by the screw shown in the rear. Around one end of this magnet is wound a coil, B, of fine insulated copper wire (silk covered), the ends of which are attached to the larger wires, C, which extend to the rear and terminate in the binding screws, D. In front of the pole and



BELL'S NEW TELEPHONE.

coil, B, is a soft iron disk, E. Finally the whole is inclosed in a wooden casing having an aperture in front of the disk, and which, besides serving to protect the magnet, etc., acts somewhat as a resonator.

The principle of the apparatus we have already explained in some detail, but it may be summarized here as follows: The influence of the magnet induces all around it a magnetic field, and the iron diaphragm, E, is attracted towards the pole. Any alteration in the normal condition of the diaphragm, produces an alteration in the magnetic field, by strengthening or weakening it, and any such alteration of the magnetic field causes the induction of a current of electricity in the coil, B. The strength of this induced current is dependent upon the amplitude and rate of vibration of the disk, and these depend in turn upon the air disturbance made by the voice in speaking, or in any other similar source. Therefore, first, a wave of air throws the diaphragm into vibration; second, each movement produces a change in the magnetic field; and third, an induced

[Continued on page 212.]



APPLICATIONS OF PROFESSOR BELL'S NEW TELEPHONE.

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NEW YORK, SATURDAY, OCTOBER 6, 1877.

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STEAM RAILWAYS IN THE STREETS OF NEW YORK.

The Court of Appeals of New York State has rendered a decision covering the cases before it, based on the questions arising under the State constitution and laws relative to the construction of elevated railways in the city of New York. The sum and substance of the judgment is that existing companies are at full liberty to go on and complete their roads in accordance with the plans modified and approved by the Rapid Transit Commission of this city, and that they are under no necessity of obtaining the consent of the property owners to use the streets for their purpose. The various obstructions placed in the path of these enterprises by courts of inferior jurisdiction are entirely swept away, and the decision, being that of the appellate court of last resort, becomes settled law. The immediate consequences, it is reported, will be the construction of an elevated road on the east side of the city similar to that already in existence on Ninth avenue on the west side, together with branches extending along some of the finest cross streets, and the continuation of the Gilbert Elevated Railway, which has already been begun in West Broadway, over its projected route. Probably other competing lines will also be undertaken.

This result is hailed as "a victory for rapid transit" with scarcely a dissenting voice on the part of the press of the metropolis. We desire none the less to record our disapprobation, and to say, as we have steadily held from the time when the elevated system of city railways was first broached, that in our opinion this mode of transit is unsuited to the wants of the public, unjust to our citizens, open to grave objections from an engineering point of view, and manifestly inferior to other systems, the success of which has been demonstrated by the plainest results of experience. That rapid transit is an urgent necessity admits of no question; but the need is not such as to warrant the hasty conclusion that the end will justify any means. The business welfare of our city depends greatly upon the condition of its streets, and that these should be maintained clear and unobstructed is a measure of public policy even more important than the securing of quick transit. The Elevated Railroad is a serious obstruction, it has proved ruinous to the property past which it runs, and it is an unsightly blemish on the magnificent thoroughfares which now constitute the chief ornament of New York.

We need not go on and multiply objections now that the elevated road has the sanction of law. We simply wish to point out that a project loaded with them has been adopted, in preference to a system in which they are absent. The elevated road and the underground road are now and have been for some time in operation in this city simultaneously, where one was made and has been maintained in the teeth of the opposition of citizens and property owners, the other, which stands as one of the most splendid engineering achievements of recent years, was constructed in accordance with a most urgent popular demand. Residents along Fourth avenue held public meetings to insist that the tracks of the Hudson River and other lines be sunk, and no one for an instant advocated their elevation. Rapid transit trains are now constantly run over this underground road, and people have had the opportunity to judge of its thorough efficiency. In Baltimore and St. Louis, the underground system has been adopted in decided preference and now exists; in London it has been in successful operation for many years, and even in Constantinople, a city destitute in other respects of the most ordinary improvements, the underground railway now furnishes the means of transit.

The subject must now be regarded as singularly anomalous. A project, the feasibility and advantages of which are recognized by the best engineers, which is a demonstrated success and which is objectionable to nobody, is strangely enough deferred in favor of one, the practicability of which is by no means free from doubt, which has afforded only very restricted proof of its benefits, and which meets the strongest disapproval from every one directly affected by it, and numbers its supporters only among those whose property is not likely to be injured by the incursion of its tracks.

THE EXTENSION OF TEA CULTURE.

For a number of years the Department of Agriculture at Washington has been trying, without much success, to induce the citizens of our warmer States to undertake the cultivation of tea. The plant has been successfully grown in a number of States. In many parts of the South and in California, the tea plant thrives quite as well as in its native country. In fact, there is no reason to doubt the capacity of the country to produce all the tea required, certainly for home consumption, and thus keep at home the millions annually paid to the tea-growers of China and Japan. The great obstacle to this extension of home industry appears to be the prevalent impression that, to be successful, tea-growing must be carried on in large plantations. If that were true it would be hopeless to expect ever to compete with the tea growers of China, Japan, and other countries, where labor is plentiful and cheap. That sort of tea-growing is barred out of this country by the high price of labor. But that does not or need not prevent our raising a large, if not the larger, part of the tea we use. Even in China it is the wide and general distribution of the tea plant, not its wholesale culture, that makes the annual crop so large. The two hundred and fifty million pounds a year sent to foreign countries is probably not more than one tenth the amount produced; yet the subordinate part allotted to tea-growing

is one of the most striking facts noticed by travelers in the tea-producing districts. Large plantations are few, and six or seven hundred weight is a large annual average for an individual farm. But, while few grow tea on a large scale, every one who has a garden has a few tea trees in the corner of it. In this way millions of trees go to make up the bulk of the tea crop without materially affecting the general agricultural industry of the country. It is rather a domestic industry left to women and children than an integral part of agriculture; and though of late years tea plantations are increasing in number and importance, no specific enumeration is yet made of tea lands in the revenue returns of the taxable lands of the empire. In like manner, by the general raising of a few shrubs for domestic use by families owning garden plots, a large portion of the fifty million pounds of tea annually consumed in this country might easily be grown on the spot without perceptibly interfering with present garden products or household industries.

The recent rapid extension of tea-growing in Japan, Java, British India, and elsewhere is evidence that there is nothing in Chinese soil, climate, or industrial conditions to secure to that country the monopoly of tea growing. In Japan tea is cultivated as far north as the 39th parallel, the most favorable region lying between the parallels of 30° and 35°, north latitude; while the cultivation is most successful between the 21st and 33d parallels, though the plant thrives almost anywhere up to the 45° north latitude. The Japanese crop has nearly trebled during the past twelve or fifteen years, and large areas of newly planted shrubs are rapidly coming into bearing.

Next in rank as a tea-producing country is Java. Since 1860 the industry has advanced so rapidly that the annual crop is now about half that of Japan. The plantations are most successful on the mountain slopes from three to five thousand feet above the sea; and the crop is said to pay better than coffee. Tea growing has also been begun lately in the British Straits Settlements with promising results.

The most rapid recent development of the industry, however, has occurred in British India, particularly in Assam. The first sample of Assam tea was sent to market in 1843; now there are upwards of 100,000 acres of tea plantations in Assam, yielding nineteen or twenty million pounds a year. In Bengal, Madras, the northwest provinces, and the Punjab, the industry is rapidly spreading and the prospect good. The crop of 1875-6 was estimated at 29,000,000 pounds—thus giving India the lead of Japan. The most of the India tea goes to England, where it is much liked.

In Ceylon also, tea culture has advanced very rapidly of late. In Brazil, it has been grown successfully in several provinces; but for home consumption Paraguay tea is preferred, and for export, coffee growing is more profitable. Tea growing is also advancing in Tonkin, Cochin China, Malacca, the Corea, and several of the islands of the Indian Ocean, formerly devoted to coffee; and efforts are making to introduce it into Australia and Jamaica. France, Spain, Portugal, Algeria, Italy, Turkey, and the Crimea, all have climates suitable for tea growing; and the same may be said of Tasmania, New Zealand, Mexico, and Central America.

THE CONGO RIVER.

Thanks to Stanley's pluck and energy, the well founded belief that Livingstone's Lualaba was no other than the Congo has now been fully justified; and henceforth the Congo must rank with the three or four great rivers of the globe. It is to Africa what the Amazon is to South America, the Mississippi to North America, the Yang-tse Kiang to Asia. It certainly exceeds the Nile in volume, and possibly also in area of drainage. Rising in the upland north of Lake Nyassa, it flows northerly through the great interior basin of Africa, until it reaches a point about the second degree of north latitude (long. 24° E.) when it swerves to the westward, then to the southwestward until it approaches the coast. Where Livingstone was stopped, the Lualaba was a noble stream from 2,000 to 6,000 yards wide; after making the great bend near the equator, it develops into a still broader stream, from two to ten miles wide, choked with islands. At the cataracts, where the river breaks through the coast mountains, the stream narrows to 500 yards or less; then spreads out into a broad stream from two to four miles wide with a current flowing about three miles an hour. The volume of water discharged is enormous; Captain Tuckey's estimate—2,000,000 cubic feet a minute—is probably not far from the truth. At its mouth the Congo is a thousand feet deep, and the water has been found to be perfectly fresh nine miles from the coast. For forty miles out the sea is perceptibly freshened by the vast volume of fresh water poured into it. The tide is felt as far as the first cataract, 140 miles up the river. In its lower course the river spreads out into extensive swamps covered with mangrove and palm trees.

The first successful explorer of the lower Congo was Captain Tuckey, who ascended the river to a considerable distance above the cataracts, when he was forced to turn back. His belief was that the Congo drained some large lakes north of the equator, and was a continuation of the Niger.

The next to reach the cataract was Captain Hunt, of the British steamer *Alecto*, in 1857. Six years later Captain Burton attained the same point. In 1872 Lieutenant Granby's expedition for the relief of Livingstone ascended still further, but was recalled in consequence of Livingstone's death. Cameron's failure to descend the river is fresh in the memory of all. He was forced to take a more southerly course to the coast by the opposition of the cannibal tribes, through

whose territory Stanley's progress was a continuous battle. The German expedition under Captain Von Homeyer, which started in 1875 to explore the lower Congo to prepare the way for German colonization, will probably be heard from through Stanley, when details are received of his hazardous yet successful journey. One important point in connection with the future of the Congo is already apparent; Cameron's scheme for the development of the Great Interior Basin by means of steam navigation is likely to be long delayed. The great cataracts near the equator, not less than those near the coast, must ever present serious obstructions to the commercial development of the interior.

DOMESTIC WATER SUPPLY IN THE COUNTRY.

A great deal more difficulty is experienced in obtaining a proper supply of water in country houses than need be the case. The usual source is the cistern which receives the rain water from the roof. From this receptacle the water is pumped by hand to a tank in the garret, and the tank serves as a distributing reservoir whence the water is led by the pipes to the different apartments. Wells near the dwelling often replace the cisterns, but in any event there is the same labor to elevate the water so as to render it available where wanted. Where mechanical means are used, wind-mills seem to be favored, but these are open to several objections, the chief of which is their liability to become useless during the sultry windless days of a hot summer, and the fact that to compensate for the irregularity of the working a large reservoir is required for the water pumped in order that the supply may be constant.

Farmers will find that a small steam engine will serve their purpose in this particular much better than any other device. There are numerous excellently made and yet cheap engines in the market, especially suited to the work. Many are combined with their boilers so as to be portable; and if they are not already provided with pumps, these can easily be supplied in connection with them. Apart from the saving in time and muscle effected, the engine renders its owner independent of cistern or of any other single source of supply. It frequently happens that springs exist near houses, but on such low ground that the labor of pumping by hand is too great. Here the engine will prove a great help; and similarly if it becomes necessary to carry a pipe even over a considerable distance to get water, the engine is capable of doing the extra work. There are besides the incidental advantages of the extra safeguard secured against fire, and the obviation of the necessity of drawing water from sources near the house and perhaps, as is frequently the case, in too close proximity to the cesspool.

As for the skill required, any person possessed of an average share of common sense and the ability to manage a stove or cook cattle feed can run a little engine. It should have a trustworthy governor, and the boiler a free working safety valve. Then the operator has only to see that the bearings are kept oiled and the grate replenished. Many small engines are now made with interchangeable parts; so that if a portion gives out, it is as easy to replace it by sending to the manufacturer as it is to obtain a new part of a mower or reaper. Where the amount of water required in one house is not enough to make work for an engine, two or more neighbors might club together for its purchase, or some enterprising person might with one portable engine make a livelihood by going from house to house and pumping up supplies of water sufficient to last over a few days at a time.

NOTES OF PATENT OFFICE DECISIONS.

AMENDMENT OF MODELS.—Previous to taking an appeal to the Board of Examiners-in-Chief on the pertinency of the reference of rejection cited, Siebert made a preliminary motion before the Commissioner of Patents, to finally dispose of the question of alleged "new matter" which had been agitated at various times during the pendency of his application. He desired to amend the model belonging to the case so as to restore a missing element—a steam pipe—which it was admitted it originally contained, but which had been lost, and upon the basis of the model thus amended to correspondingly change both drawing and specification to agree therewith. So far there would have been no objection, but Siebert was desirous not only that the pipe should be restored, but that it should be placed upon the model in a particular manner, in a substantially upright vertical position with relation to the oil cylinder of the lubricator, to which it was connected. Were this the only position that would satisfy the spirit of the invention, there might perhaps have been no serious objection to this adjustment of the pipe; but as either a horizontal or a downward vertical position of the pipe would be equally in keeping with what was indicated as the *modus operandi* of the machine, a serious doubt arose as to whether the amendment could be allowed to go to the extent contended for, particularly as it would have resulted in the introduction of a new force or principle—hydraulic-column pressure-feed—in the working of the machine, which was nowhere indicated or hinted at in the original description.

The Commissioner holds that the right to cover, after discovered uses and results, is upon the assumption that the mechanism for which a patent is granted is invariable, so that there is permanency and certainty in the results accomplished. He therefore decides that the pipe may be restored, but not in a vertical upright position, and that the drawing must not show, or the specification describe, it in such relation.

SECOND EXTENSION OF THE VOELTER PATENT.—The Commissioner of Patents has granted a second extension of the Voelter patent for reducing wood to paper pulp. The original patent bore date August 29, 1857, was extended for seven years from August 29, 1870, and was reissued June 6, 1871. The act of Congress, approved March 3, 1877, authorizing this application for a second extension, directs that if "the Commissioner shall be satisfied that the said Henry Voelter, without neglect or fault on his part, has failed to obtain, from the use or sale of his invention or discovery, a reasonable remuneration for the time, ingenuity, and expense bestowed upon it, and the introduction of it into use, and that it is just and proper, having due regard to the public interest, that the term of the patent should be so extended, the said Commissioner shall extend the patent for the further term of seven years." In the early history of this patent great difficulty was experienced in introducing the wood pulp manufactured under it to the favorable attention of paper manufacturers. Indeed it was not until the year 1868 that Voelter began to realize anything from it. In that year, he sold his interest in the patent to Alberto Pagenstecher for a yearly payment of \$6,000, during the life of the patent, including any extensions which might be granted.

From the evidence, it appears that the making of this contract by Voelter was, in view of all the circumstances, a reasonable and judicious disposition of his invention, warranted by his own circumstances and by the extraordinary amount of capital and enterprise required for the successful introduction of the invention against the prejudices of paper makers and consumers. Voelter received under his contract with Pagenstecher \$12,285 profit, before the grant of the first extension, August 29, 1870. Of the \$42,000 he should have received under the said contract, during the first extension of the patent, he surrendered about \$10,000 of the amount as a voluntary contribution towards the very heavy litigation expenses to which the patent had been subjected. He also paid Mr. Prang, his agent in this matter for the New England States, a commission of twenty-five per cent of the amount collected from Pagenstecher, namely \$10,500. His net receipts, therefore, during the first extension of the patent, were about \$21,000. He testified that he received, for the same time, from his European patents for the same invention, not over \$7,000, clear of his expenses. The assignee and licensees under him, interested in the further extension of the patent, had not realized, according to the evidence, more than five per cent upon their investments.

The Commissioner being satisfied that the inventor and those claiming under him had been unable, from many causes over which they had no control, and from no fault of their own, to realize such benefits as the object and spirit of the patent laws were intended to confer, grants a second extension of the patent for seven years.

SARGENT'S CASE.—The Secretary of the Interior has rendered his decision in the matter of the motion of James Sargent for the revocation of the order of the Commissioner suspending the issue of letters patent to him for an improvement in time locks, pending the equity suit against him by the Yale Lock Manufacturing Company, in the name of John Burge. Our readers have already been furnished through our columns with a detailed history of this case.

The Secretary of the Interior revokes the order of the Commissioner of Patents, and directs the latter to issue the patent to Mr. Sargent.

LOCOMOTIVE WHEEL SLIDING.

The sliding of locomotive wheels over the rails has generally been regarded as occurring only when the coefficient of friction of the wheels on the rail, or in other words, the adhesion, falls below the normal limit on which is based the calculation of the load to be drawn by the engine. M. Rabeuf, in a recent communication to the French Academy of Sciences, now states that he has investigated a series of facts which lead him to consider that sliding is a phenomenon much more general and more complex than is generally supposed.

On the 1st of May last, M. Rabeuf tested a new high speed engine for the French Northern Railway Company. The coupled driving wheels were 81.9 inches in diameter and the adhesive weight carried by these wheels was about 59,400 pounds. The weather was fine and dry. The grade of the track was 0.05 to 1. Throttle wide open and boiler pressure 124 lbs. per square inch. Under these conditions the engine descended the grade, and having no load to drag attained a speed of 62 miles per hour. This should correspond with a velocity of the coupled wheels, says M. Rabeuf, of 303 turns per minute. Now the actual rotation was 260 turns in the same period. They slid therefore on the track, and hence the velocity of translation should have been over 75 miles per hour. The relative sliding amounted to 0.16.

Astonished at this result, M. Rabeuf repeated the same observations on several engines of different types, comparing their actual velocity of translation over the road with the velocity of rotation of the driving wheels. He found that the sliding or skating was almost nothing on an up grade, but very notable on a down grade. It augments rapidly with the speed, and on descending slopes varies between 13 and 25 per cent. It averages therefore 20 per cent, so that its suppression if possible would result in considerable economy in consumption of fuel and wear of rails and tyres. M. Rabeuf assigns no cause for the phenomenon.

TAX COLLECTION BY MACHINERY.

The State of Virginia has adopted a machine to make bar-keepers and liquor sellers honest and to prevent their evading the revenue tax on liquor sold at retail. The apparatus which now must by law decorate every Virginian bar is simply a registering dial combined with mechanism which whenever the index is moved ahead sounds a bell. The dial indicates up to a million drinks. Tampering with it is prevented by the peculiar seal, which consists of a miniature tongue of brass that perforates a bit of paper carefully fitted into the lock. After this tongue is in place, the paper bears only a single perforation. Any attempt to violate the seal will result in defacing and tearing the paper, and this will be sufficient to subject the saloon keeper to prosecution under the law.

Two results have followed the introduction of the invention, which might easily have been anticipated. The first is that the liquor men have raised the price of their beverages so as to cover the amount which they are now obliged to pay in taxes, and the second is the production of devices to swindle the machine. Already one enterprising individual has begun using a bell behind his counter having precisely the same sound of the gong in the machine. He went through all the motions of operating the latter, and the false bell sounding made it seem as if the drink had been properly registered.

The Fair of the American Institute.

The 45th annual Fair of the American Institute opened in the usual Exhibition Building on the corner of 63d street and 3d avenue, in this city, on the 12th ultimo. The show bids fair to be an excellent one. In the Main Hall there is now a better display than we can remember ever to have seen at so early a date during the progress of previous exhibitions. On the other hand the machinery department is in a state of backwardness, even worse than usual, and in marked contrast with the rest of the display. Some of the energy manifested in the general portion of the show might profitably be turned toward advancing this department. We shall make our usual notes on the novelties exhibited when the preparatory proceedings are finished.

Chlorhydrate in Tanning.

In what is known as white tanning, and in tanning glove leather and kid especially, a paste is employed which contains wheat flour, yolk of eggs, alum, salt, etc. Knapp had shown that the action of the egg yolk was chiefly due to the finely divided oil contained in it. Many attempts have therefore been made to employ some other oil, in an equally fine state of division, but without success. C. Sadlon now proposes to make an oil emulsion with the aid of chlorhydrate. He claims that in his experiments the skins take up this tanning material rapidly and perfectly, and the leather is as beautiful as when eggs are used.

The preparation of chlorhydrate ($C_2H_5ClO_2$) by the method in use, namely, by acting upon glycerin with hydrochloric acid gas at 212° F., is too difficult and expensive for this substitute to be profitably employed at present. But as the materials are not dear or rare, any considerable demand for chlorhydrate would, no doubt, be followed by an abundant supply at a reasonable price. Further experiments are, however, required to determine whether the process is practicable on a large scale.—Gerber.

Analysis of Insulating Glass.

It is well known to physicists that glass differs greatly in regards to the resistance it offers to the passage of electricity. A bell glass made for a Thomson electrometer possessed such an unusual insulating power that, when it happened to be broken, Primke took the trouble to analyze it. The percentage of all but soda in it, he says, agrees with that in a sample of optical glass analyzed by Berthier. The results were as follows:

	Bell glass.	Optical glass.
Silica.....	58.450	59.2
Potassa.....	9.236	9.0
Soda.....	3.745	—
Lead.....	28.019	28.2
Lime.....	0.064	—
Magnesia.....	0.054	—
Sesquioxide of iron.....	0.474	0.4
Oxide of manganese.....	—	1.0
	100.042	97.8

Omitting the impurities, we have silica 58.77, potassa 9.28, soda 3.77, oxide of lead 28.18. Such a glass could be obtained from the following materials:

Rock crystal pulverized.....	10,000
Pure potassa from alcohol.....	1,880
Pure caustic soda.....	890
Pure red lead.....	4,840
Arsenious acid.....	18

Hints about Glue.

Good glue should be a light-brown color, semi-transparent, and free from waves or cloudy lines. Glue loses much of its strength by frequent re-melting; therefore, glue which is newly made is preferable to that which has been re-boiled. The hotter the glue the more force it will exert in keeping the joined parts glued together. In all large and long joints it should be applied immediately after boiling. Apply pressure until it is set or hardened.

THE DIPLOGRAPH.

Mr. Ernest Recordon, of Geneva, Switzerland, has recently invented an ingenious writing apparatus for the blind, to which he has given the above name. As shown in the accompanying engraving, for which we are indebted to *La Nature*, it consists of two disks, R and R', turning on the same shaft. The first has on its periphery the alphabet for the blind, the letters being formed of combinations of dots (in this case raised points), and the other carries the ordinary alphabet in raised type. Besides the dot alphabet on the periphery of disk, R, a similar alphabet is made around its left face. Two sheets of paper, A, and A', are extended in front of the edge of each disk.

A blind person using the apparatus proceeds as follows: With the fingers of his left hand he feels along the alphabet on the face of disk, R, until he recognizes the letter which he desires to imprint. He then turns the disk until that letter comes just beneath a pointer placed above the wheel. The corresponding letter on the edge of the disk being situated just 90° from the similar letter on the face, it follows that, when the last mentioned letter is at the upper extremity of the perpendicular diameter of the disk, the first letter is at the extremity of the horizontal diameter, or, in other words, comes directly in front of the paper. The handle, M, is then pushed forward and the disk is thereby carried against the paper, causing the raised points forming the letter to leave their impress thereon. In contact with the type on the periphery of disk, R', are two inking rollers, and said disk is placed exactly corresponding to disk, R, so that, when a given letter on the latter is brought in face of the paper, the same character on disk, R', is similarly placed. Hence, on one sheet of paper a letter in dots, legible to the blind person, is pricked, while on the other sheet an ordinary printed letter is impressed. After each forward movement of the disks, a simple mechanical device moves the paper support slightly to the left, so that the successive letters are thus impressed in their regular order.

The entire apparatus is exceedingly simple, and *La Nature* states that the first time it was placed in the hands of a blind person he comprehended it at once and operated it without difficulty. It enables the blind to write whatever is desired in duplicate. One copy they can read themselves by the fingers and so may verify their writing, while the other copy is legible to people having the use of their eyes. The device affords a means of two blind persons maintaining a correspondence or of writing to the blind, by persons not conversant with the raised alphabet, in which last case the necessary adjustments are made on the type wheel.

IMPROVED NAIL FORGING MACHINE.

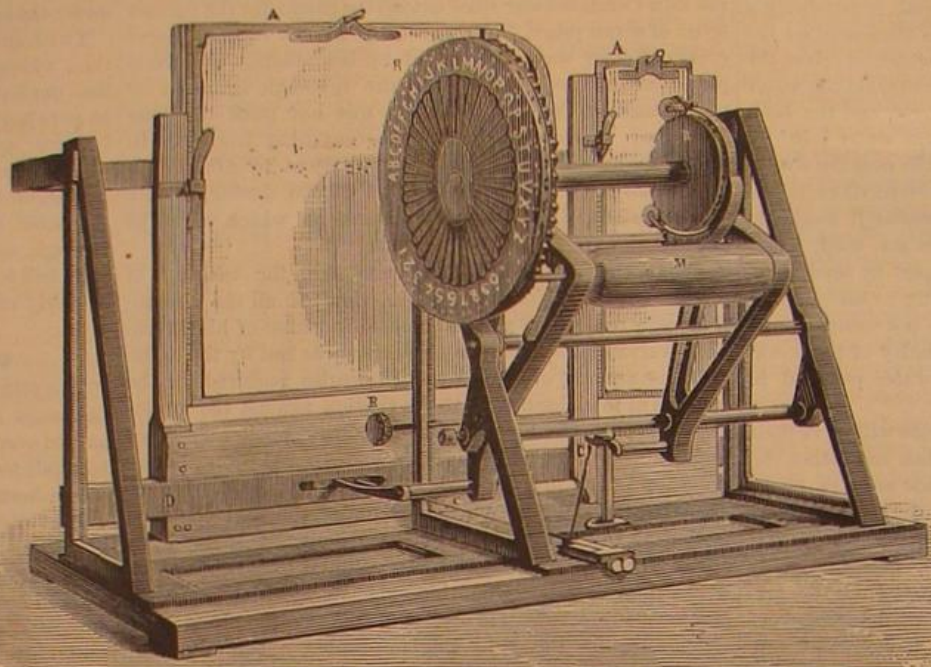
We illustrate herewith a machine constructed by Messrs. Taylor and Challen, of Birmingham, England for producing from strip iron, nails similar to hand-made, at rates varying from two to three hundred per minute, and lengths of from 6 inches to 1 inch, two nails being completed at each revolution of the driving shaft of the machine. The framing consists chiefly of a main casting, to which are fixed an upper frame, carriages for the driving shaft, and other details. The principal moving part is a heavy steel slide, deriving its motion from a crank pin with adjustable throw; this slide carries two shears, two gripping dies, and sundry indispensable appendages, to some of which it imparts motions for guiding the nails between the stages of cutting off and finishing.

The successive operations by which each nail is perfected are as follows: A piece of iron about 6 inches long, and of a width and thickness somewhat greater than the length and thickness respectively of the finished nail, is inserted at a red heat to the feeder of the machine; a narrow strip is immediately cut off the lower side of the heated iron, and by the motion of the steel slide is carried to and pressed against a fixed die; while in this position another die rises at right angles, and presses the partially formed nail against another fixed die. Thus the headless nail is firmly held on its four sides, and while in this position a lever, moved by a cam, and carrying a suitable tool, advances and forms the head, thus completing the nail. The return motion of the steel slide releases the nail, leaving it free to fall, but as its weight is not sufficient to insure this happen-

ing, a "knocker off" is provided, which at the right moment forcibly ejects the nail by way of a guiding shoot into a receptacle placed outside the machine.

It is to be noted that the tools for shearing and gripping, and which have to be changed with each different size of nail, are made of a special mixture of cast iron. They are thus easy of preparation and renewal, while at the same time answering their intended purpose as well as or better than the finest cast steel at less than half the cost.

The whole of the machine is carried upon an open top cast iron water tank, serving as a receptacle for the tongs



THE DIPLOGRAPH.

and tools heated in withdrawing the iron from the furnace. Several of these machines, says *Engineering*, in which we find the above, are now successfully at work.

A Mining Tunnel Thirty-one Miles Long.

After thirty-three years of uninterrupted labor the great undertaking of the Rothschoberger water adit is so far completed as to admit of its use. The method of draining the Freiberg mines, Saxony, by means of a deep tunnel, had already been discussed in the beginning of the present century, as a question of necessity for the future mining prosperity of the vicinity; and undoubtedly the Rothschoberger tunnel is the greatest work of the kind that has ever been undertaken to aid the exploration of a mining district. Other great adits, such as those of the Hartz mountains and the

famous Sutro tunnel, fade when compared with a tunnel which has already attained a length of more than 26 English miles, and will be with its branches, when completed, more than 31½ miles. The plan was to conduct the water from the Freiberg mines to the nearest practicable point on the River Elbe. Rothschoenberg, 12 kilometers above Meissen, was chosen as the most advantageous place for the mouth, on account of its having the lowest level at the shortest distance from Freiberg. The preliminary surveys were made in 1843, but the work was not thoroughly taken in hand until the third quarter of the year 1844.

Since that time the driving of the tunnel has been unceasingly carried forward, but coupled with many hindrances and difficulties, such as quicksands, immense quantities of water, etc., which have trebled the cost and retarded its completion.

The tunnel is ventilated by eight air shafts, and lies some 400 feet below the deepest Freiberg water adit. It has a uniform height of 9.84 feet, with a somewhat smaller breadth. The present length of the adit with its ramifications is 43,000 meters (all of which length is now in use), and will be when completed over 51,000 meters, or 31½ miles. The cost of the tunnel is estimated at 12,000,000 marks or \$4,000,000, and will be paid for by a tax on all the mines which it directly benefits. The gradient of the floor is only 0.03m. in 100 meters. This small gradient may make it necessary to clear the tunnel occasionally, but this can be accomplished without difficulty with suitable boats and dredges. Five miles of this tunnel are perfectly straight, without the slightest curve, and along the whole length the curves are very light. One rather interesting occurrence during the past year was the striking of an old mine, of which no maps are in

existence. The mine is probably more than four centuries old, and the timber which had been used as supports, etc., was found for the most part sound. Two new veins were also struck, but only one of them will be exploited. It is rather remarkable that nearly the whole driving of the tunnel has been done by hand. Burleigh drills, driven by compressed air, having been introduced within the past year. The rock throughout nearly the entire length is solid gneiss, which accounts for the great time that has been taken to the work, it being necessary, with hand boring, to put in as many as from 40 to 50 holes to the face.

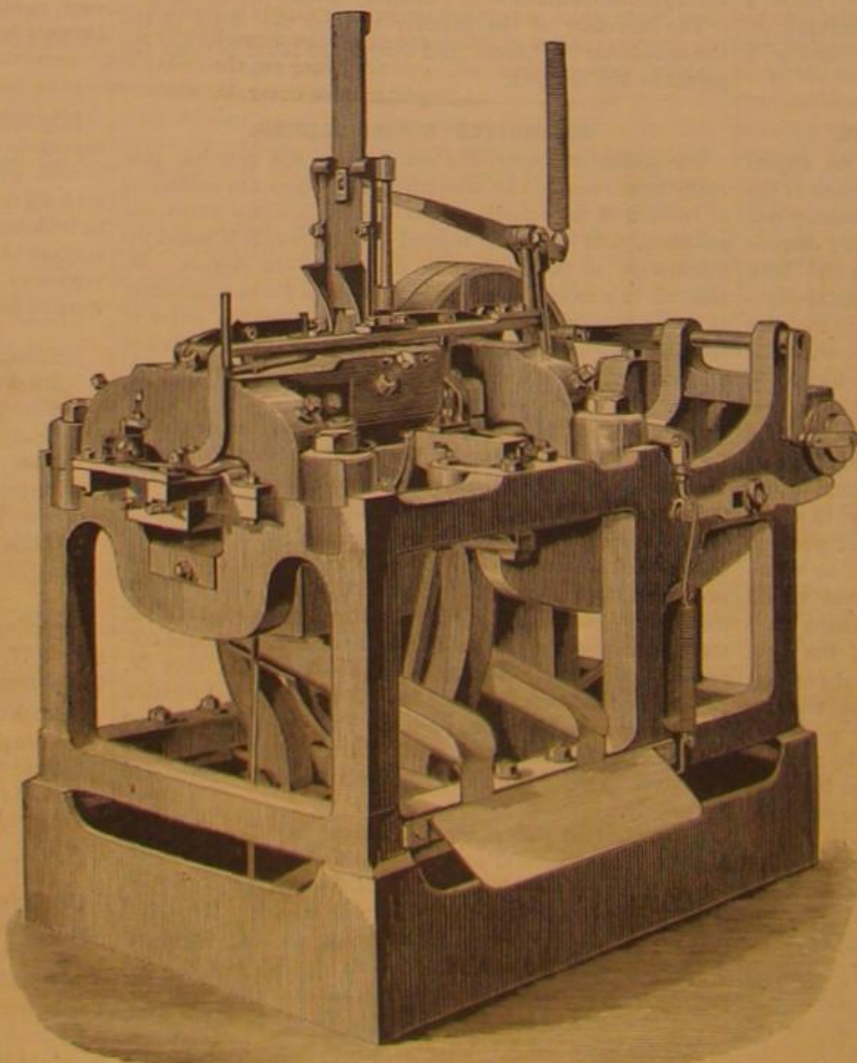
The necessity for the continued prosperity of the Freiberg mines, which have now been worked for about seven centuries, may be gathered from the fact that at the present time there are more than 6,000 laborers, with their families, amounting altogether to some 20,000 persons, who derive sustenance from the mines and metallurgical works connected with them. It may reasonably be expected that the Rothschoberger tunnel will give fresh impetus to the Freiberg mining, and considerably augment the output of ore, which has of late years somewhat fallen off, owing to the immense quantities of water which continued to flood the mines, and prevented the veins of ore being followed and worked below a certain depth.

Saxony may well and justly be proud of a tunnel which is without doubt the longest in the world, and which has required so much time, perseverance, skill and labor as the Rothschoberger water adit.

A New White Paint.

Native barytes, or barium sulphate, is mixed with pulverized stone coal and tar, and exposed to an intense heat, so as to convert it into barium sulphide. The latter being soluble can be dissolved out, and to the clear solution is added a corresponding quantity of zinc chloride in solution, when zinc sulphide will be precipitated while barium chloride remains in solution. To the solution of barium chloride is added white vitriol (zinc sulphate), when a precipitate of barium sulphate will be formed and zinc chloride left in solution, which latter can be filtered and again employed to precipitate the barium sulphide.

The two precipitates obtained as above, namely, zinc sulphide and barium sulphate, are well washed, mixed, dried, heated to a cherry red, then thrown into cold water, and finally ground in water and dried. The white pigment thus obtained covers well, and is well suited to mix with oil, as a substitute for lead, especially where sulphur compounds exist or may be generated.



NAIL FORGING MACHINE.

Gold Crystals from the Ural.

Helmbacker describes, in a recent number of the *Mineralogische Mittheilungen*, an interesting collection of crystals of gold brought by Tunner from the washings of Inzeloklog near Syserts in the Ural. Some of these crystals were pure golden yellow, while others had a brownish color almost like bronze. As the specific gravity of both kinds of gold was found to be the same, the cause of the color cannot be attributed to difference in the substance, but rather to a thin coating of simonite which caused the bronze yellow color. From the density the percentage of gold was found by the Archimedean rule of alligation to be about 77 per cent.

A New Fluorescent Dyestuff.

A Zurich chemist has obtained a new fluorescent dye by acting upon resorcin with oxalic and sulphuric acids. It dissolves readily in alkali, and dyes silk, as well as mordanted wool, red. It resembles eosin in chemical properties. Treated with an excess of fuming sulphuric acid, it dissolves with an orange yellow color, which gradually turns to green blue, green, and finally a beautiful blue. When heated to 212° F. it changes to a purple red. When supersaturated with dilute caustic soda, the solution turns a beautiful carmine red, and exhibits magnificent fluorescence.

IMPROVED MULE HEAD STOCKS.

We reproduce from *The Textile Manufacturer* cuts and description of an improved mule head stock, manufactured by Messrs. Asa Lees & Co., of Oldham, England.

The head stock of this mule stands on strong iron foundation plates, and, mounted on these plates, parallel with the frame of the head stock, run two main slips, upon which is supported a self-contained square, firmly tied together in every part. And upon planed beds, on this square, are fixed the whole of the brackets, etc., so that not a single article is bolted to the woodwork. This arrangement conduces greatly to the stability of the setting, and the accurate working of the parts contained in the square, as no giving way is possible through the shrinking of the woodwork. The rim band guide pulleys are 11½ inches diameter, and run in double journals. The cop governing motion is entirely self-acting, making a cop bottom without the aid of the minder; and being actuated by the fallers, is purely automatic, only giving chain when required, thus producing a bottom, hard, evenly wound, and entirely free from snarls. The backing-off motion performs the delicate operation throughout the building of the cop, without any hooking up of the chain by the minder, the chain being of uniform tension throughout the whole time. This motion is obtained by means of a cam, introduced to work along with the ordinary backing-off pulley, and which is made to correspond to the variable cells of yarn upon the spindle—a work of great nicety—and when in action it brings the faller wire down, in the same ratio as the yarn is unwound from the spindle, thus avoiding, in one case, the fracture of the ends by the wire descending too fast; and in the other preventing snarls by its too slow depression.

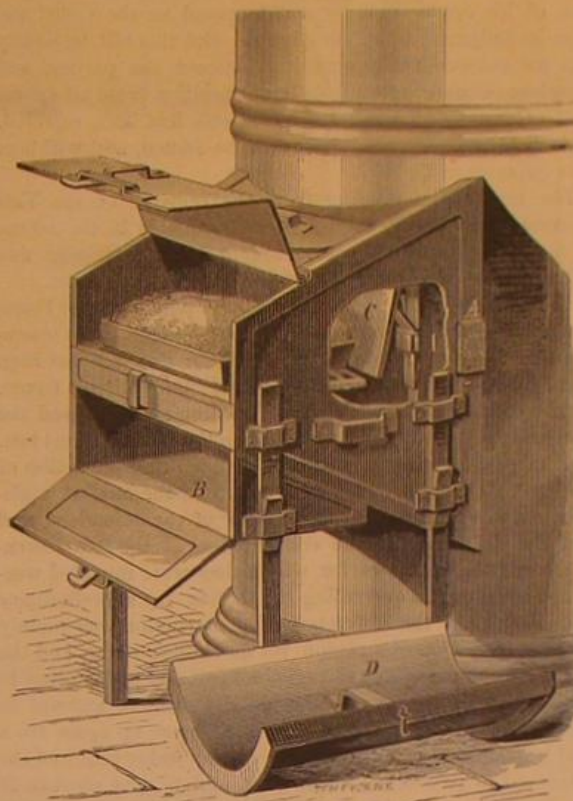
By an ingenious arrangement of levers, whereby a correlative action is obtained, no two motions can be in gear at the same time. The act of putting the taking-in motion in gear must first disengage the drawing-out motion, and if the latter is put in gear it will throw out the taking-in motion first. The carriage is also forced to come out on the retaining catch, and to back off before the winding can commence. The drag wheels are so arranged that one tooth is equal to half an inch of yarn. This mule is also supplied with a patent full copstopping motion, which will stop the mule when the spindles have received a specified number of draws. By this means every set of yarn doffed may be made to contain the same length of yarn, and by a careful and accurate method of weighing it would be easy at any time to ascertain the counts of the yarn of each set delivered from the mule. The copping arrangement stands on the foundation plates, and is supported on double shaped plates, back and

front; the rail being supplied with self-adjusting loose incline, which insures regularity of faller locking

DREW'S IMPROVED BAKER.

The invention herewith illustrated is an improved baking attachment for stoves of all kinds, so that the heat of the latter may thus be utilized for cooking purposes. It may be adjusted to stoves of any shape.

The construction of the device is plainly shown in the engraving. The side walls are extended beyond the segmentally recessed and inclosed top and bottom walls. Slides are also provided above and below, which are moved forward or backward in suitable guides. The side walls may



be notched to fit the rim of a stove, the notches otherwise being closed by pivoted pieces as at A. The baker is supported on adjustable front and hind legs, so that it may be placed at any height to suit different stoves. The legs slide in guide bands and are secured by wedges or clamp screws.

A warmer, B, is arranged below the bottom of the baker, and serves for heating plates, etc. The baker is provided with a hinged door as shown and also with a grate or shelf for holding the articles to be cooked. On these last the heat from the stove is deflected by the inclined top of the compartment. In order to prevent the heat cooking the side of the object nearest the stove first, a deflector plate, C, is provided. To graduate the temperature in the oven, the entire apparatus is simply moved a little away from the stove. This precludes the necessity of opening the doors. When baking is not going on, the front part of the device is closed by the detachable cover, D, which re-

tains the warmth and protects the contents of the baker from dust, etc.

Patented September 4, 1877, through the Scientific American Patent Agency. For further information address the inventor, Mr. Luna Drew, Irving, Jackson county, Wis.

Inventions before the Admiralty.

Inventors who submit devices to the English Admiralty now receive a circular to the effect that if they expect remuneration a specific claim for it must be made in the letter of submission. If the device is found worthy, a committee recommends it to the Lords of the Admiralty; an award is fixed which, if the Treasury concur, is included in the estimates and submitted to the House of Commons. If this body votes the inventor his money, then he gets it, in due course of official delay.

Composition and Purification of the Paris Sewage.

Ch. Lauth has been studying the sewage water of Paris taken from the pump at the Alma bridge and from the collecting basin at Pepinière. He found that this liquid varies in composition from hour to hour as well as day to day. In February, 1877, it contained on an average 1,242 grammes of suspended matter and 682 grammes of dissolved matter in a cubic meter. It contained 35 grammes of nitrogen and 660 grammes of organic substance; of the nitrogen only 6.88 grammes were in the form of ammonia and 1.9 grammes as nitric acid. The water when fresh from the sewer was turbid and slightly colored, but perfectly odorless. When corked up in a bottle without being filtered, it began to change in a few days, and, after 10 to 20 days, was in complete putrefaction. If the water was filtered first, it would keep two months without developing any odor.

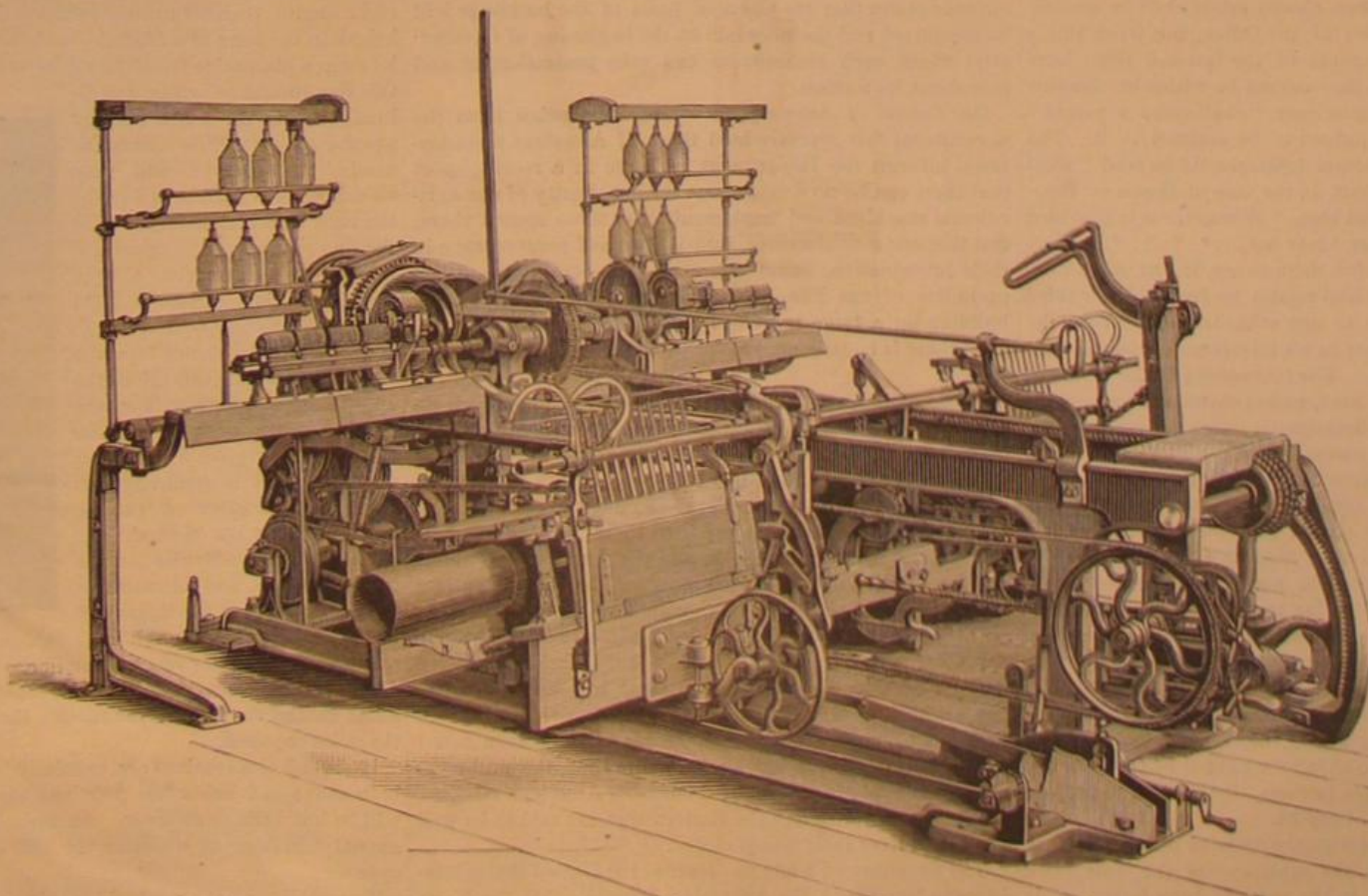
If air was caused to bubble through this liquid its properties and composition were quickly changed; the water after saturation with air is no longer capable of becoming putrid. This was proved by filling two bottles, one with ordinary sewer water and the other with water that had been aired; in 10 to 20 days the first was black and putrifying, the second was clear and odorless for two months. The chemical examination and comparison of the two samples showed that, in consequence of the air being blown through, the nitrogen of the insoluble part had decreased, while the nitrogen in the soluble portion had increased to the same extent; no nitrates had been formed, but the quantity of ammonia had increased considerably. The quantity of insoluble nitrogen was also reduced by treatment with lime; the ammonia increased from 5.282 grammes to 18.550 grammes, and the water remained odorless and colorless at the end of two months.

A microscopical examination of the fresh sewer water discovered movable and immovable bacteria, vibrios, and some monads upon the surface of the liquid; on the bottom of the vessel were fragments and refuse of all kinds, without any trace of living beings. After two days there is on the surface a skin of bacteria with knots below; the monads had increased very much and kolopods began to make their appearance.

On the fourth day vorticelli appear, together with large fringed infusoria; at the same time algae of various forms are seen. On the seventh day the water, which was previously odorless, began to smell badly and turn black; it was covered with a thick skin, which seemed to contain unicapsular infusoria: numerous remains and fragments of dead, black algae were seen. At the end of 4 or 5 weeks the odor is stinking; almost every trace of life has disappeared.

Water treated with lime was free from all vegetable and animal life. In sewage water that has had air blown into it life is very active; the algae and infusoria develop in large numbers, then disappear slowly in the course of a few weeks, but no bad odor is ever perceptible, and the water remains clear.

These facts prove that the sulphuretted hydrogen putrefaction of sewage can be prevented by the addition of lime. —*Comp. Rend.*, LXXXIV, 617.



LEES & CO'S MULE HEAD STOCKS.

[Continued from first page.]

current is generated in the coil wire. Now if, to the binding screws, wires be attached, communicating in like manner with an apparatus precisely similar to that described, it will be clear that there will be a closed circuit of wire, and our induced current will pass through the second telephone and back again to the first one. But in passing through the coil in telephone No. 2, it modifies the magnetization of the magnet and increases or diminishes its attraction for the diaphragm. Hence every vibration made by the first disk is repeated by the second one, and whatever sound produces the vibration of one is transmitted to and reproduced by the other.

Our large engraving, Fig. 2, affords an excellent idea of how the instrument is used, and also of about the extent of circuit over which it is known to be capable of successful operation. We suppose the closed wire circuit to extend from New York to Newark, thence to Paterson and Yonkers, and back to New York, a distance of about 50 miles air line, or some 70 miles by railway. The figure marked New York may be considered as a public speaker delivering a lecture to be heard in the towns mentioned. He talks into one telephone while he holds another to his ear, in order, for example, to hear the applause, etc., of his auditory; or he may be maintaining a discussion or debate, and he then hears his adversary's replies or interruptions. Now, at Newark there is simply a reporter, who takes down the speech phonographically; the words pass on through that telephone and reach Paterson. Here we show two persons, each with a telephone, the two instruments being connected. Each hears from his own instrument. Perhaps, in the future, operatic or concert companies and lecturers, instead of traveling over the country, will simply send out telephones enough to present each person of their audience in a distant city with an instrument apiece, and do their talking and singing once for all in the metropolis. In Yonkers we show three persons listening to a single instrument, which may be done in a very quiet room. Finally, in a side sketch we show how the telephone is arranged to serve as a speaking trumpet between office and shop in a factory. Of course for a long circuit there would be earth connections instead of the wire loop.

The telephone has advanced considerably beyond the status of a "beautiful scientific toy," which many hastily pronounced it, and is now in constant use in numerous private lines in New York, Boston, and Providence. Professor Bell recently exhibited it before the British Association at Plymouth, England, where it attracted great attention. It is at present manufactured by the Telephone Company, of New York, Mr. Charles A. Cheever, Manager, 32 Tribune Building, this city.

Communications.

Our Washington Correspondence.

To the Editor of the Scientific American:

The Sargent case, of which you gave a detailed account in No. 12 of the current volume, was decided by the Secretary of the Interior in favor of the applicant, on the 13th inst. The grounds of his decision in brief are as follows: The Commissioner of Patents' duties are defined by the statutes and must be exercised in accordance therewith, and with such rules and regulations as may, with the approval of the Secretary of the Interior, be adopted to facilitate the business of the bureau. Letters patent are not to issue until the right thereto has been clearly established in accordance with the law and rules of the Office; but when this is done, and all the requirements of the law and rules have been fully complied with, they cannot be withheld. Section 4993 states that the Commissioner "shall issue a patent" after the applicant is adjudged to be entitled to it. The words "may issue," in Section 4,904, should be read "shall issue," as the Supreme Court, in the case of *Mason vs. Pearson*, 9 Howard, 260, decided that, "Whenever it is provided that a corporation or officer 'may act' * * * it may be insisted on as a duty for them to act, if the matter devolves on a public officer and relates to the public or third persons." No appeal lies to any other tribunal from a decision of the Commissioner in an interference case, and his decision is therefore final. The proceeding in the Court of Equity is a proceeding *de novo*, and is in no sense an appeal from the Commissioner's decision; it cannot, therefore, justify the withholding of a patent. Nor can the withholding be justified by what is termed the discretionary power, in view of the statute which says that the patent "shall issue," because the Commissioner should not doubt the correctness of the conclusions arrived at by his Office.

The Secretary states that he has no doubt that he is charged with the duty of seeing that the Commissioner of Patents properly performs his duties, and that he has therefore the power to direct the Commissioner to issue the patent. As, notwithstanding the bill in equity filed by Mr. Sargent's opponents, the Secretary can see no reason why the patent should not be issued, he, after acknowledging that he believed the case to have been judged by the Commissioner in a spirit of absolute fairness, directs him to prepare for issue the patent to Mr. Sargent.

When it was announced what the decision of the Secretary of the Interior would be, the attorneys of the Yale Lock Manufacturing Company, in the name of John Burge, made a motion to the Equity Court of the District of Columbia, for an injunction and an order restraining Sargent from tak-

ing out his patent until the hearing of said motion, which restraining order the court granted. The motion for injunction coming on to a hearing, Chief Justice Carter of the Supreme Court, holding Equity Court, made a decree on the 19th inst., denying the injunction and dissolving the restraining order, on the ground mainly that he could not see any good reason for granting the injunction; that the reasons for and against just about balanced each other; but that as the party who had asked this injunction had not so far established his rights before another and independent— independent so far as the present proceedings were concerned—tribunal, he, as the judge of another tribunal, had no power over the Secretary of the Interior or Commissioner of Patents. The only power the District Court had in such cases was, where an inventor was dissatisfied with the rejection of his application, he could appeal to the Court and have its judgment upon his rights. But this bill in equity was an independent proceeding between the parties, and therefore occupies a totally different position from an appeal to the Court by an applicant whose case had been rejected. It is believed the patent will now be issued, and will bear date September 25, 1877.

The next move, judging from the remarks of the Yale Company's counsel to the court, will probably be the asking of an order restraining Mr. Sargent from exercising any rights he may have acquired by the issue of the patent.

The application of the owners of the patent on the Fountain register, for a preliminary injunction against the manufacture of the so-called "Moffett Liquor Punch," has been heard by Judge Hughes of the United States Circuit Court, at Alexandria, who overruled the motion and dissolved the temporary restraining order granted on the 8th of August last. The judge in giving his decision claimed that the action of the Patent Office, in granting a patent on the Moffett register, made a *prima facie* case in favor of the defendant, and that the difference in the construction of the two instruments and the purposes for which they were intended warranted the court in overruling the motion for a preliminary injunction. As the difference of construction was mainly in the substitution of a pinion for an endless screw, and the purpose in one case was to register fares and in the other to register drinks, these variations do not seem to amount to much. As, however, the matter is to come up again for a final hearing on the 17th of October, the judge required the defendant to give bonds for \$20,000, and to give account of the number of machines manufactured and the receipts from their sale. In the meantime the Moffett registers have been placed in most of the bar-rooms throughout the "Old Dominion," each bar-keeper being required to keep account by it of all drinks sold, and to pay into the treasury of the State two and a half cents on each glass of alcoholic liquor sold, and a half cent on each drink of malt liquor. This has caused, it is said, the raising of the price of liquor from ten to fifteen cents per glass, and great is the outcry thereat. The register is a machine about the size of a small cigar box, with a dial in front and a crank in the rear, which the bar-keeper, every time he dispenses a drink, turns once, thereby operating the register and striking a gong. The title usually given it is really a misnomer, as there is no "punch" connected with it, excepting that kind which the machine is intended to register, and such as result from their too free use.

The Secretary of the Legation at Paris has forwarded to the State Department a copy of the circular issued by the directory of the Exposition and sent to the commissioners of foreign countries, urging them to prompt action. The circular states that the essential parts of the buildings will be completed and the floor laid by the beginning of October—after which each commission can take possession of and parcel out its section.

Our Consul at Antwerp, in noting the absence from the agricultural fair recently held there of American manufactures, informs the Department of State in a recent report that there can be no doubt about the superiority of our agricultural machines and implements over those shown there, and that our manufactures, by patience and perseverance in their introduction, could overcome the conservatism and prejudice of the Flemish peasants and farmers, thereby building up a large trade in Belgium; and that what holds good there is equally applicable to all other European countries.

From our Consul at Liverpool, the Department has received a report stating that from ten to twelve thousand operatives, in the cotton mills at Bolton and vicinity, have struck rather than submit to a reduction of five per cent on their wages, and that 106 mills have closed in consequence. He states that the men are reported to be in good financial condition to sustain the strike, and that large contributions will be supplied by other associations. The same operatives struck against a similar reduction in 1874, but submitted to an arbitration, which was decided against them. The five per cent, however, was restored in 1875, and the present strike is occasioned by another attempt to take it off. Unless arbitrators are again called in, the present strike will probably prove a stubborn one, for while the men assert their ability to remain out an indefinite time, the mill owners, on account of continually decreasing American markets, the famine in India, and the Eastern war, are said to be well pleased to have their places closed.

The Secretary of State has notified the United States Ministers to Brazil and the Argentine Republic that the Navy Department has determined upon sending out the United States vessel Guard to connect the longitudes between Lis-

bon, the coast of Brazil, etc., and directing the ministers to report this to the governments to which they are respectively accredited, with a view of having these governments afford such assistance to the officers of the vessel as they may be able.

The Treasury Department lately advertised for bids for the purchase of the paper pulp resulting from the destruction by maceration of government securities, bank notes, etc., of which it is believed there are upwards of six hundred tons, and awarded it to a Philadelphian who bid \$9.53 per ton, which is \$3.50 per ton more than the department has heretofore received for similar material.

The Post Office Department is in receipt of thousands of plans from all sections of the country, for cancelling or mutilating postage stamps after they have been once used, in such a manner as to render it impossible for any one to use them a second time. Most of these plans are for methods that were long since proved impracticable either from the time consumed in cancelling, from the destroying of the letter as well as the stamp, or from some other equally difficult cause to remove. From the immense number of this class of letters, the department finds it cannot reply as promptly as the senders wish to this class of correspondents.

The Department of Agriculture reports that the condition of cotton averages for the whole cotton belt about the same as last year. Florida, Alabama, Mississippi, Louisiana, Arkansas, and Tennessee make higher averages than in 1876. The Carolinas, Georgia, and Texas report lower—the greatest reduction being in Texas. The caterpillar is present in all the Gulf States and in South Carolina, but has done little damage yet except in Texas. In several parishes in Louisiana the loss is considerable from this cause.

Washington, D. C.

OCCASIONAL.

How to Establish a Meridian Line.

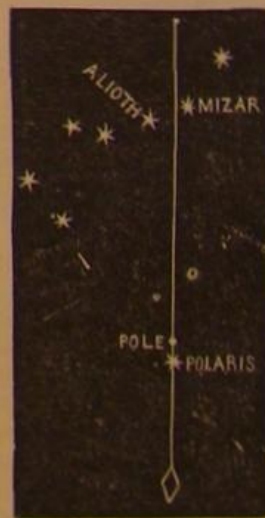
To the Editor of the Scientific American:

It may be interesting to many of your readers to know how to establish a meridian line and what is called a noon mark. It is not only convenient where correct local time is not easily obtained, but it is very essential in different localities to determine the magnetic variation for the purpose of surveying. Owing to magnetic ores in the ground, the compass needle does not always point toward the magnetic pole. To detect the local variations a meridian line is necessary, which is so very easy to establish that no town should be without it. There are two methods, one with an engineer's transit or theodolite, the other is by alignment, which requires nothing more than three or four sticks, a plumb line, and two candles. The former method is capable of giving the most accurate results when the instruments and manipulations are all right. The latter, however, being accurate enough for most purposes, we will describe it. The stars to be observed are Polaris (the north star) and Mizar (the middle star in the handle of the Dipper). Polaris comes to the meridian five minutes in time before Mizar. These stars coming to the meridian so near the same time one above the other below the pole, we can use them to ascertain the true position of the pole of the earth.

For temporary work, a stake driven in the ground will answer, but for permanent purposes stone posts or mason work placed below the frost is advisable. Two hundred feet is a very convenient distance; less may be used for a compass and very much more for instruments with telescope. At the southern end of the location drive a stake or erect the pier having two lines cut on the top crossing each other at right angles, then set up three sticks six or seven feet in length, in the form of a triangle, with the apex over the cross, let drop a plumbline from the top to the center of the cross; this line should be white, and illuminated on the south side by placing a light a little above the head of the observer, who may sit sideways or astride of a chair, the back of which being toward the line serves as a support for his head, which requires to be in a fixed position. Place a light in a perpendicular with Polaris, at the required distance from the southern station; this gives the approximate position for the northern post or pier. After this pier is in position the true northern point is found by taking a lighted piece of candle, having the wick central, and placing it perpendicular on the top of the pier, and adjusting it so that Polaris and the light shall be bisected by the plumbline at the southern station, five minutes before Mizar reaches the line, or twenty-five after Alioth (the first star in the handle) has passed it, then draw a line around the base of the candle, the center of which is the point required.

If several observations are carefully made when Mizar is both above and below the pole, and the mean taken, there will be but little or no error. As Polaris has a much larger annual variation than Mizar, in 1892 they will be exactly opposite.

To establish a noon mark from this meridian line all that is required is to attach to the upper part of the plumbline some object large enough to make a shadow, then when the



center of this shadow is on the meridian line, the sun is on the meridian. A mark can then be made in some convenient place where the sun shines in at a window or door, then by referring to the almanac at any time it may be seen how much the sun is fast or slow of true time; this will give the correct time within the fraction of a minute.

New York, September, 1877.

D. C. CHAPMAN.

Who Built the First Railroad in the United States? To the Editor of the Scientific American:

In the "American Historical Record," Vol. I, page 543, in an article by Theo. Livingston Chase, under the caption "The First Railroads and Locomotives in the United States," the author asserts that the first railroad in this country was that built in 1807, by Silas Whitney, on the western slope of Beacon Hill, near Boston. Can I obtain any information which will lead to the verification of this date? Up to the publication of the article above mentioned, priority had always been given to the tramway built in 1809 by Thomas Leiper, Esq., of Philadelphia, to move stone from his quarries in Nether Providence (near Ridley, Delaware Co., Pa.). The contemporaneous Philadelphia newspapers all speak of this tramway as the first road of its sort in America. Mr. Leiper made a preliminary experiment in the presence of a number of prominent citizens of Philadelphia, in the Bull's Head Tavern Yard, Northern Liberties, on July 31st, 1809, and immediately afterward the work on the railroad in Nether Providence began. The railroad was finished in October, 1809, and is thus described: "It was built for the transportation of stone from the quarries of Thomas Leiper, Esq., on Crum Creek, to his landing on Ridley Creek, a distance of about one mile. The ascents were graded incline planes, and the superstructure was made of white oak with cross-ties and string pieces. The cars or trucks were very similar to those now in use, the wheels being made of cast iron with flanges."

In the absence of any direct evidence confirming the date of the Beacon Hill Railroad, this road will, of course, take prominence as being the first authentic railroad built in this country, but I trust that if any such evidence exist, it will be brought to notice. The subject deserves consideration as well for its historical as its scientific interest.

R. P. ROBINS.

Philadelphia, Pa.

Soldiers' Rations.

A soldier in the field, whether marching or fighting, must put forth more muscular energy than in times of peace; and according to Dr. Parkes and other authorities, it is the nitrogen in his food, more than anything else, that is necessary to the activity of the muscle, and this is required in greater quantity in proportion to the increase of work. That hard labor can be performed for some time without any increase of nitrogenous diet is true no doubt, but in this case it is at the expense of the nitrogenous constituents of other parts of the body, in the neighborhood of the muscle, and it would be impossible for a man to continue such labor for any length of time. Whether the nitrogenous matter he assimilates is contained in meat or bread seems to be a matter of little import. An English soldier who gets a three quarters of a pound ration of meat daily is said to be no better off, as regards the nutritive character of his diet, than a German soldier, whose staple food is rye bread, and this one can well believe, looking at the constituents of the two food stuffs. Meat from a lean animal contains but 12.8 per cent of nitrogenous matter, whereas samples of rye which have been analyzed have been found to contain as much actually as 15.8 of the same body. Moreover, the amount of water in a pound of meat and a pound of bread is a matter that must not be overlooked, for while in the former it amounts to 57 per cent, in the latter case it is only about 40. As, too, a loaf of bread constitutes of itself a very perfect diet, the starch and fat it contains supplying the calorific and heat-producing matter necessary in animal food, we may assume that troops fed upon good bread are as well off as those supplied with more costly rations. At the same time it cannot be denied that different climates and different conditions have a vast influence upon dietary, and while British soldiers require a goodly allowance of meat to sustain their energy, the Turk rarely tastes such food from one week to another. In fact, in the Moslem soldier we have the most easily satisfied of beings, so far as the commissariat is concerned. He does not even require bread, but will fight for weeks and months together upon rations of meal or bruised Indian corn, which serves him indifferently for breakfast, dinner, and supper. The Russian has rather better food, although from our point of view his fare may appear frugal enough. Two pounds of black bread and a quarter of a pound fresh meat, or bacon in lieu thereof, with garlic, salt, and plenty of tea, seem to be the daily rations of the Czar's soldiers, though a coarse sweet bean, known in this country as the locust bean (Johannisbrod), is occasionally, also employed as food. There is no knowing what the composition of Russian bread is, but assuming it to be for the most part of rye or Indian corn, there should be little difference between the nutritive qualities of the rations of the Turks and Russians, supposing, that is, the soldiers in both cases receive pretty well as much as they can eat. There is enough nitrogenous matter to make muscle and bone, as well as sugar and starch, or non-nitrogenous bodies to supply animal heat and to support the respiratory organs. Taking milk as the most perfect food we have for our standard, which may be said to be made up

of nitrogenous matter, oil, and sugar, we find that the proportion of nutritive, to heat-producing or calorific matter, is one to two. Beans and peas come next in order to milk, the proportion here being as one to three, while in oatmeal it is as one to five, and in rye, wheat, Indian corn, etc., as one to seven or eight. Thus the Turk and the Russian, being fed mainly upon rye and Indian corn, derive equal benefit from their rations, although the Muscovite soldier gets additional energy, no doubt, from the small ration of meat allowed him.

The highly nutritive character of pea flour at once points to the *raison d'être* of the pea sausage of the scientific German soldier. This newly invented food stuff consists, as our readers probably know, of peameal and bacon fat, suitably seasoned, and pressed into skins and boiled. The ordinary daily ration of a German soldier is 2 lbs. of rye bread and a dinner of soup, which sometimes has a piece of meat floating in it, but generally does not; this, together with a scanty stipend, which barely suffices to buy him a cup of coffee in the morning and a herring, or salted cucumber, to eke out his bread with, constitutes the whole of his allowances. In the last European war, these comestibles were replaced during some portion of the campaign by the *Erbsecurst*, and there cannot be a doubt that the health of the Teuton army was improved by a regular and sufficient supply of this suitable food, while at the same time it greatly simplified the commissariat service of the invaders. Butchers, bakers, army ovens, and cooking pontoons were for a while dispensed with, and thus it was possible for corps and regiments to move, when necessary, without a great deal of impedimenta. Moreover, as we have seen, the pea flour gave that extra nutrition which troops subject to unusual exertion, coupled with exposure to cold and frost, required. To the English palate the pea sausage had an unmistakable taste of tallow, and there is no doubt that all kinds of fat and grease were employed in its production when the supplies of bacon ran short. Animal fat of some kind was, however, absolutely necessary to supply the system with heat, and combining the former in this way with pea flour was a most happy idea. The pea sausage might either be eaten cold in the condition in which it was issued to the soldier, or made into a sort of soup with boiling water.

And here we may mention a circumstance of especial interest to scientific men, in connection with the manufacture of this new food. The *Erbsecurst* was produced in such huge quantities that it was found to be absolutely impossible to procure a sufficient number of skins and bladders to contain the preparation. All sorts of substitutes were tried. Oiled fabric and vegetable parchment, as well as other waterproof materials, were essayed in vain, for an envelope was required which was elastic and unaffected by boiling water. At last a chemist stepped in and solved the problem. He proposed the use of gelatin mixed with bichromate of potash, or in other words the process employed by photographers now-a-days in producing what are termed carbon prints. It is well known that if a solution of gelatin and bichromate of potash is spread upon paper and exposed to light, the gelatin becomes insoluble in a very short time, and will effectually resist the action of cold or hot water to dissolve it, this principle being in fact that upon which photographic prints are produced, the portions of a surface which refuse to wash away constituting a picture. This same mixture was used for treating the sausages. The food was pressed into proper shapes and then dipped into the bichromated gelatin solution, after which it was exposed to daylight for a couple of hours, when the gelatin formed a tough skin around it, capable of being boiled with impunity. Turning to the British soldier we find in him the most daintily fed of all warriors, unless it was the Servian in last year's war. If we are to believe special correspondents, the rations of the Servian soldiers were almost unlimited, and furnished a striking contrast to the fare of the frugal Turks. An oka, or 2½ lbs. of brown bread, half an oka of fresh meat, together with a modicum of rice, meal, and paprika, was the daily ration, the last named comestible being employed for making soup; the *pot-au-feu*, so we were assured, was to be found simmering in camp from early morn till noon, and then only came off to make room for the coffee kettle. The Servian soldiery, too, usually had a ration of spirits called *slivovitch*, or plum brandy, allowed them, and yet withal they had no such powers of endurance as the maize-fed Turks. In this country a soldier's ration is three quarters of a pound of meat and one pound of bread, which is supplemented in war time by a quarter of a pound of cheese, together with cocoa or tea, sugar, etc. In the Crimea there was a standing order that hot tea should always be kept ready when practicable, so that the men might partake of it at any time, and in the Abyssinian and Ashantee campaigns the camps were never broken up of a morning before the troops had been supplied with a cup of warm coffee for breakfast. Tea and coffee exercise the same effect upon the system as wine and spirits, but stimulative action is less marked, and our commanding officers are enjoined never to issue a ration of spirit except under extraordinary circumstances, as in the case of distressing marches, or when troops are engaged in the trenches or up at the front. And as we have said, with this apparently liberal feeding, our men do not receive so much actual nourishment or nitrogenous matter as the German soldier, whose mainstay is the 2 lb. loaf of black bread he receives daily. The meat, bread, sugar, etc., received by our soldiers in the Crimea yielded, we are told by the Royal Commissioners, but 23.52 oz., of nutritive principle, while Germany gives her soldiers 32.96

oz., which is still further increased when the latter are fed on such highly nitrogenous diet as the pea sausage. The Turks, poor as their food may seem to us, probably derive as much nutriment from it as English troops from their bread, meat, and cocoa, for, weight for weight, the Turkish rations contain more nitrogenous matter. If, too, their meal is what is termed "whole flour," it will, since it includes the husk, contain more nitrogen still, and, like oatmeal, be one of the most generous foods known. Our Scotch troops, we fancy, would be little the worse if fed solely on porridge for a time. The reader may remember Lord Elphinstone's report on Dr. Johnson's definition of oats as the food of horses in England and of men in Scotland: "Yes," said he, "and where else will you find such horses and such men?" A growing soldier, hard at work all day at gun drill or other laborious work, does not buy extra meat when he is hungry, but foregoes his beer at the canteen for another pound loaf, thus approaching his diet very nearly to that of the German warrior, whom we have shown lives almost entirely on bread and enjoys the most nutritive fare. At the same time it is necessary to bear in mind that the conditions under which a man lives must guide the nature of his food. A man inhabiting a cold climate, such as ours, requires more animal food than would be the case if he lived in a country nearer the equator, and British troops, we fear, would lose much of their energy if fed altogether on farinaceous food. But, as we have striven to show, it is not always a so-called liberal diet which affords the soldier the greatest quantity of nutriment.—H. Baden Pritchard, in Nature.

Castings Boxes for Saw Mandrels.

Wet a piece of thin writing paper with oil, and wrap it it around the journal of the mandrel (the oil will cause the paper to stick to the journals); let the joint in the paper come on the side of the journal between the boxes; heat the boxes before pouring off; lay the mandrel in and let it remain until the journal and box are both warm, but not so as to burn or scorch the paper. The mandrel should then be taken out, and the oiled paper stuck around it. Pour the metal around the outside of the paper after the lower boxes are poured; pack between the two with layers of paper, and put on the upper box, bolting it down. After the upper box is poured, take it off and take off the paper, which will leave the journal of the mandrel free to run without heating. As the journals wear down so as to become too loose, take out a layer of paper from between them.

Effect of Cheap Japans as Dryers.

Cheap japans, used as dryers, are in part responsible for a large class of paint troubles, which are described under the head of "chipping," "cracking," and "becoming fatty." Too many painters are led away by cheap japan (on account of its good drying qualities), that has but little binding and less elastic hardening properties; and color ground in it with a little oil (which it has no desire to mix with) is liable to curdle as soon as you put them together, and gets gritty or fatty. Thin it down with turpentine, and let it stand over night, and it will look like liver in the cup; and as the turpentine leaves it, it gets spongy.

Cement for Petroleum Lamps.

A cement particularly adapted for attaching the brass works to petroleum lamps is made by boiling three parts resin with one part of caustic soda and five of water. The composition is then mixed with half its weight of plaster of Paris. It sets firmly in half to three quarters of an hour. It is said to be of great adhesive power, not permeable to petroleum, a low conductor of heat, and but superficially attacked by hot water. Zinc white, white lead, or precipitated chalk may be substituted for plaster, but hardens more slowly.

Vermillion.

Vermillion is a mixture of sulphur and mercury, and is frequently found to turn to a dark brown color if exposed to the atmosphere. A remedy for this is said to be to add one eighth part flour of sulphur to the paint when mixing. To detect adulteration in vermilion, place a little on a red hot iron; if pure, it will evaporate entirely; if not, there will be an earthy residue.

ANILINE BRONZING FLUID.—Take ten parts of aniline red and five of aniline purple, and dissolve in 100 parts of alcohol at 95°, taking care to help the solution by placing the vessel in a sand or water bath. As soon as the solution is effected, five parts of benzoic acid are added, and the whole is boiled from five to ten minutes, until the greenish color of the mixture is transformed in a fine light-colored bronze. This bronze is stated to be very brilliant, and to be applicable to all metals, as well as to other substances. It is easily laid on with a brush, and dries promptly.

USE OF POWDERED PUMICE STONE ON VARNISHED WORK.—Pulverized pumice stone is used to remove the gloss and imperfections on varnished surfaces. It is applied by rubbing with woolen cloth and water. Rotten stone is used in the same manner, but applied only on work that requires polishing.

LEAD and zinc do not really unite. When melted together and allowed to cool slowly, the lead falls to the bottom. If kept together in fusion and repeatedly stirred, the zinc sublimes with great rapidity.

IMPROVED MITER MACHINE.

The annexed engraving represents a new miter machine adapted to the uses of carpenters, frame makers, and other workers in wood. It is easily adjustable, the saw is accurately guided, and means are provided for taking up the wear of the blade.

A is the miter box; stationary and movable bars support the saw guides, B, and rest on a rotating support placed directly beneath the center of the miter box. The bars are connected by means of eyebolts at each end. The pivot of the movable bar passes through the eye, and the stem of the eyebolt enters horizontally through the stationary bar, and is held at any desired point by means of a set screw. Below the bars and not shown are two short lever arms having a rod passing between them which supports a spring. This spring serves to close the posts together, and they are locked together by means of latches, C, at the top, so that when the saw is in place the posts cannot be spread apart.

The guide rollers, B, are constructed with a groove at the top for holding the back of the saw, while the two flanges near the bottom steady the blade. Between these parts the slides of the rollers are cut away as shown, so as to prevent the lodgment of sawdust which might clog them and prevent their rotation. The saw blade has a socket, D, formed at each end into which vertical bars from the top or back bar enter. These bars are perforated and a pin is inserted through the side of the socket into one of the holes in order to hold the saw. As the blade becomes worn the pins can be shifted, so that the edge is retained always at the same distance from the back, and its relative position to the guide rollers will remain always the same. A set screw, E, serves to draw the blade tight.

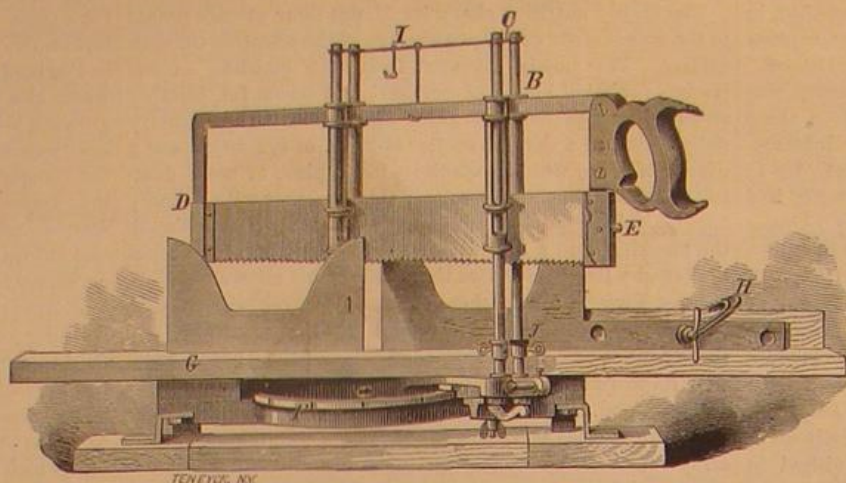
A quadrant, F, suitably graduated, is attached to the front of the frame, and the supporting bars move over it and are secured at any point by a clamping screw. The bedplates for the support of the working sole, G, are secured to the frame and have their inside ends beveled so as to allow the supporting bars to swing between them. The sole is made of any desired length, and the work to be cut lies upon it, resting against the back of the box. When any number of pieces are to be cut of the same length, they are simply gauged by setting a clamp, H, to the desired position. A rod extends across between the posts, and a hook, I, depends therefrom to support the saw when not in use. The depth of the cut is regulated by means of adjustable collars, J, which may be set to arrest the rollers when the saw reaches the bottom of its travel.

Patented February 13, 1877. For further particulars relative to sale of patents address the inventor, Mr. John P. Tierney, at Whittier & Fuller's, Sacramento, Cal.

NEW METAL GRINDING MACHINE.

The annexed engraving, which we extract from the *Revue Industrielle*, represents a new metal grinding and dressing machine devised by M. Bollmann. The carriage, L, on which the work is fixed, receives reciprocating motion by means of gearing moved about the axes, H, and governed by a toothed wheel having a hand brake. This toothed wheel receives motion, at M, from the driving pulley. The lifting and lowering of the carriage is effected by the wheel, D. The small hand wheels, B and C, on the left serve to produce transverse motion of the carriage and to regulate, by means of a spring and friction brake, the pressure with which the work is held against the stone.

The latter has a sheet iron cap, S, and a wrought iron guard to prevent accidents in case of its rupture. The movement of the carriage is such that the object is always presented before the wheel which rotates at the average velocity of 5,760 feet per second. A second stone may be added at G, on the same spindle, being received between the flanges, for use on small work.



TIERNEY'S MITER MACHINE.

The remaining features of construction will be readily understood from our engraving.

The working parts are fastened to the iron bed, which is securely bolted to the standards. Bolts or screws, which can be readily removed, hold the machine firmly in place to the floor.

Awards at the Paris Exhibition of 1878.

The French *Journal Officiel* publishes a report to the Marshal-President concerning the Exhibition of 1878, from the Viscount de Meux, Minister of Agriculture and Commerce. The document states that the forward state of the works, both on the Trocadéro and in the Champ-de-Mars, leaves no doubt that the buildings will be completed by the end of October, two months earlier than had been counted upon. Already all the foreign countries which are going to take part in the pacific struggle know the place they are to occupy, and the space reserved for French exhibitors is allotted. Under those circumstances the Minister considered that the time had arrived to determine the question of recompenses. To accomplish that object he called together the Superior Commission. It commenced its task by appointing a sub-committee, presided over by M. Dumas, permanent secretary of the Academy of Sciences, who drew up a scheme, and submitted it to the general body. The matter was maturely deliberated, and, having been adopted, and finally approved by the Minister of Agriculture and Commerce, he recommends it for the sanction of the Marshal-President. The main features of the project are that a sum of \$300,000 shall be devoted to recompenses, to be awarded by an international jury. That body is to consist of 650 members, 350 foreigners and 300 Frenchmen. The former are to be divided among all nations exhibiting, in

proportion to the space occupied, the number of their exhibitors, and the importance of the objects. In addition 325 supplementary jurymen—175 foreigners and 150 French—are to be nominated. The foreign members are to be appointed by the government of each country; the French members will be designated by decree on the proposition of the superior commission. The document is followed by a decree ordering it to be carried into execution.

Chlorophyl and its Uses in the Arts.

Frémy has recently published some new and rather surprising statements in regard to chlorophyl. According to this eminent chemist we have in chlorophyl a mixture of phylloxanthine and phyllocyanate of potassium. The following proofs are adduced:

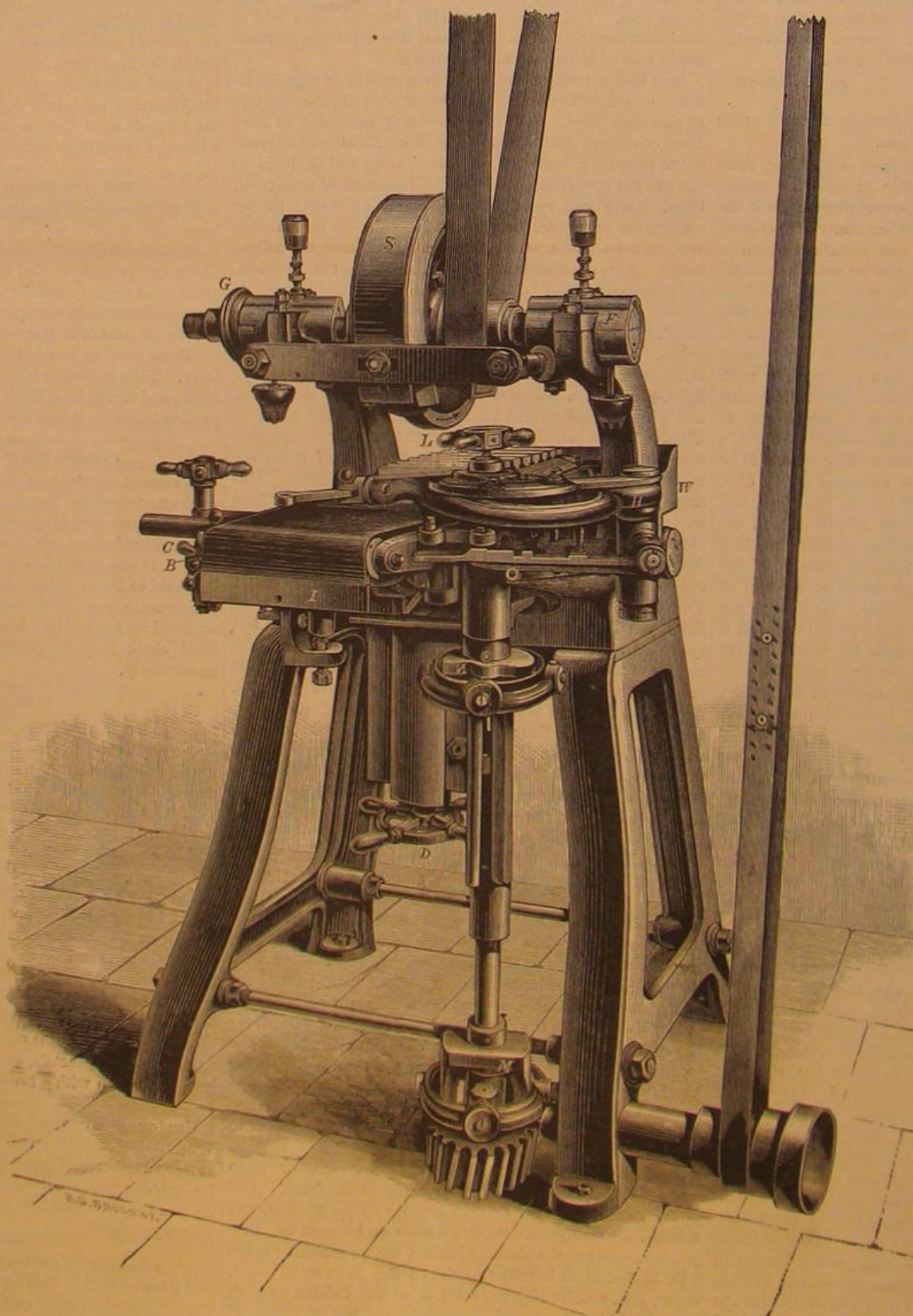
1. On treating green leaves with 62 per cent alcohol he obtained a yellow solution of phylloxanthine; if this treatment then be continued with 70 per cent alcohol, the phyllocyanine united to potash goes into solution.

2. The alumina lake of chlorophyl, when digested with 62 per cent alcohol, also gives up nothing but phylloxanthine.

3. If we have a solution of chlorophyl in alcohol of high percentage, and treat this with a mixture of ether and hydrochloric acid, the ether takes possession of the phylloxanthine and is colored yellow; while the hydrochloric acid dissolves the phyllocyanine with a blue color. (The acid must be diluted with an equal volume of water and the ether added last.)

4. If some baryta water be poured into an alcoholic solution of chlorophyl, a dark green barium phyllocyanate, insoluble in alcohol, is formed, while the alcohol acquires a beautiful yellow color due to dissolved phylloxanthin.

The barium phyllocyanate is not decomposed by carbonic acid; all other acids, even the most feeble organic acids, decompose the phyllocyanine and turn it brown. If, however, we employ sulphate of potassium (sodium or ammonium), we obtain by double decomposition barium sulphate and potassium phyllocyanate, which dissolves in alcohol with a splendid blue



NEW METAL GRINDING MACHINE.

color. This salt is also soluble in ether and in the hydrocarbons, as well as in water containing a slight excess of alkali. If linen be dyed with this potassium phyllocyanate solution, the fiber takes it up and can be washed with water and not give it out, but it is dissolved by alcohol or ether. Before the spectroscope the salt exhibits the well known black bands in the center of the red. When the leaves turn yellow they lose, as has long been known, a large portion of their potash, but a part of it remains bound to the phyllocyanide. On the ground the phyllocyanide is decomposed by fermentation and the potash given back to the soil.

In the preparation of preserved and canned vegetables, the use of copper salts to brighten the color is so general that Pasteur declared recently that it was scarcely possible to find a single box of shelled peas in all Paris, in which copper could not be detected. Hence from a sanitary point of view we greet with pleasure the discovery, by Guillemare and Letecour, of a substance which will render the use of this poisonous substance unnecessary and superfluous. They color the vegetables with chlorophyll. Their process is as follows: Spinach or leguminous leaves are treated with caustic soda, in which the chlorophyll is soluble. The solution is now precipitated with alum, and the lake thus formed well washed. It is then dissolved in sodium phosphate, which has previously been saturated with acid calcium phosphate. When vegetables are heated for five minutes or more with this solution, they take up the chlorophyll and hold it so firmly that they will not give it up subsequently by heating to 117° C. (243° Fah.), in the cans or boxes in which they are to be kept or sold.—*Dingler's Journal*.

THE WINE PALM.

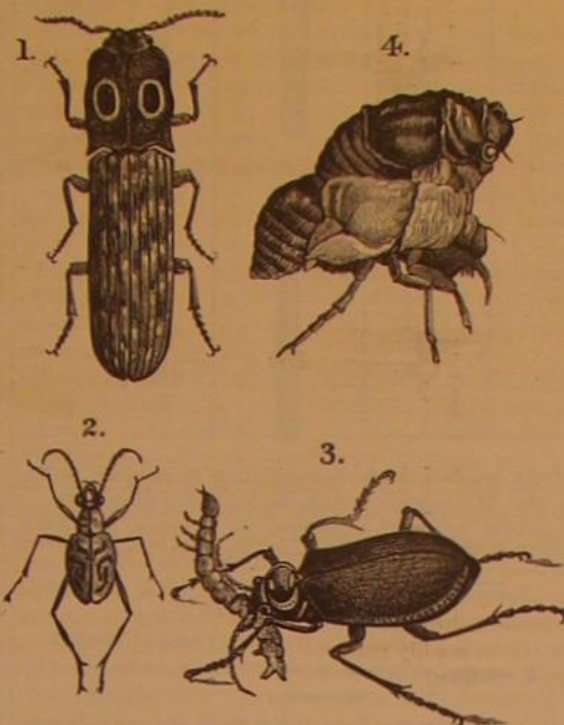
The species of palm represented in the annexed engraving is called *caryota urens*, popularly known as the wine palm. The genus of which it is a member is a small one, containing only nine species—which number might probably be yet further reduced—all of them natives of India and the adjacent islands. They are lofty trees, having bipinnate leaves, which are easily recognized by the shape of the leaflets; these, instead of being long, narrow, and tapering, as in most palms, are wedge-shaped, tapering to the base, and broad at the upper extremity, where they are curiously and irregularly toothed or jagged. The male and female flowers are borne either upon one spike or occasionally upon separate ones, and the roundish, fleshy fruits are of a purplish hue, each containing one or two seeds. The fruits of *c. urens* are very sharp and acid; so much so, indeed, that it is stated they will produce a strong burning sensation if applied to the skin, and from this property the species has acquired its specific name. Although certainly of less economic importance than the cocoanut and some other palms, this *caryota* is a very useful tree. Beginning with the trunk, a small quantity of very hard wood is yielded by its outer portion, of which the Cingalese make pestles for beating their rice. The inner portion or pith of the trunk is much more important; it is made by the natives into bread, or boiled by them into thick gruel, in either of which conditions it is highly nutritious; it has the same properties as sago, of which it may be considered a kind. From the leaf stalks a very strong, tough fiber is obtained, called kittul or kettule fiber; from this many articles are made, such as ropes, brooms, and baskets; while a woolly material, which is scraped off the base of these stalks, is sometimes used for caulking boats; the leaf stalks themselves are employed as fishing rods, for which they are very suitable, being light, tapering, and elastic. The most important part of the tree, however, is the spike of flowers, from which a large quantity of the juice is obtained; this juice is known as toddy, or palm wine, and it is stated that as much as 100 pints will be yielded by a good tree in the course of twenty-four hours. When boiled, this juice yields very good palm sugar, or jaggery, as it is called; about 8 gallons of the juice, boiled over a slow fire, will yield 4 gallons of thick syrup. To this syrup small pieces of the bark of *shorea robusta* (the saul tree) are added, and when boiled again the jaggery is produced. The manufacture of this sugar is undertaken by a particular caste of natives, and from this *caryota* and two other palms (*cocos nucifera* and *borassus flabelliformis*), all the sugar used in Ceylon is obtained.

Some of the finest quality, made by the head men, forms an excellent substitute for Chinese sugar candy. The cakes of jaggery, which are about as large as an ordinary bun, are wrapped separately in plantain or banana leaves, and are hung up until required for the market or for other purposes. The tree is sometimes called the jaggery palm, from the product which it yields. Although not so common in cultivation as some other palms, the *caryota* is sometimes met with.

ABOUT SOME INSECTS.

BY C. F. W. SKIDG.

The largest elater or spring beetle we have in the United States, is the velvet spotted elater, *Alaus oculatus*, Esch., (Fig. 1, natural size). It received its specific name, *oculatus*, from the large eye-like spots upon its prothorax, which, however, have no connection with the insect's power of vision, but are simply ornamental markings. Some time ago a specimen was sent to me, with these remarks: "I caught it on the pavement, but not with my fingers; no indeed, its eyes looked too wicked. There happened to be a



match box lying near it, so I pushed the ugly brute in it with a stick. If it had not been for that match box you never would have seen this bug with a wicked eye."

The young of this beetle are often found in old apple trees, feeding upon the wood. The perfect insect I have never observed abroad earlier than June 14th. That it completes its transformations much sooner is evident, for my brother dug, from a rotten stump, a newly transformed beetle, on the tenth of February of the present year.

Along the sandy sea beaches of New Jersey is found a swift-footed white beetle, with peculiarly arranged black lines upon its back (elytra). It seems to be the *cicindela*

dorsalis of Say (Fig. 2). The name *dorsalis* refers to the lines upon its back, but as most of the *cicindela*, or tiger beetles, have similar placed markings, this may be called in English the strand tiger beetle.

I once saw large numbers of these beetles upon the carcass of a common fowl, which evidently had been washed overboard from a passing vessel. They were most numerous upon the fowl's head and were tearing away at its eyes and comb with a seeming relish. They did not bury themselves in the carcass like true carrion beetles (*silphidae*), but remained upon the surface, inserting their jaws only in the flesh. They feed also upon insects; I saw one eating a green grasshopper; and although it was larger than the beetle itself, it flew some distance with it before alighting.

The green insect hunter, *calosoma scrutator*, Fabr., (Fig. 3) belongs to the family *carabida*. It is a swift runner, predaceous in habits, and beneficial in the number of caterpillars and other injurious insects it devours. Its elytra are bright green with a red border; its body beneath, glossy green; its prothorax, blackish blue, margined with gold; and its legs, deep purple. In Pennsylvania and New Jersey it is a common insect during the summer months.

Fig. 4 represents a frosty cicada, *cicada pruinosa*, Say, quitting its pupa case. It leaves its shell in a manner similar to the seventeen year cicada, *C. septendecim*, Linn. It is called *pruinosa*, from the frost-like substance found about its body. It is an annual species, never very numerous, and is found even in the center of the city of Philadelphia.

Effect of Poisonous and Antiseptic Gases upon the Fermentation of Fruit.

BY LECHARTIER AND BELLAMY.

Fruits when excluded from access of air continue to live for a certain length of time, and the duration of this process depends upon the state of ripeness in which they were plucked. This life of the cell is manifest by a destruction of the sugar accompanied by the production of alcohol and carbonic acid. If the fruit be exposed to poisonous or antiseptic vapors, the vital power of the cells is totally destroyed, or at least greatly reduced. On the 6th of September, 1875, three experiments were tried with green apples (*pommes de locard*), which had not yet attained their natural size. In this young fruit the decomposing power of the cells is very considerable and takes place in a comparatively short time. An apple weighing 49 grammes was enclosed in a flask, and in 49 days produced more than 400 c. c. of gas. On the 25th of October this process ceased, and did not begin again within seven months, when the experiment ceased. In three other experiments, likewise begun on the 6th of September, three apples, plucked the same day, were suspended in separate flasks. On the bottom of the first flask were placed a few crystals of carbolic acid, in the second flask was placed a fragment of potassium cyanide, and in the third a piece of camphor. Under the influence of carbolic acid and hydrocyanic acid vapors, which were diffused through the atmosphere of the first two flasks, no trace of gas was developed for 83 days. Only a small quantity of gas was developed in the third flask. Hence the action of the camphor was less energetic than the other substances; it diminished the vitality of the cell without completely destroying them.

These experiments agree in their results with those of Gayon, who knew nothing of these investigations of Lechartier and Bellamy. Gayon made two series of experiments, one begun December 9, 1876, and the other March 15, 1877, for the purpose of studying the effect of certain vapors upon the intercellular fermentation of fruit. He employed for this purpose apples (*pommes Dieu*) which were suspended in vessels provided with gas delivery tubes. In the flasks were placed layers of chloroform, ether, and carbon disulphide. A comparative experiment was made in ordinary air without the addition of any volatile substance. The results agree with those in the above note completely. The evolution of gas began rapidly in ordinary air; in one case 303 c. c. of gas were generated in five weeks, and in a second case 376 c. c. were evolved in six weeks. With chloroform and ether, however, not a single bubble of gas was given off; the apples changed color both within and without. With carbon disulphide fermentation began; and in one experiment, 15 c. c. of gas was evolved in four days, with another experiment 25 c. c. in five days. Still the evolution of gas soon ceased and the color changed in a similar manner, as before mentioned.

Ether and chloroform seem to totally prevent fermentation in the same manner as carbolic acid and hydrocyanic acid, whereas carbon disulphide and camphor merely retard it.—[*Comptes Rendus*].

[We have recently published some facts in regard to the antiseptic action of carbon disulphide, and chloroform was pro-



THE WINE PALM.

posed several years ago as a good means of keeping milk sweet, and we could have expected that their action upon fruit would have been similar. We would suggest to our readers to repeat these simple experiments with other volatile substances, naphtha, the essential oils, chlorine, sulphurous acid, and the like.—Eps.]

Improved Carmine Ink for Draughtsmen.

The solubility of carmine lake in caustic aqua ammonia is attended with this disadvantage: that in consequence of the alkaline properties of ammonia, the cochineal pigment will in time form a basic compound, which, in contact with a steel pen, no longer produces the intense red but rather a blackish color. To avoid this evil, the *Polytech. Notizblatt* recommends to prepare the ink as follows: Triturate 1 gramme of pure carmine with 15 grammes of acetate of ammonia solution, and an equal quantity of distilled water, in a porcelain mortar, and allow the whole to stand for some time. In this way a portion of the alumina which is combined with the carmine dye is taken up by the acetic acid of the ammonia salt and separates as precipitate, while the pure pigment of the cochineal remains dissolved in the half saturated ammonia. It is now filtered and a few drops of pure white sugar syrup added to thicken it. In this way an excellent red drawing ink is obtained, which holds its color a long time. A solution of gum arabic cannot be employed to thicken this ink, as it still contains some acetic acid, which would coagulate the bassorine which is one of the natural constituents of gum arabic.

The Best Form of Electro-Magnet.

M. Du Moncel has recently conducted investigations in order to determine the relative diameters of the iron core, and of the magnetizing coil, for producing the best results. He has concluded, first by calculation and afterward by direct experiment, that the thickness of the coil should be precisely equal to the diameter of the core. This is a valuable point, and one which electro-magnet makers will doubtless at once turn to profit.

THE SPONTANEOUS MOVEMENTS OF THE HORNWORT.

For some time past the works of Dutrochet and Payer, resumed and continued by Duchatre, Sachs, and others, have familiarized botanists with the movements of torsion or flexion peculiar to certain vegetables. M. Rodier has recently called attention in *La Nature* (whence our engraving) to a new phenomena of the same class which he has observed in certain aquatic plants which live entirely submerged. His investigations have chiefly been carried on with relation to the hornwort (*Ceratophyllum demersum*) which, he states, at certain epochs, executes spontaneously regular movements having a well marked periodicity in their amplitude. The hornwort grows in slow streams or ponds and has sessile leaves cut into thrice-forked thread-like rather rigid divisions. The ordinary variety has a smooth marginless fruit beaked with a long persistent style, and with a short spine or tubercle at the base on each side. Its ordinary attitude is vertical, and at the upper part of the stem, where the leaves are slightly separated, the peculiar motion is manifested. These movements consist in a bending and regular return of the stem or branches combined with a more or less marked torsion. For six hours the stem bends more and more; then during the following twelve hours it returns to its former position, and continues bending over in the opposite direction for four hours, when it again returns, occupying a like period to regain its upright position. Thus a branch is vertical at 6 A.M.; at maximum inclination at noon; straightened again at midnight; inclined to maximum in opposite direction at 4 A.M.; returned vertical at 8 A.M., and so on. These oscillations, though generally occupying the same length of time, become less marked as the plant grows older, owing to its becoming more rigid, and ultimately they are confined to the end of the stem.

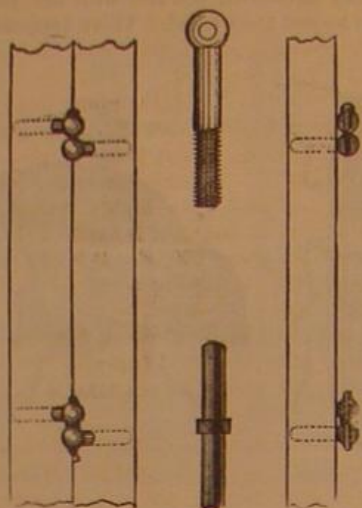
The torsional movement occurs sometimes in one direction, sometimes in another. Angles of 35° have been measured in nine, 120° in seven, and 450° in nine hours.

The annexed engraving exhibits the movements of a plant observed on March 30 and 31 last. The direction of motion is northeast and southwest. No explanation of the phenomenon is offered. It continues the same when (1) the light is suppressed, (2) when the plant is illuminated by means of a mirror from a direction opposite to that normally the case, (3) when the light is half shut off by a screen, and (4) when the light is transmitted through red glass.

BEAUTIFUL WHITE FINISH.—A beautiful finish may be given to parlors or extra work in houses, by mixing zinc white in white dammar varnish. This forms the china gloss of commerce.

BEAUDET'S IMPROVED HINGE.

The annexed illustration represents a new hinge which is claimed to possess superior advantages in point of cheapness and durability. It consists simply of two eye bolts, one screwed into the casing, the other into the door. The apertures in the bolt heads come in the same vertical line. Through the eyes a pin having a collar around its middle portion is inserted. The inventor states that the device



saves fully one half the workman's time in hanging doors, blinds, etc., in comparison with the hinge in common use.

For further information address the inventor, Mr. John Beaudet, 109 Tremont street, Cambridgeport, Mass.

ASTRONOMICAL NOTES.

OBSERVATORY OF VASSAR COLLEGE.

Position of Planets for October, 1877.

Mercury.

Mercury keeps very nearly the path of the sun. It may be seen in the early morning before sunrise, almost exactly in the east. The best time to look for it will be from the 8th to the 13th.

On October 1, Mercury rises at 5h. 16m. A.M., and sets at 5h. 12m. P.M. On October 31, Mercury rises at 5h. 52m. A.M., and sets at 4h. 36m. P.M. On October 7, Mercury rises a little before 5 A.M., and north of east.

Venus.

Venus will continue visible throughout the month after sunset, setting a little after 7 P.M., being the first of the four bright planets to disappear below the western horizon.

Mars.

Although Mars was in the best position for astronomical work in September, it will be quite as interesting to the or-

being the first, is Jupiter. On October 1, Jupiter sets at 9h. 31m. P.M., and on October 31 it sets before 8 P.M.

Although Jupiter's position is less and less suited to observation, it can still repay one for turning the telescope upon it, as the varied positions of its four moons are always interesting.

Saturn.

On October 1, Saturn rises at 4h. 54m. P.M., and sets the next day at 3h. 57m. A.M. On October 31, Saturn rises at 2h. 52m. P.M., and sets at 1h. 52m. A.M. of the next day.

Although Saturn appears small and unnoticeable when compared with the brilliancy of Mars, it is a much larger planet and a more interesting object. The ring which surrounds it is now very narrow in appearance, so that a small glass scarcely shows the opening, and it seems to be a bright band projecting each side of the spherical body.

Uranus.

Uranus is still very nearly in the same position with the bright star Regulus. It passes east of the star in October. It will be directly east of Regulus, on the 27th, when at the south, but as it comes to the meridian in the morning, it cannot be seen at that time by ordinary telescopes. It can, however, be found before sunrise very readily, by sweeping the small telescope around east of Regulus.

Neptune.

Neptune will be in the best position on October 29, but cannot be seen without a good glass.

A New Kind of Sugar in Walnut Leaves.

Tanret and Villiers have discovered in the leaves of the walnut tree a new sort of sugar nearly allied to the inosite. They have given it the name of nucite. Its chemical composition may be expressed in the new system by the following formula, $C_6H_{12}O_4 \cdot 2H_2O$. It has a sweet taste, crystallizes in inclined orthorhombic prisms, has a specific of 1.54, is easily soluble in water, alcohol, ether and chloroform. It does not turn the plane of polarized light nor reduce Fehling's copper solution. It is not fermentable, even after boiling with diluted sulphuric acid. When treated with nitric acid, it does not form either oxalic nor mucic acid.

Precipitation of Manganese with Hydrogen Peroxide.

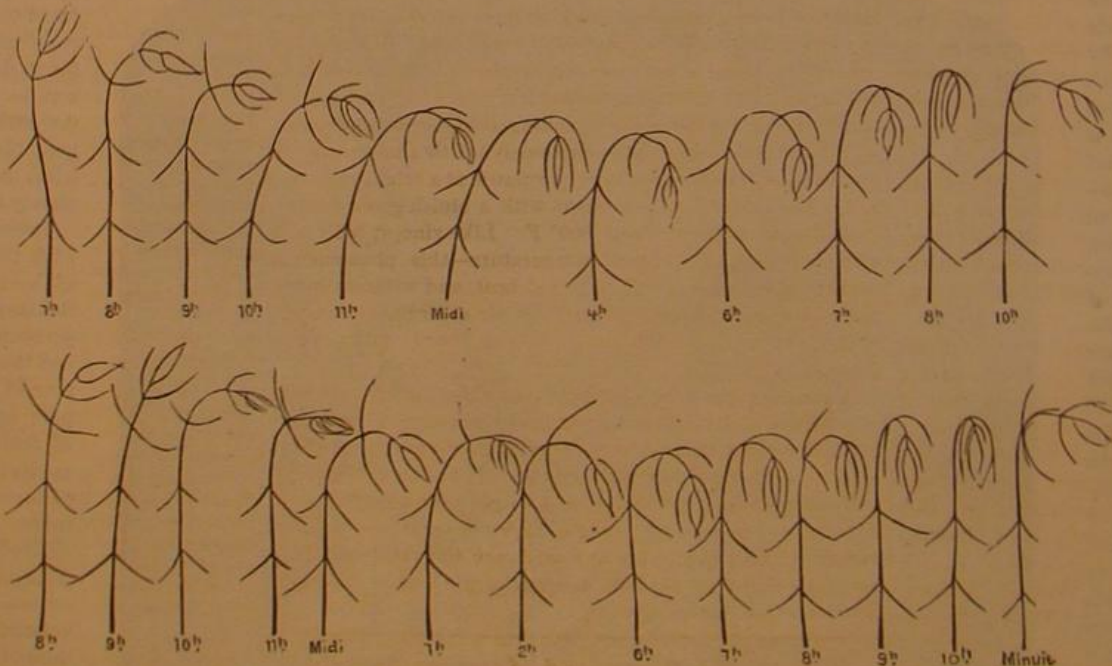
The determination of manganese is of such importance that many different methods have been devised for precipitating it from solution. The reagent mostly used at present for the purpose is bromine, although it possesses some disadvantages that we need not describe here.

Dr. G. Rosenthal has recently published this method of determining manganese with hydrogen peroxide. His process is as follows: After precipitating the iron with sodium acetate, the filtrate is evaporated to 150 c. c. For every 10 or 15 centigrams of manganese he adds 10 c. c. of a solution containing 10 per cent by volume of hydrogen peroxide and allows it to stand 30 to 60 minutes exposed to a gentle heat. It is then gradually neutralized with a few drops of dilute ammonia, when a black flaky precipitate of hydrated manganese peroxide is thrown down, while oxygen is liberated from the action of ammonia upon the excess of hydrogen peroxide. It is now gently heated and more ammonia added, when the gas evolution continues some time. It is easy to arrange it so that at the end of the operation the odor of ammonia is still barely perceptible. This is easily recognized from the tendency of the precipitate to separate from the liquid, very similar to precipitation of hydrated ferric oxide by ammonia. The liquid is decanted and precipitate washed with hot water, first by decantation then on a filter, until the chlorine reaction ceases. The precipitate should look black. A large excess of the peroxide should be avoided. Much chloride of ammonium is also injurious. Rosenthal has employed his process with success in the analysis of spiegeleisen, ferromanganese, slags and ores. He also directs attention to the non-necessity of double precipitation of the iron, if the solution be neutralized warm until it begins to be turbid, heat nearly to boiling, when no precipitate should fall, then add a measured volume of a hot 25 per cent solution of crystalline sodium acetate in the proportion of 10 parts to 1 part of iron, heat again to boiling, when the precipitate should settle nice and clear.—*Dingler's Journal*.

LIQUID SHOE POLISH.—The following is a German recipe: Dissolve 34 ozs. of shellac in half a pint of alcohol. Rub smooth 25 grains of lampblack with 6 drachms of cod-liver oil, and mix. A few drops are to be applied to the leather with a sponge.

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The longer linseed oil used for painting is kept the better, both in regard to its drying qualities and its transparency.



SPONTANEOUS MOVEMENTS OF THE HORNWORT.

dinary observer during October, the diminution in size being scarcely perceptible to the eye, and its position being more favorable for evening observation.

Mars rises south of east on October 1 at 4h. 49m. P.M., and comes to the meridian a few minutes after 10 P.M. At the time of southing it will have an altitude of about 36° (in this latitude). Saturn will be east of it, and above it by 41°.

An ordinary glass will show the disk of Mars of a ruddy hue, and the white spot at the upper part (as seen in the telescope), which is supposed to be the icy pole: that which has been turned away from the sun. With a good glass, dark spots are seen on Mars so well defined that they can be measured. The return of these spots as Mars revolves on its axis is watched in order to determine the time of revolution or the length of its day. The small satellites are not within the reach of ordinary telescopes.

On October 31, Mars rises at 2h. 47m. P.M., and comes to the meridian at 8h. 18m. P.M.

Jupiter.

The second bright planet which sets in the evening, Venus

Interesting Facts about Metals.

Platinum, the densest of the ordinary metals, possesses also one of the highest points of fusion. The metal fuses when exposed to the heat of the oxyhydrogen blowpipe. When in the state of very fine wire it may be melted into small globules by the heat of an ordinary mouth blowpipe, and is quite readily fused in very small quantities by the aid of a hot blast supplied to an ordinary Bunsen gas flame. Platinum belongs to the class of metals which soften before they attain perfect fluidity. This peculiarity gives it the valuable property of welding, or the uniting of surfaces without the use of solder, and enables the finely divided metal, technically termed the metallic sponge, to be wrought into a solid and compact bar. Platinum is not known to be volatile, though perhaps, at sufficiently high temperatures, it, in common with all substances, would be vaporized. Platinum does not combine directly with oxygen, and therefore would not be wasted during the process of melting.

Gold melts at about 2,016° to 2,190° F., according to different authorities. It is neither affected by water nor air at any temperature, and is not attacked by ordinary acids. It is the most malleable of all the metals, and may be beaten into sheets of surpassingly wonderful thinness. Its very great malleability renders it unfit for use for jewelry or for coinage until its hardness, and consequent durability, are increased by alloying it with silver or copper. Exposed to the heat of the oxyhydrogen blowpipe, it is known to be vaporized; and it was formerly supposed that it was not volatile at lower temperatures, but the researches of Napier and Makins show that volatilization occurs at temperatures of an ordinary muffle furnace when alloys of silver and gold are cupelled with lead. An analysis of deposits taken from the chimney of a small reverberatory furnace, in daily use for cupelling gold for months, showed 14 per cent of silver and 7.1 grains of gold for every 8 ounces of silver. Still, after the destruction of a lot of jewelry by a fire, a great proportion of the gold should be recoverable, since but a small quantity, if any, would be volatilized; and the metal is not at all affected by air or water, as before remarked.

Lead melts at about 630° F. Unlike gold, it combines readily with the oxygen of the air, forming various oxides—mainly litharge, a product of the direct oxidation of the metal. When melted and exposed to the atmosphere, it absorbs oxygen very rapidly; so that, unless caution be exercised in melting, it is apt to waste from the direct oxidation, and especially from the fact that, at a white heat, it boils and volatilizes. When in a very finely divided state, metallic lead combines so rapidly with oxygen that it takes fire while falling through the air, and burns with a red flash. This metal possesses the valuable property of welding in the cold, provided the surfaces joined are clean and free from oxide. Lead forms alloys with nearly all the metals. Many of its alloys are of great value. It alloys but imperfectly with copper, cobalt, nickel, and iron. The following are some of the more important alloys:

Alloys.—*Type metal*, an alloy consisting of 83 parts of lead and 17 parts of antimony, with sometimes a little zinc. This alloy, heated in the air, rapidly loses its antimony by oxidation—the antimony oxidizing at a lower temperature than the lead; the oxide resulting from the action always contains, however, according to Watt, a large percentage of the oxide of lead.

Stereotype plates sometimes contain $\frac{1}{4}$ part tin; music stereotype plates contain, tin 12 parts, lead 7 parts, and antimony 1 part. The general composition of ordinary stereotype plates is: lead 70 parts, antimony 15 parts, and bismuth 15 parts; this alloy expands on cooling, and is therefore applicable for casting stereotype plates.

Solders.—*Lead alloyed* with tin forms various solders: fine solder contains 2 parts of tin and 2 of lead; common solder, equal parts of tin and lead; coarse solder contains, lead 2 parts, tin 1 part; plumber's solder is the same as the last.

Peiser is composed of 80 parts lead and 20 parts tin, but to these copper, antimony, or zinc is generally added. Lead alloyed with tin and bismuth forms a variety of alloys that are remarkable for their extraordinarily low melting points.

Rose's fusible alloy, formed of 2 parts of bismuth, 1 of tin, and 1 of lead, melts at about 95° C., or 203° F., or less than the boiling point of water.

Britannia metal is an alloy of equal parts of brass, tin, antimony, and bismuth; or, better and safer, 100 parts of French pewter, 5 of antimony, and 5 of brass.

Bronze contains copper, tin, and lead.

Bell metal contains 5.6 parts of zinc, 10.1 parts of tin, 80 parts of copper, and 4.3 parts of lead. All of the foregoing alloys are more or less wasted or dissipated by the action of heat, owing to the ready oxidation or volatilization of the lead, or of some one or other of its constituents.

Silver melts at about 1873° F., or at about a bright red heat. Like gold, it is not attacked by air or moisture—the tarnish which appears on silverware being caused by gaseous compounds containing sulphur, which are frequently present in the air. A very extraordinary property is possessed by silver of absorbing a considerable number of times its oxygen when highly heated in that gas, or even in common air. This oxygen is not combined with the silver, but is given off at the moment of solidification of the metal—a circumstance which produces the peculiar arborescent appearance common to masses of the pure metal. The presence of a small percentage of copper prevents the absorption of oxygen. According to Lampadius and Depretz, silver gives off vapor at very high temperatures. The presence of

a small quantity of arsenical vapors greatly increases the ease with which it is volatilized.

Bismuth melts at about 518° F. It is but little oxidized by contact with air; if strongly heated, it burns with a bluish flame; at a high temperature it volatilizes freely. It is obtained from its ores by simply exposing them to heat.

Copper melts at about 2100° to 2300° F. It is very ductile, malleable, and tenacious; at very high temperatures it is slightly volatile; it is unaffected by dry air, but in the damp becomes coated with an adherent green crust. When exposed at a red heat to the air, it is rapidly oxidized, and becomes encrusted by a black scale. At a high temperature copper burns with a green flame.

Nickel is somewhat less fusible than pure iron; this would put its melting point at about 3000° F. Like iron, it is capable of becoming magnetic, but loses this property at temperatures above 660° F. Though combining readily with oxygen, it is not oxidized when highly heated, since heat drives off the oxygen as fast as it is fixed.

Cadmium melts at about 500° F. It is commonly associated with ores of zinc, and being a very volatile metal distills off when zinc ores are roasted.

Manganese has a high melting point, but fuses when exposed to the heat of a good wind furnace. It has a strong attraction for oxygen, and will even take it from water at low temperature.

Iron, intrinsically the most important of the metals, fuses at temperatures dependent on its purity. When containing carbon, or in the condition of cast iron, it melts at 2786° F., but when pure, or in the condition of wrought iron, a temperature of 3280° F. is necessary to melt it. Iron softens before melting, and possesses in a marked degree the property of welding. It has powerful affinities for oxygen, taking it from the air when moist—a circumstance which explains the fact that it is seldom found in a pure or metallic state, except in meteorites. Dry air at ordinary temperatures does not affect it, but when heated to redness it absorbs oxygen and becomes coated with a scale of black oxide. When in a finely divided state, the metal burns while falling through the air, and even in the condition of ordinary filings it burns with brilliant scintillations when thrown into a fire or the flame of an ordinary gaslight. Its high point of fusion renders it an admirable protection of woodwork against ignition from neighboring fires, though its rate of expansion, as shown in the table, somewhat vitiates its protective action in case of fires, from its tendency to warp from unequal expansion.

Tin melts at the temperature of 455° F. It is not acted on to any extent by air or water. When exposed to a temperature somewhat above its melting point, it absorbs oxygen greedily, and is converted into a whitish oxide, known technically as pasty powder.

Zinc melts at about 770° F. It undergoes a series of remarkable changes under the influence of heat. At ordinary temperatures it is comparatively brittle; between 250° and 300° F., it is quite malleable, and in this state may be readily rolled or beaten into sheets, which have the valuable property of retaining their malleability when cold. The brittleness of the metal at ordinary temperatures is doubtless to be attributed to its crystalline structure, which is probably effaced during the operation of rolling at higher temperatures. At 400° F. zinc becomes so extremely brittle that it may be readily powdered. Zinc is very volatile at a bright red heat, and in the presence of air burns with a bluish-green flame.

Antimony melts at about 800° F. Like zinc, it boils and volatilizes, but at a higher temperature—this phenomenon occurring with zinc at a bright red heat, and with antimony at a white heat. It is unaffected by air at ordinary temperatures, but will, if sufficiently heated, burn with a white flame.

Aluminum has a melting point intermediate between that of zinc and silver. It is a good conductor of electricity, being about eight times a better conductor than iron; is also a better conductor of heat than silver. It has an exceedingly low specific heat, and therefore does not take a long time to liquefy. It has been subjected to high temperatures in closed vessels without exhibiting any tendency to volatilize. It is not oxidized by the air even at a strong red heat.—*American Exchange and Review.*

Recent American and Foreign Patents.

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NEW AGRICULTURAL INVENTIONS.

IMPROVED THRASHING MACHINE.

James P. Gordon and John W. Gordon, Coal Valley, Ill.—This invention relates to an improved grain thrasher and separator, to which the sheaves are fed for thrashing and separating the grain, and by which the straw is carried off in quick and effective manner, the straw-stacker being supported in convenient manner on the separator; and the invention consists of a revolving cylinder with convex thrashing teeth, taking up and separating the grain from the straw, in connection with a fixed piece with concave teeth. Back of the thrashing-cylinder is a slowly revolving beater or regulator, and back of the regulator a more rapidly revolving "flipper," which conduct the straw and grain forward, and separate them from each other in connection with an endless carrier with intermittently

tilting and link-connected sections, having wire rake teeth and drop holes. The concave teeth present less resistance to the passage of the straw than the convex cylinder teeth which set on the heads or ears and thrash the grain out while the straw is passed through without being cut or broken into small pieces. There being no short pieces of straw, the grain is more easily cleaned, as the work of fans and riddles is facilitated. The convex cylinder teeth and fixed concave teeth are more durable than the ordinary teeth, as they do not stick on the straw, but pass through, exerting a sharper stroke and thrashing more rapidly than the common tapering teeth. By thinning the teeth of the concave and thickening those of the cylinder, the striking surface of the latter is increased, while the resisting surface of the former is diminished. The space being thus enlarged for the material to pass through the concave, a greater quantity of straw may be passed through in a given time. The concave may be so attached to the separator frame that it may be lowered or raised, and thereby the distance between the sides of the teeth enlarged or decreased. The main advantage of the convex and concave teeth is that they thrash out the grain and draw the straw through without cutting up the same.

IMPROVED RIDING CULTIVATOR.

Squire J. Hinkle, Saratoga, Ind.—The object of this invention is to furnish an improved riding cultivator, which shall be simple in construction and easily guided and controlled, and which shall be of light draft, and without any downward pressure upon the tongue. The whiffletrees are pivoted to pass a little above their lower ends. By this construction the tongue and doubletree are raised above the plants being cultivated, while the points of the draft attachment are lowered so to be about in line with the points of resistance. The rear end of the machine is supported on casters wheels. The inner ends of the braces, connecting the fore wheels with the hind ones, are attached to the middle part of the cross beam, and the inner ends of the braces are attached to a block. To the rear ends of the blocks are pivoted the forked forward ends of the plow beams, so that the said plow beams may have a free vertical play. This construction allows the rear ends of the plow beams to be moved freely in any direction. The rear parts of the plow beams are forked, have their rear ends curved downward, and their inner arms the shorter, to bring the plows to the proper distance apart.

IMPROVED CORN-STALK CUTTER.

Benjamin C. Clevenger, Chanute, Kan.—This invention relates to an improvement in the class of corn stalk cutters in which blades are caused to project intermittently through a slot in a revolving drum. The invention consists in the construction of the drum, the distinguishing feature being the arrangement of the bars which form the guides for the blades, whereby the circular beads of the drum are rigidly connected and braced, and suitable slots or openings are formed, through which the blades may work in and out. The arrangement referred to consists in placing the outer edges of the bars close together, and their inner edges several inches apart, thereby securing the circular drum beads rigidly together, and forming a narrow slit or opening—sufficiently wide for the blades to work through, yet allowing space behind said openings for the vibratory movement of the blades. The knives are bolted or otherwise detachably attached to the outer ends of pairs of arms, the inner ends of which are pivoted to the axle. The axle is bent twice at right angles at the inner sides of the wheels, so as to form a long crank, and its ends are attached to the frame in such a way that the crank of the said axle may project downward, so that as the machine is drawn forward, the knives may project as they approach the ground, so as to cut the corn stalks into pieces as they lie upon the ground.

IMPROVED CULTIVATOR.

Jacob Summers and Joseph Trimble, Muncie, Ind.—The object of this invention is to furnish an improved cultivator, which shall be so constructed that it may be readily adjusted for use as a two horse or a one horse cultivator, and that when used as a one horse cultivator it may straddle a row of plants while the horse walks upon one side of said row. The invention consists in the combination of the bar, the two bolts, and the eye with the forward ends of the two beams, and in the arch formed of the two adjustable bent bars and the connecting bar or link, in combination with the forward parts of the two pairs of beams, as hereinafter fully described. The two parts of the cultivator are exactly alike, except that the position of the beam is reversed. The beams, at a little distance from the outer ends, are curved outwardly, and then extend to the rearward in lines parallel with their forward part. The bend of the inner beam is such as to bring its rear part in line with the forward part of the outer beam; and the bend of the outer beam is such as to bring the plows to a proper distance apart. When the machine is to be used as a two horse cultivator, one of the handles is detached and the beams are connected by a bar or bolt. When the machine is to be used as a one horse cultivator, the forward ends of the two beams are connected. The lower parts of the beams are horizontal, and have several holes formed through them to receive the bolts, by which they are secured to the said pairs of beams, so that, by adjusting the bars, the plow beams may be adjusted farther apart or closer together, as may be desired. This construction leaves the pair of plow beams free to move to adjust themselves to uneven ground, and allows them to be readily moved in guiding them in cultivating crooked rows, and avoiding irregular hills.

IMPROVED BEE HIVE.

Duncan L. Murff and David Kyle, West Station, Miss.—The object of this invention is to furnish bee hives which shall be so constructed that the surplus honey can be readily removed, that will prevent the moth from entering, and that shall be simple in construction and convenient in use. The invention consists in the bee hive formed by the combination of the vertical end boards, the horizontal board, the inclined rear and front boards of the brood chamber, and the front board and the hinged cover of the honey case chamber with each other; in the triangular honey cases, in combination with the triangular chamber formed above the triangular brood chamber.

IMPROVED CULTIVATOR.

John C. B. Thomas, Palmyra, Mo.—The object of this invention is to furnish an improved cultivator, which shall be so constructed that it may be readily adjusted to cultivate tall plants without injuring them, which will allow one horse to advance a little before the other without turning the plows out of line, and will enable the cultivator to work to the end of a row and close to a fence. The invention consists in the adjustable frame work formed by the combination of the axles, bent upward at right angles, the three armed couplings, the cross rod, and the set screw, with each other, and in the cross slots formed in the inner arms of the three armed couplings, to receive the set screws that secure the ends of the cross bar in said arms, to give a play to the frame.

IMPROVED FENCE.

Josiah V. Richardson, Tuckerman, Ark., assignor to himself and R. E. Richardson, of same place.—The invention relates to the construction of the fence panels, and the application of a clamp for securing them together, whereby they are made to form a line of continuous self-supporting fences. The posts are placed on opposite sides of the boards forming the panels, near their ends, and a short horizontal piece is attached to the lower end of the posts. The overlapping ends of the panels are fastened together by a notched piece, which clamps the sections securely. The ends of the boards forming the corner panels are notched, so that the boards interlock when connected together to form a corner.

IMPROVED PLOW SULKY.

Samuel Penneck, Ithaca, N. Y.—The object of this invention is to provide a plow sulky in which the wheels may be adjusted independently and easily, and in which the plow beam may be moved laterally and vertically. The plow beam is clamped to the arm by bolts, and a plate. The wheels

are adjusted to the proper height by rotating a worm wheel by means of a worm. The center of gravity of the machine may also be moved, so that more or less of the weight of the plow, the frame, and the driver, may be thrown on the tongue.

IMPROVED TOBACCO STRIPPING AND DRYING MACHINE.

William Davies, Henderson, Ky.—This invention relates to improved application for extracting or separating the stems from leaf tobacco, and for rolling out or flattening and drying the leaves at the same time, so as to be readily booked for market. The invention consists of hollow heated and revolving rolls, of which one has an annular groove and circumferential cutting knives at both sides thereof, said knives registering with corresponding circumferential recesses of the other roll. The manner of operation is as follows: The operator places one end of the leaf between the rolls, with the stem pointing either end into the space between the rolls, the leaf being then caught and drawn through between the rolls. As the leaf passes into the rolls it is stretched out to its natural limits either by the hands of the operator or by rollers with diagonal grooves or otherwise. The heat of the rollers dries the leaf at the same time, and dispenses, thereby, with the separate drying operation.

IMPROVED CORN PLANTER AND FERTILIZER DISTRIBUTOR.

Frederick U. Stokes, Urbana, O.—The object of this invention is to furnish an improved machine which shall be so constructed as to open furrows to receive the seed, drop the seed, and cover it, and then drop a fertilizer upon the hills, to mark the hills, and at the same time promote the growth of the plants, and which shall be simple in construction and automatic in action. The plows for opening a furrow to receive the seed have the upper ends of their shanks pivoted to supports attached to the frame in such a way that the said plows may be swung forward to raise them from the ground. The seed hoppers are attached to the frame and have discharge holes formed in their bottom, through which the seed passes into spouts and is deposited in the bottom of the furrow in the rear of the plows. The dropping slides work upon the bottom of the hoppers, through holes in the sides of said hoppers. The slides are provided with holes to receive the seed from the hoppers and convey it to the discharge holes in the bottom of said hoppers. The slides are prevented from carrying out any more seeds than enough to fill their holes by the cut-offs attached to the hoppers directly over their discharge holes, and beneath which the slides pass. The operating mechanism of the machine is so arranged that the fertilizer dropped from the rear hoppers may fall exactly upon the hills planted from the forward hoppers, so that by using plaster or other light-colored fertilizer the hills will be plainly marked, rendering any other marking of the land unnecessary, while enabling the field to be planted in accurate check row.

IMPROVED FERTILIZER.

Charles F. Pankin, Charleston, S. C.—This invention relates to a compound consisting of a mixture of finely powdered bone or mineral phosphates and finely powdered sulphur, the said ingredients being mixed together and applied in a dry state; and the conversion of the insoluble phosphate of lime into soluble phosphate of lime is effected by the sulphuric acid eliminated by the natural oxidation of the sulphur of the mixture in the soil to which it is applied. To prepare the fertilizing compound, take 95 parts of insoluble phosphates, in a finely powdered state, and mix with it 5 parts of finely powdered sulphur. This mixture when applied to the soil becomes slowly transformed, the sulphur being first converted into sulphuric acid by a natural process of oxidation, and uniting with the insoluble phosphates to form a soluble phosphate, which is dissolved by the moisture of the soil, and acts in the same manner as phosphates made by artificial processes. The advantage of this method of manufacturing soluble phosphate are: First, the mixture contains no sulphate of lime and no water of combination, requires no expensive machinery to make the mixture, and therefore the cost is less as compared with superphosphates prepared with sulphuric acid. Second, as the ingredients are mixed together in a dry state, with sulphur in so small a proportion, the percentage of phosphate of lime in the compound is greater as compared with that in the superphosphates prepared in the usual way.

IMPROVED PEANUT THRASHER.

John Lee Underwood, Smithfield, Va.—The object of this invention is to provide for peanut growers an improved machine by which the peanuts may be picked off the vines without tearing the vines to pieces, so that the latter may be used in more advantageous manner for feeding purposes. The peanuts and vines are at the same time cleared of any adhering dirt, which is separated with the lighter peanuts by the machine from the heavier ones. The peanut vines are fed along the top of a horizontal wire frame to the action of a ribbed roller, and are drawn through between roller and frame, so as to be exposed to the clearing action of the rapidly revolving reel without tearing the vines to pieces. A reel armed with wires comes against the wires of the frame in the rotation of the reel, and taking hold of the peanuts and removing them from the vines, while they are prevented from being drawn down or torn by the retaining action of the longitudinal wire frame and ribbed roller. The peas are dropped from the reel on to a hopper and discharged through the mouth of the same on a horizontal and laterally reciprocating finger bar, on which the peanuts are exposed to the blast of a fan. The lighter peanuts, small pieces of vine, dirt, and other impurities are separated by the fan blast from the heavier peanuts, which are dropped on an inclined plane and discharged into a receiving receptacle below the machine, thus picking the peanuts without tearing the vines, and without crushing the peas, in a rapid, thorough, and economical manner.

IMPROVED MOWER.

Carl Lindbom, Stockholm, Sweden.—This invention consists in simple and effective devices for actuating the cutter bar of a mower or reaper. The sections are provided at the inner circumference with undulating faces having alternating projections and depressions, which run parallel to each other, so that the projections of one section enter the depressions of the other, and form thereby an undulating groove in which the crank pin of a shaft projects. The construction of the wave wheel admits, by the interposition of intermediate disks of varying thicknesses, the adjustment of the distance of the outer disk sections, which forms a considerable advantage when the same are worn off by long use. When it is desired to throw the cutter bar out of action, the lever is locked by a pivot catch, which throws the crank pin out of gear with the groove of the wave wheel, and discontinues the action of the same on the crank shaft and cutter bar. The reciprocating motion is thus imparted to the cutter bars of mowers and reapers by a simple, durable, and easily repaired and adjusted mechanism.

IMPROVED GRAIN AND GRASS SEED HARVESTER.

John W. Walton, Germantown, Ky.—The object of the invention is to effect an improvement in the class of machines designed and adapted for stripping the ripe seed from the standing stalks of grass or grain, and by this mode of harvesting the same enabling the farmer to avoid the labor and expense incurred in the operation of cutting the grass or grain stalks, and consequently thrashing out the seed. The invention consists in so attaching the seed box or receptacle to the wheeled frame, and in connecting such mechanism therewith as will enable it to be adjusted vertically, corresponding to the height of the standing grass or grain, without throwing it out of an approximately horizontal position.

IMPROVED REVERSIBLE PLOW HOOK.

John A. Yarn, Belvidere, N. C.—The object of this invention is to furnish an improved plow hook to take the place of the ordinary plow hook which shall be simple in construction, easily adjusted to cause the plow to run deeper or shallower in the ground, strong and durable, and which, when one of the hooks becomes worn, may be reversed and the other hook used. The invention consists in a double or reversible draft hook. If it

is desired to have the plow work still deeper in the ground, the lower hook may be turned back, and the upper hook turned forward. With this construction, when one of the hooks becomes worn, the device may be reversed and the other hook used, so that the device will last twice as long as an ordinary draft hook or clevis.

IMPROVED IRON FENCE.

Samuel H. Dickey and John D. Davis, Oxford, Pa.—The improvement consists in the arrangement of sets of parallel horizontal bars in connection with the pickets, and means for fastening the same, the said pickets being connected at the point of crossing by means of a bolt, clamp, and spring armament. The improvement also consists in the construction and arrangement of the line posts and braces, and of a clamp for connecting and holding the rails at their junction.

IMPROVED SEED PLANTER.

Emanuel Gerber, La Fayette, Ga.—The object of this invention is to furnish an improved machine for planting corn and other seed, which shall be so constructed that it may be readily arranged to plant the seed at any desired depth, at any desired distance apart, and any desired number of kernels in a hill, and which shall be simple in construction and convenient in use. The lower edges of the forward part of the hopper that are over the dropping wheel are notched, to prevent the kernels from being broken while being carried out by said dropping wheel or plate, and the spaces thus formed are covered by leather or other suitable material, to prevent any more seed from being carried out by said plate than enough to fill its dropping holes. The number of kernels dropped for a hill may be regulated by adjusting the hopper so that its forward end may project to a greater or less distance over the dropping wheel. When the hopper is drawn back, so that its discharge hole projects over only a part of the dropping holes, the dropping holes will receive a less number of kernels.

IMPROVED PLOW STOCK AND SWEEP.

John S. Bowling and Robert Bowling, Alexandria, Ala.—The object of this invention is to furnish an improved plow, which shall be so constructed that the point and sweep can be adjusted to work at any desired angle, and which shall be simple in construction and convenient in use. The invention consists in the combination of the adjustable steel spring with the adjustable slotted foot, and with the bolt that secures the plow plate to said foot; and in the combination of the sweep, the hinged bar, and the adjusting bolt, with the adjustable slotted foot, and with a bolt that passes through said foot, which is slotted longitudinally from its rear end nearly to its forward end. The lower end of the beam is inserted in the slot of the foot a little in front of its center, and is pivoted to it by a pin or bolt. The plow plate is placed upon and is secured to the forward end of the foot by a bolt. To the rear end of the foot is pivoted the lower end of a bar, which passes up at the rear side of the beam, and its upper end passes between the arms of a U bar, and is secured to said arms by a bolt. Several holes are formed in the bar to receive a bolt, so that, by adjusting the said bar, the foot may be adjusted to hold the plow plate at any desired pitch. The U bar passes around the beam and is secured to it by a bolt or rivet. The sweep, which is made V-shaped, and is secured at its angle to the forward part of the bar, which is hinged to a plate placed upon the lower end of the bolt, and is secured in place by the nut of said bolt. The rear end of the bar has a hole formed through it, to receive a bolt, which passes up through the slot of the foot. Several washers or blocks are placed upon the bolt, so that the pitch of the sweep may be adjusted by placing the blocks upon the bolt above or below the foot, or some above and some below.

IMPROVED FRUIT PICKER.

H. Clement Berber, Price, Mo.—The object of this invention is to furnish an improved device for picking fruit from trees where they cannot be reached by hand, which will enable the fruit to be picked and lowered to the ground without being injured, and which shall be simple in construction and convenient in use. The invention consists in an improved fruit picker formed of the pivoted cup having teeth formed upon its edge, the forked socket shank having teeth formed upon the ends of its forks, the cord, and the pulley, as hereinafter fully described. In using the device it is passed up beneath the fruit to be picked, in such a position that the said fruit may enter the said cup, and a slight twist will generally cause it to fall into the cup. In case the stem adheres firmly to the branch the picker is adjusted to bring the stem between the teeth of the forks of the shank, and a slight pull upon the cord will cause it to be cut by and between the teeth.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED PLATFORM WAGON.

Nathaniel B. Wood and Elliot R. Fitch, Hubbardville, N. Y.—The object of this invention is to furnish platform wagons which shall be so constructed that the pole irons may be attached directly to the axle, in which the forward and rear axles shall be connected by a reach, and in which the springs will not bind, and shall be less liable to break than with the usual construction. With this construction the irons of the pole can be attached directly to the forward axle. This construction also enables the rear part of the pole to be made with an upward bend, which has heretofore been impracticable with platform wagons. Upon the side edges of each outer leaf of the springs are formed lugs, which project past the side edges of the inner leaves, and thus keep the said leaves in proper position. This construction avoids the necessity of making slots in the leaves, and thus weakening them.

IMPROVED VEHICLE BRAKE LOCK.

John Hahn, Spades, Ind.—This invention relates to an improved brake operating and locking device, which may be applied to any vehicle or railroad car; and it consists of a revolving screw shaft with hand crank, operating a traversing nut and slide frame, and thereby the lever connections. By turning the crank in one direction the nut is drawn up and the brake applied. By turning in opposite direction the nut is moved down and the brake released. The device is easily operated, and has the advantage of applying the brake in uniform and more or less powerful manner, and locking the same thereon as long as required, forming thus a reliable brake-operating device for vehicles.

IMPROVED TRUSSED WAGON AXLE.

Charles E. Cookerly, South Pueblo, Col., assignor to William Farnsworth, of same place.—The object of this invention is to furnish wagons which shall be so constructed that the axles will not be liable to break when the wagons are heavily loaded and drawn over rough and uneven roads. The invention consists in the combination of the skein bridges and the truss rod with the skeins and the axle; and in the combination of the jointed guard rods and the brace frame with the axle nuts, the axle, and the hounds. The truss rod passes over bridges upon the lower side of the axle, enters the lower parts of the inner ends of the skeins, passes along the upper sides of the skein bridges, passes out through the outer ends of the skeins and has nuts screwed upon its ends. The rod thus forms a truss from the top of the skein bridge to the axle bridge, and from the top of the skein bridge to the outer end of the skein, so that the axle cannot break without drawing the rod apart longitudinally. Tension rods are placed to keep the skeins in place, which serve to strengthen the axles, and prevent them from breaking at the inner ends of the skeins.

IMPROVED WAGON BRAKE SHOE.

Independence E. S. Alexander, Henry, Tenn.—This invention consists of a clutch to be used in the place of a brake shoe, that is composed of two notched or shouldered levers and a frame or base piece having ears, between which the said levers are pivoted. The object of the invention

is to provide a brake shoe that may be applied with little pressure, and that will not wear the face of the tire. When it is desired to retard or stop the wheel, pressure is applied to the brake bar in the usual way, when the free ends of the levers, being forced back by contact with the face of the tire, clamp the edges of the tire between the shoulders.

IMPROVED WAGON TIRE TIGHTENER.

William G. McCreight, Atlanta, Miss.—The object of this invention is to furnish an improved attachment for the rim of wagon wheels, to enable the tire to be easily and quickly tightened without being removed from the wheels, and which shall be simple in construction, convenient in use, and effective in operation. It consists in the combination of the draw screw and the brace screw with flanges formed upon the ends of an open tire, so that by screwing in the draw screw and then screwing in the brace screw the draw screw will draw the ends of the tire toward each other and tighten it upon the felloes.

IMPROVED SPRING SEAT AND REACH FOR VEHICLES.

Adonijah J. White, Castile, N. Y.—This invention relates to an improved spring seat and reach for wagons which combines lightness and elasticity with a simple and cheap construction; and the invention consists of a centrally hinged reach in connection with a cross brace supported by rods from the upper section of an elliptic spring, which is centrally attached to a second elliptic spring arranged convexly to the former, and suspended from the bottom of the seat by means of rods or loops. The seat rests by tenoned arms in mortises of the reach sections, in front and rear of the hinge connection of the same. The suspended springs, in connection with the flexible reach and cross brace, impart to the seat the required elasticity, so that it does not raise or throw the rider on rough roads, but cushions the weight of the same in agreeable manner. A pin on the rim of the fifth wheel prevents the wheels from striking the side of the wagon when turning. The wagon can, by the combined spring seat and jointed reach, be made light, cheap, and durable, so as to exert less strain on the horse, and furnish an easy-going and comfortable wagon.

IMPROVED SLEIGH RUNNER FOR WHEELED VEHICLES.

Mitchell C. Wright, Chatham, O.—The object of this invention is to provide runners that may be readily applied to the bodies of wheeled vehicles to render them serviceable in winter. A thimble is fitted to the axle that takes the place of the axle box in the wheel. Upon the upper side of the thimble a step is formed, and upon its lower side a lug is made, to which braces are bolted. The braces are fastened to the knees of the runner, and the braces are bolted to the rave. The runner is supported by these braces at such a distance from the outer end of the axle as to run in the ordinary sleigh track, and several holes are made in the lug on the under side of the thimble to receive the bolt that retains the several braces, so that the runner may be adjusted. An arm is formed on each part of the support for limiting its motion. The thimble is retained on the axle by the same nut that retains the wheels. The runners are oppositely arranged for opposite sides of the vehicle. The front runners only need be provided with posts. The runner is readily applied to or detached from the axle, and when applied converts the vehicle into a complete sleigh. The runners are capable of independent motion, and the peculiar method of attaching the thimble permits them to move freely.

NEW HOUSEHOLD INVENTIONS.

IMPROVED IRONING BOARD.

Francis H. Young and John S. Sheldon, Stanhope, N. J., assignors to said Sheldon.—The invention relates to an improved ironing board, on which shirts and other articles may be ironed with great facility, the board being readily stored away after use, and taking up but a small space. The invention consists of an ironing board whose front end is recessed to form a larger board for the bosoms and a smaller board for the sleeves, the front part being supported by a hinged adjustable leg and locking brace that fold to the board after use. The covering is secured to the board by means of a fastening wire that extends around the board, being laid into a circumferential groove in the edge of the board and fastened thereto at the ends. In this manner tags may be dispensed with, and the board readily covered again when the old cover is worn out. The front part of board is extended forward and made of ring shape, for the purpose of being used as a rest or support for the flat iron when both hands are temporarily required for arranging the clothes on the board. When the brace is released from the upper leg section the leg may be readily swung up to the board, and thus the entire board stored away in folded state, taking up but a small space, and being instantly put up again for use with convenience and ease.

IMPROVED CHURN.

Charles P. Greene, Providence, R. I.—The object of this invention is to furnish an improved churning apparatus which shall be so constructed as to bring the butter in a very short time, and develop all the butter there may be in the milk, and which shall be simple in construction, convenient in use, and easily operated. The invention consists in an improved churning apparatus, formed of the case made in two parts, and provided with the partitions concealed upon their upper sides, the churn body made in two parts, and provided with the hopper and the lid, the three bevel gear wheels, the crank, and the two dashers.

IMPROVED CHURN.

Van Ranselaar Wilcox and Aurelius Benedict, Perry, and George Benedict, Cleveland, O.—This invention relates to an improved churn dash, that works in quick and easy manner, for churning butter; and it consists of a tubular churn dash with enlarged conical lower part and top valve for admission of air. The dash slides in the wood-lined cream saver, and rests on a supporting spiral spring placed between the cream saver and a fixed flange or collar of the dash. The cream saver is supported in a socket that is attached by its slotted base to the churn lid. The upper end of the dash is provided with a wooden top or cap having a valve for the admission of air on lifting the dash, so as to accelerate the downward motion of the cream. When desired, a whistle device may be connected by a chain to the cap, and inserted on removing the cap, so as to serve as a signaling device or dinner horn. The churn dash breaks up the cream in rapid manner by the assistance of the pressure of atmospheric air, while the motion of the dash is made easy by the cushioning spring, so that the churn is worked in rapid, easy, and effective manner.

IMPROVED FOLDING BEDSTEAD.

William W. Rogers, Indianapolis, Ind.—The object of this invention is to provide a bedstead that may be easily and quickly folded together, so that it will occupy but little space, and that may be as readily unfolded and put into condition for use. To the legs of the bedstead, bars are jointed, which are also jointed at their lower and inner ends to a spider, and above the center of this spider an internally threaded sleeve is supported by braces that are attached to both it and the spider. These braces are also jointed to another spider which is placed centrally over the sleeve. Braces are also jointed to the spider and are provided at their outer ends with the forks which embrace the bars. A screw passes through the spider into the sleeve and is capable of drawing the spiders together when screwed into the said sleeve. A bed bottom, consisting of a netting of cords having a rope border, is provided with a number of hooks having oblong loops which are secured to the bottom by a strap of webbing, which passes around the rope border of the bottom, and through the oblong loops of hooks, and one or both of its ends are fastened by buckles. The manner of folding the bedstead is as follows: The screw is loosened, and the bottom removed, when the hooks are taken from their loops, and the screw removed from the sleeve, when the spider is raised up, drawing the braces with it. The legs and other parts may now be folded closely together. Although this improvement is described as applied to bedsteads,

it is obvious that other articles of furniture, such as sofas, tables, etc., may be constructed on the same plan.

IMPROVED FAN ATTACHMENT FOR ROCKING CHAIRS.

John F. Rakes, Greenup, Ky., assignor to himself and William Bryson, of same place.—The object of this invention is to provide a fanning device for attachment to rocking chairs or cradles, to be operated by the motion of the same. A short piece of tube is secured to the bottom of each rocker. In this tube is inserted the lever end of the fanning device which is retained to the arms of the chair by pivoted rods. In the bottom of the tube attached to the rocker projects a short distance, the end of the tube forming a barrel for receiving a spiral spring. A rod runs through the tube and is secured at its lower end to a cap that shuts over the tube and incloses the lower portion of the spring. The upper end of the tube is squared to receive the squared end of the rod, which is curved, and to it is hinged a socket for receiving the fan. The upper end of the tube is supported by an arm which is pivoted to the under side of the arm of the chair, and embraces the said tube loosely, so that it may slide and turn in the arm as it swings on its pivot. One of the attachments may be used, or two may be employed, as may be desired. When the attachment is not in use the fan is folded down parallel with the tube, and the arm is turned on its pivot, bringing the said tube parallel with the back of the chair. By swinging the arm out at right angles to the arm of the chair, the apparatus is brought into position for operation. When the rocker of the chair is moved so as to raise its center from the floor, the spring throws the rod downward, drawing the short arm of the socket downward, and throwing up the fan. When the center of the rocker touches the floor the fan is thrown down by the movement of the rod. It will be seen that the chair, in rocking in either direction, produces a full stroke of the fan in both directions.

IMPROVED MILK STRAINER.

Henry T. Jones, Catskill, N. Y.—The object of this invention is to furnish an improved strainer for milk pails and other uses, which shall be so constructed that it may be easily and thoroughly cleaned, which shall be strong and compact, will furnish no passage for any dirt, and may be easily renewed as required. The invention consists in the combination of the double cam ring and the lugs with the gauze, the flange, and the plate, to which they are applied. With this construction, by turning the cam ring back to bring its lowest parts beneath the lugs, the said ring cam may be readily detached, allowing the gauze to be taken out and the gauze and spout to be easily and thoroughly washed and cleaned.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED HEMMER FOR SEWING MACHINES.

John P. Ioor, Indianapolis, Ind.—The object of this invention is to provide a hemmer for turning hems of different widths, that may be attached to sewing machines of various descriptions. A plate having a slot for receiving the thumb screw binds it to the sewing machine, and having an offset portion, the end of which is rolled under, forming a guide for the inner edge of the hem. The said guide is tapering, being largest at the end that receives the cloth; and upon the edge of the metal forming the same an ear is formed, which is bent upward so that it extends across the opening of the guide parallel with the plane of the plate. A bar is attached to the guide and extends through a slot in the plate, and to it a slotted bar is attached, which is offset, so that it may extend over the guide. A rib is formed on the plate for guiding the slotted bar, and a binding screw is provided for clamping it in any desired position. The hemmer is adjusted to the sewing machine so that the smaller end of the guide is in front of the needle. The cloth to be hemmed is placed between plates and around the ear. The width of the hem is regulated by adjusting the slotted bar.

IMPROVED CIRCULAR SAWING MACHINE.

John M. Shaw, Shaw's Mills, Ga.—The object of this invention is to provide a simple, inexpensive machine for sawing pickets, laths, staves, shingles, and for general work. Shingles may be sawed with this machine by bolting the timber and afterward setting the adjustable gauge one half inch from the front edge of the saw and about one eighth inch from a line drawn across the face of the saw at a distance of twenty-one inches, or a little more than the length of a shingle from the front edge of the saw. A stop block is fastened to the track for limiting the motion of the table. The bolt is placed upon the table and against the gauge, and is moved forward against the saw. As soon as the bolt is pushed forward it leaves the gauge, so that there is no friction between the gauge and the bolt. The bolt must be reversed end for end after having made three shingles.

IMPROVED BALANCE RYND.

John Smith and Jabez Snashall, Buffalo, N. Y.—The object of this invention is to furnish an improved balance rynd for millstones, by which the upper stone or runner is so poised on the rynd that it adjusts itself at all times to any unevenness in the bed stone, and insures thereby greater uniformity in grinding. The invention consists in a balance rynd having pivots at the lower and diametrically opposite ends, in combination with boxes set into the upper stone or runner, for balancing the same thereon. The support of the runner leaves the stone free to find its own balance, and takes the place of the fixed connection of the rynd with the runner. The boxes fit the pivot ends of the rynd, and allow the latter to oscillate without throwing the stone out of balance.

IMPROVED STEAM BOILER.

Henry S. Coleman, Chelmsford, Eng.—This invention relates to what is known as double boilers, the object being to lessen the consumption of fuel by maintaining such a circulation of water as will effectually prevent the formation of deposit on the bottom of the lower barrel of the boiler, and reduce the incrustation generally. In the present invention, instead of having in each connecting tube a circulation tube of smaller section than the connecting tubes, as previously made, there is a circulation tube in every alternate connecting tube only. In this case the circulation tubes fit in and form a continuation of the connecting tubes, and the water passes down the circulation tubes and rises through the intermediate connecting tubes. These tubes are so supported as to be readily moved out of the way when cleaning the boiler.

IMPROVED CAR AXLE BOX.

Richard B. Eason, New York city, assignor to himself and Silas A. Allen, of same place.—In this invention the box is simplified, the oil chamber is quickly filled and placed in position, and the oil fed to the packing and journal in proportion to the motion of the axle. The invention consists of a car axle box with lower extension chamber, and of a hinged or detachable oil chamber, with semi-circular or other shaped part fitting into the chamber of the box, and having an exit-opening and a valve for closing the opening when the oil chamber is inserted, but opening the valve when the oil chamber is in position, by the contact of the valve stem with the bottom of the extension. The oil chamber is seated tightly in the axle box or lower casing of the same.

IMPROVED DREDGING BUCKET.

John McKeever, Jersey City, N. J.—This invention relates to improvements in dredging buckets, by which they may be worked with great facility in opening and closing; and it consists of bucket sections swinging by fixed lateral pivots in triangular side frames, which support at their apexes the operating shaft. When the operating shaft is turned to open the bucket, the center chains are wound up and the side chains are unwound, while by closing the bucket the center chains are unwound and the side chains wound up, so as to change in this manner the bucket and raise and discharge the same, being then lowered and closed for taking up

the next charge of mud, and so on, forming a dredging bucket of effective and quick construction.

IMPROVED SEWER TRAP AND FLUSHING GATE.

John Peter Schmitz, San Francisco, Cal.—This invention includes two devices—one a hollow float-valve which is hinged at the mouth of the sewer, and the other an extensible detachable gate placed athwart the cesspool or trap. The float-valve is closed except when the accumulation of water in the trap is sufficient to raise it. It may also be held closed by a rod or staff, when it is desired to allow water to accumulate in the cesspool, for the purpose of flushing the sewer. The gate or partition is perforated, formed in two parts which are connected by bolts passing through slots. The gate has laterally projecting fingers which take into the wall of the cesspool and hold the gate in place. The gate may be removed, or adjusted to a different position, by loosening the bolts and sliding one part on the other, so as to withdraw the pins from the wall.

IMPROVED SAWING MACHINE.

John J. Reinhart and William Houghton, Logansport, Ind.—For constructing a cheap, portable, and easily running sawing machine it is necessary to use a vertically reciprocating saw, do away with the long pitman, and dispense with the crossheads and slides, and provide, in addition thereto, some appliance by which the saw is caused to recede from the kerf after making the stroke, so as to pass up clear, and is brought forward again at the top of the stroke to descend perpendicularly. The invention is intended to meet these requirements, and consists of a vertically reciprocating saw, operated by a forked pitman and vibrating arm at upper end, pivoted to an adjustable muley head. By changing the relative bearings of pitman and lower vibrating arm, any desired motion of the saw can be obtained. By the receding of the saw when ascending, a saw with curved or hooked cutting teeth may be used, of which each tooth operates in the nature of a chisel, cutting at right angles to the grain, so as to require less power than any other.

IMPROVED TOOL-CARRYING TRUCK FOR USE IN BORING OIL WELLS.

Henry T. Blackwell, Edenberg (Knox P. O.) Pa.—The object of this invention is to furnish an improved machine for carrying the bits for boring oil wells from the tempering tub to the auger, and holding them while being screwed into the auger stem, which shall be simple in construction and convenient in use. The invention consists in the combination of the wheels and axle, the main frame, the curved rack bar, the brace bar, the pivoted bar, the spring bars, the round, the swiveled frame, and the gear wheel, crank, and pawl, with each other, as hereinafter fully described. The frame is designed to receive the bit, the cutting end of which rests upon the lower cross bar of the said frame, and which is secured in place by two hand screws passing through the side bars of the said frame. The side bars of the frame rest against the edge of a plate, shelf, or frame attached to the frame, the middle part of said edge being cut away to give space for the bit.

IMPROVED CAR COUPLING.

Floyd Heaveney, Laramie City, Wyoming Territory.—The object of this invention is to provide an improved car coupling adapted to automatically couple cars of different heights with the common form of short link, and which shall always maintain the said links in proper horizontal position for entering the drawbar of the next car. The invention is an improvement upon that form of car coupling which employs a series of link throats for coupling with cars of different heights of drawbars, and a spring-seated receding support for the coupling pin, which is forced back by the entering link to allow the coupling pin to fall through and couple the cars. The improvement consists mainly in a spring-pressed stem carrying at its front end a crosshead extending through the several throats of the drawbar and combined with the same, the said crosshead having beveled faces for each of the throats, and performing the several useful functions. First, of supporting the coupling pin, and permitting the same to be tripped with an equal movement and leverage for all of the throats. Secondly, the sustaining the short link in horizontal position, and thirdly, serving as a spring cushion to permit the link to recede a little and adjust its outer end to the throat of the opposite drawbar, if said link in failing to enter the throat snugly should strike against one of the partitions.

NEW MISCELLANEOUS INVENTIONS.

IMPROVED THIEF AND ROBBER TRAP.

William E. Wharton, Lawson, Mo.—The object of this invention is to provide for use in banks, stores, etc., a thief or robber trap, so constructed that it may be tripped by the cashier, proprietor, clerk, or other person stationed behind the counter, or in any other convenient place, and thereby precipitate the thief or burglar into the cellar or apartment below. The tilting sections constitute that part of the floor of a banking room which is in front of the counter. On removing the support of levers from the tilting sections, they will tilt and precipitate any one standing thereon into the cellar or apartment below. It is hence within the power of the cashier, clerk, or other person having access to the tripper, to tilt the sections whenever a robber has gained access to the bank or store, and thus precipitate him into a place of secure confinement without incurring the danger of personal encounter and injury.

IMPROVED ALLOY FOR PLATING METALLIC ARTICLES.

Moses P. Page, Eureka, Ill.—The object of this invention is to provide a cheap and readily fused plating composition or alloy, by which all kinds of metallic articles used in the household, shop, or farm, may be plated, so as to be protected effectively against corrosion, requiring less labor in being kept clean, and obtaining a superior and neater appearance thereby. The composition is obtained by taking one part of silver, ten parts of tin, one part of nickel, and four parts of copper, with a small quantity of carbon, and so on, the proportions being according to the articles and the degree of temperature to which they may be exposed. This mixture with the metals is then placed in a plumbago crucible, the vacant space above the metal being filled with charcoal heated with bituminous coal piled about it to the top of crucible, the coal surrounded by sheet iron to prevent the escape of heat. The crucible is covered with a plate of iron, except when the mass is being stirred. The heating is continued about two hours, when the mixture is taken off, thoroughly skimmed, and after the subsidence of the red heat, poured into moulds. In regard to the carbon, a round plate of iron is used with a rod made stationary in the center, on the inside of crucible, and pass this through a perforated plate that forms the cover. This device keeps the pulverized carbon submerged in the fused metals. The carbonized plating is best adapted for bolt heads, carriage trimmings, and soft iron generally. The articles to be plated are dipped into the composition until thoroughly and uniformly coated with the plating material.

IMPROVED BUCKLE AND SNAP HOOK.

Fayette W. Knapp and Christopher Schallhorn, Fiddletown, Cal.—This snap hook is provided with a spring latch, which consists of a piece of sheet metal, bent so as to embrace the sides of the hook, and swinging on a rivet, which passes through both it and the hook. Ears are formed on the latch to prevent the ring inclosed by the hook from getting between the latch and the hook. A slot is cut through the sides of the free end of the latch to receive ears formed on the sides of the spring, which spring presses upon the shank of the hook, and throws the latch against the extremity of the hook. The end of the shank of the hook is provided with a stud, having formed upon it the large flat head. A cross head is secured in the arms of the yoke, and upon which the buckle tongue is placed. Side pieces are attached to the yoke, forming an oblong loop, through which the strap engaged by the buckle tongue passes. The strap

is attached to the buckle by passing it upward through the loop, placing the buckle tongue through one of its perforations, drawing the strap down until the said tongue rests on one of the side pieces, and then passing the shorter end downward through the loop, and drawing it down tightly. The swivel connection between the buckle and snap permits of drawing upon the strap without injury to the strap, buckle, or snap. The loop formed at the lower end of the yoke by the connecting side pieces holds the strap firmly, and leather loops are dispensed with. The latch of the snap protects the spring, so that it is not easily injured.

IMPROVED CAR AXLE BOX.

James W. Hill, South St. Louis, Mo.—This invention relates to truck boxes for railroad car axles; and the nature of this invention consists in casting or otherwise applying, to the outer face of a truck box, a button head fastening in combination with an opening through one end of the lid or cover, whereby an inexpensive and safe attachment is secured. The cap or cover is constructed with an elliptical opening through one end, the longest diameter of which is in a direction with the length of the cap. When the cap is held upright the button head can be passed through the hole and turned upon the neck. The cap is thus safely attached to the box, and will not be liable to casual detachment whether it be left open or shut.

IMPROVED CAP.

Solomon Katz and William Katz, New York city.—The object of this invention is to furnish caps provided with inner sliding bands, which shall be so constructed that they may be lowered to cover and protect the back part of the head and neck, and may be raised within the cap, when not required for use, so as to be entirely out of sight and out of the way, and which shall not increase the thickness of the cap materially, or make it heavy or clumsy.

IMPROVED DOOR AND ALARM BELL.

Jefferson G. Wiggins, Seneca Falls, N. Y.—This invention relates to bell alarms for doors; and the nature of it consists in combining, with the knob and spindle of a door latch, an alarm bell, which may or may not be sounded by turning the knob to open the door, or it may be sounded from the outside of the door without turning the knob.

IMPROVED SPOOL HOLDER.

Frederick W. Claybrook, Hague, Va.—The spool holder is formed of two parts, one a device consisting of a spring wire whose ends are bent to adapt them to enter the eye of a spool, and the other an ornamental pin or hook adapted for attachment to the clothing on the shoulder or about the waist of the person crocheting. The two parts are hinged together, so that they have due freedom of movement.

IMPROVED PERFUMED CHARM.

Charles A. Atkinson, New York city.—The invention relates to an improved charm or personal ornament; and it consists in forming the body of the charm of porous earthenware to the desired configuration and scenting the same by the absorption of a perfume.

IMPROVED GAS DROP LIGHT.

William B. S. Taylor, New York city.—The lamp or light may be raised and lowered at will, within the stationary part or frame, as usual in drop lights. The gas-conducting tubes, which connect the light with the stationary part of the chandelier, are elastic and flexible, and are so attached and arranged on the sides of the light that they cannot be injured by the heat, which is the inevitable result when the tubing is attached above the light in the usual way.

IMPROVED FIRE ESCAPE.

Benjamin A. Richardson, Norfolk, Va.—The object of this invention is to save life and property in case of fire, by affording means for persons to safely descend from the windows or roof of a building. The improvement consists of linked sections composing an improved ladder. The links or side pieces of one section are about double the width of the side pieces of the other section, so that these sections will fold closely within each other. The sections gradually diminish in size from the middle section to the terminal sections, forming a long ladder, which, when it is folded, will occupy a very small space.

IMPROVED SUSPENDER END.

John H. Murfey, New York city.—This invention consists of a peculiar cord loop that is attached to the buckle fastener or clip, and to end pieces having holes for receiving buttons. The object of the invention is to provide a suspender end that will adjust itself, and that may be easily adapted to the requirements of different persons. The loops, instead of being fastened by a metallic clip, may be stitched into a leather or cloth fastening.

IMPROVED HOPPLE.

Benjamin F. Melton, Gainesville, Texas.—This invention relates to hopples for fettering animals when turned out to graze; and it consists of a metallic band composed of three equal parts, two of which are hinged to a third, and provided with a fastening, by means of which it may be secured to the leg of the animal. A link is secured in the joint between the parts by the rivet of the joint, and designed to receive a chain attached to another similar jointed band. The edges of the band are flared, and may be perforated, so that a lining may be attached. The hopple is to be worn by the animal below the pastern joint, and the chain connecting the two bands may be made adjustable.

IMPROVED FIRE ESCAPE.

Jules A. Tixier, Brooklyn, N. Y.—The object of this invention is to furnish a fire escape, which shall be simple and neat in construction, and at the same time small, so that it can be conveniently carried by travelers and used whenever there may be occasion. The invention consists in the grooved and perforated cylinder, cast solid with the frame, and provided with the loop and the single or double rope. The loop is passed around the waist of the person, who grasps the rope below the device in his hands, and passes out of the window, when his weight causes the said device to slide down the rope, the rapidity of descent being controlled by throwing more or less weight upon a rope which he holds in and allows to pass through his hands.

IMPROVED FEED COOKERS.

Mortimer B. Mills, De Witt, Iowa.—This invention has relation to boilers for cooking feed for beasts; and the nature of the invention consists in the combination of a wooden barrel with a furnace, the fire chamber of which is extended well up in the barrel and surrounded by the water therein, and the smoke pipe is carried directly up through the top of the barrel. The object is to have a shell, which is a poor conductor of heat, and to obtain as large an amount of heating surface in a given space as possible. For the purpose of creating a very rapid circulation of water in the barrel, and also to obtain a large heating surface, the fire chamber is of less diameter than the interior of the barrel, so that a water circulating and heating space is left.

IMPROVED LOCK FOR POCKET BOOKS.

Emil Sabr, Brooklyn, N. Y., assignor to R. Neumann & Co., New York city.—The invention relates to a pocket book lock of simple and cheap construction, which is so made that the working parts are entirely hidden from view, and thereby a lock of neater appearance obtained; and it consists of a base plate having a spring plate riveted thereto, the spring plate being bent at the end to receive the pivots of the swinging face plate of the lock, which turns on the spring end, and is retained in open or closed position by the same. The face plate swings readily on the bearing of the spring plate, and is held reliably in closed or open position by the action of the spring.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion.

A Book worth having.—The "Artificer's Assistant" seems to be in great demand. (A condensed table of contents was published in this paper September 22d, last page. It's worth referring to.)

For Sale low.—Several Steam Launches, 25 to 50 feet, or would like to hear of routes to run them on; also one second-hand Band Saw Mill. S. E. Hartman, Worcester, Mass., Manuf. of Launches and Engines.

Blake's Belt Straps. The most durable fastening for rubber and leather belts. Greene, Tweed & Co., N. Y.

A brass 4 inch Turbine Waterwheel, with shaft, pulley, pipes, and Gem meter, for sale; \$75. W. S. Loomis, Holyoke, Mass.

For Amateur Photographic Apparatus. Outfits with complete instructions. Price, from \$5 to \$30. Send stamp for information to E. Sackmann, 278 Pearl St., N. Y.

Best Pulleys and Couplings made; secured to shafts without keys, set-screws, bolts, or pins. Send for catalogue. Taper Sleeve Pulley Works, Erie, Pa.

Safety Linen Hose for factories, hotels, and stores, at lowest rates. Greene, Tweed & Co., 18 Park Place, N. Y.

For the best Gate Valves of all kinds, apply to D. Kennedy & Co., 88 John St., N. Y.

Wood-working Machinery. A large stock of new and second-hand for sale low. Schenck's Machinery Depot, 36 Liberty St., N. Y.

Wanted.—Complete set of good second-hand Machinery for Planing Mill, and making Mouldings, Sash, Doors, etc. Cash. Address P.O. Box 308, N. Y. city.

Wanted.—Machine for making Horseshoes. Address Hollidaysburg Iron and Nail Co., Hollidaysburg, Pa.

Stationary and Yacht Engines, Boilers, Propellers, and sets of Castings, furnished from 1 to 20 H. P.; also Steam Pumps for Yachts. Wm. J. Sanderson, 21 Church St., Syracuse, N. Y.

Carpenters and Mechanics expert with tools, can make from \$5 to \$10 per day in their own neighborhood. No humbug. Thompson & Co., 84 Wood street, Pittsburgh, Pa.

New and second-hand machinery taken in store and sold on commission. Consignments solicited. Schenck's Machinery Depot, 36 Liberty St., N. Y.

Plumbers.—Address Bailey, Farrell & Co., Pittsburgh, Pa., for the best and cheapest iron case street hydrants.

Magic Lanterns and Stereoscopes of all prices. Views illustrating every subject for public exhibitions. Profitable business for a man with small capital. Also lanterns for college and home amusement. 74 page catalogue free. McAllister, Mf. Optician, 49 Nassau St., N. Y.

"Little All Right," the smallest and most perfect Revolver in the world. Radically new both in principle and operation. Send for circular. All Right Firearm's Co., Lawrence, Mass., U.S.A.

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

Shaw's Noise-Quelling Nozzles for Escape Pipes of Locomotives, Steamboats, etc. Quells all the noise of high pressure escaping steam without any detriment whatever. T. Shaw, 915 Ridge Ave., Philadelphia, Pa.

John T. Noye & Son, Buffalo, N. Y., are Manufacturers of Burr Mill Stones and Flour Mill Machinery of all kinds, and dealers in Duffour & Co.'s Bolting Cloth. Send for large illustrated catalogue.

Power & Foot Presses, Ferracite Co., Bridgeton, N. J.

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

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing metals. E. Lyon & Co., 479 Grand St., N. Y.

Solid Emery Volute Wheels.—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 39 Park Row, N. Y.

Steel Castings from one lb. to five thousand lbs. Invaluable for strength and durability. Circulars free. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

Yacht and Stationary Engines from 2 to 20 H. P. The best for the price. N. W. Twiss, New Haven, Conn.

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

Arbors or Mandrels hardened, ground perfectly true and durable. For machinists, jewelers, and others use. Send for circular. A. A. Pool & Co., Newark, N. J.

Patent Scroll and Band Saws. Best and cheapest in use. Cordesman, Egan & Co., Cincinnati, O.

Chester Steel Castings Co. make castings for heavy gearing, and Hydraulic Cylinders where great strength is required. See their advertisement, page 222.

Silver Solder and small Tubing. John Holland, Cincinnati, Manufacturer of Gold Pens and Pencil Cases.

For Boulit's Paneling, Moulding, and Dovetailing Machine, and other wood-working machinery, address B.C. Machinery Co., Battle Creek, Mich.

Best Glass Oilers. Cody & Ruthven, Cincinnati, O.

Mill Stone Dressing Diamonds. Simple, effective, and durable. J. Dickinson, 64 Nassau St., N. Y.

Reliable information given on all subjects relating to Mechanics, Hydraulics, Pneumatics, Steam Engines, and Boilers, by A. F. Nagle, M. E., Providence, R. I.

Notes & Queries

(1) L. C. S. asks for a recipe for making bayrum? A. Bay rum is made by digesting the leaves of the bay plant, an aromatic plant grown in the West Indies, in rum, and subsequent distillation. An imitation is made as follows: $\frac{3}{4}$ fluid drachms oil of bay, $\frac{1}{2}$ fluid drachm oil of pimento, 1 fluid oz. acetic ether, 1 gallon alcohol, 3 quarts water. Mix, and after two weeks repose, filter.

(2) F. B. S. asks: What is best for making a small air pump airtight? The air seems to escape around the top of the cylinder, on the top of which is screwed

a brass cap, through which passes the piston rod. A. Cut a disk of rubber and place in the cap, so as to fill it and fit nicely. Screw the cap to place.

(3) H. G. says: I notice in the SCIENTIFIC AMERICAN for September 15 an article on the increase of water in springs by the use of a siphon. Would a straight pipe leading into a spring that was completely bricked up and covered with earth answer as well as a siphon? A. No. The water must be conducted by the pipe to a point lower than the outlet of the spring.

(4) S. C. Q. asks how to join some clay pipes so that they will be rendered perfectly watertight? A. Warm the ends of the pipes, dip in melted pitch, press firmly together, and let them remain so until the pitch hardens.

(5) C. B. says: I have a pair of blue steel clock hands. I want to give them a dull black "ebony" appearance. A. Dissolve asphaltum in turpentine with gentle heat, and give the work one or two applications. The first coat must be thoroughly dry before the second is applied.

(6) J. T. P. says: I wish to remove some large poplar and walnut stumps from one of my fields. Can I blow them out with dynamite? A. In some parts of the West dynamite cartridges have been successfully used, by boring a hole under the stump with a long earth auger, inserting the cartridge, and firing it with fuse.

(7) J. M. asks how to remedy a gun that scatters the shot too much in shooting? A. Reducing the charge of powder or using a slower burning powder and selecting that size shot that will make the best target is one remedy. If the gun be worn at the muzzle by shooting, shorten it an inch or two. Sometimes reaming it with a lead plug and emery for a little distance down the muzzle may be effectual. There are many little things that affect the shooting of guns, which a gunsmith can best inform you. For directions to bronze a gun barrel, see (36) p. 303, No. 13, present volume.

(8) W. W. W. asks: 1. How to melt gold, such as old watch chains, and other old jewelry? A. Place the metal, pounded into small lumps, in a clean black lead crucible, and expose to a very bright red or white heat in a furnace until completely fused, when it may be run out. 2. Can I melt it in a common parlor stove? A. In quantities of more than a few dwts. at a time, probably not.

(9) E. B. L. asks: 1. How to finish up shelf brackets? A. Finish by coating once or twice with black baking japan, which must be dried in a kiln or oven. 2. How to finish the raised parts with yellow powder? A. The yellow finish is a light coating of bronze powder, which is put on by first varnishing the work with a thin varnish, and then apply the powder with a bit of leather, rubbing it on where the varnish was applied, or the bronze and the varnish can be mixed and applied with a small brush.

(10) W. C., of St. Johns, N. B., says: I have charge of a printing press and have great trouble in keeping the rollers clean. It seems almost impossible to get off a hundred clean impressions. The dirt seems to be like paper dust. The rollers work all clean, but the face of the type fills up. What is the cause of it, and how can I prevent it? A. To keep the impressions continuously clean and even is one of the most difficult lessons of the pressman to learn. The filling up of the type is caused either by the rollers being "green" from being new, or made so by washing in lye; or, more likely, in having an ink with too strong a body, which draws from the paper the light particles and leaves them on the type. If the rollers are green, wash in oil. If the trouble is with the ink, thin it out by adding oil, or procure a lighter bodied ink.

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

J. L.—It contains lead and probably silver—you should have it assayed.—D. C. S.—Magnesite is, when in masses sufficiently free of foreign matters, one of the most valuable ores of iron. Its precise value depends much on the locality of the bed, facilities for mining or smelting, cost of transportation to market, etc. A quantitative analysis would be necessary to determine its richness.

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 Torpedo Defence. By F. P.
On Labor and Capital. By M. J.
Also inquiries and answers from the following:
H. D.—J. W. S.—A. M.—W. N. W.—B. B.—D. S.—W. M.—R. & Co.

HINTS TO CORRESPONDENTS.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

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

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

Hundreds of inquiries analogous to the following are sent: "Who makes riding cultivators or buggy plows? Who publishes books on photography? Who makes and sells weather strips for doors, windows, etc.? Who makes and sells dynamite cartridges? Who makes wood brackets? Who makes knitting machines and hair weaving looms?" 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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FOR WHICH

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AND EACH BEARING THAT DATE.

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10,164.—CORSET GORE.—T. S. Gilbert, Birmingham, Conn.

10,165.—HANGING BARKETS.—W. Hamilton, N. Y. city.

10,166.—CARPETS.—D. McNair, Boston, Mass.

10,167.—OIL CLOTH.—J. Meyer, Lansingburg, N. Y.

10,168.—CARPETS.—T. J. Stearns, Boston, Mass.

10,169 and 10,170.—CARPETS.—W. De Hart, Amsterdam, N. Y.

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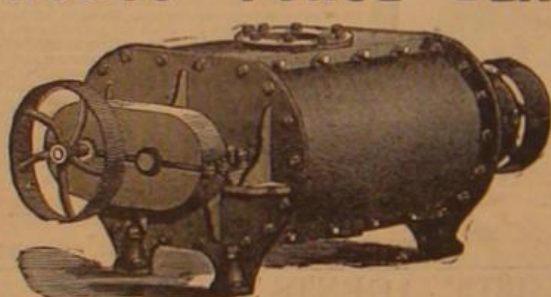
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Aniline Dyes.

There has been at various times much discussion on what may be termed the sanitary aspect of the aniline dyes. Although it may be at first difficult to see in what way the color of an article of costume can possibly affect health, yet the relation of the one to the other is not so remote as might be anticipated. Socks, stockings, and gloves are worn next the skin, and poisonous matters may thus be brought into the system; even the very wear and tear of ordinary costume, in the event of the color not being of a very firmly adherent nature, results in a portion of coloring matter being liberated in the form of a fine dust, and thus inhaled by the lungs. In France, stringent measures have had to be adopted to prevent the artificial coloration of cheap wines with "fuchsine." Recent experiments have now beyond doubt established that aniline dyes, at least, the reds and blues, are in their pure condition comparatively inert, and that the ill effects which have been sometimes attributed to the use of these dyes are traceable, not to the pure coloring matters themselves, but to traces of arsenic which they contained, and which arose from inefficient purification subsequent to manufacture. Enterprising scientists may always be found who are willing to become martyrs, for science or for notoriety, and the present inquiry has had its self-sacrificing hero in the form of Herr Seidler, of Riga, who administered to himself three quarters of a grain of aniline red every morning, for a period of five weeks, without any ill effects. When it is pointed out that a single grain of aniline red is said to be sufficient to impart a good pink color to fif-

teen gallons of alcohol, it would be necessary to drink an enormous quantity of artificially colored wine in order to equal a single morning performance of Herr Seidler. So far the question is practically settled, the only remaining difficulty being our inability to ascertain whether pure or impure coloring material has been used in any purchased article; and it will therefore be better, as a simple matter of precaution, to be on our guard against the indiscriminate use of aniline dyes for coloring purposes.—*Medical Examiner.*

THE MANUFACTURE OF WALL PAPER.

The use of paper as a covering for walls originated in China. It was introduced in Europe as a substitute for tapestry hangings—whence the term paper hangings—by the French. At the present time, owing to the improvements which have been effected in printing, and the wide range of colors open to the artist designer, it offers probably the cheapest and most ornate means of mural decoration.

The blank paper is received by the manufacturer in the long rolls made by the Fourdiner machine, and weighing from 80 to 85 lbs. to the roll. It varies in quality according to the printing and finishing which it is to receive—weighing 9, 10, 12, and 14 ounces to the length of eight yards, which constitutes the usual length of the roll as sold at retail. The first process undergone is termed

"GROUNDING,"

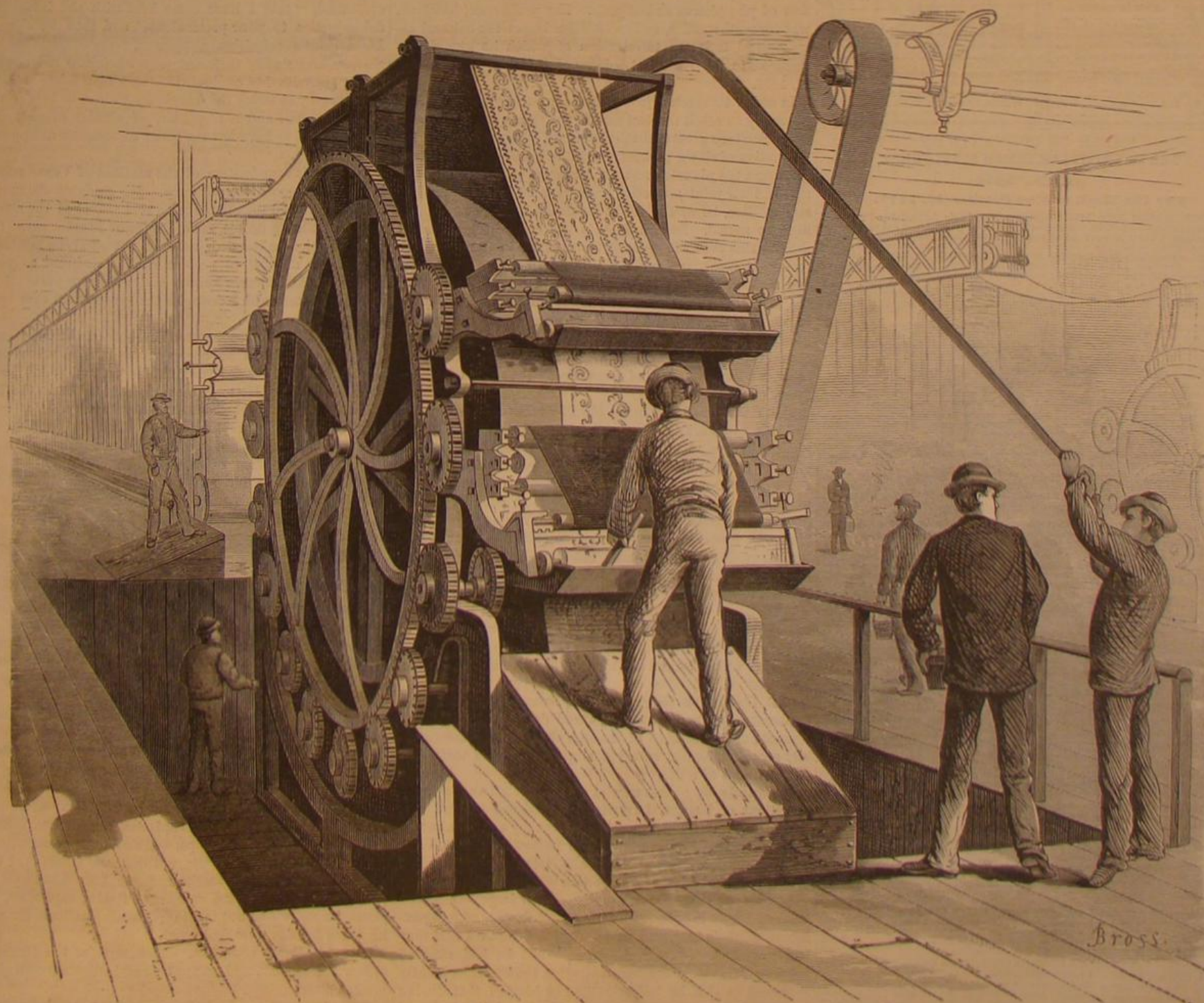
and the object is to give the paper the requisite body to enable it to receive the colored pattern. The grounding ma-

chine is represented in Fig. 1. While passing over a roller the paper is covered with a mixture of so-called Jersey clay, which contains some 18 per cent of alumina, glue, and water, and if the surface is to be finally polished—or satin finished—a percentage of lard oil is added. After the mixture is applied it is evenly distributed over the paper, first by two reciprocating brushes, then by a rotating brush roller, and lastly by two brushes like the first. It then is conducted up between endless belts across which sticks are laid, and over which sticks the paper is suspended in festoons. The sticks are so placed that a length of paper measuring just four yards hangs between any two. The belts are kept in constant motion, and the paper is thus conducted along the loft, which measures some 160 feet in length. Steam coils are placed beneath the belts, and a temperature of 120° maintained. About nine minutes are occupied by any one festoon of paper in making the journey from grounding machine to the point where it is again made into a roll, and during this period it becomes thoroughly dried. Frequently coloring matter is mixed with the ground paint, and the paper is thus given a flat tint, which forms a background for the pattern, or which is left unaltered when the paper is meant to be perfectly plain and to resemble paint or kalsomine when attached to the wall.

IMPRINTING THE PATTERN BY BLOCKS

is done in two ways, either by the block or old process, or by the roller or improved process. In either case each color entering into the design must be printed separately,

[Continued on page 226.]



THE MANUFACTURE OF WALL PAPER.—THE PRINTING MACHINE.

Class 14. *Bridges*. Includes everything connected with bridges and arches, their piers and abutments, trusses and

girders for bridges, floors, and roofs, iron trusses, piers, and columns.

Class 15. *Brushes and Brooms.* Includes everything connected with brooms, brushes, mats, mops, and machines for making them.

Class 17. *Butchering.* All relating to slaughtering and skinning animals, dressing their carcasses, cutting meat, sausage making, catching animals for slaughtering, hair cleaning, and brine tubs.

Class 20. *Carpentry.* Includes all the woodwork of houses (except trusses and girders), iron laths, wood laths, and machines for nailing them, scaffolds for building, ladders, fire escapes, wood and metallic blinds.

Class 21. *Carriages and Wagons.* All relating to the construction of wheeled vehicles, sleighs, trucks, barrows, velocipedes, and their fittings.

Class 22. *Casting.* All appliances, machines, modes, and tools used in foundries, excepting type-foundries.

Class 31. *Dairy.* Includes all machines and appliances for milking, butter and cheese making, except milk coolers and testers.

Class 37. *Excavating.* Everything relating to excavating, boring, and grading, well curbs, Artesian wells, post hole borers, sand pumps, submarine excavators, etc.

Class 39. *Fences.* Includes also gates, posts, post drivers, wire stretchers for fences, etc.

Class 40. *Files, rasps, and machines for making, redressing, and sharpening.*

Class 45. *Furniture.* Basin clamps, blacking boxes and holders, broom hangers, cigar racks from this class are destroyed; but the whole of the class, except these few articles, is saved.

Class 47. *Garden and Orchard.* Includes tools (not machines) for digging, cultivating, and preparing the soil, planting, transplanting, weeding, protecting, potting, and forcing plants and trees; orchard culture, destroying insects, gathering fruit, sorghum strippers, and maple sap gathering.

Class 49. *Glass.* All relating to the composition, tools, machines, presses, furnaces, pots, and other apparatus for manufacturing, cutting, and roughing glass, modes of manufacturing glass articles, and some processes for ornamenting glass.

Class 51. *Grinding and Polishing.* Everything relating to the modes, apparatus, tools, processes, and appliances for grinding and polishing glass, metal, stone, and wood.

Class 53. Includes everything relative to the manufacture of hardware; but not the articles when manufactured.

Class 55. *Harrows.* All devices for scratching, rolling, and pulverizing the soil; also corn and cotton-stalk choppers and pullers, and stone gatherers.

Class 56. *Harvesters.* This includes all kinds of machines and implements for gathering and securing the crops (excepting hand hay rakes and forks), all the models of which, with the exception of the cutters for harvesters and about thirty of the old models of reapers and mowers, were destroyed.

Class 57. *Hoisting.* Includes every appliance used in elevating all kinds of solid materials, loading machinery, stump extractors, capstans, and windlasses.

Class 59. Consists of horseshoes and machines for making them. The former were saved and the latter destroyed.

Class 60. *Hose.* Most of this class was saved, but hose couplings, bridges, and spanners were destroyed.

Class 61. *Hydraulic Engineering.* All relating to aqueducts, canals, dykes, harbors, breakwaters, docks, quays, sub-aqueous explorations and works, piles, improvement of rivers, etc.

Class 64. *Journals and Bearings.* Includes all journals, bearings, shafting, couplings, lubricants, lubricators, belt shifters, tighteners, pulleys, and universal joints.

Class 65. *Kitchen Utensils.* Apple corers, slicers, and parers from this class were burnt, but all the remainder was saved.

Class 72. *Masonry.* Includes all structures of stone, brick, concrete, and iron, plastering and plasterer's tools.

Class 74. *Mechanical Powers.* All relating to horse powers, arrangement of gearing, brakes for machinery, cranks, pitmans, treadles, modes of converting, multiplying, reversing, and transmitting motion, pawls and ratchets, rope clutches, eccentrics, cams, traction wheels, spring motors, fly wheels, and tide powers.

Classes 75 to 82. Relate to metal working, all the models of which were destroyed, with the exception of tacks, staples, nails, spikes, machines for threading sheet metal caps, eyelet machines, tuyeres, alloys, nut locks, wood screws; screw taps, plates and dies; manufacturing sewing machine shuttles and cop tubes, machines for making, up-setting, and bending tire, manufacturing carriage axles, lining axle boxes, tire setting and cooling, farrier's tools, anvils, machines for twisting metal, and the manufacture of spinning rings.

Class 83. *Mills.* All the cases relating to machinery for grinding bark, cane, coffee, grain, gunpowder, paint, spice, and sugar; flour bolts, rice cleaning, hulling, and polishing; smut, scouring and hulling machinery in general.

Class 85. *Nails.* This class includes the different varieties of nails, spikes, tacks, and staples, which were saved, and the machinery for making, all of which was destroyed.

Class 86. Includes machinery for the manufacture and preparation for market of pins and needles, all of which was destroyed except one of Crosby's.

Class 90. *Ores.* Apparatus, machines, and processes for crushing and grinding ore, stone, coal, or bone; for separat-

ing ores of precious metals, mechanically or by amalgamation.

Class 94. *Paving.* Includes all patents relating to the materials, compositions, making, repairing and sweeping sidewalks and roadways; paver's tools and machines; garbage boxes; vault covers and lights.

Class 97. *Plows.* All machines employed for plowing, breaking, digging, trenching and paring the soil, cultivating crops, digging roots, and laying tile.

Class 98. *Pneumatics.* This includes all mechanical applications of air and other elastic fluids (excepting motive power engines), balloons, and ventilation.

Class 100. *Presses.* Includes presses of every description, except hydraulic, printing and copying, the last two of which, with their appropriate class No. 101, were saved, but the hydraulic and the other presses were destroyed.

Class 103. *Pumps.* This class includes all machinery for pumping or elevating liquids, hydraulic engines, jacks, presses and rams.

Classes 104 to 106. *Railways.* This includes everything relating to the roadway, cars, and their fittings.

Class 107. *Manufacture of Railway Irons.* Includes every machine or process for manufacturing or repairing rails, car irons, axles, tires, wheels, and metal fittings.

Class 108. *Roofing.* All cases relating to the materials, compositions, and varieties of roofing, apparatus for roofing, skylight operators, cave troughs and brackets, roof fenders and spouts.

Class 110. *Saws.* Includes everything relating to saws and sawing machinery.

Class 111. *Seeders and Planters.* All machines and devices for sowing and planting seeds and distributing fertilizers. These were all destroyed except the cotton seed planters, of which only a few were lost.

Class 113. *Sheet metal.* Includes all modes, machines, and tools for the manufacture of articles from sheet metal.

Class 119. *Stabling.* All relating to the care of horses, cattle, sheep, and poultry; shelters, stalls, preparation of food, feeding, and currying.

Classes 121-2-3. *Steam.* From this class (which includes all kinds of steam machinery, locomotives, etc.) traction engines, lubricators, and steam and air brakes have been burnt. The remainder being saved.

Class 125. *Stone Lime and Cement.* Includes mining, quarrying, boring rock, stone, marble and slate working, artificial stone; lime, mortar, concrete and cement.

Class 130. *Thrashing.* All machines and devices for husking, thrashing, shelling, winnowing and stacking.

Class 131. *Tobacco.* Includes all processes, machinery and appliances for the manufacture and use of tobacco.

Class 134. *Tubing and Wire.* All methods and machines for the manufacture of tubing and wire.

Class 137. *Water Distribution.* Includes well tubing, filters, pipes, couplings, fountains, hydrants, irrigating devices, street sprinklers, and railway water tanks.

Class 138. *Water wheels.* All the models of the different kinds of water wheels, chutes, forebays, penstocks, and gates for water wheels.

Class 140. *Wire working.* Includes the manufacture of wire articles of every description, all of which were destroyed except wire cloth and looms for making it, and machines for making wire heddles.

Class 141. *Wood Screws.* This class includes the different varieties of patented screws, most of which were saved, and the machines for their manufacture, all of which were lost.

Classes 142-3-4-5. *Wood working.* All the models of these important classes, which include all machines and tools for working wood (except saws and sawing machinery, which are also destroyed—see class 110), were burnt.

If a model cannot be placed under any of the above classes, it may, as a rule with very few exceptions, be considered as saved.

NOTES OF PATENT OFFICE DECISIONS.

The appeal from the decision of the Board of Examiners-in-Chief, in the matter of the application of Phillips, for improvement in paper, has been decided adversely to Phillips. The purpose of his invention was to make a paper suitable for the manufacture of paper bags and other like articles, which should be cheap and strong, and at the same time possessed of a good finish. To this end he provided two vats in his paper machine, one of which contained bleached pulp, and the other unbleached pulp, from the same stock and of the same quality. A layer of bleached pulp was superposed upon one of the unbleached, and the two felted and compressed together during the progress of the continuous web through the machine. The effect was to make a paper having a bright exterior surface from the presence of the bleached pulp, and at the same time possessed of the requisites of cheapness and strength from the use of the unbleached.

It was admitted by the applicant that the prior English patent, No. 834, of 1864, resembled his invention not only in the manner of making and the machinery devised for the purpose, but also in the resulting product. The English patentee claimed a compound paper for the purpose of making paper hangings, consisting of a lower layer of the inferior coarser pulp, and an upper layer of finer pulp deposited thereon, and united together as pulp into a single continuous web during their passage through the machine. Phillips, however, rested the merits of his case entirely on the ground that his particular article, a compound paper made of bleached and unbleached pulp, presumably of the same

stock and quality, was new to the trade in view of the state of the art, and was therefore patentable. The Commissioner affirms the decision of the Board of Examiners-in-Chief, rejecting Phillips' application for a patent, and holds that, while there was nothing in the English patentee's specification which would lead to the conclusion that his finer and coarser pulps were made from the same stock, yet it was evident that he selected these finer and coarser qualities of pulp for the same purpose proposed by Phillips. He insured a good finish on the exterior by the finer pulp, and strength and durability by the coarser pulp beneath. The bleached pulp which Phillips proposed to employ was well known in its characteristics, and had been in use in the art for a long period of time past. Applied to the unbleached pulp it gave a superior finish, and at the same time made a stronger paper than would be the case if it were used alone. These qualities, however, were set forth in the English patent. Phillips, therefore, had done nothing more than substitute one well known pulp for another, where both performed the same office in the same way and produced the same effect. It might evidence judicious selection to take the bleached pulp in preference to another light one from a different stock, but this involved no invention.

The decision of the Board of Examiners-in-Chief in refusing the claim of James Greaves for a patent on the substitution of polygonal shafts and corresponding sleeve-shaped revolving bearings for round shafts and splines, on the cylinders of a carding machine, is reversed by the Commissioner on appeal and the claim allowed. The condensing cylinders were represented as several feet in length, and were arranged in parallel rows, between which passed the material that was to be condensed. For the accurate and successful operation of the machine, it was necessary that the opposite cylinders should be exactly parallel; but it was found that, upon the end to which the pinion was applied for rotating the cylinder, the round shaft, with its spline, pressed upon by the pinion in its rotation, was rapidly worn, and to such an extent that, after a use of comparatively few months, that end of the shaft would drop and leave the upper and lower cylinders out of parallel with each other. On the other hand, the polygonal shaft being kept from rotation within the pinion by means of its corners instead of the spline, the wear was distributed more uniformly; and further than this, when in operation, the forcible rotation of the pinion acting upon the corners tended to hold the shaft, even when worn, in an exactly central position, so that the wear, although as great perhaps as in the round shaft and spline, became a matter of comparatively little importance, so long as the shaft was of sufficient size to be turned by the pinion. Therefore the Commissioner holds that, while a polygonal shaft is generally a well known equivalent for a round shaft and spline, yet, in this particular connection with the condensing cylinders, the former performed a new and highly important function, not contemplated or called for by any of the previous uses, and was therefore patentable.

Litharge.

Litharge is an oxide of lead, prepared by scraping off the dross that forms on the surface of melted lead exposed to a current of air and heated to a full red, to melt out any undecomposed metal. The fused oxide in cooling forms a yellow or reddish semi-crystalline mass, which readily separates into scales; these, when ground, constitute the powdered litharge of commerce. Litharge is also prepared by exposing red lead to a heat sufficiently high to fuse it. English litharge is obtained as a secondary product by liquefaction from argentiferous lead ore. In grinding litharge, about one pound of olive oil is usually added to each hundredweight, to prevent dust. Litharge is employed in pharmacy to make plasters and several other preparations of lead. It is used by painters as a dryer for oils.

Black Finish for Brass.

Make a strong solution of nitrate of silver in one dish and nitrate of copper. Mix the two together and plunge the brass into it. Now heat the brass evenly until the required degree of dead blackness is obtained. This is the method used by French instrument makers to produce the beautiful dead black color so much admired in optical instruments.

PHOTOGRAPHS OF THE BRITISH NORTH POLE EXPEDITION.—A series of the views has been published under the supervision of Sir George Nares. One photograph demonstrates the discovery of coal in the arctic regions, a solid mass of this valuable material, more than twenty-five feet broad, being depicted. Other pictures show very plainly the nature of the ice masses of which the frozen sea consists, and prove more than all the descriptions in the world how difficult it must be for sledges to make way over this sea of troubles.

TO MAKE SOFT SOLDER DROPS.—Melt the solder and pour it in a steady stream of about one eighth of an inch in diameter, from a height of two or three inches, into cold water. Take care that the solder, at the time of pouring, is no hotter than is just necessary for fluidity.

DIORREXINE.—This explosive, largely manufactured and used in Germany, has been analyzed by M. Fels, and found to consist of picric acid, wood charcoal, beech sawdust, nitrates of potash and soda, sulphur, and water.

A good dryer for paints is made by grinding or dissolving a small quantity of sugar of lead in linseed oil.

[Continued from first page.]

so that there must necessarily be as many blocks or types prepared as there are tints in the pattern. The blocks are constructed of two layers of wood, a thin piece of maple fastened to a thicker backing of pine board. Each block is about 26 inches wide, two feet long, and an inch and a half to two inches in thickness. On the maple all of the design to be printed in a single color is drawn and afterwards cut out by engravers, so that the lines are in high relief. The more delicate figuring is not made in the wood, but is supplied by the insertion of bent pieces of brass, as we shall explain more fully in referring to the manufacture of the printing rollers further on. When the wood carving is completed, the work is brushed over with boiled oil, and when dry sent to the printer for use. The workman stands before a table, Fig. 2, over which passes the paper.

Hanging above the table, supported by an india rubber cord, is the block. The upper end of the cord is attached to a small wheel traveling on an iron guide, so that the block may be swung from the table over to the place where it receives its covering of color. This last is obtained from what is termed the "slush box," which consists of a shallow box, the bottom of which is covered with painted ticking. This box floats on a mixture of water and paper pulp contained in a larger box, so that its bottom is always perfectly level. The workman first places the paper across his table, then swings the block over to the slush box and brings its carved side down on the paint. Next, he carries the block back again and places it on the paper, of course using great care in the registering, so that the impression may fall exactly on the right place. A vertical movable arm attached to a frame above is now rested upon the back of the block, and forced down by a lever worked by the foot of the operator. This process is repeated until the whole piece is covered with the pattern, when it is hung up until perfectly dry.

Hand printing is now used on borders where there are many colors, and in the finer qualities of decorated paper, where the care requisite for printing the numerous tints can scarcely be exercised during the motion of the rapid working cylinder machines. In

ROLLER PRINTING

the impression is obtained from a series of rollers, on the surface of which the design is raised. This process is used for all the cheaper grades, and hence for very much the greater proportion of all the wall paper manufactured. The rollers are of maple lined interiorly with brass. Four different sizes are used, measuring respectively 13, 16, 18½, and 22 inches in circumference. Their width in all cases is 18½ inches. The pattern of the design is first drawn on paper and colored, and then the outlines of the various parts are transferred upon the rollers, each roller printing, as before stated,



GROUNDING MACHINE.

only such portions as are of one particular hue. Unlike that of the blocks described above, the surface of the roller is not engraved away, but the pattern is made by driving in pieces of thin brass, which the workman, Fig. 3, bends in a vise so as to correspond with the lines of the pattern. Where there is a considerable area to be printed "solid," its outlines are raised in brass, and inside the metal boundaries thus made is packed glued felt. In some cases where the paper is not grounded rollers are covered entirely with felt with the exception of such portions representing the pattern as are intended to be left white. After the design is thus produced the roller is placed in a lathe, fixed in the slide rest of which is a vertical file which smooths the surface, or if the roller be entirely felted it is submitted, when the glue in the felt is dry to the action of an emery wheel.

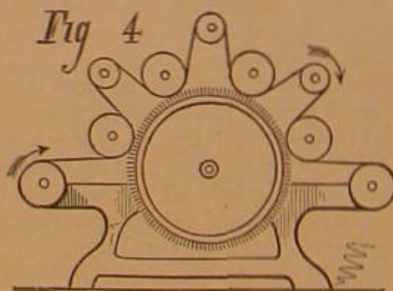
The printing machine consists of a large cylinder or drum

around which the paper passes. While being thus carried the paper receives an impression from each roller in turn, the rollers being disposed around the periphery of the cylinder. Each roller is supplied with color by an endless belt of felt, which passes down into a receptacle filled with the paint. If the paper is striped the colors are blended by dry paint brushes held in contact with the surface as the cylinder rotates. In the large illustration on the first page a 12 roller machine is represented. This prints therefore twelve colors at once.



HAND PRINTING.

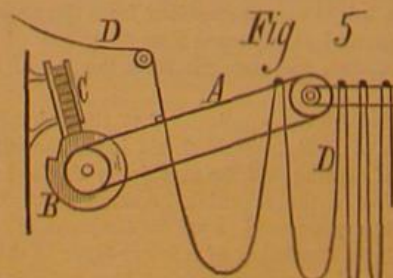
If, however, the paper is to be satin finished, before the above operation takes place it is put through a polishing machine shown in section in Fig. 4. This consists of a central rotating brush against which the paper is carried by several metal cylinders. The alumina and oil in the ground-work admit of its being finely polished. The printed pattern is, however, in dead color, so that when the paper is finished some portions have a luster while others do not, thus adding to the detail of the ornamentation.



POLISHING MACHINE.

As the printed sheet emerges from the machine, it is led over sticks on endless belts the same as before described during the grounding process. An ingenious device is employed for placing the sticks under the paper, which is represented in Fig. 5. At the ends of the roller over which the endless belt, A, passes, are two cams, one of which is shown at B. Above the cams and resting on their periphery is a pile of sticks, C. The cam shoulder equals in height the thickness of one stick. Hence at each revolution of the cam a stick is moved from the bottom of the pile and carried down on and across the belts. Between the latter comes the paper, D, which thus falls in folds over the sticks as they are laid in place.

After the paper has been carried on the belts to the end of



the loft (becoming dried meanwhile) its end is connected to a swiftly rotating horizontal spindle which winds it into tight rolls. These measure but 8 yards in length, the sheet being cut by the attendant as soon as a mark placed by the printing

machine comes to the spindle. If the paper is to be embossed this is now done by passing it between engraved metal rollers. Nothing further then remains but to send it to the markets.

THE COLORING MATERIAL

is made of ordinary dry pigments combined with the Jersey clay and gum substitute. This last is produced from potatoes, large quantities of which are raised for this especial purpose. The tubers are simply dried and ground, the powder forming when mixed with water an extremely adhesive size. Sometimes ordinary glue size is employed. Paris green and the arsenical colors are now rapidly going out of use in paper coloring, chrome green being utilized in preference to the former.

We have obtained the material for this article and the annexed engravings from Messrs. Christy, Shepherd & Garrett the proprietors of one of the largest wall paper factories in the country. The establishment is located at No. 510 West 23d street in this city; 125 workmen and 13 large printing machines are here employed, producing six million rolls of paper per year.

How to Detect a Ripe Watermelon.

Few people know, from an outside inspection, how to determine the ripeness and the perfection of a watermelon. Inquiries are frequently made in the horticultural journals as to the means to be used to arrive at a reliable rule for settling this question. Within a few days, says a correspondent of the *Country Gentleman*, I have seen directions given to reach a correct conclusion on the subject, by pressing the melon and noting the manner in which it emits a crackling sound under the operation. These results are to be obtained after some experience in judging of its peculiarity under pressure. Considering the vast quantities of this delicious fruit consumed at the north, after shipment from the sections where the vine flourishes, but where the fruit is always picked in an immature state in order to bear transportation well, it is really a serious matter to be able to know certainly when buying a melon, perchance on the street or at a dealer's stand, whether one is securing a ripe melon or not. In nine cases out of ten the chance is that your melon is only half ripe, and therefore not a great acquisition for your dessert.

Now let me give you and your readers an infallible sign by which to know a fully ripened melon. When the melon begins to change color inside, and its seeds to turn black, a small black speck, scale, or blister begins to appear on the outer cuticle or rind. These are multiplied and enlarged as the fruit matures. A ripe melon will show them thickly sown over the surface. A partial development only indicates half ripened fruit. A full crop of blisters reveals its perfect ripeness. When hundreds of melons are strewn



MAKING PRINTING ROLLERS.

along the sidewalk, you will have to look pretty sharply to find one that exhibits a satisfactory "escutcheon," to borrow a term from M. Guenon. But it is unfailing when found, and by following this guide you may walk away with your melon with the most entire confidence. The blister is only to be seen upon a close inspection, but is plainly visible when that is given.

How to Attach Photographs to Glass.

W. T. Watson, of Harriston, Canada, gives the following method to fasten photographs on glass without leaving air bubbles, and also how to make them transparent: Allow the photograph to remain in water until thoroughly soaked, then place between blotting paper. It should remain until it is just damp enough to be pliable. Then coat the face of the picture with good paste made from flour or starch, and lay face on the glass. Commence in the center of the pic-

ture and rub outwards toward the edges to dispel all air and paste. Be very careful not to get paste on the back of the print. Keep it damp with a sponge until the rubbing is finished, being careful not to break the surface of the paper. When perfectly dry, lay on a heavy coat of castor oil and it will soon become transparent. If too much oil, rub off the surplus with a cloth. Allow it to stand a day or two, when it may be colored.

IMPROVED APPARATUS FOR TESTING BANK CHECKS.

The device herewith illustrated is intended as a safeguard for bank checks, which will enable any alteration or raising of the figures of the same to be at once discovered. Certain perforations are made in the paper which, by their position, indicate the true amount, but it is impossible for any one to make these perforations at the right places, unless he possesses the depositor's peculiar combination, while the presence of a perforation in the wrong place immediately discredits the check.

The invention includes two separate devices—one to be in the possession of each depositor, the other to be kept by the bank. The first is represented in Fig. 2, the second in Fig. 1. Both have metal base plates, A, to which are hinged other plates, B. The plate, B, in Fig. 2, has inscribed upon it just seven concentric polygons, which are intersected by thirty-one radial lines. At each of the points of intersection (except at those on the innermost polygon, where they are spaced further apart) apertures are made. The radial lines are numbered as shown at their outer ends. These numbers are called combination numbers. The apparatus used by the bank is represented in Fig. 1. In the outer plate, B, is a circular hole around which numbers are marked. Within the circle is placed a loose polygonal plate, C, marked off and perforated in precisely the same way as the outer plate of the depositor's apparatus. This plate is held in position by lugs, D, and is provided with a handle or extension piece, E.

The mode of using the device is as follows: On the depositor's portion, Fig. 2, is inscribed the number 68. This gives 18 as the index number of that particular apparatus, 50 being taken as the starting point. We will suppose that the index being 18, the depositor's combination number is 22, and the amount of his check \$1,235. After filling out the check, he places it on his plate, A, beneath the plate, B, Fig. 2. A pin at F, in the lower plate, then perforates the check, and enters a hole in the upper plate. Beginning with the units of the sum to be marked 5, is added to the combination number. The total of 27 is now found on the edge of the polygon, and through the hole in the outside polygonal line opposite that number a hole is pierced by the pin shown at G. The figure in the ten's place or 2 is next added to the combination number, and the pin is forced through the hole in the second polygonal line opposite the number 24, and so on, the hundreds being marked through the third polygonal line, the thousands through the fourth, and so on to the tens of thousands. The hundreds of thousands and the millions are marked in the two inner polygonal lines.

When a check is received at the bank the index and combination numbers of the depositor are noted. The plate, C, is then adjusted to bring the zero point opposite the depositor's index number on the surrounding circle, the handle, E, furnishing a convenient means of doing this. The check is then placed so that the pin, G, on the plate B, Fig. 1, corresponding in position to the similar pin in Fig. 2, enters the hole in the check made by the latter. The perforating pin, F, is then used in the same manner as already described. The check in being removed from the apparatus is examined, and if no new punctures have been made it is genuine; but if new holes have been formed, then there is proof of the raising or forging of the check.

Patented through the Scientific American Patent Agency August 21, 1877. For further particulars address F. and A. D. Grafelmann, Middle Village, Queens county, L. I.

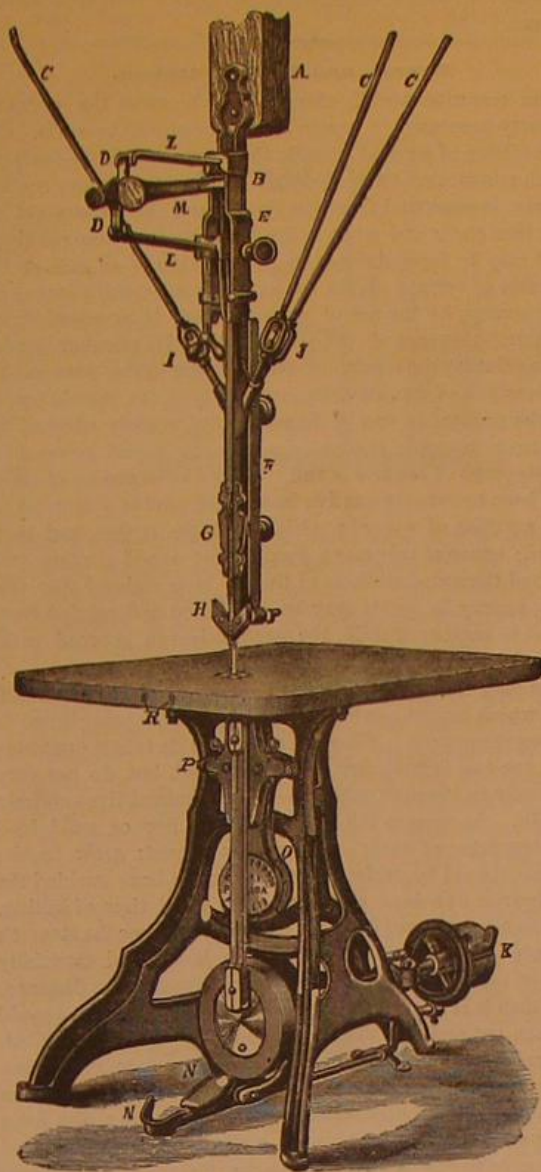
American Machinery in New South Wales.

Messrs. J. A. Fay & Co., the well known manufacturers of woodworking machinery, of Cincinnati, Ohio, inform us that the Metropolitan Exhibition of New South Wales, to which they contributed quite largely, proved remarkably profitable and satisfactory to them. They received four medals in competition with other American and the English manufacturers. We have taken occasion before this to direct the attention of our readers to the extensive demand for improved American machinery in Australia, and Messrs. Fay & Co.'s statement goes further to show the ready appreciation which our industrial products there encounter.

CEMENT UPON IRON OR STONE.—A cement made of glycerin and litharge hardens rapidly, and makes a durable cement upon iron or stone. It is insoluble and is not attacked by acids.

WALKER BROTHERS' IMPROVED SCROLL SAW.

Workers in wood are generally aware that while the band saw is excellently suited for outside work, it is not so for inside cutting or perforated work. The jig saw, on the other



hand, is adapted to both, and for the latter variety especially, owing to the facility with which its blade can be detached or unhooked and passed through the holes made in the piece to be sawed. On its capabilities in this particular are based the claims of superior economy usually advanced for the jig or scroll saw.

A new machine of this description is represented in the accompanying illustration. It is designed for general use on medium or fine work in hard or soft wood. It is durably constructed, and is provided with convenient means for the adjustment of all its parts.

As the straining device for the blade is one of the most important features in the construction of the scroll saw, special attention may be directed to the ingenious arrangement herein embodied. The object is to produce an even tension on the blade at all points of the stroke, and to enable the strain to be varied at pleasure. Springs, L, links, D, and lever, M, are attached to a casting that may be moved up or down the standard, B, for blades of different lengths. More or less strain may be imparted by turning the hand nut, I, so moving the lower spring, L. As the lever, M, travels on its upward or downward stroke, it throws the supports of the limbs, D D, forward and backward; in this way the lever tension of the blade is maintained. The links, D, are attached to the ends of the springs and lever so as to roll on their points of contact or bearing surfaces, thus reducing friction of the working parts. The upper and lower fastenings for the saw blade are made to fit any thickness, and the blade can be quickly changed for perforated work without raising and lowering the upper slides or hold down, F. The lower slides, P, have a parallel adjustment, and are set up for wear by simply turning one screw, P, at the sides of each slide.

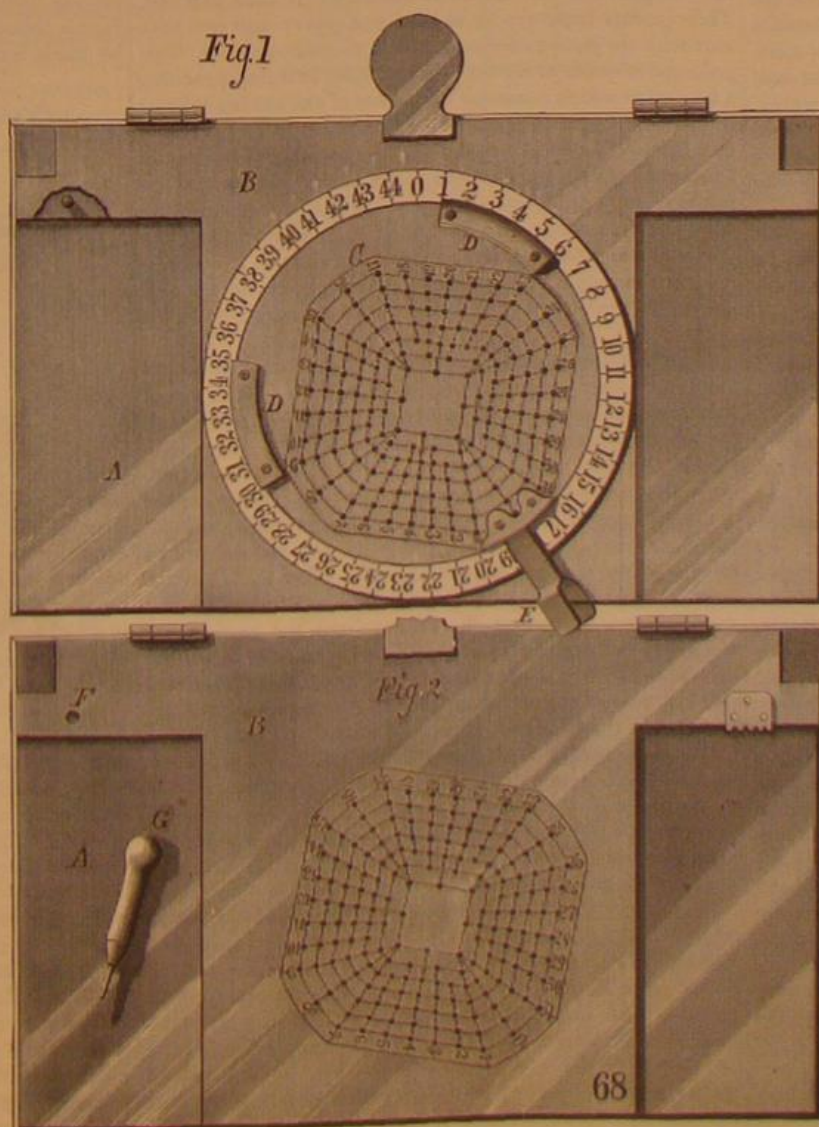
A small rotary blower, O, attached to the frame under the table and driven by a pulley on the balance wheel shaft, forces a blast of air against the sawdust as it comes from the blade, keeping the slides free from dust, preventing absorption of the oil in the lower slide and guides, and preventing the noise and heat so common in slides when running loose and dry. A rubber tube, not shown in the engraving, is attached to the blower and conducts the air above, keeping the sawdust from the working lines of the sawyer.

The table is made of wood or iron, as preferred, and the filling around the saw blade may be of wood or of hardened steel. The latter is kept in place and adjusted by the screws, R, in front of the table. The hold down, F, and the slides, G, may be adjusted independent of each other for thickness of stuff or length of blade, and the back and side guide, H, removed, when not in use, for long or narrow blades. The lower slides, P, may also be set up for wear and kept parallel without trouble and loss of time. The saw is started and stopped by the foot of the operator on the rod and brake, N, and the belt shifter, K—another important improvement—may be set for the belt in any direction. All the parts are well made and fitted, and guaranteed in every respect. The pulleys are 6 inches diameter by 3 inches face, and should make from 900 to 1,050 revolutions per minute. Patented May 27, 1873. For further information address the manufacturers, Messrs. Walker Bros., 73 and 75 Laurel street, Philadelphia, Pa.

Egg Raising.

The egg traffic of this country has risen to an importance which few comprehend. The aggregate transactions in New York city alone must amount to fully \$8,000,000 per annum, and in the United States to \$18,000,000. A single firm in that line of business east handled \$1,000,000 worth of eggs during the year. In Cincinnati, too, the traffic must be proportionally large. In truth, the great gallinaceous tribe of our country barnyard contributes in no small degree to human subsistence, eggs being rich in nutritive properties, equal to one half their entire weight. Goose, duck, hen, pullet, and partridge eggs are the principal kinds produced in America. We have nothing, however, like what we are told used to be found in Madagascar, or have been found there, the gigantic woa egg, measuring thirteen and a half inches in extreme length, and holding eight and a half quarts. One of these birds, with a single effort, might supply a modern boarding house with omelettes for a day.

The perishable nature of eggs has naturally detracted from their value as a standard article of diet. The peculiar excellence of eggs depends upon their freshness. But lately the process of crystallizing has been resorted to, and by this process the natural egg is converted into a vitreous substance of a delicate amber tint, in which form it is reduced seven eighths in bulk compared with barreled eggs, and retains its properties for years unimpaired in any climate. This is indeed an achievement of science and mechanical ingenuity, and has a most important bearing on the question of cheaper food, by preventing waste, equalizing prices throughout the year, and regulating consumption. In this form eggs may be transported without injury, either to the equator or the poles, and at any time can be restored to their original condition simply by adding the water which has been artificially taken away. The chief egg-desiccating companies are in St. Louis and New York. No salts or other extraneous matters are introduced in the process of crystallizing, the product being simply a consolidated mix-



APPARATUS FOR TESTING BANK CHECKS.

ture of the yolk and albumen. Immense quantities of eggs are preserved in the spring of the year by liming. Thus treated they are good for every purpose except boiling. It is a common trick for some dealers to palm off eggs so treated as fresh, so that imposition is easily practised. In the desiccating process, however, the difference becomes apparent, as from four to five more limed eggs are required to make a pound of eggs crystallized than when the fresh eggs are used, and eggs in the least tainted will not crystallize at all.

Some of the most experienced egg dealers declare that there is no profit in raising poultry to compare with producing eggs. A single hen will lay from twelve to fifteen dozen eggs per annum, selling at an average of thirteen cents per dozen, and the birds thus occupied can be housed and fed for less than fifty cents for the whole period. In the East the price per dozen is much higher. Here we buy them by the dozen. Step into an eastern produce or grocery establishment, and they sell so many eggs for a quarter of a dollar. There is no reason why the crystallizing process should not become quite general, and egg production stimulated as never before, and the food supply receive large accessions from this source. The already great and increasing consumption of eggs in England and France shows growing appreciation of this form of food compared with any other. It is thought the annual sales in the United States alone must aggregate nearly \$20,000,000. In Lima, Peru, eggs sell at one dollar per dozen, equal to four dollars per pound crystallized. It is thought that this new process of preserving for utilization the industry of our hens and pullets may be very acceptable as well as beneficial in a business and domestic point of view.—*Cincinnati Commercial*.

An American Surgeon in England.

Dr. Sayre seems, from all accounts, to be having quite an ovation among our British cousins; and probably no American surgeon ever before received such marked attention on their part. The *Lancet* for July 14 announces his arrival in London, and offers him a cordial greeting, and, in the issue for July 21, gives an extended account of the principal points insisted on by Dr. Sayre "in his forcible expositions of pathology, diagnosis, and treatment of spinal curvature." All the late numbers of the *British Medical Journal* contain references to his visit. That of July 14, in speaking of his demonstration at University College Hospital, gives the details of his method of treatment of Pott's disease and lateral curvature, and those for July 21 and July 28 contain reports of his demonstrations at St. Bartholomew's and Guy's Hospitals respectively.

His first demonstration of his method in London was at University College Hospital, by invitation of the surgical staff, before an immense audience.

Tuesday, July 17, he delivered a clinical lecture at St. Bartholomew's Hospital, at the invitation of Mr. Callender, and the same week he also appeared at the London Hospital. Wednesday, July 25, he visited Guy's Hospital, by invitation of Mr. Durham, and "put up" two cases of Pott's disease and one of lateral curvature, before a large number of the profession. The first of the cases of Pott's disease was the daughter of Dr. Gooding, of Cheltenham, and the second a child of eleven, who had never stood, and the worst case, Dr. Sayre said, which he had ever seen. In less than half an hour he had the satisfaction of making her walk, which, of course, created the greatest enthusiasm among the audience. On the day following, he "put up" four cases at the Royal Orthopaedic Hospital, of which he had previously had photographs taken.

Dr. Sayre then made a visit to Birmingham, at the request of the branch of the British Medical Association located there, and, by invitation of Mr. West, senior surgeon, gave a demonstration in the amphitheatre of the Queen's Hospital, which was crowded to its utmost capacity. He lectured for one hour, during the course of which the plaster jacket was applied to two cases of Pott's disease, and one of lateral curvature, and at its conclusion, Mr. West made a fine address, and moved a "hearty welcome and thanks to the great American surgeon." The sequel is thus described by an eye witness: "Mr. Furnieux Jordan seconded the motion with such a glowing tribute, and in such fervid eloquence, that Dr. Sayre became completely overcome. He spoke of the millions of human sufferers, heretofore tortured by rack and screw, and even then left miserable and misshapen, which would now be made easy and comfortable, and restored to perfect health and perfect form. He thanked God that the days of the hunchback had passed away, and that the instruments of torture would never again be resorted to. At the conclusion of his remarks there was not a dry eye in the house, and there probably never was such a scene in any medical meeting before. Tears of gratitude got the better of Dr. Sayre's ability to speak, and he broke down completely in his first attempt to respond. In a few minutes, however, he sufficiently recovered himself to express his appreciation of the sentiments just uttered, and shortly afterward so electrified the audience with his enthusiasm that one would have thought the roof would go off the amphitheatre."

On the 6th of August, Dr. Sayre was to go to Manchester to be present, as a delegate from the United States, at the annual meeting of the British Medical Association; after which he expected to devote himself for a time to the preparation of a work on the treatment of spinal disease, which will be immediately put in press by Messrs. Smith, Elder & Co., of London. During his stay in England he has been

the recipient of much generous hospitality. Among the pleasantest of the entertainments which he has attended were a delightful breakfast, attended by all the principal men of the place, which Mr. West gave him at Birmingham, and a magnificent dinner in the Royal Hall of St. Bartholomew's Hospital, at which there were nearly four hundred guests present.

Rennet and Its Preparation.

The manufacture of cheese depends upon the peculiar property possessed by casein of being curdled by acids. On the addition of an acid to milk, the casein, or cheesy portion, which constitutes three fourths of the nitrogenous matter present, is separated from the liquid, and this separation of milk into curds and whey is the first step in cheese making. Curd may be formed either by the addition of an acid, or by the juice of certain plants, or, as is the universal practice in this country, by the use of rennet, which is prepared from the fourth stomach of the young calf. Its peculiar action in coagulating the casein of milk is due to the presence in this stomach of minute cells contained in the gastric juice, and the process is one of fermentation, rapidly effected by minute microscopic bodies, of which the liquid composing the steepings of rennets is full. Over one thousand of them have been counted in one five hundredth part of a drop taken from a gallon of water in which a single rennet had been soaked; hence at this rate a good rennet would contain two hundred thousand millions of them. It is claimed that this active agency in rennet may be multiplied and carried from one lot to another of milk, the same as leaven in bread making, and hence rennet is really a true yeast.

It is only the fourth, or true digesting stomach of the calf, from which rennet can be prepared out of the inner lining or mucous membrane. They are usually in their best condition when the calf is from five to ten days old, but do not vary materially in strength while the young animal lives entirely on milk. As soon as the calves begin to live on solid food the strengths of their stomachs as rennets grow feeble. The calf should be perfectly healthy, must have suckled the cow four or five days, and to within a short time of killing. If it has been without food for any length of time the stomach becomes inflamed and congested with blood, and especially so if the calf has been driven or carried much of a distance, since then it is of no value for rennet. The stomach should be taken out and well cleaned at once after the calf is killed, by careful wiping with a moist cloth or sponge, or by rinsing, but in no case should water be poured upon it. As soon as cold, let it be lightly salted and left to dry on a dish for a day or two, then stretched on a hook or crooked stick, and hung up to dry in a place where the temperature is moderately warm. The Bavarian method is to blow up the rennet like a bladder, and tie one end to keep out air, first putting on it a little salt at the place where tied; the skins, being thus made very thin, will dry rapidly and keep well; sometimes they are suspended in paper bags.

Rennets lose their strength if kept too warm, but they are much improved by alternate freezing and thawing if kept open to dry air; they should not be allowed to gather dampness, since their strength will evaporate if thus exposed. Their quality improves by at least one year's age and they part with the strong odor so common to green rennets. This prepared stomach or rennet, when steeped in water, produces a decoction which possesses the power of thickening milk or of decomposing it and separating the casein from the liquid or whey. The most convenient way to prepare the rennet for use is to place the stomach in a stone or earthen jar containing a brine sufficiently strong to prevent it from tainting, with not exceeding two quarts of cold water; allow the whole to stand for five days; then strain and put it into bottles; or the rennet may be soaked over night in warm water, and next morning the infusion may be poured into the milk.

In from fifteen to sixty minutes the milk becomes coagulated, the casein separating in a thick mass. The rennet possesses the chemical property of producing lactic acid, by acting upon the sugar in the milk; the acid unites with the soda in the milk, which holds the casein in solution, when the casein separates, forming the curd. Showing the wonderful power of this agency, by taking a single ounce of this membrane or rennet thoroughly washed and dried, and placing it into eighteen hundred ounces of milk, heated to 120° F., complete coagulation of the whole quantity will shortly follow. Remove the rennet from the curd, again wash, dry and weigh it, and it will be found to have lost but one seventeenth part of its weight. Thus it may be proved that one part of the active matter of the stomach may coagulate about thirty thousand parts of milk.

It would be seen from these facts that but a small comparatively small amount of rennet would be required by our cheese factories; but such is not the case. The desire to hurry cheese off to market in ten or twenty days from the hoop requires far more of the rennet than is absolutely necessary in the more moderate operations of private dairies in former days. The home supply from the millions of calves which are slaughtered in this country is wholly inadequate to meet the demand for rennets, hence they are largely imported from Europe. It is to be hoped that the enterprising chemists and investigators of the age will discover some method of extracting the active agent in rennet, and in a state of absolute purity and freedom from objectionable animal matter, with a degree of uniformity in strength as well as concentrated form. While American cheese making has made wonderful progress during the past twenty years, their

yet remains a wide field for careful study and intelligent progress.

To Find the Contents of Boilers.

To find the contents of cylinder boilers multiply the area of the head in inches by the length in inches and divide the product by 1728; the quotient will be the number of cubic feet of water the boiler will contain. Example: Diameter of head, 36 inches; area of head 1017.87 inches; length of boiler, 20 feet or 240 inches. Now multiply 1017.87 by 240 and the product will be 244,288.80; divide this by 1728 and the result will be 141.37 cubic feet, which will be the contents of the shell.

In flue boilers, multiply area of the head in inches by the length of the shell in inches; multiply the combined area of the flues in inches by their length in inches, subtract this product from the first and divide the remainder by 1728; the quotient will be the number of cubic feet of water the boiler will contain.

Proper Speed of Circular Saws.

Nine thousand feet per minute, that is nearly two miles per minute, for the rim of a circular saw to travel, may be laid down as a rule. For example: A saw 12 inches in diameter, 3 feet around the rim, 3,000 revolutions; 24 inches in diameter, or 6 feet around the rim, 1,500 revolutions; 3 feet in diameter, or 9 feet around the rim, 1,000 revolutions; 4 feet in diameter, or 12 feet around the rim, 750 revolutions; 5 feet in diameter, or 15 feet around the rim, 600 revolutions. The rim of the saw will run a little faster than this reckoning, on account of the circumference being more than three times as large as the diameter. Shingle and some other saws, either riveted to a cast iron collar or very thick at the center and thin at the rim, may be run with safety at a greater speed.

PRACTICAL MECHANISM.

BY JOSHUA ROSE.

NEW SERIES—No. XXIII.

COGGING.

The term cogging is applied by pattern makers and wheelwrights to the process of furnishing wooden teeth to iron wheels, in the rim face of which are cast mortises to receive the wooden cogs. The term cog is applied to the piece of wood out of which the tooth is formed. This includes the shank fitting into the mortise together with the tooth projecting from the face of the wheel. The term tooth denotes the part forming the tooth independently of the part fitting into the mortise.

The object of using cogged wheels is to avoid the jar and noise incidental to the use of large cast gear wheels, which it is found impracticable to cast true. If the wheel is cast from a wooden pattern, this pattern is liable to warp. Furthermore, the rapping of the pattern in the mould tends somewhat to destroy the truth of the mould. Even if these elements of error are eliminated in making the mould by using a moulding machine, the unequal shrinkage of the casting induces untruth. After a gear wheel is cast, the face is then be turned true. While in the lathe a circle may be made for the bottom of the teeth, and another for the

Fig. 224.

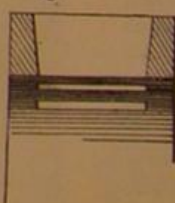
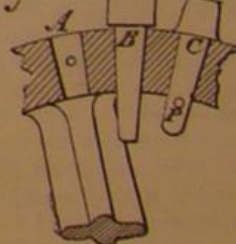


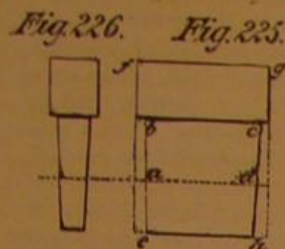
Fig. 223.



pitch line. Other circles may be made as are deemed necessary as guides for adjusting the instruments used to form the outlines of the teeth. The wheel may be marked off as carefully as can be, and the teeth after marking may be chipped and filed to the lines; but it is not found in ordinary practice that by any such means a degree of truth sufficient to avoid jar and noise is attainable. This is especially the case with large wheels, and cogging is resorted to. It is usual to cog the large wheel of a pair that run together, and to make the wood teeth thicker across the pitch line than the iron one. If two cast wheels are made to run together, there is usually given a certain amount of clearance between the spaces and the teeth, whereas, when a cogged wheel is employed, this clearance is dispensed with, and back lash is avoided. The woods generally used for cogging are hornbeam, hickory, button wood or sycamore, maple, and locust. The blocks for the cogs should be cut out and kept so as to thoroughly season before being used. There should, when there is likely to be a demand for them, always be kept a spare set of cogs, so that they will be ready for use, well seasoned and less liable to shrink and thus come loose in the mortises.

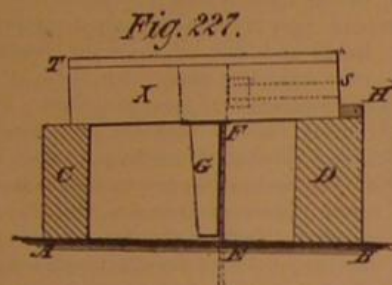
When the cast wheel arrives from the foundry it is taken to the machine shop, bored and turned across the face. The mortises receive a little attention, burrs and sprue fins are removed, the rough places levelled, etc. If it should be found that any of the mortises are "blind," that is, stopped by the arms of the wheel, as shown at A, Fig. 223, a cir-

cumstance which is avoided as much as possible in the designing of the wheel, a small hole must be made through the rim to admit of the passage of a wire or screw. The first step taken toward getting out the wood teeth is to obtain the exact size and shape of the mortises. For this purpose, if the wheel is a spur, we must cut out two pieces of thin wood, as templates to fit the mortise, one representing the length of the mortise, as in Fig. 224, and the other its width. The templates must be tried in several holes, so as to insure their being the correct size. *a b c d*, Figs. 225 and 226, represent



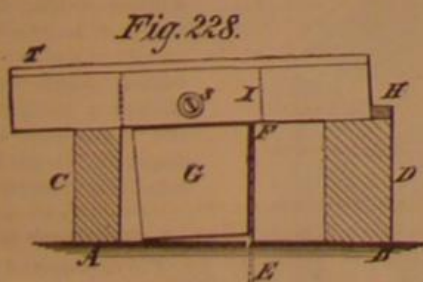
one of these templates. From it we get the size of the rough cogs. Add above *b c* the height of the finished tooth, and from a quarter to half an inch more, according to the size of the wheel, to allow for turning off. Make a good allowance in this direction, as also at the other end of the piece, for the wood may be bruised by the hammer in driving the cogs in and out. The size of the cog is shown at *e f g h*, the length, *f g*, being that of the finished tooth and not less than $\frac{1}{4}$ inch allowed on each side for turning. To obtain the thickness, take that of the finished tooth, shown at *C*, Fig. 223, at the thickest part and allow about $\frac{1}{4}$ inch of a side for trimming.

Having now the full size and thickness, cut out the number of cogs required, with three or four spare ones, as some may be split or possess some defect. To avoid damaging the teeth a broad, flat-faced heavy hand hammer should be used to drive them with.



It is taken for granted that a circular saw bench is accessible, for without this cogging is made with difficulty. Have the saw in good order, and mount upon it a simple contrivance for shanking the cogs. It is composed of a box and two guides. These are illustrated in Figs. 227, 228, 229, and 230. The parts throughout being marked with the same letters.

Make *A C* perpendicular with *E F*. Let *E F* be the height the saw stands above the table, which should be a little higher than the length of the shank of the cog. To the line, *E F*, apply the form or template, *a b c d*, of the width of the shank. Produce the top line of this form and it is the top of the guides. Make the guide, *C*, at such a distance from the saw as to admit of the passage of the cogs the widest way. Make a box composed of two pieces, one piece being of sufficient thickness to take in the whole rough tooth of a cog in a mortise cut through the center of it, as indicated by the dotted lines in Figs. 231 and 232, and shown in full in Fig. 234; the thin piece, *T*, forms a backing to stop the cog in the mortise, it also, by being placed with

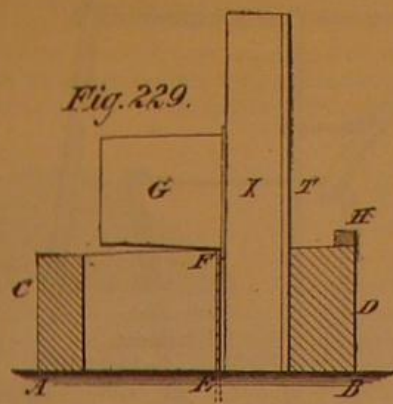


the grain in an opposite direction to that of the box and screwed firmly, adds much to the strength of the box and enables it to resist the strain of the blinding screw, *S*, by which the cogs are held while being sawed. Having the thickness of the box, lay it off upon the opposite side of *E F*, and draw the guide, *D*; if, as at *G*, in Fig. 234, the size of the top of the shank be laid down, then the distance from it to the sides and ends of the box must be equal to *E F*, the height of the saw above the table. Having the size of the box, we can now mark the position of the guide, *H*.

Eight movements with the box over the saw shanks the cog, two movements, as in Fig. 231, make slits through the width of the stuff and bring it to the right thickness; at Fig. 232, two movements, with the box held in the direction shown, brings the shank to the width. The box is now to be held with one of its edges on the table and passed between the guide, *D*, and the saw. It is to be passed through four times. A slab is detached each time. Figs. 229 and 230 illustrate two of these positions, and after turning the box upside down the other two movements may be performed.

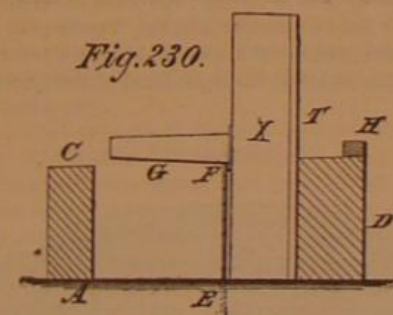
Having now completely shanked one cog, it must be compared with the templates and tried in the mortises. Care and

patience at this time may save hours of labor in fitting. Proceed now to fit the cogs to the mortises, as at *B*, Fig. 223, driving them tightly and leaving them with their shoulders, say, $\frac{1}{4}$ inch above the rim at the widest part. Use raw linseed oil to lubricate the surfaces while driving. All the cogs being now driven into their places, take a little instrument, shown in Fig. 224, called a fork scriber, and with this



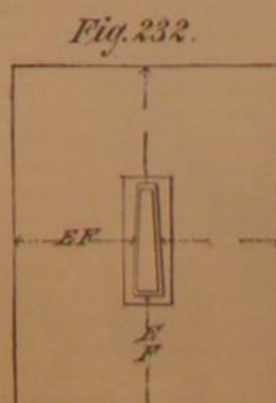
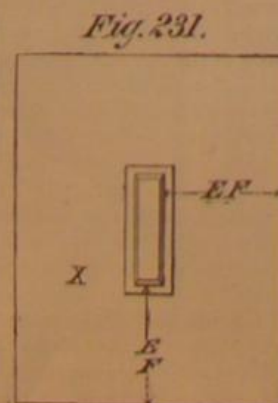
trace a line upon the shoulder of each cog by allowing one prong to travel along the turned face of the wheel while the other is pressed against the wood. The shanks of the cogs must also be marked with a common scriber where they project through on the under side of the rim.

Number all the cogs with a pencil, and number two of the mortises with a center punch or stamp, to show the direction of the numbering. Now drive out all the cogs and "shoulder" them, that is, dress the shoulders to the fork scriber line, so that, when driven in, the shoulders will fit the face of the wheel. This being done, mark a mark on the shank; into this mark on both edges of the cog insert the fork scriber and scribe a line parallel to the first but nearer up to the shoulder. This line shows where the under side of the rim will come when the cog is next driven in, for of course it will be driven just as much further as the distance between the two points of the fork scriber. In Fig. 223, observe the pin, *P*, the top of which lies against the rim, so in finding the center of the hole for the pin we must place it nearly one half the diameter of the wire below the fork scriber line. Make this nearly so as to have a little draw on the cog, and insure that the wire pin shall touch the rim. Then when the cogs shrink and become loose in their mortises, as they often will, the pins will at least keep



the shoulders in contact with the rim. Cogs in blind mortises are made to fit at the first drive and not removed, unless from some oversight it is inevitable. Carefully examine the hole and remove lumps or cut away the wood to escape them, and gauge the size and depth of the hole. Do this to avoid the unpleasantness of having to draw the cog when once driven in.

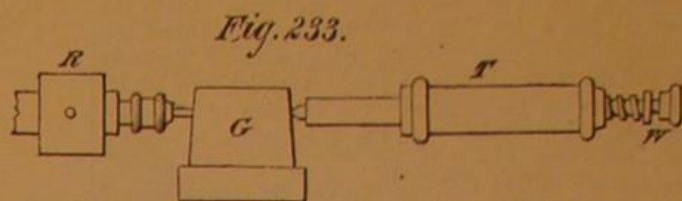
The cogs may now be bored for the pin. This is most rapidly performed by running a boring bit in the lathe. The ordinary pin bit will do, but let it be so pointed as not to run away from the center mark made with a center punch. It should be lubricated with tallow or beeswax very frequently, or the temper will be drawn, because the material is so hard, and the speed so high. It takes too much time to run the lathe mandrel back and forth by means of its screw, therefore, to remove the cap and wheel, fit a wooden knob or handle on the end of the screw and work the mandrel by hand. This will be clearly understood by turning the



attention to Fig. 233. *R* is the running head with bit held by a chuck, *G*, the cog, *T*, tailstock, *W*, the knob of wood. This method bores the cogs rapidly and straight. The cog

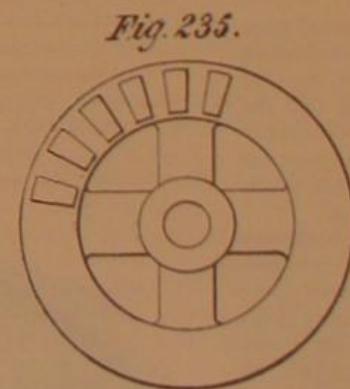
when bored half way may be reversed and the rest of the boring completed from the other side.

The next process is to saw the shanks off to an equal length measured from the shoulders, which have been dressed. In Fig. 234, *S* is the circular saw, *F* a guide strip, *B* a planed board, *H* a handle, *T* a stop. The cog, *G*, is shown with its shoulders resting against the edge of the board and its side against the stop. In this position it is



held firmly by the left hand, the right hand seizes the handle and pushes toward the saw. A second stop is shown at *O*; it is fixed to the table to prevent the board by any inadvertence from being pushed too far. The ends of the shanks may now be rounded at the corners or chamfered to give them a presentable appearance, and the cogs are ready to be again driven into the wheel. A mixture of white lead and boiled linseed oil is to be made of the consistence of thick paint. This with a piece of stick or brush is applied to that part of the shank which remains in the rim. Each cog is then driven into the mortise, to which it was fitted and which may be known by the number marked on it. Insert the pins, pieces of strong wire pointed like a center punch; these are in length somewhat less than the rim is wide but longer than the tooth. The wheel now goes to the turning shop, where the teeth are turned to the proper size and the pitch lines marked. Upon its return it is divided off, the outlines of the teeth drawn on both sides, and the excess of stuff removed with chisel and gouge. If it is possible to remove a portion with a good sharp hand saw, that may be done, as much time may be saved thereby. When the teeth are all formed, filed, and sand-papered, they may receive a few good soakings of raw linseed oil.

In bevel wheels the mortise is narrower at one end than at the other, as shown in Fig. 235. It follows that the shanks of the teeth must be made to fit, therefore an extra template must be made, so as to have one for each end of the mortise. The shape of the mortise, or in other words, the top of the shank and its size, is to be laid down as in Fig. 232,



and the distance, *E F* (the length of the top of the circular saw from the saw to the table), laid off on all sides, so that the box will assume a shape corresponding to that of the shank, the guides remaining the same. In this way the outer edges of the box form a gauge to saw the cogs.

Fast Flying.

A recent contest took place under the auspices of the Philadelphia Pigeon Flying Society, No. 2, the course being from Hamburg to Philadelphia, a distance of seventy-five miles. The birds participating were of last spring's brood, and, without exception, were from first class stock. The weather for the fly was favorable, and the time made the best on record in this country. The winning bird was a handsome blue specimen. The following is the result:

	n.	n.	n.
James Grist.....	1	13	00
John Dalton.....	1	41	30
Henry Heintz.....	1	54	56
William Knight.....	1	55	35
John Parker.....	1	57	20
Arthur Chambers.....	2	01	50
Arthur Chambers.....	2	04	35
Thomas Grist.....	2	08	05

An International Exhibition of hops, and of tools and apparatus used in the cultivation, drying, packing, and preservation of hops, is to be held at Nuremberg from October 7 to 15 next. Forms of application and all necessary information can be obtained from Herr Eduard Vollrath, Nuremberg.

IMPROVED SLEEPING CAR.

We illustrate herewith a new construction of sleeping cars, by which the same may be easily converted into day or parlor cars. The arrangement is also such as to relieve the upper part of the car from the weight of panels and bedding. Fig. 1 is an interior view of the car with some of the berths in place, and Fig. 2 is a plan view.

The car is provided with fixed side seats of a length equal to that of a sleeping berth. Two revolving chairs are placed in front of and at opposite ends of each sofa. Under the latter is a box which holds a folding bed or mattress, the two stanchions or posts for supporting the berths, the front rail, and the folding panels or partitions which form the divisions between the sections. The location of the chair pedestals, as will be seen from Fig. 2, is such as to secure a free passage way through the car.

In making up the sleeping sections, the stanchions are reared upon the chair pedestals, the chairs being previously removed, folded, and stowed away. The upper ends of the stanchions are secured by a bracket attached to the roof of the car. Near the lower portion of each post is a collar having projections to sustain the lower bed. This collar slides over the junction of post and pedestal. Near the middle of the stanchion is a shoulder to receive and support the front and end rails of the upper berth. The inner ends of these rails have tongues, which enter sockets in the car wall. The berth bottom is supported by cleats on the inner sides of the end rails. This arrangement of separate and distinct end rails gives the advantage of making up the berths either independently of each other or all at once, as desired.

The upper berth is formed by placing the cushions of the side seats on the cleats above mentioned; while the lower berth is made by a folding bed supported upon the long seat frame and the projections on the lower stanchion collar. The ends of the side seats have double walls, to receive between them a panel, which is used to form an extension of the seat end and to aid in partitioning off the berth. Above it, the end partitions are formed by a curtain or flexible partition, which extends outward from the car wall, and which is self-closing by a spring or similar suitable means when not held extended. Rods are provided from which curtains from both upper and lower berths are suspended.

For ventilating the lower berths a vertical flue is formed in the car wall between the windows, and opens into the car just above the berth, with a register. The flue extends to nearly the top of the car, and has an outside aperture. The movement of the car draws air up from the lower berth through this conduit, thus ensuring thorough ventilation. This is an important advantage, and one calculated to render the occupancy of lower berths much more agreeable and healthy.

It will be observed from Fig. 2 that the sections on the two sides of the car are so arranged that the divisions, and consequently the revolving chairs, are not opposite each other, but intermediate.

The principal advantage claimed for the construction above detailed, over that of the ordinary sleeping car where the upper berths are folded up against the roof, is the decreased weight of the vehicle itself. As the upper berths are not fastened to and sustained by the side of the car, that portion need not be so strongly and heavily built as is usually the case. The inventor informs us that, while the common Pullman sleeping car weighs from 28 to 35 tons, his car weighs but 21 tons, a saving in weight of considerable importance.

Patented Aug. 14, 1877. For further particulars, address the patentee, Mr. E. P. Kellogg, 279 Pearl street, New York city.

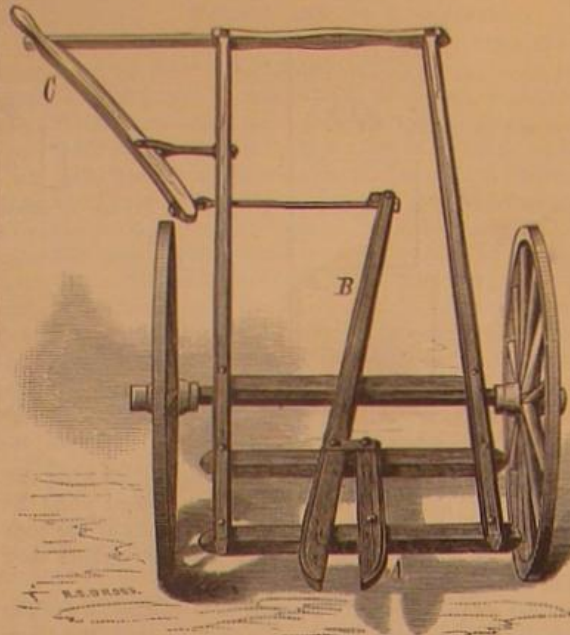
To Clean Vessels that have Contained Kerosene.

Wash the vessel with thin milk of lime, which form an emulsion with the petroleum, and removes all traces of it. By washing a second time with milk of lime and a very small quantity of chloride

of lime, and allowing the liquid to remain in the vessel about an hour, and then washing it with cold water, the smell may be removed. If the milk of lime be used warm, instead of cold, the operation is rendered much shorter.

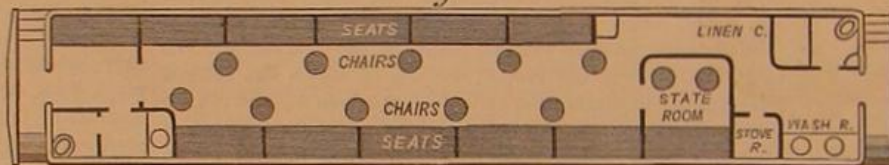
BROWN'S IMPROVED COTTON STALK PULLER.

We illustrate herewith an improved implement for pull-



ing cotton stalks from the ground, thus freeing the latter from roots likely to interfere with plowing. By its use it is claimed that one man can clear off three acres of stalks in a day.

Fig 2



KELLOGG'S SLEEPING CAR—PLAN VIEW.

The device consists of a frame mounted on wheels. To the forward cross bars in front of the axle is secured a stationary jaw, A, and a pivoted jaw, B. To the rear end of the latter is attached a rod connecting with a lever, C, the handle of which comes at the right hand of the operator who

pushes the machine ahead of him. The jaws seize the stalk near to the ground. The long rear portion of the frame is then used as a lever—the axle being the fulcrum—to lift the plant clear of the soil. The stalk is finally dropped by turning the machine to one side and opening the jaws.

This apparatus was exhibited at the State Fairs in Austin and Houston, Texas, in 1876 and 1877, and there obtained, we are informed, the highest premiums. It was patented by Mr. R. D. Brown, September 19, 1876. For further information address Messrs. J. J. Conklin & Co. Austin, Texas.

Projected Trans-Asiatic Railways.

No less than four great projects are now under consideration for railways across the continent of Asia. They are as follows: 1. The Baranowski project or shortest road between Moscow and Peshawur—the English fortress commanding the valley of the Indus. This starts from Saratoff, crosses the Kirghis country, follows the Amon-Deria, and traverses the mountainous region of the Hindoo-Couch. 2. The Lesseps-Cotard project: line extends from Orenburg to Peshawur via Omsk, Taschkend, Samark, and Balk. 3. The Bogdanovitch project: line extends from Moscow to Peking via Kazar, Ekatherinoburg, Omsk, Tomsk, and Irkutsk. 4. The Ruththofen project: line joins the Siberian road at Omsk, passing Taschkend, Samarkand, and Balk. At the last mentioned point the route turns to the west to Teheran, and rejoins at Tiflis the Russian Caucasian line now under construction.

The Anthropoid Apes.

Professor Garrod, of London, stated, in a recent lecture, that he had dissected seventy apes out of the anthropoid class, and one of them exhibited the vermiform appendage of the cæcum, or blind gut, which is characteristic of man. But the anthropoids have it quite humanly developed. The

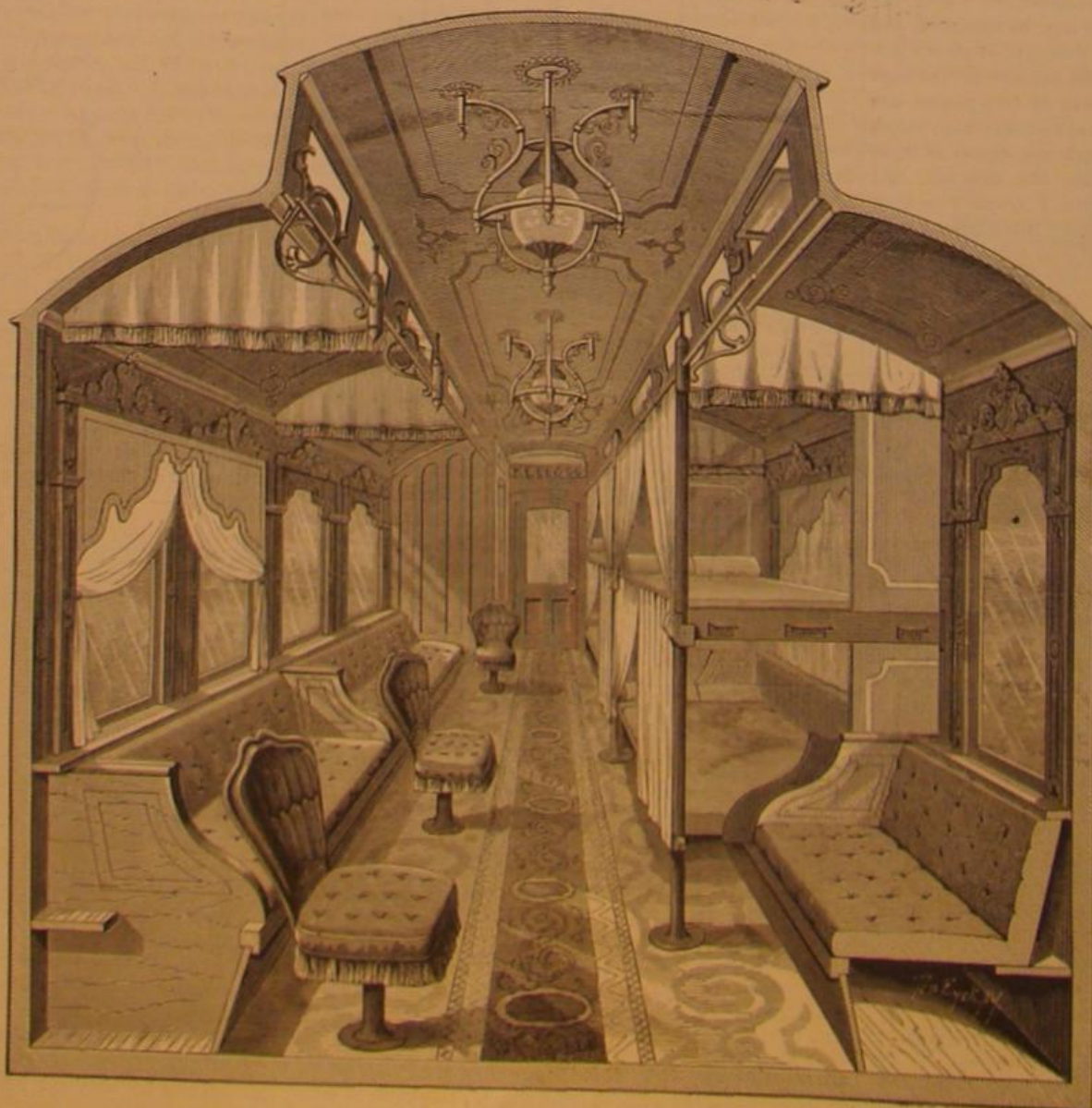
hands and feet of an orang recently dead were exhibited along with those of a man, and presented the same structure. Professor Garrod showed that the structural resemblance between the anthropoid apes and man are so close that the reason for the mental and moral differences remains still an unsolved problem. Perhaps the most striking and important portion of his discussion was that in which he proved that the vocal apparatus of man are present also in the anthropoid apes. The ape does not converse, and yet the difference between his vocal apparatus is so infinitesimal as to defy observation. It is to this point that physiological investigation must now be particularly directed.

Diet for Walking.

In August last, a pedestrian named Smyth, appearing under the name of "The American Postman," accomplished the task of walking three hundred miles in six days, at Dublin. His regimen during the walk was as follows: He takes a small chop and some cocoa for breakfast. In two hours afterward a raw egg beaten up. His dinner consists of a sage pudding and a small quantity of very raw beef, without drink, and his supper of as much cocoa and bread and butter as he wishes. Each day he is allowed a quart of milk and occasional sips of ginger ale. He takes no alcoholic beverage whatever.

A Fourth Oil Rock.

The existence of a regular fourth sand, south of Bradford, has been conclusively demonstrated by the tests made on the Big Shanty well, located on the Dent track. This well, it will be remembered, was drilled several months ago to a depth of 1,598 feet, striking the third sand at 1,545 feet. The sand was about forty feet thick, and the well has been producing five barrels a day ever since, up to a few weeks ago, when the Company decided to drill the well deeper. This was done, and at a depth of 1645 feet a fourth sand was found, twelve feet in thickness and of a good quality. Pumping has already been started and the supply will be improved.



KELLOGG'S IMPROVED SLEEPING CAR.—Fig. 1.

THE SKULL OF THE DOMESTIC FOWL.

BY C. FEW SMITH.

Bones constitute the foundation and framework of all the vertebrate animals, and yet how few persons know, or desire to know, anything about them. I have known ornithologists (?) who could determine the correct species of a bird at one glance, and yet were ignorant of the name and position of almost every bone in a bird's body. This is learning zoology before having studied its A B C. An ornithologist who has slaughtered thousands of our birds, simply for their "dry skins," says he "can see nothing in dry bones." I think it would be more beneficial to him and others, and most certainly so to the birds, if he would cease this wholesale slaughter, kill as few birds as possible, and these study thoroughly, both interiorly and exteriorly.

For the first step into the osteology of the aves, I give drawings of the skulls of three varieties of the domestic fowl (*Gallus domesticus*). A poultry fancier presented me with the head of a prize "McClellan game cock," and of a "white Polish hen." On examining the skull of the latter I found the frontal region extremely gibbous, and with twelve holes entering into the brain chamber, two of which were two eighths of an inch in length. I do not know whether all individuals of this breed have the skull thus perforated, that is to such a degree as this, but if they have, it were better this white Polish deformity were rapidly and for ever exterminated. The premaxillaries running up between the nasals are weak and thread-like, and indeed the whole skull is weakly put together. We often see among poultry fanciers the most deformed and unnatural breeds the most prized. I would suggest this: Let some popular poultryman work up a fancy breed—something new and interesting—a breed without eyes, and without feet, and give it some good but short name, say, for instance "E-pluribus-unum-sic-semper-tyrannis" fowls. It would be a success. A breed of this description would have many recommendations. It would eat little, never scratch, never suffer from blindness after a combat, and best of all, would be an everlasting "sitter." Poultry fancier, what wouldst thou have more?

The skull of the game cock is more of the typical or natural order. The brain case is thick, solid, firm and heavy; the premaxillae, running toward and between the nasals, are strong, broad, and arched; the *os quadratum* and the maxillae are strongly made, and the whole skull is substantially put together. It belongs to a breed of chickens which should be encouraged.

I regret the smallness of my collection of fancy chicken crania, for I should like, if able to study out the good or bad points appearing in the various varieties.

Fig. 1 is a lateral view of the skull of the McClellan game cock, and Fig. 2 that of the white Polish hen. Fig. 3 is the under view of the skull of a common chicken, with the nasals, frontals, and lacrymals removed; PMX, the premaxillae, including the bill and the two narrow bones running up from its center; MXP, the maxillo-palatine process; PL, the palatine bone, with the vomer, VO, between or in the center; PT, the pterygoid; MX, the maxilla (the upper jaw proper); QU, the *os quadratum*, quadrate or anvil bone, with or upon which the mandible or inferior maxillary articulates. Fig. 4 is the upper view of the skull of the

cockerel, showing the sutures, the bones not yet ankylosed. The sutures are undistinguishable in adult fowls. FR is the frontal; PA, the parietal; SOC, the supra occipital. The foramen magnum is of the usual size, and, as with all birds, there is but one occipital condyle.

Effect of Green Vitriol and Carbolic Acid upon the Growth of Plants.

Both sulphate of iron and carbolic acid are employed to disinfect fecal matter, which is afterwards employed as fertilizer. Nessier has therefore been experimenting upon the effects of these disinfectants upon the germination of seeds and the growth of plants. If the soil was kept quite dry the

small, tapered to the base, but scarcely stalked, the upper ones adnate, and the uppermost decurrently confluent. Below the small basal pinnae each edge of the stipes is set with a row of abortive ones reduced to wart-like excrescences or callosities. The color of the sterile fronds is a dark green on the upper surface, and a paler green beneath. No fertile fronds have yet been produced.

The plants to which the above description applies have been recently imported from South Africa, and are therefore to be classed as greenhouse ferns. As such they are a valuable acquisition, since they prove to be of free-growing habit, not indicating the tendency of other allied forms to dwindle away; but on the contrary, pushing their fronds with remarkable vigor.

Separation of Vanadic Acid from the Alkalies.

The interest which is beginning to be felt in this rare element, vanadium, since it has found such a valuable application in the arts, in dyeing, printing, etc., induces us to insert an abstract of Gerland's paper, on the separation of vanadic acid from the alkalies in the form of ammonium vanadate.

In the first experiment pure pentoxide of vanadium was fused with 3 molecules of sodium and potassium carbonate; the mass was dissolved and precipitated hot with a hot saturated solution of sal ammoniac, and when cold filtered and washed until the filtrate left no residue upon evaporation, then washed with weak alcohol until the chlorine reaction ceased. The salt was pressed and dried over sulphuric acid. An analysis of 1 grain of this salt showed the presence of 2.11 per cent potassium.

In the next experiment ammonium vanadate was prepared from potassium ortho-vanadate, and was found to contain 2.42 per cent of potassium.

The first of these salts, when purified by dissolving in boiling water and pouring into a boiling solution of sal ammoniac, still held on to 0.23 per cent of potassium chloride, while the second contained 0.25 per cent of potassium after re-crystallization and purification.

In a third experiment the pentoxide was converted into sodium orthovanadate by fusing with sodium carbonate; the solution was precipitated by ammonium chloride and purified asbestos. Analysis showed the ammonium salt to be perfectly pure and free from sodium.

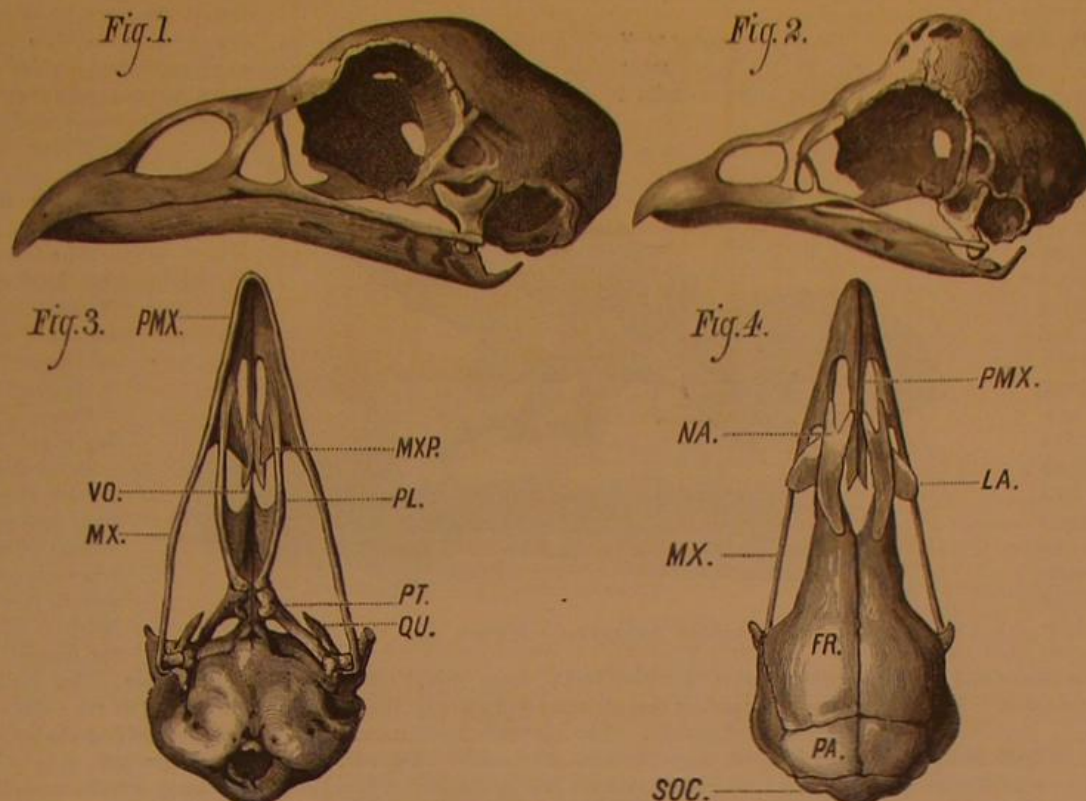
These experiments prove that ammonium vanadate cannot be prepared free from potash if the solution contained any potash, while sodium does not adhere to it in this way, hence in analysis the introduction of any potassium salt must be carefully avoided.

Gerland states that several other salts of vanadium also possess this property of carrying down small quantities of potassium which they stubbornly retain. Among these are the neutral and acid vanadid sulphates, vanadylo-sulphate and vanadylid-sulphate.

To a certain extent ammonium acts like potassium, so that metavanadic acid (VHO_2) holds on firmly to a small quantity of ammonium, which cannot be removed by digestion with acid. Copper ortho-vanadate cannot be obtained pure if ammonia were present when it was precipitated.

Prussic Acid to Absorb Carbonic Oxide.

C. Böttger states that in studying the subject of glyoxylic acid he passed pure carbonic oxide gas through pure hydrocyanic acid



THE SKULL OF THE DOMESTIC FOWL.

plants died when 25 parts of sulphate of iron or 10 parts of carbolic acid were added to 170,000 parts of earth. If the soil was moist the plants would stand 200 parts of sulphate of iron and 50 parts of carbolic acid to 170,000 of earth, without injury. When the manure is evenly distributed, as it should be for other reasons too, these disinfectants are uninjurious to husbandry.

LOMARIA DALGAIRNSIE.

This plant is a very fine greenhouse fern of arborescent character, with something the aspect of another arborescent form of the same species known to cultivators as *L. zamioides*. It has a blackish trunk, which is shaggy at the apex, with long subulate dark brown scales. The fronds are but subcoriaceous in texture, pinnate in the lower part, and pinnatifid above; the pinnae lanceolate, acute, the lower ones



LOMARIA DALGAIRNSIE.

distilled over chloride of calcium and cooled, when he observed a large absorption of the gas. When he treated this liquid with concentrated aqueous hydrochloric acid and shook the two liquids they refused to mix, but formed two layers. On removing the vessel from the cooling mixture the liquid gave out a steady stream of pure carbonic oxide. After some time the evolution of gas became stronger, especially when warmed by the heat of the hand. Prussic acid was then mixed with the carbonic oxide. Finally, the liquids mix with violent gas evolution. The products correspond to those of pure prussic acid. He was unable to obtain glyoxylic acid in this manner. The experiment was repeated a second time with precisely the same results.—*Be-richte d. D. Ch. Gesell.*

SIGNOR IGNAZIO'S "FLYING MAN."

Signor Capretti Ignazio, of Milan, has recently added to the list of avatars with which attempts have been made to navigate the air, an apparatus which he designates the "Flying Man." Like his predecessors, he has chosen the wings and tail of a bird as models for his machine. Each wing is composed of sixteen pieces of cane, which are connected by sets of movable fans. The tail resembles a section of an umbrella. The canes in the wings are adjusted to a shell working on a universal joint, which in turn is attached to a framework that is strapped to the body. At the furthest stretch of the arm is a band ring, to which are bound sticks of cane connected with the larger ones on which the fan moves. There is also strapped upon the back of the wearer a large folded bag, which, by a simple movement, can be converted into a sort of parachute in case any portion of the flying gear gets out of order. By the arrangement of a large number of movable fans, the operator is relieved of a great amount of resistance which it would be natural to suppose the air would offer; and the entire apparatus is said to be readily manipulated by a cool-headed adventurer.

NEW SMOKE-BURNING FURNACE FOR STEAM BOILERS.

The novel smoke-consuming furnace herewith illustrated is the invention of M. Ten-Brink, of Arlen, Baden, and is now in use on some 500 locomotives on the French Chemin de Fer de l'Est. The engraving, which we extract from the Belgian *Bulletin de Musée*, exhibits the application of the system to a simple cylindrical boiler with the heater, K, placed below, with its major axis at right angles and horizontal to that of the boiler. One or two furnaces, F, traverse the heater, making with the horizon an angle of about 45°. In these furnaces is placed the grate formed of the table, P, and bars, R, the latter resting on the table at one extremity, and at the other on a support riveted to the end of the furnace. The table has two lateral sides surmounted by a cover, so that a close four-sided box is formed upon the door and grate extremities. The front piece to which this box is attached is a plate of cast iron in which several different openings are made. The aperture, s, serves to remove the ashes, etc., and thus to facilitate the descent of fuel on the grate; a second opening, l, affords passage to the draught under the grate. Fuel is inserted through the door, p, and a hinged cover, r, admits air in order to insure the complete combustion of disengaged gases. The heater is connected to the boiler by short tubes through which the cooler water at the bottom of the generator descends into the heater while the steam formed in the latter passes up into the boiler through an annular space formed by larger tubes surrounding those above mentioned.

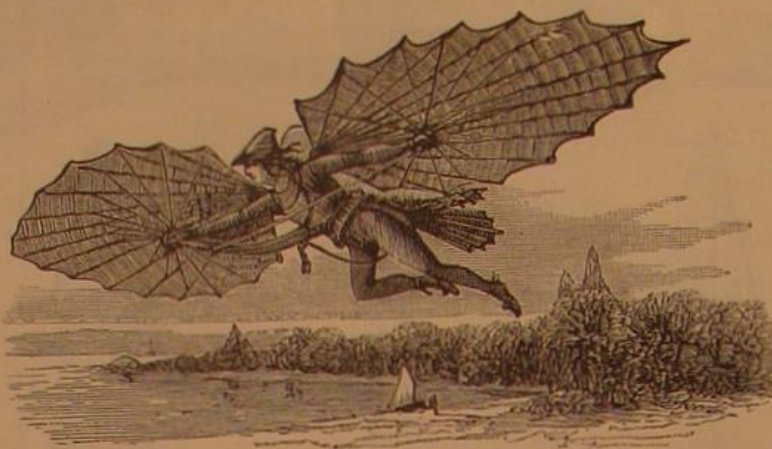
The following figures show the results of a comparative test made between a boiler provided with this furnace and one having the ordinary plane grate. The trials lasted five consecutive days. Both boilers were alike and each had three heaters and two water tubes. The heating surface of the two principal boilers was 172 square feet 32 inches; of the two water tubes, 70 square feet, and of the three heaters 341 square feet 31 inches, or, in all 583 square feet 63 inches. Boiler I had a Ten-Brink furnace of 48 square feet 63 inches. Boiler II had an ordinary plane grate.

	I.	II.
Quantity of water vaporized	112640 lbs.	78100
Temperature of feed water	63.5° Fah.	63.5° Fah.
Water vaporized reduced to 32° Fah	106047.4 lbs.	77394.8 lbs.
Consumption of fuel	11825 "	11319 "
Ashes per 220 lbs. of fuel	30.24 "	31.98 "
Pure coal consumed	10738 "	10680 "
Vaporization per 2.2 lbs. of fuel	30.8 "	15 "
calculated by re-		
ducing water to 32° Fah	22.3 "	16.76 "
Water entrained by steam calculated by		
Hirn's method	4.5 per cent	4.4 per cent.
Temperature of gases in chimney	321.9° Fah.	390.2° Fah.

New and Remarkable Galvanic Battery.

In ordinary galvanic batteries the electric current results from the chemical action of a liquid acid upon a metal, but according to the invention of Mr. Paul Jablochkoff, of Paris, whose name has recently been mentioned in the SCIENTIFIC AMERICAN in connection with an improved electric light, the current is produced by the action upon carbon of a solid body in a state of fusion. Instead of taking a metal for the negative electrode of a battery—that is, the electrode which is consumed in the action—he takes coke or an artificial conglomerate of carbonaceous matter possessing the same qualities, and acts upon this electrode by means of nitrate of potash or of soda or of ammonia in a state of fusion. He prefers to employ the nitrate of soda on account of its cheapness.

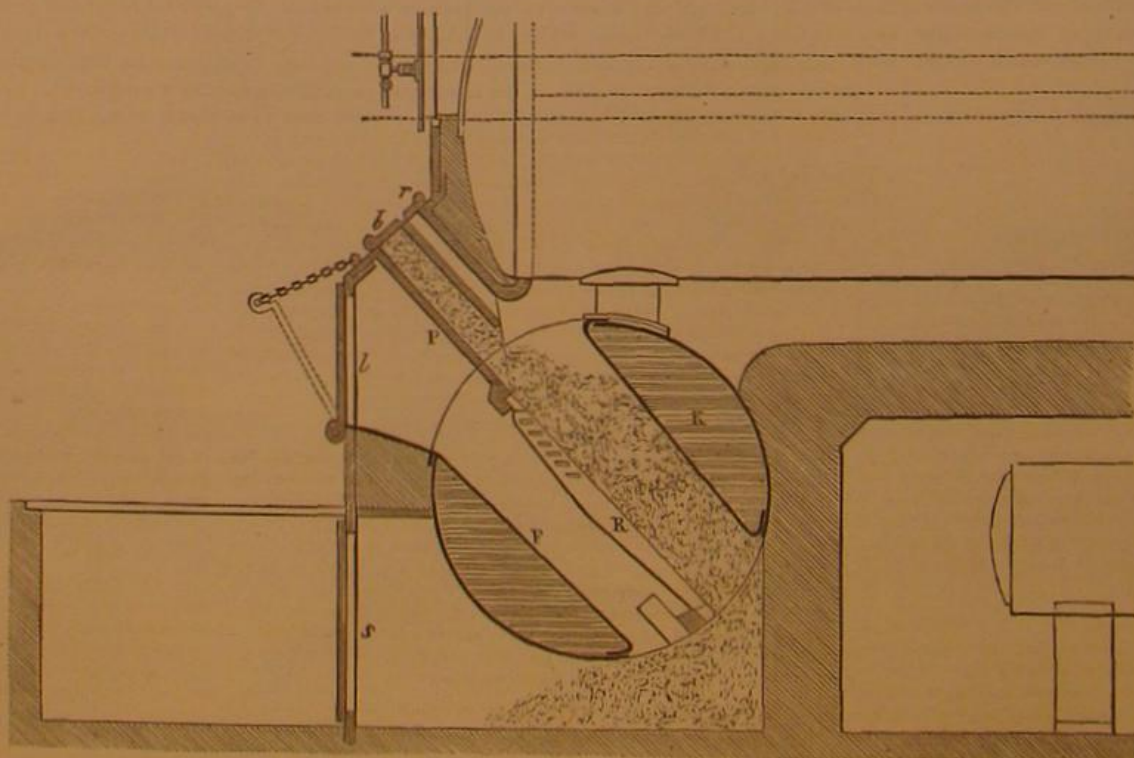
The carbonaceous matter is acted upon by the molten nitrate in the same manner as zinc is acted upon by the different acids or salts in the ordinary batteries. As the



SIGNOR IGNAZIO'S "FLYING MAN."

second electrode, he places in the same liquid either platinum or other metals that are not acted upon by the liquid in the presence of carbon. The crucible itself, in which the nitrate is fused, may constitute the positive electrode. For introducing the carbon into the liquid, the former may have attached to it a metal rod which serves for attachment of the conducting wires, or he places a metal grating or perforated metal receptacle in the liquid in which the carbon is contained, such grating or receptacle being insulated from the crucible if this constitutes the second electrode. In the latter arrangement the carbon may be added from time to time, as in a furnace, in proportion as it is consumed.

For bringing the battery into action in the first instance, the nitrates may either be fused in advance in the crucible, and the carbon be then introduced, or the nitrate may be placed in the crucible in a pulverulent state, and the carbon be ignited and plunged into the nitrate, which will become fused thereby. While the battery is in operation, large quantities of gases are developed similar in their nature to



SMOKE-BURNING FURNACE FOR STEAM BOILERS.

those produced by the combustion of gunpowder. These gases, collected by any suitable arrangement, as, for instance, in a boiler or closed chamber, may be utilized as motive power, so that this improved battery serves as a source both of electricity and of motive power. By mixing various metallic salts with the nitrates, the double effect may be obtained of regulating the intensity of action of the battery, and of obtaining metallic deposits upon the positive electrode, as in the ordinary electroplating process.

According to one arrangement of batteries, constructed according to this invention, the crucible containing the nitrate and carbon forms the positive electrode, the carbon being suspended in the liquid nitrate in a wire gauze cylinder

attached to a cross bar, the ends of which rest upon a ring of insulating material on the top of the crucible. The latter is closed in by a hinged cover having an aperture, to which is connected a pipe for conveying the gases generated to wherever required. According to another arrangement, the crucible is made of earthenware, glass, or other non-metallic substance, centrally within which is placed the wire gauze cylinder containing the carbon, and surrounding this is a metal cylinder constituting the positive electrode, or this may simply consist of a rod or bar of metal. If it be desired to employ the battery principally or entirely for utilizing the gases generated as motive power, the crucible or vessel containing the nitrate and carbon is closed at top, and is provided with a pipe leading to a boiler or closed vessel for collecting the gases under any desired pressure. The top or dome of the crucible may in this, as also in the previous arrangements, be provided with a hopper by a valve, through which carbonaceous matter may be introduced from time to time, and also with a second hopper for the addition of nitrate when required.

British Official Reports on the Philadelphia Exhibition.

The following are the classes treated of by Mr. Barlow, in this report: "Water Wheels, Water Engines, Hydraulic Rams, Windmills, etc." and "Apparatus for the Transmission of Power," "Shafting, Belting, Cables, etc.," "Hydraulic Jacks, Presses, Elevators, etc.," "Pumps and Apparatus for Lifting and Moving Fluids."

In the first class, Mr. Barlow noticed an extensive display of turbines, which seem to have superseded water wheels and other water motors. There were also some ingenious contrivances for applying small amounts of hydraulic power. In the second class, leather belting occupied a prominent position from the extensive use made of it in the States as a transmitter. The Belgian hair machine belting is also noticed. Wire rope also was extensively shown, and there were some driving chains working over cogged chain wheels, and constructed so as to be detachable for lengthening or shortening, which attracted notice. In the shafting, the shafts made by a process of cold rolling afforded the greatest novelty. These are first rolled hot, then treated with acid to remove scale and oxide, and finally subjected to cold rolling in cast steel rollers. In the elevator class, a curious safety device was noticed. The lifting chain is a strong flat-linked endless chain, arranged so that it can only move in the direction of its length. If the chain breaks, the lower part below the carriage, being unable to move laterally in its groove, becomes a rigid support to the carriage. Among the pumps were some pulsometers and vacuum engines. The former are characterized as being cheap in construction and repair, but wasteful in steam from condensation. As the latter are intended to be worked by exhaust steam from other engines, all the work they do is so much utilization of waste power. Other pumps, hydraulic rams, etc., are also noticed.

Looking at the exhibits of the whole group, Mr. Barlow was struck by the great fertility of invention displayed in America, and the excellent workmanship. American machinery seems somewhat lighter than English, and therefore less steady and free from vibration. "The aim at improvement takes two different directions: one being that of obtaining simplicity and cheapness of construction, putting the cost of working as of secondary importance. The other being the endeavor to obtain high perfection in the details and great economy of working, treating the cost of construction as of less importance. The one, in fact, being aimed at cases where engines and machinery are employed for temporary purposes, the other directed to those cases where continuous working is the object."

The Machinery Hall, as a whole, gave "a high opinion of the mechanical skill of the Americans."

A Watch.

[Lines Printed on an old English Watch Card.]

Could but our tempers move like this machine,
Not urged by passion or delayed by spleen;
And true to Nature's regulating power
By virtuous acts distinguished every hour.

Then health and joy would follow as they ought
The laws of nature and the laws of thought—
Sweet health to pass the present moments o'er,
And involving joy when time shall be no more.

ASPHALTUM may be used to advantage in staining imitation of hard woods.

Inventions Patented in England by Americans.

From August 25 to September 11, inclusive.

BREECH-LOADING GUN.—A. J. Crocker, Providence, R. I.
 BINDING WIRE.—S. G. Mason, Vicksburg, Mich.
 CONVERSION OF IRON ORES.—M. J. Hamilton, St. Louis, Mo.
 LABELS.—A. Kimball, New York city.
 LOOM.—W. Riding, Norristown, Pa.
 PROPELLING CARS.—J. B. Tibbitts, Hoosic, N. Y.
 REFRIGERATING APPARATUS.—G. C. Roberts (of New York city), London, England.
 RESTORING CHAIRS, ETC.—Eva B. Reid, New York city.
 SEWING THREAD.—A. R. Arnold, Newark, N. J.
 SHOE STIFFENINGS.—D. Scrymgeour, Boston, Mass.
 SPRING TRAP.—I. A. Paine, New York city.
 TACKS FOR SHOE SOLES.—L. Goddu, Winchester, Mass.

Recent American and Foreign Patents.

Notice to Patentees.

Inventors who are desirous of disposing of their patents would find it greatly to their advantage to have them illustrated in the SCIENTIFIC AMERICAN. We are prepared to get up first-class wood engravings of inventions of merit, and publish them in the SCIENTIFIC AMERICAN on very reasonable terms.

We shall be pleased to make estimates as to cost of engravings on receipt of photographs, sketches, or copies of patents. After publication, the cuts become the property of the person ordering them, and will be found of value for circulars and for publication in other papers.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED MACHINE FOR BUNCHING HAY FOR FUEL.

Marcus E. Getter, Alden, Minn.—The box or frame of this machine is supported upon legs, and a shaft is journaled in the side of the box, and is provided with steel tines which extend horizontally through the box and project through a circular opening in the side of the box opposite that in which the shaft is journaled. Short tines are placed in alternation with longer tines, and both are tapered throughout their entire length. A semi-cylindrical presser is placed directly under and parallel to the tines, and is connected by a bar with a foot lever which is pivoted to the crossbar that connects the legs. A slide, moving in guides at the side of the box, closes the opening, and is notched to fit over the ends of the tines, and prevents the hay from escaping at the side of the box. The operation is as follows: Hay is introduced into the box as the tines are revolved, and as it is wound upon the tines the presser is thrown upward by means of the foot lever. This causes the hay to wind closely upon the tines. When the bunch is sufficiently large the slide is raised by moving the lever. The bunch is then discharged from the tines through the opening by throwing the forked lever forward.

IMPROVED APPARATUS FOR HEATING AND LIGHTING.

Charles Ritchie, Brixton, Eng.—The vapors arising from the combustion of coal gas are highly injurious to health, and greater in volume than is generally supposed, exceeding, as they do when condensed into liquid form, a half ounce to every foot of gas that is burned. These vapors contain sulphurous acid, carbon, and other deleterious matters, which, especially the sulphurous compounds, have great affinity for water, and may hence be gotten rid of by condensation. The object of this invention is to condense the vapors and separate them so far as possible from other products of combustion; also to heat and ventilate the apartment in which the gas is burned for illuminating purposes. Siphonic action results naturally from the arrangement of passages or flues so that the combined currents of heated air, vapors, and products of combustion from the gas flames at burners are curved downward and then upward through a long circuitous route, whereby the heat becomes mostly radiated or absorbed from the traveling vapors, and the vapors and gases, being rendered heavier than the air, fall to the bottom of the apparatus, where condensation takes place. The noxious substances are thereby eliminated, and the heated air and certain light products of combustion pass on into an apartment which is ventilated by the constant change of air without the delivery of noxious matter into the same.

IMPROVED BEDPIECE FOR CLOTH-PRESSING MACHINES.

Herman Springborn and Christian H. Baush, Holyoke, Mass.—The present invention relates to improvements in that class of cloth-pressing machines in which a pressing roller is fitted to a heated concave bed. The invention consists in a hollow bedpiece, made in two parts, and connected by means of dovetail projections and recesses, and having between them air spaces. The object of the invention is to provide a bed for cloth-pressing machines in which both heat and cold may be employed, so that the cloth may be both hot and cold pressed in passing over the bed. The side parts of the bed are made of cast iron or other suitable material, and are each chambered out or made hollow—one to receive a current of water, cool air, or other suitable medium for cooling the bed, and the other for receiving steam, or for containing a gas flame or other suitable heating medium. The parts are connected together by dovetail projections formed on one part and a dovetail slot formed in the other part, the side of which is cut away, forming air spaces that prevent the intercommunication of heat and cold. The parts are put together by sliding the dovetail projections of the one part into the dovetail slot of the other part. This arrangement permits of the expansion of one part of the bed independently of the other part, so that as one part of the bed is warmed and the other cooled, neither part will be strained. Steam is taken into one part through an aperture and the water of condensation is removed through another aperture, and cold water is taken one part through one aperture and escapes through the other aperture. Cloth, in passing over the concave surface of the bed, is first subjected to hot pressure between the roll and the bed, and is afterwards subjected to cold pressure beneath the same roll.

IMPROVED COTTON GIN.

Robert Dickinson, Darlington Court House, S. C.—This invention relates to cotton gins, and consists, first, in constructing the ribs forming the breast in pairs or gangs, for the purpose of allowing them to be secured firmly and substantially in their places; second, in flanges or fins fixed to the ribs, and so constructed and arranged that foreign substances cannot be brought in contact with the saw teeth; third, in clearing-brushes arranged between the saws and the brush cylinder, and receiving the saw teeth through them, for the purpose of preventing clogging and danger from fire, and also for the purpose of carding and straightening out the lint on its way to the brush cylinder. The saw shaft is journaled in boxes on the main portion of the frame, and is consequently detached from the driving shaft, and will not be thrown out of true thereby, nor caused to heat in its bearing. This arrangement prevents any grinding or rubbing of the saws against the ribs or bars, and lessens vibration and wear. Hitherto the ribs have been made separate. In this improvement they are constructed in pairs or gangs, for the purpose of more rigidly securing them to the end rails. Single ribs work loose, and have less bearing on their rails than the double or triple ribs, and are more liable to cause clogging. The ribs are all provided with flanges, which are constructed of an angular form, with the lower ends rounded and the upper edge sloping upward. These flanges serve as guards, and protect the saw teeth from contact with sticks, nails, matches, and other foreign substances which might be in the cotton. This brush cylinder is constructed in the usual manner, and its shaft is entirely independent of the saw shaft; consequently the latter will not be subjected to strain or wear, which is so objectionable in gins where the saw shaft and brush cylinder are geared together. The

brushes are designed to extinguish fire which may take place, from any cause, in the gin, and they also operate to card and straighten out the lint on its way to the brush cylinder.

IMPROVED JACQUARD MACHINERY.

Warren P. Jennings, Brooklyn, N. Y.—This invention has relation to Jacquard machinery, and the nature of the invention consists, first, in the employment of a cam wheel of peculiar construction, in combination with gearing and rotating arms, for giving more positive intermittent rotation to a card cylinder during its vertical movements; second, in combining a heater with the cards, which is so arranged that the latter are prevented from being injured by moisture in the air. A cam wheel communicates a positive rotary motion to the card cylinders, giving them one eighth of a revolution at each stroke, and bringing them into proper position at the termination of every ascending stroke. The movements are so direct and timed that there will be no tendency to displace the cards on the cylinders while bringing them successively into position for operation. The chain of cards is constructed in the usual well known manner, and near the guide roller, over which the cards pass to the cylinder, is arranged a heater, covered by a shield. This heater may be a perforated gas pipe, where it is desired to use gas jets, or a lamp or steam may be used where gas is not to be had. In damp weather cards absorb moisture and swell, so that they do not work true. To prevent this the heater is so arranged that the cards are kept dry.

IMPROVED MACHINE FOR PICKING STONES, ETC.

Charles Fuller, Little Marsh, Pa.—The object of this invention is to furnish an improved machine for picking, hauling, and delivering stone, manure, dirt, etc., which shall be simple in construction, effective in operation, and conveniently operated and controlled. The invention consists in the combination of the hinged crossbar and the U-rods, connected by crossbars with the frame work of the machine; in the combination of the adjustable crossbar and the guide rods with the hinged crossbar to which the U-rods are attached, and with the frame of the machine; in the combination of the lever provided with the slotted curved arm and the pin with the frame of the adjustable crossbar and the hinged crossbar, to which the U-rods are attached; in the combination of the notched fulcrum bar with the crossbar of the U-rods, and with the axle of the carriage; in the combination of the ratchet bars, the pawls, the rod, and the lever with the crossbar of the U-rods, and with the frame of the carriage; and in the combination of the scraper provided with the keepers and the flange socket with the lower arms of the U-rods. When the machine is to be used for handling dirt and other fine substances a scoop or scraper is placed upon the lower arms of the U-rods. The scraper has two or more keepers formed upon its bottom to receive two or more of the rods, and thus keep the rear part of the scraper in position.

IMPROVED WINDMILL.

Oscar B. Fuller and Leonard A. Fuller, Mount Pulaski, Ill.—The object of this invention is to furnish an improved windmill, which shall be simple in construction, inexpensive in manufacture, reliable in operation, and easily controlled. The wheel is formed by attaching wings to the radial arms of a hub, which revolves upon a journal formed upon or attached to the outer end of a bar or beam. To the inner side of the wheel is attached an eccentric flange to receive the forked outer end of a lever. The lever is pivoted to a short fulcrum post, the lower end of which has a T formed upon it to fit into a T groove formed in the plate attached to the bar or beam, so that the fulcrum point may be adjusted as required. To the inner end of the lever is attached the upper end of the rod, which passes down through the tube and hollow stop, and from the lower end of which motion is taken to the machinery to be driven. Upon one end of the shank of the vane is formed an arm which strikes against a shoulder formed upon the side of the inner end of the bar or beam. By this arrangement the vane cannot turn out of line with the bar or beam in one direction, but may turn in the other direction into a position at right angles with said bar or beam. A special advantage of this improved windmill is that the lever so greatly increases the power of the wheel that it may be used for raising water from deep wells while using a small wheel, which could not be done with the old construction, as the resistance of the pump was so great that the wheel had to be made very large, and on this account was very expensive in construction, and very liable to be broken by a heavy wind.

IMPROVED DRILL CHUCK.

Henry B. Beach, West Meriden, Conn.—This invention relates to an improved chuck of simple and effective construction, which grips the object with considerable power as the same is inserted into the chuck, passing nearly through the entire length of the same, so as to obtain a greater bearing surface, and hold the object rigidly and without vibration. The solid center piece is made in one piece with the spindle to be placed in the arbor of the lathe, or to be screwed to the face plate. The center piece is provided with an exterior screw thread, and with guide recesses for the jaws, which are side grooved to receive tenons of the part, so that no vibration of the ends of the jaw may be produced, and are pressed in outward direction by spiral springs resting between the center piece and in sockets of the rear ends of the jaws. The jaws are moved inward by an outer cap that turns by an interior thread on the center piece. The cap bears, by its conical front end, on the corresponding tapering jaws, exerting a uniform pressure upon the outer tapering surface of the same, so as to accurately and steadily draw in the jaws on screwing back the cap over the center piece, the springs returning the jaws when the pressure is relaxed by the forward screwing of the outer cap. The chuck is readily adjusted to the work by turning the cap forward or backward on the center piece, the jaws clamping by their interior faces the work with great power.

IMPROVED BULL WHEEL FOR DERRICKS.

William J. McKee, Petrolia, Pa.—The object of this invention is to furnish an improved bull wheel which shall be stronger, and at the same time lighter, than wheels constructed in the usual way. The outer ends of the arms or spokes are notched and slotted, so that the segments of every other one of said layers may pass through the ends of the said arms or spokes, and the segments of every other layer may abut against said arms or spokes. By this construction the strain will come right over, and will be distributed among the arms or spokes of the wheel, and a lighter and stronger wheel will be produced. The face of one of the wheels is grooved to receive the driver or tug rope, and the other has a wide flat groove formed upon it to receive the brake strap or band.

IMPROVED MIDDINGS SEPARATOR.

Myron H. Alberty, Cherokee, Kan.—The object of this invention is to purify middlings and separate the fuzzy and branny particles, and at the same time separate the heavier from the lighter middlings, by subjecting them to currents of air while passing through the machine. The invention consists in the combination of a series of air passages provided with gates at their outer and inner ends, with a blast fan and a set of air chambers; in the combination, with the blast fan and the inlet air passages, of adjustable riddles, an exhaust or settling chamber, and an exhaust fan. The middlings are introduced through an opening in the case into the chamber and fall upon inclined boards, and pass through an opening between said boards into the first air chamber, where they are met by one or more currents of air from one or more of the passages, and by currents of air through the holes in the first riddle, and the fuzzy or branny particles are carried over the upper end of the riddle into a chamber. The heavier middlings fall upon the riddle and pass down through its holes against the air passing through said holes into the second air chamber, where they are met by a current or currents of air. The fuzzy and branny particles are again blown off by the air from the passages and the air passing up through the holes in the second riddle, and are driven over the upper end of the said riddle into a chamber. The heavier middlings fall upon a riddle and pass through its holes into the third air chamber, where they are again

met by a current or currents of air, and the fuzzy and branny particles that may still remain are driven over the end of the inclined board into a chamber.

IMPROVED SPINDLE, BOLSTER AND STEP FOR SPINNING MACHINE.

John T. Beall, Petersburg, Pa.—This invention relates to certain improvements in the construction and adaptation of the spindle, bolster, and step of a spinning machine, designed to secure automatic lubrication, the best bearing surfaces for the parts, and to prevent the tendency of the oil to exude at the joints and spread over the entire surface of the same. The invention consists mainly in arranging the bushing in the upper end of the bolster slightly below the upper edge of the bolster, so as to form a cup or recess to receive the oil, which has a tendency to rise upon the spindle and spread upon the outside of the bolster, and in surrounding said upper bushing with a packing of fibrous material which retains and filters the oil and resembles that which accumulates in the cup or recess. It also consists in the particular arrangement of parts whereby the two bearings of the bolster and the toe of the spindle in the step are all oiled at a single joint instead of permitting the spreading of oil upon the outside surfaces.

IMPROVED TREADLE-OPERATED CONFLUENT PUMP.

Richard H. Schenck, New York city.—This invention relates to an improved suction and force pump of effective construction, that is operated by the feet, and arranged to throw a uniform stream of water; and it consists of two cylinders with alternately treadle-acted pistons, that are connected by a chain or rope passing over a central pulley between the same, each stroke of the pistons producing the induction and eduction of the water, in connection with suitable valves and channels connecting the cylinders, suction and discharge pipes. The stroke of each treadle produces the lowering of one piston and the raising of the other piston, the pistons exerting thereby, simultaneously, a suction and force action, so as to draw in the water by the induction pipe and discharge it by the eduction pipe. The eduction pipe takes up the water in the air chamber and passes out at the top of the same, the air in the air chamber regulating the flow of water and keeping it up in uniform manner.

IMPROVED SCRAPER AND DITCHER.

Joel Rice, Liberty, Mo.—The object of this invention is to furnish an improved machine for opening ditches, grading and repairing roads, grading yards, lawns, etc., and for various other uses where earth is to be moved short distances. The sides of the ditcher are jointed together at one end, set at an angle to each other, and connected adjustably by means of curved overlapping arms which are perforated to receive locking pins. Said arms support a platform, upon which the driver is to stand or sit, when he desires to add his own weight to that of the scraper. To the bars, at their angle, is attached a notched bar to which the draught is applied. The outer side of the side bar is made straight, and is designed to rest against the land side of the furrow opened by the plow which the scraper is following, and the outer side of the side bar, that pushes back the dirt, is slightly concaved. With this construction the scraper may be used to throw the dirt to the right hand or to the left, as may be desired, or in following a left or right hand plow, or to throw the dirt to the same side while passing back and forth along the same furrow in opening a ditch, by using it with one or the other side upward, as may be required, to throw the dirt in the desired direction.

IMPROVEMENT IN SECURING HANDLES IN TOOLS.

Lazare Landecker, San Luis Obispo, Cal.—The object of this invention is to furnish an improvement in securing handles in hammer heads, and in all other tools in which the handles are inserted in eyes, by means of which the handles will be held firmly and securely in place. The invention consists in the teeth, points, or other projections formed upon the surface of the eye of a tool, to be forced into the handle as it is spread by the wedges, for securing said handles immovably in said eye. The projections also prevent the handle from turning in a round eye, and hold it immovably in place.

IMPROVED HYDRAULIC CEMENT.

James C. Gostling, New York city.—This invention relates to an improved hydraulic cement; and it consists in a composition formed by mixing together calcareous shell marl, containing from seventy to eighty per cent of carbonate of lime, silicious clay, pozzolana or anthracite coal ashes, and ribbon stone containing a large percentage of magnesia. When sufficiently dry, place it in a kiln, in alternating layers with coal or coke, and burn it to a moderately hard clinker. After burning, grind it, by means of burr stones or other suitable machinery, to a powder sufficiently fine to pass through a sieve of fifty meshes to the square inch.

IMPROVED TYPE-DISTRIBUTING MACHINE.

Robert T. P. Allen, Farmdale, Ky.—This invention consists in the construction and combination of devices whereby the types (composing the column or page of matter to be distributed) are individually and successively forced into spring clamps, or holders, that are carried by a rotating wheel, and by such holders delivered to automatic releasing mechanism, and distributed into separate receptacles. For details, see patent.

IMPROVED ROAD SCRAPER.

Samuel Pennock, Ithaca, N. Y.—This invention relates to machines for scraping and leveling roads, and it consists in a scraper supported by a suitable frame carried by wheels, and adjustable as to its height, and in a toothed bar carried in front of the scraper, to be used or not, as occasion may require. By operating one or the other lever the end of the scraper bar may be raised, so that by driving up on one side of the road and down on the other the road may be ridged or rounded, as may be desired, or by arranging the scraper bar in a horizontal position the road may be made level. The bar is adjusted so that its teeth cut away the projecting and uneven portions of the surface before it is scraped.

IMPROVED DIRECT-ACTING FORCE PUMP.

John K. Van Pelt and Washington Lee, Texarkana, Ark., assignors to themselves and William H. Elliott, of same place.—This invention has reference to an improved direct-acting force pump of extremely simple and durable construction, that is adapted particularly to mining and other purposes, as no valves are used and no parts are liable to get out of order by sand and grit. The invention consists of direct-acting plungers that force the water from the cylinders, having supply holes through bottom channels to a discharge pipe having a swinging or sliding cut-off that alternately establishes and interrupts communication with the cylinder and channels. The top part is provided with cylinders and plungers, sliding therein, and being operated by plunger rods and a fulcrum lever. The water enters the cylinder through supply holes at both sides, and is forced by the direct action of the plungers down into the water channels of base part and into a connecting chamber, with which the discharge pipe communicates. A swinging and balanced cut-off is arranged in connecting chamber at the foot of discharge pipe, and carried by the alternating action of the plungers from one side to the other, so as to rest on seats of chamber. The cut-off produces the connection of the cylinders with the discharge pipe at the descent of the plungers, and forces at each stroke the water through one of the channels into the discharge pipe. The pump works in simple and effective manner, without valves or suction, and is readily filled at each upward stroke of the plungers as it is submerged in the water. When the motion of the plunger is stopped the water falls back into the water chambers, and remains cool, without being exposed to freezing as in the valved pumps, in which the water is sustained above the plungers. The pump is not liable to become filled with sand or sediment, so as to get out of order, being thereby of special advantage for pumping gritty or impure water.

IMPROVED STREET-CAR ENGINE.

Francis V. Mathews, New Orleans, La.—This invention relates to motors for driving street and other cars, and it consists of a pair of oscillating steam cylinders supported under the car by the truck, and provided with vertical shafts upon which are placed worm wheels that engage with wheels on the car axles. The frame of the engine is attached to and supported by the truck frame of the car. The cylinders are oscillating, and with their upper trunnions journaled in a support, and the lower trunnions are journaled in the main frame. These cylinders are provided with central ports at their ends, and with a face that is fitted steamtight to the part of the engine frame. Between the ports there is an exhaust port and a valve capable of covering either of the ports, and the exhaust port is pressed against the valve seat by a spring. The valve is provided with a rod that is connected with an arm on a rocking shaft that is connected with a suitable lever in the car by which it is moved. Vertical shafts are journaled in the frame and provided with crank disks at their upper ends, from which the crank pins project. The piston rods of the cylinders are connected with the crank pins. Upon shafts are endless screws or worms, which engage the wheels on the car axles. The engines run in opposite directions, which gives to both axes a motion in the same direction, the screws being placed on opposite sides of the axles. The valve is placed so that it covers one of the ports and the exhaust port when steam enters the exposed port and drives the engine, the used steam escaping through the covered port and the exhaust port. When it is desired to reverse the engine the valve is moved so as to admit steam through what was before the exhaust port, and to permit the used steam to escape through the other port. The crank pins may be connected by a rod when the cylinders will assist each other. The frame of the engine is constructed so as to inclose the cylinders, worm wheels, and other working parts of the engine, so that none of the parts are exposed to dust, and all noise is confined, so as to be unobscurable.

IMPROVED FIRE ESCAPE.

Henry Elbe, Niagara Falls, N. Y., assignor to himself and Adolph Goldsmith, New York city.—This invention relates to means for removing persons and furniture from the windows of a building which is on fire. To the wall of a building a rail or track is strongly secured by means of brackets. This rail is set off a little from the wall, and, if desired, it may be inclosed inside of the cornice or a receptacle especially provided for it. A car is constructed to move up and down the track. To this car are attached chains of sufficient length to be controlled by persons on the sidewalk below. The chains are intended to enable a person to move the car at any desired point on the rail. The ladder is made of metal, and the side bars of short links pivoted together, which will allow the ladder to be rolled up when not in use. In combination with this apparatus is used a fender or shield, made of sheet metal plate, of suitable size to cover one or more windows, and it is perforated at different points for allowing the nozzle of a hose pipe to be inserted through it. The fireman will thus be protected from flame and smoke while playing on the fire.

IMPROVED HORSE POWER.

Edwin R. Lancaster, Alum Mills, Va.—The object of this invention is to furnish an improved horse power which shall be so constructed as to economize space without sacrificing power or effectiveness, and which shall be simple in construction and convenient in use. To the base frame of the machine is attached a large internally toothed gear wheel, the upper side of which is made wide and smooth, to serve as a way for the small wheels or rollers, pivoted to the corners of the frame. To the center of the frame is attached a post, the lower end of which revolves upon a pivot attached to the center of the frame. A small gear wheel meshes into the teeth of the large gear wheel. Another shaft revolves in bearings attached to one end of the frame, and to its upper end is attached a large gear wheel, the teeth of which mesh into the teeth of a small gear wheel attached to the upper end of the shaft, which revolves in bearings attached to the middle part of the frame, and to it is attached a large gear wheel, the teeth of which mesh into the teeth of a small gear wheel attached to another shaft, which revolves in bearings attached to the frame, and to its upper end is attached a grinding mill, which is thus carried around by and with the frame; no more space will be required than enough for the driving mechanism, and a neat and compact machine is produced. By this construction the machine will be evenly balanced, so that it will run steadily and easily.

IMPROVED CONNECTING ROD.

George W. Wilks, Robertson Fork, Tenn.—This invention consists in the arrangement in the straps of a connecting rod of side pieces between which are placed boxes, which are so proportioned that their surfaces that come into contact are reduced to a knife edge to admit of adjusting the boxes without filing, so that they may be forced together by the screws as the box becomes worn, and the necessity of filing the boxes is avoided. By means of this improvement the boxes of a connecting rod may be accurately adjusted without removing and filing them, and when adjusted cannot become accidentally loosened or disarranged.

IMPROVED WASHING MACHINE.

James H. Calvert, Princeton, Ky.—The object of this invention is to furnish an improved washing machine which shall be simple in construction, convenient in use, and effective in operation, washing the clothes quickly, thoroughly, and without injuring them. The invention consists in the combination of the crossbars, the pivoted bent levers, the connecting rods, and the springs with the suds box and the platform attached to said suds box, to form a yielding bed for the clothes while being operated upon. By this construction the clothes, while being operated upon, will be supported by a yielding bed, which will adjust itself to the varying thickness of the clothes being operated upon, so that the clothes may be operated upon evenly by the washing cylinder, thus protecting them from being cut or injured.

IMPROVED DOUBLE ACTING PUMP.

Riley I. Knapp, Guilford, Ill.—The object of this invention is to provide a simple and efficient pump that may be used either as a lift or force pump. To the cylinder a piston is fitted which is attached to parallel rods. This piston is provided with the usual leather packing, and with a central opening that is closed by a valve. In the cylinder a tubular piston is placed, which is provided with a valve and packing. To this piston, rods are attached which extend upward, and are pivoted to a lever that is pivoted to the standard. The piston tubular is fitted to a stationary hollow piston, which is attached to the standard by means of a strap. This piston is provided with packing and a valve, and to its upper end a pipe is attached. This hollow piston serves as an air chamber in equalizing the flow of water through the pipe.

IMPROVED BALING PRESSES ON WHEELS.

Michael McCarty, Pueblo, Col.—The object of this invention is to furnish an improved baling press, which shall be simple in construction, convenient in use, strong and durable, and so constructed that it may be readily moved from place to place. The baling box is made in two equal parts or halves connected together, held in position and strengthened to withstand the outward pressure of the bale while being compressed by three iron bands. The rear end of the baling box is closed by a door, which serves as a stationary follow block, and is hinged at its lower edge to the bottom of the box. The material to be pressed is introduced through a door formed in the forward part of the top of the baling box. A crossbar is attached to the outside of the movable follower, the ends of which project so as to pass through the spaces between the parts of the box, and to the projecting ends are attached the forward ends of rack bars, which pass back along the sides of the box. The racks are drawn back to compress the bale by gear wheels which mesh with them, and with which are rigidly

connected the wheels or pulleys around which are wound, and to which are attached, the draw ropes.

IMPROVED TRICYCLE.

Matthew E. Croft, Hordcon, Wis.—The object of this invention is to furnish an improved tricycle designed for use by mechanics and others for going to and from their places of business, by merchants and others for sending small parcels from one place to another, and by youths and others for amusement and exercise, and which shall be simple in construction and easily operated. The invention consists in the combination of the arched bars, the block, the seat, the cord, the stirrups, the rods, and the stay bars with the wheels, the axles, the tubes, and the bolster. The rear ends of two arched bars are bolted to the end parts of the forward bolster. The arched bars incline toward each other, so that their middle parts may be near each other, and to said middle parts is secured a block, which gives strength and rigidity to the bars, and to which is secured the seat or saddle upon which the rider sits. Over the forward part of the seat passes a cord, to the ends of which are attached stirrups to receive the rider's feet. To these stirrups are pivoted the rear ends of two rods, the forward ends of which are pivoted to the forward axle, near its ends, so that the rider can guide and turn the machine with his feet. The rider propels the machine by means of two rods which he holds in his hands, and which he presses against the ground. In starting, the rider presses both rods against the ground at the same time, but after he has got up enough motion to give momentum to the machine he can use the rods alternately.

IMPROVED MACHINE FOR SEWING BUTTONHOLES.

Richard M. Melhuish, Hoxton, Eng.—This invention relates to mechanism adapted for sewing machines of the Thomas or Howe type, for the purpose of sewing straight buttonholes and fancy stitching. By this invention this is accomplished with ease and rapidity, it not being necessary to turn the fabric round in order to work the two edges and finish off the ends of the buttonhole. The mechanism is for imparting to a movable cloth plate, upon which the work is clamped, a vibrating to and fro motion across the line of the hole, and also a traversing motion in the direction of the hole to feed the work as required. In sewing a buttonhole two parallel lines of stitches are made, the vibrating feed plate being caused to traverse first in one direction and then in the other by turning round a cam, each end of the intended buttonhole being barred as the needle arrives thereat, after which the hole is cut.

IMPROVED DEVICE FOR LOWERING FLUIDS INTO OIL WELLS.

Sebastian A. Fithian and Isaac N. Fithian, Karns City, Pa.—The especial object of this invention is to furnish an improved device for lowering fluids into the bottom of oil wells to cleanse them from obstructions, open the crevices, soften the paraffine so that it can be pumped out, etc., and which shall be simple in construction, convenient in use, and effective in operation. The invention consists in the combination of the barrel provided with the ball, the bottom at a little distance above its lower end, and the perforations in its sides below said bottom, the single or double valve, the spring catch, and the closely fitting cover. When the retaining valve is open the closing valve rests against and closes the lower end of the barrel, so that the fluid contained in the barrel will be forced out through the holes formed in the sides of said barrel below the bottom, and will thus be forced against and clean the sides of the well.

IMPROVED PISTON PACKING.

Isaac H. Congdon, Omaha, Neb.—This invention relates to an improved piston packing, by which the packing rings are evenly pressed against the cylinder, so as to wear in uniform manner; and the invention consists of a solid and annularly grooved ring resting against the lugs of the piston head, and having cylindrical pockets in which adjustable spiral springs are placed that press against an inner sectional ring and outer sectional packing rings. The packing is specially adapted for locomotive and stationary engines, and is cheaper than the semi-elliptic springs and brass packing in use. The pressure of the springs adjusts itself as the packing rings wear off, the springs being readily reset by taking out the follower bolts and head and turning the set bolts to the required degree of tension, the follower being readily replaced without interfering with the packing rings, as they remain in the solid and circumferentially grooved ring.

IMPROVED GRAIN SEPARATOR.

Reuben Sprengle, York, Pa.—The action of an oscillating rocker, made of longitudinal slots on the carrier, shakes the grain in effective manner out of the straw as it is conveyed up by the carrier, the grain being collected below the carrier in any suitable manner. The carrier shafts run slower than the rocker operating shaft, giving thereby the rocker a chance to take out all the grain. The straw passes slowly over the machine, being thoroughly agitated by the quick beats of the rocker, without throwing any grain off the shaker. The machine runs without jarring, and takes the straw as fast as it is fed from the cylinder, so as to obviate the choking of the same. The shaker is secured by end hooks to eye bolts of the thrasher, and readily connected or detached from the same, it being also so supported as to be raised or lowered at the upper end to provide for the condition of the straw.

IMPROVED STUMP EXTRACTOR.

Charles Tener, New Market, O.—This invention relates to machines which are designed for extracting stumps and stones, and the nature of the invention consists in a portable frame, which can be taken apart or erected at pleasure, and which affords a substantial support for two rack bars, spring pawls, a vibrating actuating lever, and a lifting link. A strong timber is secured midlength of beams, and constructed with openings through it to receive two rack bars, the teeth of which are pitched forward. The lower ends of these bars are slotted and pivoted to a long lever, which is made of sections secured together so that they can be readily detached. The operation of the machine is as follows: The link is made fast to a stump, and the lever is vibrated, which gives alternate upward movements to the two ratchet bars, the pawls holding them firmly after each upward stroke.

IMPROVED APPARATUS FOR STRETCHING FELT JACKETS FOR ROLLERS IN PAPER MACHINES.

Luther Cole, Corinth, N. Y.—This invention relates to apparatus for stretching felt covers for couch and other rolls in a paper machine, and it consists of two tapered bars and two oppositely arranged wedges placed between the tapered bars, and operated by a spindle having cut upon it a right and left hand screw thread for moving the wedges simultaneously in opposite directions, so as to spread the tapered bars upon which the jacket is placed. The felt jacket to be stretched is drawn over the bars when the instrument is contracted. The bars are spread by drawing between them the wedges by turning the threaded spindle. The bars, the outer edges of which are parallel, stretch the jacket evenly and uniformly throughout its length.

IMPROVED SAW FEEDER.

James G. Cofman, Pierpont, Mich.—This invention relates to devices which are designed to hold a hand saw down to its work during the operation of cross-cutting logs. The nature of the invention consists in combining, with a spike, an adjustable spring roller and one or more dogs, so arranged that, when the spike is driven into the ground alongside of a log, and the latter firmly secured thereto, one man can conveniently manage a hand saw in the operation of cross cutting. This roller is arranged a little to one side of the spike, and presses upon the bowed back of the saw, holding it down to its work and guiding it. The sawyer regulates the pressure of the roller on the saw by means of a crank and its attachments, which are just in front of him while at work. The spike is driven into the ground alongside of a log, the latter is firmly secured to the spike. The saw is then started into the log, and the roller adjusted down upon it, and kept down with the required pressure during the entire operation.

IMPROVED DOG FOR SHEET-METAL ROLLING MILLS.

Edward C. Hegeler and Frederick W. Matthiessen, La Salle, Ill.—This invention relates to the dogs (so called) that are placed at the rear side of the rolls used in the manufacture of sheet metal, and it consists in a jointed dog, provided with friction rollers, and with a tail piece or lever that sustains the weight of the dog, and also any pressure that may be exerted upon it by the sheets of metal passing through the rolls. A nose piece is jointed to the front end of the casting and rests upon the roll. The sheet metal, as it passes from the rolls, is received by a nosepiece, and directed so that it will pass over the roll to the table of the rolling mill. The weight of the casting and friction rolls, and the pressure of the sheets, are sustained by the tail piece, and only a part of the weight of the nose piece rests upon the roll.

IMPROVED MACHINE FOR WELDING TUBES.

John French, South St. Louis, Mo., assignor to himself and James W. Hill, of same place.—The flue or tube to be welded is placed upon a mandrel which rests in semicircular notches in the ends of the arms of the holder, which is secured to the base, and the notch in its inner arm is made the same size as the cavity of the die, and is beveled so that, when the end of the tube or flue is placed upon the forward end of the mandrel and is slipped back, it can readily pass through the said notch. The forward end of the mandrel is tapered so that the flue or tube can be slipped upon it without its being necessary to take hold of the said mandrel. Upon the mandrel is formed, or to it is attached, a collar which is placed between the arms of the holder to prevent the mandrel from getting out of place.

NEW AGRICULTURAL INVENTIONS.

IMPROVED SULKY PLOW.

Roberson A. Renfro, Rockwall, Tex.—The object of this invention is to furnish an improved sulky plow, which shall be simple in construction and convenient in use, and which shall be so constructed that it may be adjusted to run level when used as a breaking plow, with one wheel in the furrow, and when used as a cultivator with both wheels upon the surface of the ground. The axle at the inner end of each journal is bent twice at right angles, the right-hand crank thus formed having a drop of six inches, and the left-hand crank having a drop of four inches. The right-hand wheel is made four inches more in diameter than the left-hand wheel, so that the frame of the sulky may be level when the right hand wheel is running in a furrow four inches deep. When the machine is to be used as a cultivator the wheels are exchanged, and the frame will then be level, with both wheels running upon the surface of the ground. The plow beams may be provided with breaking plows or with cultivating plows, according to the kind of plowing required to be done, and one or more plow beams may be used, as may be desired.

IMPROVED CALF MUZZLE.

Henry W. Fuller, Seneca, Kan.—This invention has reference to an improved anti-sucking bit and muzzle for calves, which may be attached without straps, so as to form an effective weaner; and the invention consists of a spiked and jointed nose piece, attached to a side wire that is extended in bow shape over the head, and connected by an anti-sucking bit of spiral wire. The ends of the sections that enter into the nostrils are made of ball shape, and press lightly, without hurting the calf, on the nose by the flexible joint of the sections. The nose piece is provided with spikes, attached to the sections, that extend at right angles from the nose piece in forward direction. The bottom spikes act as guards to prevent the teat from coming into the mouth, while the front spikes are pricking the cow, so that she does not allow the calf to take hold of the teat.

IMPROVED ROTARY CHURN.

Jacob Wolf, Henderson, Minn.—This invention relates to rotary barrel churns, and the nature of the invention consists in a novel mode of applying the dashers inside of the churn barrel, whereby they can be easily removed for cleaning. There are three sets of dashers inside of the barrel, arranged equidistant apart. Each set of dashers consists of a bar, having broad tapered blades fixed into it. The bars are notched at their ends to receive shouldered cleats, and by means of turn buttons, pivoted to one of the blades, the bars are rigidly held in their places. Holes are made through the end and side of the barrel, and provided with plugs for drawing off fluids.

IMPROVED TOBACCO HARVESTER.

Horace Jones, Knobnoster, Mo.—The object of this invention is to provide an instrument for splitting and cutting tobacco stalks at one operation. The manner of using the instrument is as follows: The handle and the short arm of the lever are grasped by the hand, and the knife is forced downward through the stalk, splitting it as far as may be desired. The edge of the chisel stands in the same direction as the knife, and does not interfere with the leaf. After the stalk is split the knife is withdrawn by closing the short end of the lever and the handle together, which operation also turns the chisel a quarter of a revolution, bringing it into position to cut off the stalk. By an endwise movement of the chisel the stalk is easily severed.

IMPROVED HARVESTER RAKE.

George H. Goetze, Lake Creek, Mo.—The object of this invention is to furnish an improved machine which shall be so constructed that it may be readily adjusted for use as a reaper or mower, as required, and which shall be provided with an adjustable rake for sweeping the cut grain from the platform. The two rakes may be adjusted wider apart or closer together, according to the length of the grain, by adjusting bearing blocks upon the rake shaft. The rake shaft is secured adjustably in place in its bearings by one of bearing blocks, and by a collar secured to the shaft by a set screw. When the machine is to be used as a mower, the reel and the rakes and their attachments and the platform are detached, and the cutter bar is shortened to reduce it to the proper length. The center bar is made in two parts, the adjacent ends of which are halved and bolted or otherwise secured to each other, so that it can be readily extended to adjust it for cutting grain, and shortened to adjust it for cutting grass.

IMPROVED ROTARY HARROW.

Cornelius Watson, Yanceyville, N. C., assignor to himself and James G. Gunn, of same place.—The object of this invention is to furnish an improved rotary harrow, which shall be simple in construction, strong and durable, effective in operation, and inexpensive in manufacture, being so constructed that it need not cost any more than an ordinary harrow. To the lower side of the beam is secured a plate, to the center of which is attached an axle which has a collar formed upon it at the lower side of the plate to prevent the upper end of the hub from rubbing against the plate. The axle passes down through a box inserted in the hub to prevent wear, and the hub is secured in place upon it by a washer and pin. To the hub are attached radial arms, the outer parts of which are held in position by a rim. The forward ends of the handles are inserted in a keeper attached to the beam, and are further secured in place by pins, which pass through them and into the beam, and which are covered by the keeper. By withdrawing the pin and detaching the keeper the handles and their standard may be detached when desired.

IMPROVED ADJUSTABLE WHEEL CULTIVATOR.

David Archer, Jr., Brier Hill, N. Y.—The object of this invention is to furnish an improved cultivator which shall be so constructed that it may be readily adjusted to work at any desired depth in the ground, which may be raised above the ground for convenience in passing from place to place, and which shall be simple in construction, convenient in use, and effective in operation. The frame of the cultivator is of a V form, the draft being applied at the apex. The frame is supported at front and rear on caster wheels, the supporting sides of which are so arranged that by raising a

depressing lever attached to the frame work the body of the cultivator containing the teeth is depressed or raised as it is desired to have the teeth work deeper or lighter in the ground. The retention of the frame containing the teeth at the proper elevation is easily effected by inserting bolts or pins in upright bars having corresponding holes, against which the levers have a bearing.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED DUMPING WAGON.

Thomas C. Duncanson, Jeffersonville, O.—The object of this invention is to furnish wagons which shall be so constructed that the box may be tilted to dump the load by the movement of the team, and which shall be simple in construction and convenient in use. When the load is to be dumped the wagon is brought to the desired place, a lever is operated to withdraw the bar from the king bolt, the brake is applied to the rear wheels, and the team is backed. This causes the forward part of the wagon gearing to move back towards its rear part, the box moving back upon rollers. As the center of gravity of the box passes the bolster the box tilts, and the load is dumped. A hook prevents the box from sliding off the bolster. The box may then be tipped back, the team started forward, and the lever operated to lock the king bolt in place when it reaches the forward end of the slot in the reach. The end board is then secured in place, and the wagon is ready to receive another load.

IMPROVED HOOD FOR FIREPLACE.

Herbert Clayton, Lexington, Ky.—The object of this invention is to furnish an improved device for attachment to fireplaces to prevent smoke, heat, and ashes from rising up about the mantlepiece, and at the same time to reflect the heat downward and outward into the room. The fireplace is provided with a hood and reflector, which may be made of any sheet metal that will take a polish and reflect heat. The hood is arched, and its rear edge is concave to give the reflector an upward inclination. The surface of the reflector may be either plain or corrugated, and is so arranged as to reflect the heat below the eye while throwing it out into the room. It is so formed and arranged as not to be in the way of those performing any operation about the fire.

IMPROVED TIRE TIGHTENER.

Stephen Stout, Tremont, Ill.—This invention relates to a simple and readily operated device for expanding the felly and securing them tightly to the tire, and it consists of a standard or arm resting on the hub, and carrying, in slots and crosspin, a tube with top support bearing against the felly. The tube is spirally notched at its lower end, and turned by a wrench on the pin, expanding the felly, and admitting the springing in of the split leather rings around the tenons of the spokes. On to the tube is shrunk or otherwise attached a fixed nut, by means of which the tube may be turned by a wrench, so that its lower spirally notched end, which is seated on the crosspin, is raised thereon, and forces its upper support against the felly, expanding the same and pressing it tightly against the tire, so as to admit the springing on of split leather rings to the tenon of the spoke, and thus secure the tight fitting of the tire.

IMPROVED WAGON BOX CORNER.

William B. Botsford, Mill Port, N. Y.—The object of this invention is to furnish an improved metal corner for wagon, buggy, and sleigh bodies or boxes, and seats for trunks, chests, furniture, etc., which shall be simple in construction, strong, durable, inexpensive in manufacture, neat in appearance, and easily applied. The base or sill of the box is made hollow to receive the ends of the side and end sills of the box. Upon the upper side of the base or sill is formed a rib or lugs, to the opposite sides of which are secured by rivets, screws, or bolts, the ends of the side and end boards of the box. The space between the two plates is filled with wood, cut or bent into the required form.

NEW MISCELLANEOUS INVENTIONS.

IMPROVED REFRIGERATOR.

Edward Clark, New York City.—The object of this invention is to improve the construction of refrigerators, ice boxes, ice houses, and other receptacles for ice, or for things to be kept cool so as to make them more convenient in use and more effective in operation, while at the same time being less expensive in manufacture. The ice chamber is placed in the middle part of the box and provided with the openings in the lower, middle, and upper parts of its sides, and with the doors at its top and at the lower part of its front. The case has an open bottom, and the refrigerator box is provided with a door at its top with a detachable milk vessel. It is lined with a non-conducting lining consisting of charcoal, hydraulic cement, sawdust, plaster of Paris, sand and water, mixed in about the proportions specified.

IMPROVED STOP-COCK.

Samuel M. Denniston and Charles Simmons, Prescott, Arizona Ter.—This invention consists in the combination with a stop-cock of a split-threaded tube having a T-shaped head, which may be inserted in a hole in a can, and upon which the stop-cock may be screwed. The object of this invention is to provide a device by means of which stop-cocks may be readily attached to metallic cans. The tube is split longitudinally, so as to divide the T-shaped head transversely through its center. The head is placed inside the can by putting the two parts of it together parallel with each other, with the halves of the tube extending in a straight line in opposite directions, and inserting the parts of the head into the aperture in the can and bringing the parts of the tube together. A packing ring is placed on the tube, and a stop-cock, which is threaded internally and fitted to the tube, is screwed down firmly upon the packing, thus clamping the side of the can between the head and packing ring.

IMPROVED TONGUE CLEANER.

Lazarus Morgenthau, New York City.—The object of this invention is to furnish for the use of sick and healthy people an improved tongue-cleaning device, by which the layer or film settling on the tongue may be removed in perfect and easy manner. It consists of a central scraper with concave knife edge, bush, and handles at both sides of the scraper, the sponge brush following the scraper over the tongue, and leaving the same perfectly dry and clean, as the sponge or other material absorbs the moisture and smaller particles not removed by the scraper. The sponge brush is attached to the rear edge of the scraper portion by being stitched to holes of the same, the flat sponge extending then forward to the edge of the scraper. The cleaner admits the quick and effective scraping of the tongue, so as to keep the same in clean and healthy condition, which is conducive to the preservation of the teeth when used by healthy persons, and of especial advantage for sick persons, for hospital and other uses.

IMPROVED PULLEY BLOCK.

Anton Bischoff, New York City, assignor to himself and Frederick Burger, of same place.—The invention is intended to furnish an improved pulley block for clothes lines, by which the annoying wedging in of the lines between pulley and cheek of block is fully avoided and a reliably working pulley block obtained; and the invention consists of a pulley block having cheeks with interior circular recesses fitting over the rim or flanges of the pulleys. The pulley revolves on a fixed shaft and projects, by its flanges or rims, into circular recesses at the inner side of the cheeks, which recesses extend in such a manner around the pulley that any possibility of wedging in the clothes line between block and pulley is entirely avoided.

IMPROVED OILING JOURNAL OF LOOSE PULLEYS.

Charles H. Weigle, York, Pa.—The object of this invention is to furnish a device for oiling the journals of loose pulleys while running. The invention consists in the combination of the receiver, provided with the discharge pipe and the screw cap, the piston, piston rod, and spring, the valve, fan, and spring, and the sleeve, having a right hand screw thread upon its inner surface, with each other, to adapt the device to be applied to the hub of a loose pulley. With this construction, when the pulley is revolved rapidly, the pressure of the air forces the fan back, opens the valve, and allows the oil to be forced out by the piston and spring. When the pulley ceases to revolve, the spring brings the fan to its former position, closes the valve, and prevents any more oil from being forced out.

IMPROVED BOTTLE STOPPER.

Carl E. G. Winter, Port Jervis, N. Y., assignor to himself and John G. Pfutner, of same place.—The object of this invention is to provide a bottle stopper that may be easily applied to ordinary bottles, and that operates quickly and easily in stopping and unstopping the bottle. A lever is so contrived that when the stopper is placed in the mouth of the bottle, and the lever is brought over in fastening the stopper, it carries the yoke wire past the pivot of the lever, thereby locking the stopper, and holding the arm of the lever in contact with the side of the stopper. To release the stopper, it is only necessary to raise the longer arm of the lever until the yoke wire passes the center of the pivot of the lever, when the stopper is thrown out by pressure from within bottle.

IMPROVED FOUNTAIN PEN.

Charles A. Atkinson, New York City.—The object of this invention is to furnish a writing instrument that shall possess all the features of a good fountain pen, and yet shall contain no fluid ink, which may be carried about the person without any danger of ink leaking out and staining the clothes, which may be readily replenished with a solid coloring substance, yielding a desirable ink when brought into contact with water. The instrument may be used in two ways: First, by dipping it in water to the base of the tongue, when it yields a perfect fluid ink. When through using it, it dries in a moment, and may be immediately placed in the pocket. The second way is to use the water reservoir, which is filled until the water trickles out through the valve a drop at a time, and that very slowly. The lower end of the reservoir is then inserted in the holder and the instrument is ready for use.

IMPROVED FIRE ESCAPE AND SPRING BED BOTTOM.

Joseph Kellner, Jersey City, N. J.—This invention consists in the combination of a number of spring sections and bars with two ropes, the sections forming a bed bottom when placed in a bedstead adapted to receive them, and in case of fire form an escape that may be instantly adjusted for use. These bars are arranged longitudinally in the bedstead, and the ropes that pass through the sections lie outside the said bars. When it is desired to use the fire escape, the frame containing the sections is removed and the end that is attached to the hook is removed and carried to the window and thrown out. The sections come out of the bedstead readily; and when the whole is out of the window, descent may be readily made, as it forms a strong and complete ladder.

IMPROVED TOBACCO PACKAGE.

Auguste Villaret, New York City.—This invention is intended for the purpose of packing chewing tobacco in such a manner that a single chew may be taken at any moment, in the most convenient manner, without interfering with or exposing in the least the remaining portions, which are fully protected, and the invention consists of placing a quantity of tobacco sufficient for a chew into a wrapper or shell of paper and tinfoil, or other material, of cylindrical or other shape, and connecting a number of such small packages by telescoping one within the other, and closing the end of top package. The wrapper is made of paper or tinfoil, or both, and of cylindrical or other shape, and is of such a size as to store a small quantity of chewing tobacco sufficient for one chew, both the wrapper and tobacco being pressed into the required shape by suitable machinery. The wrappers are closed at one end and left open at the other end to be inserted or telescoped one within the other. When required for use, the lowermost package or chew is first taken off, then the next, and so on, the remaining ones being always connected and closed, so as to be carried in the pocket without getting injured or soiled. The shell or wrapper is then readily removed from the chew, and the same thus obtained for use in a more convenient manner, preserving the remaining chews in a moist and fresh state, without the annoying drying out, as in the present packages.

IMPROVED VELOCIPEDE.

James Higgins and Patrick Traynor, Westfield, N. J.—The object of this invention is to furnish an improved velocipede, which shall be simple in construction, inexpensive in manufacture, and easily propelled and guided. To the axle are attached ratchet wheels the teeth of which engage pawls attached to the wheels and held against the ratchet wheels by springs. This construction causes the axle to carry the wheels with them in their revolution. To the center of the axle is attached a gear wheel, the teeth of which mesh into the teeth of a gear wheel pivoted to the frame, and its teeth mesh into the teeth of a gear wheel pivoted to the upper end of a slotted arm or standard attached to or formed upon the forward part of the frame. To the ends of the journals of this gear wheel are attached cranks for the rider to take hold of to propel the machine.

IMPROVED PERCUSSION FUSE FOR PROJECTILES.

Max Zeroni, Witten, Germany.—This invention consists of a bolt casing with suitable retaining base plate and priming device, in connection with a sliding needle bolt that is retained during the flight of the projectile by base pins, and forced into the priming the instant resistance is offered to the projectile. A frangible lead pin secures the needle bolt to the casing, together with a detachable safety wire that retains the needle bolt in position and prevents any danger of premature explosion until it is withdrawn. The fuse is set into each prepared projectile, and the safety wire passed through the bolt casing and needle bolt, and bent over at one end, so that the safety wire cannot drop out. The safety wire supports the frangible lead pin, and affords full security during transportation. Before setting the projectile into the gun the wire is simply drawn out, and thereby the projectile is made ready for use.

IMPROVED NUT LOCK.

Silas S. Crocker and Albert Wilcox, Clarence, Iowa.—The object of this invention is to furnish an improved lock or fastener for the nuts of bolts upon railroad machinery and other machinery subject to a constant or intermittent jarring, to prevent the said nuts from working loose, and which shall be simple in construction, easily and quickly applied and removed, and reliable in use. The invention consists in the lock, made of spring brass wire, having its outer part bent to form a spiral spring, in combination with the grooves formed in the bolt and nut across their threads, as hereinafter fully described. With this construction, when the nut is screwed up and one of the grooves brought opposite the groove of the bolt, the straight part of the lock or fastener is inserted in the hole formed by the said grooves, and the spiral spring of said lock is sprung into the thread of the said bolt.

IMPROVED MORTISING CHISEL.

Jasper S. Russell, Indiana, Pa., assignor to himself and James Feath, of same place.—This invention refers to an improved mortising chisel that moves the chips as fast as they are cut, and it consists of a mortising chisel having a spring piece attached to the tongue on the beveled shank piece of the chisel, said spring being extended forward to the cutting point of the chisel, and being pointed at the end and serrated at the under side,

where it forms contact with the fluted and serrated chisel. The serrations of the spring and chisel catch and hold the chips so as to pass them back between chisel and spring by the successive strokes, until they come in contact with the beveled deflecting shank piece, which throws the chips sidewise out of the chisel.

IMPROVED SPIRAL SPRING.

James Ludlum, Pompton, N. J.—This invention consists in the peculiar form of bar used in making the spring, whereby the line of greatest resistance may be brought into any required relation to the axis of the spiral; the object being to so dispose the metal of which the spring is made as to utilize it to the fullest extent, and also to economize space. This bar, from which the spring is made, differs from a round bar in having its inner surface flattened, and having the projecting rounded corners at opposite sides of the flattened portion, and in extending the side which is opposite the flattened side. The idea of the plan on which the bar is made is to bring the vertical diametrical line of a round bar nearer the axis of the spiral. To accomplish this the natural method would be to make one side of the bar flat, and add to the diameter of the bar to compensate for the deficiency in material due to flattening the side. This plan partly accomplishes the object; but it is more effectively accomplished by rendering it almond-shaped. The transverse section of the bar has the general form of a triangle having two similar curved sides and a right base, and having all of the corners rounded.

IMPROVED FILTER PRESS.

John Bowling, Cornhill, London, Eng.—This improved filtering apparatus is constructed in the following manner: A compound filtering chamber is made, or a series of chambers, by connecting a series of rings made of wood or other suitable material, which are bound together with iron hoops. The rings thus made are mounted on rollers which run on two suspended rails, so as to admit of their being easily moved, and when in contact the rings form a horizontal cylinder. The dimensions of these rings are determined by the amount and by the physical character of the matter to be operated upon in the filter. Between each two rings is suspended or otherwise placed a plate or disk of sheet metal, not less in diameter than the outer diameter of the rings. Each disk has one or more large holes cut in it, so that any dense fluid matter can flow readily from one side of the disk to the other, or from one of the series of chambers to the other. The disks are partly covered on both sides with canvas, cloth, linen, sacking, calico, felt, matting, or such like material, the holes being left uncovered. This form of filter press is specially adapted to the treatment of very large masses or volumes of matter having very low comparative value, such as waters, sewage, cement, slurry, potter's clay, china clay, whitening, yeast, and the like. In the treatment of less bulky, or of delicate and costly bodies, such as chemicals, colors, wines, beers, sugars, and the like, the apparatus may be made of glass, porcelain, or other suitable material, and mounted in any other convenient manner.

IMPROVED ROSE COUPLING.

William H. Burden and Benjamin J. Pleasance, Cleveland, O.—Each portion of the coupling is provided with a sliding three-wing valve, of which the one in the male part is to be forced open and held in this position by the valve stem of the female portion, admitting the passage of steam or water when the parts are uncoupled. By uncoupling the parts the pressure of the water would close the parts automatically. The valves stand in opposite directions to each other, and slide against cross pins that retain the valves in one direction, the conical seats retaining them when closed, they closing when the parts are uncoupled by their own weight or pressure without allowing waste of water or steam, and providing thus a very useful automatic valve action in connection with the coupling.

IMPROVED SLED.

Charles D. Hinman, Moses Ladd, and William W. Ladd, St. Johnsbury, Vt.—This invention has reference to an improved sled for coasting purposes, the same being provided with a simple and effective brake device. The front part of the brake lever swings in a central longitudinal slot of the seat, and terminates with a button, to which the cord for pulling the sled may be attached, and which increases the weight of the front part of the brake lever, so that it overbalances the rear part, and rests on the front cross brace when not in use. When the brake is used the front part is raised, so that the rear end forms contact with the ground, the brake action being the stronger the more the lever is forced back. Thus a strong and neat sled for coasting purposes is provided, which is fully within control of the rider by the brake arrangement.

IMPROVED KETTLE COVER.

Agide J. Beaudette and Louise L. Beaudette, Fond du Lac, Wis.—This invention consists of a kettle cover, one half of which is perforated with holes of suitable size, and which is provided with a cover that is capable of turning on a central pin, so as to cover the perforations, or leave them exposed, the object being to provide a cover that will permit of turning water off from articles in the kettle without danger of losing the articles or burning the hands. The advantages claimed for this cover are that it will retain articles in the kettle while the water can be readily poured off. It also prevents the escape of the main volume of steam, thus preventing the burning of the hands. It can be used to advantage when meats are cooked, as it permits the escape of steam, but prevents the spattering of grease.

IMPROVED WAGON JACK.

Amiel Bratschi, Portersville, Pa.—The object of this invention is to furnish a wagon jack that is adapted to raise wagon axles and other objects to any height, and rigidly support the same for oiling and other purposes. The invention consists of a rigid vertical guide post, secured to a suitable base, and of a sliding post, with central groove and cross pins, raised by a hand lever with hook-shaped end. The hand lever is fulcrumed to a swinging rod, and made to engage one of the cross pins of the sliding post and lock the latter, in connection with the swinging brace rod, into raised position. By raising the hand lever the sliding post is lowered, and the hook of the hand lever disengaged from the pin. The locking of the sliding post to any required height by the joint action of the hand lever and pivot rod forms the essential feature of this jack, and furnishes a simple and effective implement for the raising of axles and similar purposes.

IMPROVED TORPEDO FOR OIL WELLS.

Arjunah M. Smith, Edenburg (Knox P. O.), Pa.—The object of this invention is to improve the torpedoes or cartridges used for scattering the rock in artesian wells, for the purpose of increasing the production of oil or other mineral substances, they being so constructed that they may be handled without danger of explosion until they are at the proper point; and the invention consists of a shell, with a ball made of two parts, one part being stationary, the other working upon side pivots, to swing down for inserting or removing the hammer, with the percussion caps, without interfering with the charge of nitro-glycerin. In case the explosion does not take place for some reason or other, the torpedo has to be raised for examination. By using this torpedo it is not necessary to take the same out of the well and empty the nitro-glycerin out of the shell, which is an extremely hazardous performance; but it is stopped and made fast in the same position as when it was being filled, the swinging part of the ball is opened, the hammer removed from the shell, the caps examined or replaced with new ones, when the hammer is ready to be replaced, the ball closed, and the torpedo lowered again, to be exploded, when arriving at the bottom, by the sudden dropping of the hammer.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion.

A Book worth having; price only \$2.—The "Artificer's Assistant" is having a very large sale. (A condensed table of contents was published in this paper September 23d, page 190. It's worth referring to.)

To Manufacturers of and Dealers in Toys—Royalties to be had for new and pleasing toys. Partners wanted. Address S. E. B., 801 Asylum Ave., Hartford, Conn.

For Sale.—1 H. P. Engine. Box 492, Owego, N. Y.

Parties engaged in the Manufacture of Iron Bedsteads, will please send circulars to P. O. Box 533, Baltimore, Md. Teed's Centennial Waterwheel.—The best and cheapest wheel in the market. Address J. Mayne, Gilbertsville, Otsego county, N. Y.

Baldwin the Clothier is a patented trade mark, and it is the property of O. S. Baldwin, whose residence is in Brooklyn, N. Y.

For Sale.—42 in. x 8 ft. Pond Planer, \$425; combined Punch and Slicer for 1/2 in. iron, \$400; 40 in. x 12 ft. Screw Cutting Lathe, \$225; at Shearman's, 131 N. 3d St., Philadelphia, Pa.

Wanted.—A 15 Horse Power Engine and Boiler (stationary), either new or second-hand. State lowest cash price. Address Toole Manuf. Co., Charleston, S. C.

Saws are filed with great ease by everybody. New machine; \$2.50. Send for illustrated circulars, etc., to E. Roth & Bro., New Oxford, Pa. We want agents.

Steam Launches for sale, 32 x 8 and 40 x 9. Address R. A. Morgan, Steam Yacht and Launch Builder, Noank, Conn.

Fine Taps and Dies for Jewelers', Dentists', and Machinists' use, in cases. Pratt & Whitney, Hartford, Ct.

For Amateur Photographic Apparatus. Outfits with complete instructions. Price, from \$3 to \$30. Send stamp for information to E. Sackmann, 278 Pearl St., N. Y.

For the best Gate Valves of all kinds, apply to D. Kennedy & Co., 88 John St., N. Y.

Carpenters and Mechanics expert with tools, can make from \$5 to \$10 per day in their own neighborhood. No humbug. Thompson & Co., 84 Wood street, Pittsburgh, Pa.

Plumbers.—Address Bailey, Farrell & Co., Pittsburgh, Pa., for the best and cheapest iron case street hydrants.

Magic Lanterns and Stereopticons of all prices. Views illustrating every subject for public exhibitions. Profitable business for a man with a small capital. Also lanterns for college and home amusement. 74 page catalogue free. McAllister, M. Optician, 49 Nassau St., N. Y.

"Little All Right," the smallest and most perfect Revolver in the world. Radically new both in principle and operation. Send for circular. All Right Firearm's Co., Lawrence, Mass., U. S. A.

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

Shaw's Noise-Quelling Nozzles for Escape Pipes of Locomotives, Steamboats, etc. Quells all the noise of high pressure escaping steam without any detriment whatever. T. Shaw, 915 Ridge Ave., Philadelphia, Pa.

John T. Noye & Son, Buffalo, N. Y., are Manufacturers of Burr Mill Stones and Flour Mill Machinery of all kinds, and dealers in Dufour & Co.'s Bolting Cloth. Send for large illustrated catalogue.

Power & Foot Presses, Ferracute Co., Bridgeton, N. J.

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

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing metals. E. Lyon & Co., 430 Grand St., N. Y.

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

Steel Castings from one lb. to five thousand lbs. Invaluable for strength and durability. Circulars free. Pittsburgh Steel Casting Co., Pittsburgh, Pa.

Skinner Portable Engine Improved, 2 1/2 to 10 H. P. Skinner & Wood, Erie, Pa.

Improved Wood-working Machinery made by Walker Bros., 75 and 76 Laurel St., Philadelphia, Pa.

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

Baxter's Adjustable Wrenches fit peculiar corners. Manuf. by Greene, Tweed & Co., 18 Park Place, N. Y.

Have you seen the Briggs Lathe? Mounted on iron stand with walnut top and 21 inch driving wheel, with 3 speeds. Price \$25 complete, or \$13 without stand. Frasse & Co., 62 Chatham St., N. Y.

Polishing Supplies for all kinds of Metals. Greene, Tweed & Co., 18 Park Place, N. Y.

More than twelve thousand crank shafts made by Chester Steel Castings Co. now running; 8 years constant use prove them stronger and more durable than wrought iron. See advertisement, page 238.

Emery Grinders, Emery Wheels, Best and Cheapest, Hardened surfaces planed or turned to order. Awarded Medal and Diploma by Centennial Commission. Address American Twist Drill Co., Woonsocket, R. I.

Machine Diamonds, J. Dickinson, 64 Nassau St., N. Y.

Notes & Queries

(1) A. L. B. asks if there is any way of making paper soluble in water? A. No.

(2) A. H. asks how to neutralize the bad effect of gas in a room where plants are kept? A. The only way will be to stop the leakage of gas, if there be any, and provide better ventilation.

(3) R. P. T. asks for a flavoring for cigars? A. Cinnamon and tonka beans may be bruised and macerated in rum and the tobacco sprinkled with the spirit. Cigars may be moistened externally with a tincture of cascarrilla or of gum benzoin.

(4) W. P. P. says he is using an aniline ink with rubber stamps, but it fades, and asks if there is a remedy? A. The fading cannot be avoided where exposed to light.

(5) S. A. H. asks how to make a Leyden jar? A. An ordinary candy jar, free from cracks and flaws, will answer; line inside and out to within 4 inches of the top with tinfoil, heat so as to drive off all moisture; give the glass above the foil, inside and out, several coats of shellac varnish, and use a cork carefully fitted, dried and baked in an oven, and varnished. The chain from the brass rod and ball should be sufficiently long, and fair earth connection must be provided when charging.

(6) G. R. asks: 1. What size of wire should be used in winding the cores of an electro-magnet, and with how many layers should each core be wound, each core being 36 inches long by 3 1/2 inches diameter? A. You may use 9 spools on each core, each spool having about 16 layers of No. 12 covered copper wire. 2. Of how many pairs, and what size, of Grove or other cells, should the battery consist? A. Use three 1 gallon jars, exposing to the liquid in each about 300 square inches of surface of zinc (six plates) opposed to an equal surface of carbon. Use for the liquid acidified solution of potassium dichromate.

(7) O. H. W. asks: 1. Will a frosted window give more or a better distributed light than a plain one of the same size? A. It aids the diffusion of light but decreases the intensity. 2. What are the best and cheapest methods of frosting windows? A. By emery grinding or by the sand blast.

(8) C. A. K. asks: 1. What effect has Paris green on the system? A. It is an irritant poison, its action on the system being very nearly that of arsenic alone. It inordinately increases the secretions and diminishes the contractility of the voluntary muscles. 2. What is the best antidote for Paris green? A. Hydrated magnesia and fresh hydrated sesquioxide of iron are well recommended, but no specific antidote is yet known. The poison is but slightly soluble, therefore no chemical antidotes should ever supersede active evacuant treatment.

(9) E. C. H. asks for a simple rule how to place the weight from the fulcrum or pin of a safety valve, to produce 50 lbs. pressure. Weight of valve being 1/4 lb., area of valve .78. Weight of beam 3/4 lb.; center of gravity of beam 6 inches from pin or fulcrum. Distance from fulcrum to valve 1 1/2, weight 8 1/2 lbs. A. Multiply weight of valve by 1 1/2. Multiply weight of beam by 6. Subtract the sum of these products from pressure of steam multiplied 0.78 times 1 1/2. Divide the remainder by the weight of the ball.

(10) A. M. R. asks: 1. For a recipe for making ink suitable for use in post offices for cancelling with hand stamp? A. A fine grade of printing ink is ordinarily employed. A good ink may be made as follows: Balsam of copaiba (pure), 9 ozs.; lampblack, 3 ozs.; indigo and Prussian blue, of each, 5 drachms; Indian red, 3/4 oz.; dried yellow soap, 3 ozs.; grind to a uniform smoothness. 2. How can I make a suitable pad for inking stamp? A. Cover the metal base with a smooth piece of wood and build on this the cushion—a piece of thick, dressed leather covered with several thicknesses of silk. 3. How can I purify water in a new hemlock cistern which emits a stench? A. A few bushels of recently prepared, well burnt charcoal free from dust, thrown into the water, will often suffice. If the smell is due to the resinous constituents of the wood, it may be requisite to discharge the contents several times after replacing with fresh water, until no further contamination occurs.

(11) L. B. B. asks: 1. How does a night glass differ from a common glass? A. The instrument sometimes called by seamen a night glass is composed of a convex object glass, and a concave eye lens placed at a distance equal to the difference of their focal lengths, the magnifying power being as the focal length of the object glass is to that of the eye lens. Thus, if the focal length of the object glass is 36 inches, and that of the eye lens 1 inch, they should be 35 inches apart, and the magnifying power would be 36 times. 2. Is it possible to make a binocular glass with a power of 40 diameters? A. Yes; make the focal length of the eye piece one fortieth that of the object glasses. See p. 11, SCIENTIFIC AMERICAN SUPPLEMENT, No. 1.

(12) H. F. S. asks how Japanese lacquer is made? A. Melt 50 lbs. of Naples asphaltum and 8 lbs. dark gum anime, boil for about two hours in 12 gallons linseed oil; then melt 10 lbs. of dark gum amber and boil it with two gallons linseed oil; add this to the other and add dryers. Boil for about two hours, or until the mass when cooled may be rolled into little pellets. Withdraw the heat and thin down with thirty gallons turpentine. During the boiling the mass must be constantly stirred to prevent the boiling over.

(13) D. J. T. asks for a cement for an aquarium that will not crack or peel from glass or galvanized iron? A. Take, by measure, 10 parts of litharge, 10 parts of plaster of Paris, 10 parts of fine dry white sand, and 1 part finely powdered resin. When wanted for use, mix into a stiff putty with boiled linseed oil. Do not use the tank for three or four days after cemented.

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

E. P. C.—It is hornblende rock containing sulphides of iron and a little copper sulphide. The crystals are garnets.—E. T.—It is quartzite—composed of minute crystals of quartz.—G. M. L.—It is iron pyrites.—H. B. L.—The sand contains quartz, porphyry, felspar, fluor-spar, lime carbonate, pyrites, and possibly a little gold.—W. R. P.—It is a piece of agate.—O. B.—It is axinite, composed of silicates of lime, alumina, iron, manganese and boron.

COMMUNICATIONS RECEIVED.

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

On What is Electricity. By J. H. R.
On Science against Homeopathy. By J. W. C.

On the Liverpool Engineering Society. By W. W.

On Aerial Navigation. By W. J. L.

Also inquiries and answers from the following:

I. B.—C. F. P.—P. McN.—J. F. & S.—H. B. L.—D. D. B.—J. R. E.—J. W. D.—J. E. M.

HINTS TO CORRESPONDENTS.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

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

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

Hundreds of inquiries analogous to the following are sent: "Who publishes photographic periodicals?" "Who publishes books on brass founding?" "Who makes vulcanizing apparatus for vulcanizing india rubber?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

OFFICIAL.

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were

Granted in the Week Ending

September 4, 1877,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

Aerial currents, apparatus for, P. Mihan 194,782
Alarm register, Moffett & Dean 194,951
Atmospheric exhauster, A. B. Brown 194,764
Axes, machine for making, C. W. Cardot 194,892
Baker, altar bread or wafer, E. B. Daley 194,894
Baker, L. Drew (r) 7,869
Bale tie, J. P. Verree 194,967
Baling press, Brooks & Jordan 194,888
Ballot box, L. Van Alstyne 194,882
Bath structure, Despoix & Reboul 194,808
Bed bottom, B. Essig 194,811
Bed bottom, G. Luciani 194,882
Bed bottom, H. Winger 194,795
Bed mat, child's, O. A. Lirette 194,831
Beeswax, bleaching, H. T. Yaryan 194,799
Belting, H. Royer 194,846
Bevel, carpenters', J. A. Traut 194,851
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Bottle stopper, D. H. Murphy 194,924
Brake lever, W. F. Osborn 194,936
Brick machine, Selden & McLean 194,787
Brick machine, H. L. Oliver 194,838
Building frame, Morris & Sianser 194,896
Burglar alarm, W. H. Reiff 194,886
Button, J. John 194,872
Can oil, W. Y. Horne 194,821
Can lock, W. L. Marshall 194,922
Candle holder, W. Walker 194,940
Car awning, street, F. P. McIntyre 194,923
Car axle box, S. A. Bemis 194,801
Car coupling, J. W. Eckman 194,900
Car coupling, T. C. Lord 194,779
Car coupling, D. V. B. Smart 194,792
Car coupling, D. Zeigler 194,946
Car mover, G. W. Leek 194,828
Car wheel and axle, I. H. Randall 194,930
Car window, I. H. Randall 194,930
Cars, unloading coal, W. D. Beebe 194,760
Carpenter's scribing tool, C. E. Billings 194,761
Carpet lining, etc., D. G. Rollin 194,845
Carriage, W. H. Hancock 194,870
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Churn, W. H. Stearns 194,936
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Clamp, joiner's, W. H. Lilly 194,830
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Corn fodder machine, D. F. Hull 194,776
Corset, T. S. Gilbert 194,867
Cotton gin attachment, M. M. Massey 194,833
Cuff fastener, J. H. Myers 194,837
Curry comb, C. E. L. Holmes 194,820
Curtain fixture, D. S. Van Etten 194,793
Dental engine, E. T. Starr 194,850
D-r or hanger, T. J. Jones 194,874
Egg carrier, M. A. Howell, Jr. 194,914
Electro-magnetic alarm bell, P. Seller 194,933
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Flying machine, J. J. Pennington 194,841
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Funnel, J. N. Berg 194,887
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Furnace for roasting ores, Green & Halsey 194,772
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Harvester, cotton, F. Van Dorn 194,854
Harvester cotton, Watkins & Sale 194,855
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Hoes, manufacture of, J. C. Smith 194,790
Hoop machine, J. A. Peoples 194,842
Hoop skirt former, C. A. Sprague 194,865
Horseshoe, C. H. Perkins 194,783
Horseshoe blanks, machine for, J. H. Snyder 194,834
Horseshoe nail blanks, machine for, J. Ferguson 194,767
Horseshoe nail plate, J. Ferguson 194,798
Horseshoe nail machine, J. Ferguson 194,769
Hydrant, H. Flint 194,814
Hydrant testing machine, W. C. Allison 194,857
Knee protector, M. C. Hiestler 194,871
Lamp burner, E. Blackman 194,763
Lamps, etc., filler for, C. Chinnock 194,860
Lamps, heating attachment for, C. I. Payas 194,840
Last block fastener, W. Miller 194,878
Latch and handle, C. B. Rose 194,925
Latch for doors, etc., C. H. Smith 194,789
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Leather-scrubbing cylinder, A. Hawver 194,905
Lifting jack, W. G. Cline 194,894
Lifting jack, J. S. Kirkwood 194,827
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Mask, toilet, N. S. E. French 194,815
Milk cooler, E. W. Hoag 194,900
Molding plastic material, D. C. Lockwood 194,920
Mortising machine, W. W. Green, Jr. 194,869
Mosquito bar, M. Petrie 194,927
Nursing bottle, L. Bullard 194,859
Nutmeg grater, J. H. H. Wilson 194,942
Oil tank, T. Shaw 194,847
Ore separator, A. Work 194,707
Ore washer, J. S. Duncan 194,810
Packing box, G. Robinson, Jr. 194,844
Padlock, Smith & Egge 194,848
Padlock case, Smith & Egge 194,849
Paints, stripping tool for, L. Homann 194,912
Pendulum balls, regulating, H. C. Jacot 194,915
Pipe elbow machine, C. H. Amann (r) 7,874
Pitcher, S. W. Babbitt 194,858
Planter, corn, G. E. Bailes 194,885
Planter, corn, Gillett & Poole 194,901
Plow, Caldwell & Herren 194,891
Plow, ditching, S. Furnas 194,865
Plow, wheel, L. Chapman 194,803
Post office box, B. H. & W. H. Camp 194,890
Potato bug catcher, Corbin & Moseley 194,882
Printing press, M. Hainque 194,902
Propelling vessels, W. F. Morrison 194,835
Pump, G. W. Robaugh 194,843
Rag engine, E. D. Jones 194,824
Railroad switch, J. W. Harding 194,818
Railway gate, W. I. French 194,884
Railway truck and track, J. W. Eckman 194,899
Refrigerator E. Zahring 194,945
Refrigerator ship, J. F. Baldwin (r) 7,872
Sand pump, W. Forker 194,948
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Seeding machine, C. E. Patric (r) 7,875
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Shackle and step, R. Doty 194,883
Sheep shears, J. C. Wightman 194,794
Sheet metal elbows, F. Hoeltge 194,911
Shingle, metallic roofing, C. Comstock 194,766
Shingle sawing machine, M. Prillaman 194,929
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Stamp canceller and postmarker, G. F. Almy 194,884
Steam boiler furnaces, R. K. McMurray 194,780
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Stone, surfacing, J. M. Poole 194,879
Stove, cooking, R. J. King 194,918
Stove, lamp, B. G. Lofstedt 194,921
Thrashing machine, J. & H. Kolling 194,919
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Ventilator, C. L. Garfield 194,770
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Wagon axle box, C. J. Valentine 194,938
Wash bench, G. W. Lengfield 194,829
Washing machine, Fager & Godwin 194,812
Watch key, G. Havell 194,904
Water elevator, W. Doty 194,896
Water gauge for steam boilers, D. A. Woodbury 194,799
Water power, M. L. Prillaman 194,836
Water wheel, J. W. DeHaven 194,897
Windmill, M. L. Howard 194,822
Windmill, I. H. Palmer 194,839
Wood, preserving, I. Hayford 194,773
Wool polisher, G. Zimmer 194,947
Work stand, E. G. Gollner 194,816

DESIGNS PATENTED.

10,173 to 10,194.—CARPETS.—J. L. Folsom, Brooklyn, N. Y.
10,195 to 10,200.—CARPETS.—O. Heinicke, New Utrecht, N. Y.
10,201 to 10,217.—CARPETS.—H. Horan, East Orange, N. J.
10,218.—CARPETS.—H. Nordman, New York city.
10,219 and 10,220.—CARPETS.—G. W. Piggott, New York city.
10,221 to 10,223.—CARPETS.—J. E. Rollings, New York city.
10,224.—CARPETS.—J. H. Smith, Enfield, Conn.
10,225 to 10,228.—CARPETS.—W. L. Smith, Enfield, Conn.
10,229.—CIGAR BOX.—J. Stratton & G. Storm, Bay Side, N. Y.
10,230.—EARY CHAIR.—F. Krayl, Chicago, Ill.
10,231.—PRINTED AND WOVEN FABRIC.—W. Morris, London, England.
10,232.—HANDLES FOR TABLE WARE.—J. A. Whalen, New York city.

[A copy of any one of the above patents may be had by remitting one dollar to MUNN & Co., 37 Park Row, New York city.]

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SCIENTIFIC AMERICAN

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

Vol. XXXVII.—No. 16.
[NEW SERIES.]

NEW YORK, OCTOBER 20, 1877.

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FIRELESS LOCOMOTIVES FOR STREET RAILWAYS.

Some time ago we gave illustrations in the SCIENTIFIC AMERICAN of examples of the fireless locomotives as then used in New Orleans. The motive power of these engines is derived from a supply of hot water with which a large tank on the engines is charged from stationary boilers. These experiments were attended with more or less success, so that about a year and a half ago the Crescent City Railroad Company of New Orleans gave an order to Mr. Theodore Scheffler, a mechanical engineer of Paterson, N. J., for eight engines of this kind to be built from his designs. These engines were built and have now been at work for about a year. The engraving, which is from the *Railroad Gazette*, represents one of them without its cab. The construction is thus shown more clearly than it would be with the cab on the engine.

It has a cylindrical tank, 31 inches in diameter and 9 feet long, for holding the hot water. The capacity of this tank is about 300 gallons. The driving wheels are 30 inches in diameter, and the leading wheels 20 inches with a wheel base of 5 feet 7 inches. The cylinders are 4½x10 inches. The valve gear consists of a main valve, which works full stroke at all times, and controls the exhaust, with a steam valve on top worked by a link, which governs the admission. Both valves are, however, worked by the same link. This valve gear has been patented by Mr. Scheffler, who has promised us a detailed drawing, an engraving of which we expect to publish soon. The whole weight of the engine with the tank full of water is 8,700 lbs.

The tanks are charged with water from a stationary boiler which is heated up to a temperature due to a pressure of 220 lbs. per square inch. With such a charge the engines run about six miles with an ordinary loaded street car; the pressure in the tank at the end of the run is then reduced to about 40 lbs.

It is of course important to use the steam with the utmost economy; and as the pressure varies between such wide limits, the valve gear referred to was employed in order to

regulate the supply of steam required by the cut-off alone, and thus use the steam in the least wasteful way. The separate cut-off valve gives a much wider range of cut-off, and thus permits a much more perfect adjustment of the supply of steam than does the ordinary link motion with a single valve.

The tank and the other parts of the machine are all protected as perfectly as possible from radiation, and every possible device is employed to use the steam economically.

The stationary boilers used are of what is called the sectional or "tubulous" variety. They consist of sections of 68 two-inch inclined tubes, 7 feet long, which are attached to ordinary tube plates. On the outside of each of these plates is bolted a hemispherical cast iron cap, which incloses the ends of the tubes. Each cap is connected with a horizontal steam drum placed above the tubes, 2 feet in diameter by 11 feet long. The water is of course in the inside of the tubes, between which and the hemispherical caps and also from the latter and the steam drum there is a free communication. Owing to the inclined position of the tubes there is a rapid circulation of the water, and, consequently, it is not surprising that these boilers should be very efficient.

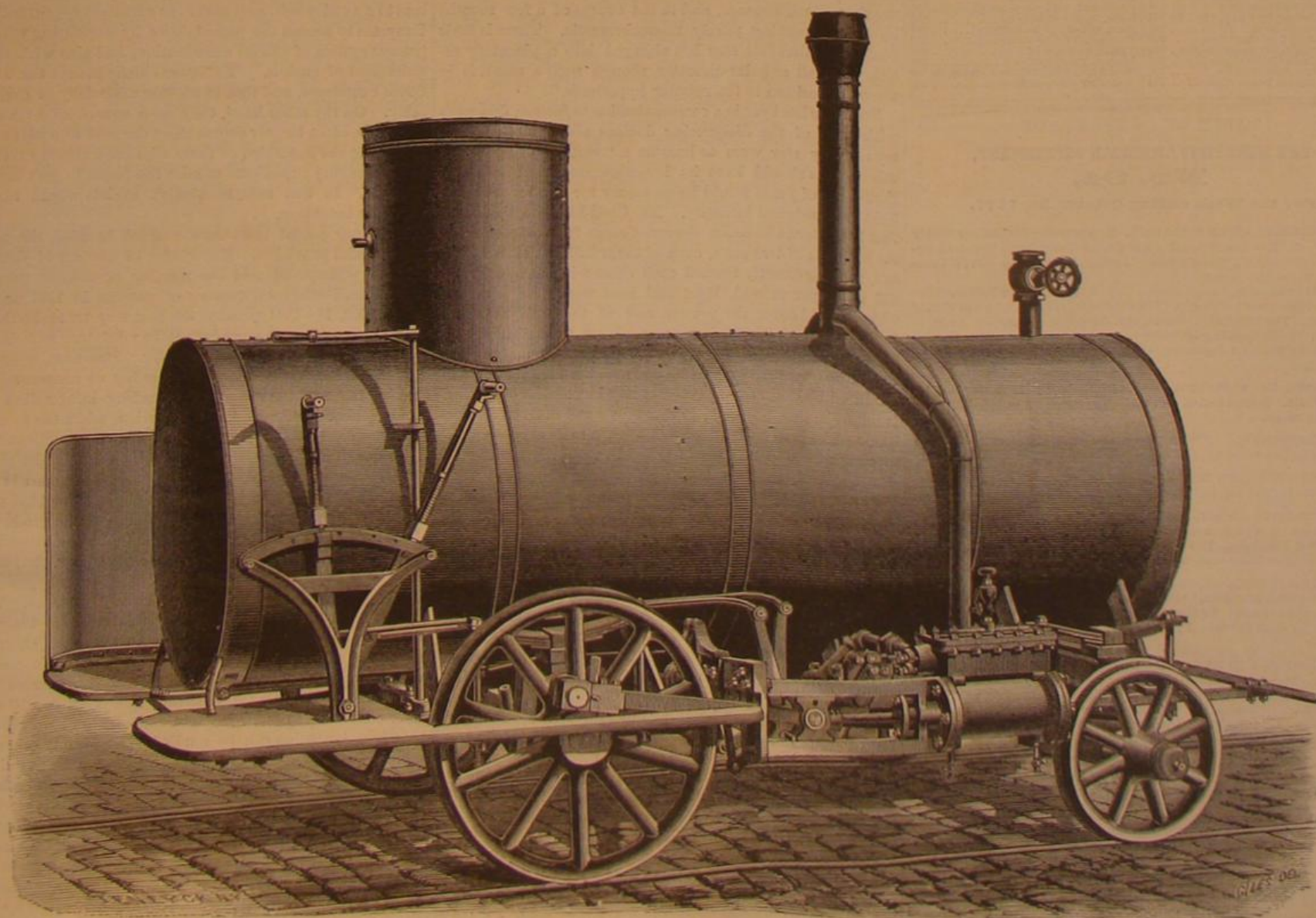
Although these engines have been working for nearly a year, we have not been able to get very complete information of their performance. One difficulty encountered was in charging the boilers with water all heated to a uniform temperature of 390 degrees, which is that of steam of 220 lbs. pressure. Of course the water in the boiler, of whatever temperature it happens to be, would rush into the tank as soon as communication was opened between the two. It is extremely difficult to have all the water in any boiler heated to a uniform temperature, and therefore that with which the tank is filled is usually below the temperature due to the pressure in the boiler. At first sight it might be supposed that hot steam could be admitted into the water with a perforated pipe or other means, and thus heat the water; but when this was done it was found that the upper stratum of water would thus become heated up to the temperature of

the steam, or near to it, and that enough steam would soon escape to the surface to make the pressure in the tank on top of the water equal to that in the boiler, after which the flow of steam into the tank either ceased or was very slow, while at the same time the lower stratum of water remained comparatively cold. This difficulty could probably be removed by some means, but it is one which has been encountered and which has interfered seriously with the success of the engines. At any rate it was found difficult to maintain a pressure in the tank equal to the boiler pressure after communication between the two was cut-off. Usually in running from the stationary boilers to the place where the engine was attached to the car, the pressure would fall from 220 to 190 lbs., but the engine would then run a distance of 3½ miles and have 100 lbs. pressure in the tank at the end of that distance. With 80 lbs. pressure the engine would pull a car while the steam was cut off at 2 inches, or one fifth of the stroke. It should be added that, as the city of New Orleans is built on a level plain, there are no grades of any consequence on this line, but it has curves of 35 and 40 feet radius, around which the engines run without difficulty.

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NEW YORK, SATURDAY, OCTOBER 20, 1877.

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STAR, NEBULA OR METEORITE.

The spectrum of the new star in *Cygnus*, discovered by Professor Schmidt, in Athens, in November last, has been made the subject of investigations by Herr Vogel, and in his recently published report he states that the spectrum was a continuous one showing numerous dark lines and bands, and several bright lines. It decreased rapidly in intensity, and at three months after the star was discovered became very faint. The most important phenomenon, however, exists in the presence of the bright lines. These, in some few star spectra, are believed to result from gases which break forth from the interior of the luminous body, where the temperature is higher than at the surface, and in fact constitute a repetition of the same phenomenon seen in the spectra of solar spots where incandescent hydrogen, rushing out of the hot interior, becomes visible above the colder spots through the hydrogen lines turning bright. Another explanation is that the atmosphere of a star, consisting of incandescent gases, as is the case in our sun, is, on the whole, colder than the nucleus, but with regard to the latter is extremely large. Herr Vogel prefers the last mentioned hypothesis and in further explanation refers to a theory proposed by Zoellner and deduced from Tycho's observations—which is that upon the surface of a star, through the constant exhalation of heat, the products of cooling, which in the case of our sun we call sun spots, accumulate in such a way that, finally, the whole surface of the body is covered with a colder stratum, which gives less light or none at all. Through a sudden and violent tearing up of this stratum the interior incandescent materials which it incloses must naturally break forth, and must, in consequence, according to the extent of their eruption, cause larger or smaller patches of the dark envelope of the body to become luminous. To a distant observer such an eruption from the hot and still incandescent interior of a heavenly body must appear as the sudden flashing up of a new star. Herr Vogel thinks that the spectrum shows beyond doubt that the decrease in the light of the star is in connection with the cooling of its surface.

Herr Vogel's investigations were completed in March last, and since then remarkable changes have occurred in the spectrum. The star, when discovered, was of the 3d magnitude, and is now less than the 10th. On September 3d it was discovered that its continuous spectrum had entirely vanished, and that all the colors save one had disappeared. On the following day Lord Lindsay, at his observatory in Scotland, obtained measurements of the wave lengths of the bright lines and found the wave length for the nucleus to be in millionths of a millimeter, 498.6, and with the extreme limits of the spectrum, between 500.8 and 493.5. In a recent letter to the *London Times*, Lord Lindsay points out that these lines are probably identical with the lines, measured by D'Arrest, in the spectra of the nebulae in 1872, and adds that 'we have the extraordinary case of a star appearing suddenly in the heavens, giving a bright line spectrum, proving incandescence, and in the course of a few months its light becoming purely monochromatic. There is little doubt but that this star has changed into a planetary nebula of small angular diameter, though such a result is in direct opposition to the nebular hypothesis.'

Professor Lockyer, in a communication to *Nature*, disagrees with both of the disagreeing doctors above quoted. He says if any star were to become a "world on fire," or in other words should have its incandescence increased, that thousands of years would be necessary for the reduction of light to its original intensity. Mr. Croll has recently shown that if the incandescence observed came for instance from the collision of two stars, each of them half the mass of the sun, moving directly toward each other with a velocity of 476 miles per second, light and heat would be provided which would cover the present rate of the sun's radiation for a period of 50 million years. Now the reduction of light of the new star was exceedingly rapid, so that, argues Professor Lockyer, we are driven from the idea that it was produced by the incandescence of any large mass of matter. It might be due, however, to that of a small mass of meteorites, and he goes on to show that such a mass at a temperature higher than that found to exist in a comet's head would give the hydrogen spectrum which was discovered with such richness in the spectrum of the new star, and which is represented in the spectra of most nebulae. If further we accept the bright line observed in the star to be veritably the chief nebula line, then, as it is well known that within certain limits the lines in the spectrum of a compound body get brighter with decrease of temperature (because at the higher one the compound almost entirely ceases to exist as such, and we get the lines of its constituents), it is a fair theory to suggest that the nebula line may belong to a compound, which may contain hydrogen as one of its constituents. To sum up the new star is (1), according to Vogel, an old star cooled and now breaking out again; (2) according to Lord Lindsay, a nebula; (3) according to Professor Lockyer, meteorites. Views could scarcely be more dissimilar, and as in the famous Reynolds, Henry, Tyndall, controversy on sound in the atmosphere, three most learned of doctors once more differ. Meanwhile, if any other astronomer wishes to investigate the subject, he will find the star during the present year in right ascension 21h. 36m. 52s. and declination north 42° 16' 53". Its magnitude is 10.5, and it is of a faint blue color situated near another star of the same size rather red. It will be visible, says Lord Lindsay, with a 5 inch telescope, and the spectrum can be seen by a small direct vision prism outside the eye piece.

PRACTICAL EVOLUTION.

It has been reserved for a German lady, Fraulein Marie Von Chauvin, to accomplish one of the most remarkable feats in evolution on record—the changing of an amphibious gilled double-breathing animal into one that is a lung-breathing and land-inhabiting. The subject was the Mexican gilled salamander or axolotl. As far back as 1867 Dumeril noted that, out of many hundreds of these creatures in the Jardin des Plantes in Paris, thirty lost their gills and assumed the form of the distinct amblystoma, a true land salamander, breathing air only by lungs. No cause could be assigned for this change, as all the axolotls were exposed to precisely similar conditions. Nor did the excision of the gills of one that had not changed throw any light on the matter, because a new set of gill tufts soon grew out again.

Fraulein Van Chauvin owes her repeated success to gradually accustoming the animal to life on land and exercising constant care as to its health and diet. Five strong axolotls were selected and were first kept in shallow water. Here they did not thrive, and the bolder measure of putting them directly on land was resorted to. Tepid baths twice a day kept up cutaneous respiration, and during the intervals between the baths wet moss was packed against the bodies. The mode of feeding was ingenuity itself. An earth worm was inserted in the axolotl's mouth as far as possible. Then the worm's tail was pinched until it wriggled so far down that the axolotl was obliged to finish the swallowing whether he liked it or not. Three of the animals persistently ejected their food, and, after fifty days' sojourn on land, died, or rather committed suicide, by starvation. The survivors, however, even after a few days showed a marked decrease in size of gill tufts and tail fin; before long, when put in water, they struggled to get back to land. Further changes went on; the skin was cast repeatedly, the gills slowly disappeared, and the gill clefts closed. The eyes became larger, and the skin, from being black and shiny, turned brownish violet black with yellow spots. Finally, the complete amblystoma form was assumed and with the amblystoma nature, the animals developing an astonishing greenness.

It is stated that the gills and tail fin seemed to shrivel by actual drying, through the action of the air, and that they were not absorbed by the vital processes of the animal itself. This is considered by Professor Huxley to be a most interesting point, as it shows how the first air-breathing amphibia may have been evolved from double breathers by a succession of dry seasons, that is, by purely mechanical causes.

THE ABOLITION OF MODELS.

The recent fire in the U. S. Patent Office destroyed about one hundred and thirty-six thousand old models, forty-nine thousand of which belonged to rejected cases. The loss is of no great importance, as, at the present rate in which models are being sent to the Patent Office—some twenty thousand a year—but a short time will elapse before the places of those burned will be supplied. In one respect, the conflagration may lead to a good result, as it makes an excellent opportunity for Congress to amend the patent laws by dispensing with the present system of official examination, and also with the requirement of models. The latter chiefly benefit the Patent Office examiners, and that in no wise materially or indispensably. On the other hand, they are a source of expense to inventors, often largely augmenting the cost of a patent and increasing the hardships of those who have already resorted to self-denying expedients to raise the funds to pay the regular fees. In this case, to abolish models would tend to stimulate invention.

When our patent laws were enacted in 1790, the model was a useful provision. Knowledge of the art of drawing was not widespread, and the number of devices patented was so small—the total number of patents in 1791 was 33, and in 1792, 11—that perhaps the best way to make the invention known was to produce it in miniature and display it in the capital city of the country. But now, when not only the number of patented devices has so enormously increased, but also the means of spreading information concerning them in almost like proportion, when the inventor can obtain at moderate cost accurate drawings and exact descriptions of his device, or can himself easily acquire the requisite draughting skill, the model plays little part in conveying the idea to others. Photography, unimagined when the patent laws were framed, now admits of the production of the most minute and perfect representations of inventions; and by the various processes of photo-engraving, etc., drawings and plans can be multiplied indefinitely.

Models, as records, but poorly fulfill their purpose. They occupy large spaces, necessitate especial care for their preservation, and, as the past fire shows, furnish an enormous mass of dry painted and varnished combustible matter, which burns like tinder. There is more sentiment than sense in the oft-repeated assertion that they constitute a great national museum, wherein the rise and progress of American invention can be studied. As for any one overhauling the chaos on the Patent Office shelves, examining even each specimen of a class, and discovering in each the peculiar advance which it may shadow forth, it is simply a physical impossibility. Long rows of models look impressive, and the average visitor is quite willing to let his imagination have free rein as to their significance; but the best that can be truly said of them is that, while some are intrinsically interesting as historical relics, the majority constitute a monument showing only in the aggregate how prolific is the genius of the American inventor. In Europe, where a patent system has existed for nearly three centuries,

and in other countries, models are not generally required, and the necessity for them has not been found to exist.

In brief, they have come to bear the same relation to our patents as does the pound or so of yellow wax which the English fasten to their patent document. The wax is of no use, neither is the toy model, except that both tend to create an impression (literal and metaphorical) of useless formality.

POSTAGE STAMP INVENTIONS.

We have heretofore called attention to the need of an invention in postage stamp cancellation, whereby the fraudulent re-use of stamps can be surely prevented. A considerable amount of ingenuity has been expended in this line, but up to the present time, we believe that no method, sufficiently effective and practical for adoption by the Post Office Department, has made its appearance; and the important problem still remains unsolved. For the benefit of those who may wish to study the subject, we will briefly recapitulate the general nature of the principal devices that have, thus far, been produced.

1. Coupon stamp. A stamp partially gummed, one end to project from the letter, the stamp to be cancelled by tearing off the projecting end. A modification consists in leaving the center portion of the stamp ungummed; center to be torn out by an instrument, and cancellation thereby effected.

2. Cancelling the stamp by means of indelible ink. Cancelling by means of ink of same kind as that used in printing the stamp. Cancelling by means of chemical ink.

3. Cancelling by means of instruments that cut the face of the stamp.

4. The use of stamps so made and printed that, on removal of the stamp, the color or ink is stripped from the stamp and left adhering to the envelope.

5. Combining explosive materials with the gum of the stamp, in such manner that, when the stamp is struck by a suitable instrument, an explosion results and the face of the stamp is burned.

6. Cancelling by means of red hot irons, or other apparatus for charring the face of the stamp.

7. Printing the stamp with chemically prepared ink of such a nature that, when warmed up to a certain degree of heat, the face of the stamp is permanently changed in color.

8. Elongating the envelope, placing the stamp on the elongated part, cancelling by punching through the stamp and envelope.

We do not wish to be understood as saying that none of these methods can be made effective; on the contrary, the probability is that relief will be found either in the perfection of some one of these plans, or in a combination made therefrom.

At the present time, the method of cancellation is so defective that thousands of stamps can be quickly cleaned, so as to look like new, by means of a bit of rubber or a damp cloth.

Moreover, it is to be remembered that there are some thirty-seven thousand post offices now open in the United States; and that the department has no means whatever of detecting the fraudulent re-use of old stamps therein. Any postmaster or his boy assistant may remove the clean stamps from the deposited letters and substitute old cancelled stamps, that are not even washed. The department is, at present, utterly unable to detect or stop this criminal practice. Herein is the answer to the question sometimes asked, "What becomes of the millions of old postal stamps?" in the collection of which certain parties, in various localities, are often so industriously employed.

The importance of a new invention that shall put a stop to stamp frauds will be understood when we remember that the value of the postal stamps now yearly sold in this country is about twenty millions of dollars, and the aggregate of stamps annually issued is seven hundred millions in number.

THE BORAX MINES OF NEVADA.—A VALUABLE DISCOVERY.

Many of the most wonderful and valuable discoveries and inventions, both ancient and modern, have been accidental. Notable instances will be readily called to mind by the intelligent reader, not only of the discovery of gold and other mines of great value, but also the germs of such great and useful arts and inventions as printing, steam, electricity, and various kinds of mechanism. Among the modern and indeed recent discoveries of great value to mankind, one in our country is particularly noteworthy. It is that of the discovery of a mine or vast bed of borax, by which a most useful and necessary article, instead of being an expensive luxury as formerly, is rendered so cheap as to bring it within the means of all classes.

This remarkable discovery was made in Esmeraldo County, Nevada, some four years ago, by a young man who was prospecting for gold and silver mines. While thus engaged, traversing mountains, cañons, and valleys on horseback, he saw, in a valley known as Teel's Marsh, what appeared to be a vast bed of white sand, resembling dry sea foam. The appearance was so novel and singular that he dismounted and descended to prospect the object. Upon arriving at the place, he found it to be the bed of a dry lagoon with the appearance of having been dry for centuries. Walking cautiously over the place, he found the surface to be soft and clayey, and often sunk ankle deep. After an examination of the curious clayey deposit he put several handfuls into his pockets, mounted his horse, and returned across the mountains to his home in Columbus. There he handed the contents of his pockets to an assayer, who, after analysis, pronounced it the richest sample of borax he had ever seen.

This fact at once created great excitement, and no little expense attended the necessary claiming, etc., on the part of the fortunate discoverer. It soon proved to be an enormous lagoon or deposit of crude borax, two and a half miles wide, and five or six in length. It was more than one man could properly manage, so a brother was sent for, and the two (now widely known as the Smith Brothers, of Nevada and New York) worked with a will, sparing neither time nor money until the whole deposit was their property, and its wealth being developed. They at once obtained boilers, tanks, crystallizers, etc., from Chicago, and commenced operations. The result is that, in the course of three or four years, the brothers have perfected an immense establishment and are producing an enormous quantity of a chemically pure article of borax, which stands first, and is in demand in every household, to whom it is supplied by grocers and druggists throughout the country. So important has this new industry become that the eminent house of W. T. Coleman & Co., New York and San Francisco, some time ago became the sole agents for the article, and they are now pushing its sale in all parts of the world. We are indebted to them for the foregoing particulars.

The most wonderful part of our story is that the vast deposit of borax in Teel's Marsh reproduces itself every two or three years, so that the supply will continue inexhaustible. This fact (and the additional one that the article has been put at the lowest figures) must prove a great benefit and blessing to the people, for borax has become indispensable for many purposes, being much used in the arts, the household, and as a hygienic remedy. Indeed, the uses of borax are so varied, and its properties so valuable, that those who have thus cheapened its production—by discovery and improved preparation—are entitled to rank among the few who have bestowed lasting benefits upon mankind and the world.

PROTECTED WORKING MEN.

A correspondent, who states that he is a railway workman, sends us quite a lengthy letter of dissent from the views expressed by us to the effect that working men should learn to live on what they can honorably earn, and to adapt themselves to the altered conditions of the labor market, brought about by the general shrinkage in values and financial stringency. Our correspondent's points are, first, that railway companies and other large concerns are in the habit of employing men from youth up at special work, until such men "become almost helpless when thrown out of their accustomed employment," and then, while the employers grow richer and stronger, they reduce the wages of their employees until the latter "sink gradually down to the level of slaves." That such concerns are morally obliged to look after the well-being of their employees. Second, that, as in this country part of the population "are driven to starvation and despair," and "cannot get the necessities of life easier than an isolated man in the wilderness," then a bad state of things exists, and the same is due to aggregation of capital in improper hands, and against this working people ought to be protected by unions, etc. Third, that certain people consider it to their interest to tyrannize over working men. Fourth, that there ought to be a safeguard against all the above, and that the writer knows—no; the SCIENTIFIC AMERICAN ought to discover—what it is.

Our correspondent writes intelligently, and his letter shows him to be an educated man. Hence there is the less excuse for his being a representative of a class of thinkers among our working men, of whom we trust and believe there are few. He labors under the notion that working men, because they are working men, ought to have some special privilege—ought to be exempted from the consequences of conditions which affect every other soul in the community—or, in brief, ought to be permitted to throw their share of the burden on other people's shoulders and go scot free. This is a confession of weakness and a virtual appeal for charity, which every manly, strong-armed worker in this country, we believe, repudiates from the bottom of his heart. The men know, or ought to know, that their fortune depends on their own efforts; that so long as work exists they have the same right to decide whether they will remain in any one place, or pursue any particular branch of trade, or hire themselves to any particular employer, as any employer has to make a selection from their ranks. If a man chooses to stay a lifetime in one place, he does it for his own benefit; and there is no law, moral or otherwise, to compel an employer to pay him more for doing so. Most employers find it to their interest to retain old and tried employees, and often to offer inducements to gain that end. But after all it is a question of pure interest; and sentimentality—always out of place in business dealings among mankind—has nothing to do with it. If work does not exist then, whatever be the cause, the working men have only to use their eyes and look about them to discover that it exists none the more for other people, who are not directly regarded as belonging to the working classes. That if there is no work for them at the looms, there is none for the dry goods merchant in his office; and so on through every branch of industry or commerce. Unless, therefore, work can be created for all the community, and every one helped and protected: a state of affairs which the SCIENTIFIC AMERICAN, though never so willing, honestly confesses its inability just at present to bring about: we do not see how we can rationally undertake to make the discovery toward which we are urged.

Our correspondent adds that we argue on the side of capital and against labor. We recognize no such distinctions. We simply see some men employing, others employed, whose

relations to each other and to the community are based on a few simple truths firmly grounded in justice and common sense. These truths, and these only, underlie the views we express.

NOTES OF PATENT OFFICE DECISIONS.

PATENTS.—Mr. Gray, an inventor, sent to the Patent Office a drawing and specification relating to an invention, and requested that they might be filed in the secret archives as a caveat. He represented himself to be, not the sole, but a joint inventor with another party of the invention represented in the papers.

The question was raised by the officer receiving these applications as to the propriety of putting on the record a caveat relating to a joint invention without the signature and oath of both inventors.

It will be remembered that caveat papers are simply preliminary papers filed in the Office for the purpose of securing notice in case of interfering applications while the caveat is experimenting of maturing his invention. A caveat cannot be merged into a patent, and is no foundation in itself for any such issue. As the only object in filing a caveat is to obtain notice of interfering applications, the right of one joint inventor to this notice should not be subject to the control of his co-inventors. The Commissioner of Patents therefore decides that it is sufficient if a caveat is signed by only one of two or more joint inventors.

TRADE-MARKS.—In the case of Cornwall and Brothers, the trade-mark sought to be registered consisted of the word "Dublin," to be printed on labels applied to boxes of soap.

It is a well recognized rule that the name of a district, town or city cannot be appropriated as the exclusive property of any one. In the case of Green (8 Official Gazette 729) the Commissioner of Patents indicated the practice of the Patent Office in regard to geographical names. If they are descriptive of a certain place or locality where the goods or articles to which they are to be applied are produced, then they are objectionable on the same ground that all merely descriptive words are objectionable as trade-marks. The applicants, however, claimed that as they did not make their soap in Dublin, Ireland, but in this country, the term "Dublin" was not descriptive in any sense, but was an entirely fanciful and arbitrary symbol. There was no evidence that there was any soap on the market known as "Dublin" soap. If such fact had been established by the evidence, it would have been the duty of the Patent Office to refuse registration on the ground that the adoption of the same title by the applicants would be deceptive and a fraud upon the public. Thus, for instance "Dublin brown stout" has a well known reputation, and the fact of its notorious use would be conclusive evidence of fraud as against a citizen of another place, who asserted the right to use the term in designating his product.

It further appeared, in this case, that there was an extensive use, throughout the country, of labels applied to soap manufactured by firms in this country, bearing the titles "Irish," "Limerick," "Scotch," etc., and that the public generally had become aware of their purely fanciful signification. It did not seem likely, therefore, that they would be deceived by the addition to this medley of the word "Dublin." Neither would the public, probably, be convinced that a sudden importation from Dublin had taken place. The acting commissioner decided that the word "Dublin," as above used, might be registered as a trade-mark, as such term thus used was not intended as, and had not the effect of, a geographical word, and that in view of the peculiar circumstances of the case it was also not deceptive.

DECISIONS OF THE COURTS.—In the case of Perrigo vs. Spaulding, a motion was made for an injunction against the defendant on a bill in equity under letters patent granted to one Birdsall—the assignor of complainants—to enjoin the use of an infringing machine. Prior to this Birdsall had sued the makers and vendors of the defendant's machine, and recovered from them their gains and profits for all machines made and sold by them, among which was the defendant's machine. The case was heard before Johnson, Circuit Judge, who, upon the above facts, denied the injunction. The following rules are laid down by the court:

When a patentee gets his remuneration by patent or license fee, a recovery of such patent or license fee from an infringer and its payment authorizes the infringer to use the particular articles for which such recovery has been had.

When a patentee chooses to use his invention himself, and finds his remuneration in the sale of the products of its use, a recovery against an infringer, for profits and damages, will be limited to the profits and damages up to the time of the recovery. Such a recovery will not carry with it any right to the further use by the infringer of the invention.

Where the patentee sells his patented instrument or machine, for use by others, finding his remuneration in the profit of the sale of the manufactured machine or instrument, a recovery of profits and damages from the manufacturer of an infringing machine is a full compensation of his injury, and places him in the same position as if he had made and sold the machine himself, and confers on the machine the right to be used while it lasts.

When a full recovery and satisfaction from one party has been had, the patentee has obtained all that the law gives him, and the particular article or machine becomes, in effect, licensed by the patentee, and may be used so long as it lasts, free from any further claim by the patentee.

THE MANUFACTURE OF PLUMBAGO CRUCIBLES.

"Dutch pots" was the commercial name for plumbago crucibles, up to forty-five years ago. The Kaufmans, of Oberzell in Bavaria, were the only manufacturers in the world, and their limited production found but restricted use, for melting pots were more commonly made of clay and sand. At the present time American plumbago crucibles, made of American black lead from the mines near Ticonderoga, N. Y., of better quality and cheaper in price than the Bavarian pots, are sold in Oberzell itself. More are sent to Germany than to any other country, and they have driven "Dutch pots" out of market after market; until, now to be found in every metal working district, they have taken their place in that long list of industrial exports in the constant growth of which may be discerned the promise and potentiality of the United States becoming the greatest exporting nation on the globe.

Graphite, plumbago, or black lead—the names are synonymous—is extracted from the mine either in the foliated or the granular form. For crucible manufacture the first mentioned variety is used, and of the quality known as "prime lump;" and in the works of the Joseph Dixon Crucible Company in Jersey city (to the President of which corporation, Hon. Orestes Cleveland, we are indebted for the facts here presented) the first process which it undergoes is that of grinding in so-called "cannon ball" mills. A section and plan of one of these machines is given in the engraving. A is a heavy iron saucer-shaped receptacle, having an aperture in the center, across which extend arms, connecting it to the central shaft, B. This shaft is rotated by the pulley shown in the direction of the arrow. Above the saucer is a disk, C, see plan view, in which are four recesses. In these recesses and resting on the saucer below are four thirty-two pound cannon balls; and attached to the middle of the disk is a sleeve, D, enclosing shaft, B, and carrying a pulley, by which it is rotated in a direction relatively opposite to that of shaft, B. A casing surrounds the mill, and through this casing at its center the graphite enters, emerging below through the funnel, E, whence it is taken away by an elevator. When the graphite enters, the centrifugal force generated by the swiftly rotating parts throws it outward so that it may be at once acted upon by the balls. Wear by the latter on the disk is prevented by steel pins, F. It will be obvious that under this condition the heavier particles of the material will approach nearest the circumference while the finer ones will arrange themselves in the order of their weights toward the center. Consequently the finest ground graphite will always be that which is escaping from the mill, while the grinding parts constantly act on the coarser portion. The substance really therefore is ground but once, and there is no grinding and regrinding of already sufficiently pulverized material. In this way, we are informed, the grinding operation is greatly facilitated and at the same time the graphite is reduced to a degree of fineness unattainable in the ordinary forms of mill.

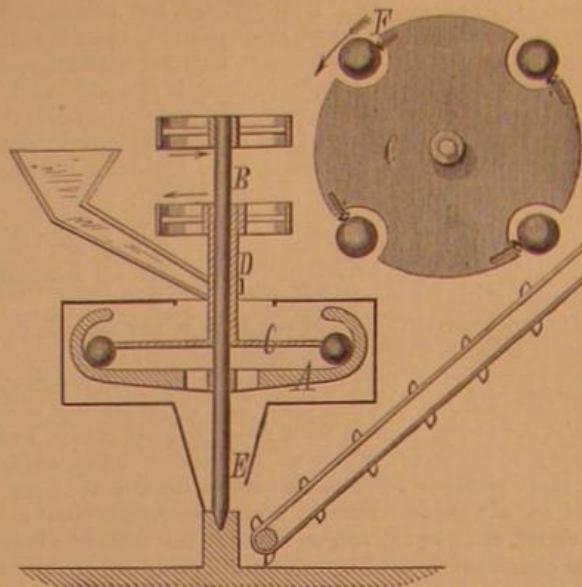
With the plumbago thus prepared is mingled a small proportion of kaolin or china clay, varying according to the use for which the crucible to be made is intended. To every 10 parts of graphite is also added 7 parts of a gray clay which is imported from Klingenberg in Bavaria, besides a little ground charcoal, the latter to secure porosity. These ingredients are mixed dry; water is afterwards added and the compound passes to a huge cast iron cylinder capable of holding about 3 tons. Here thorough stirring is done by means of arms arranged radially on a central vertical rotating shaft. Each arm, besides having four vertical beveled blades, is made flat above and beveled below, so that the mass undergoes a kneading which secures its rapid and homogeneous mixing.

The material emerges of the consistence of thick mud, and is at once moulded into crucibles. This is done either by hand or by machinery, special forms being made in the former way. The desired quantity being weighed, the moulder shapes it into an egg form and places it on the rotating potter's lathe before him. Then, with his bare hands, he presses it first into shape resembling an apothecary's mortar, then his fist goes into the middle to form the cavity, and then succeeds an indescribable series of pressures and measurings, the upshot of which is the completely formed crucible standing on the wheel. A wire run under it loosens it from its support, it is lifted off upon a board, and three squeezes between the hands convert it into a three-cornered vessel. It is then placed aside for twenty-four hours to become dry.

The machine process is exactly the same as that in common use by potters for moulding plates, tea cups, etc. A plaster mould is prepared, which is placed on the rotating wheel. Into this the ball of graphite mud is placed; and as

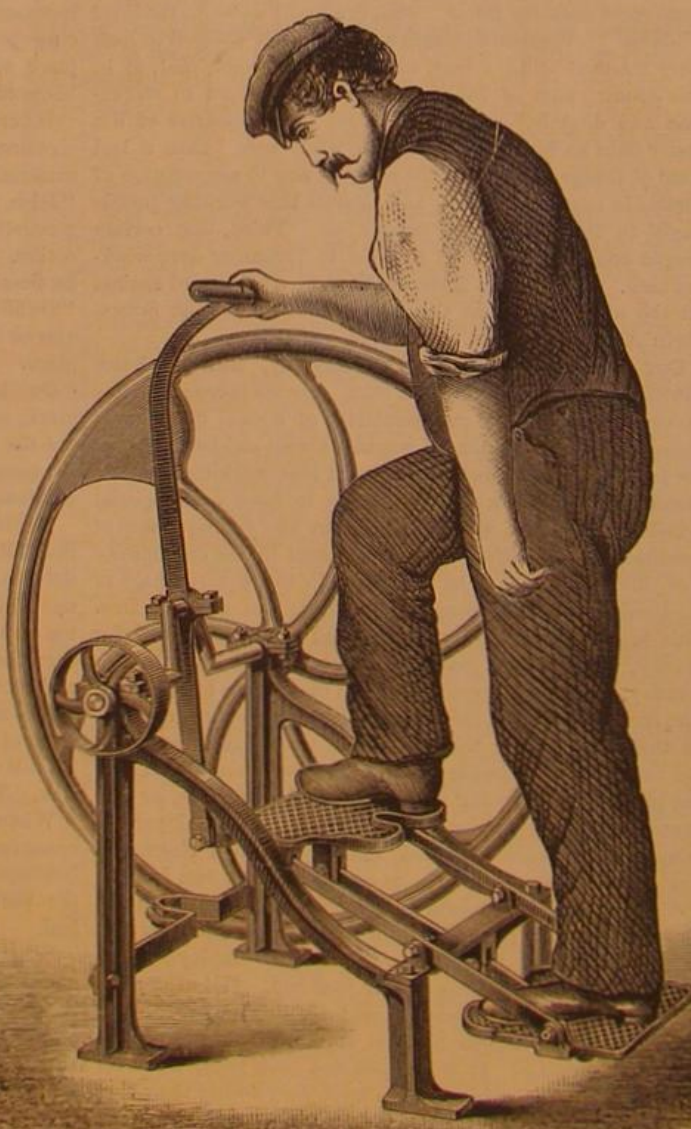
the mould rotates, a former is brought down into it from above, which carries the material out against the sides and forms the inner cavity, according to gauges previously adjusted. The mould is then taken from the lathe; and after the crucible has become dry enough, the latter is turned out, placed upside down on the wheel, and its exterior smoothed by hand.

The baking process, which next ensues, does not differ from that followed by potters. Each crucible is enclosed in



large fire clay vessels, known as "saggers," and a number of these are heaped up in the kiln. At the works visited by us, there were two kilns, one capable of holding 60,000, the other 80,000 "numbers." A "number" in crucible making means two pounds of material. When the baking is finished the crucibles emerge hard, and varying in color from grayish-white to blue-gray. The difference in hue is no criterion of quality, and is simply due to cracks or other imperfections in the saggers.

In point of size, plumbago crucibles hold from 2 ounces up to 600 pounds. Their average lifetime in brass making is from 35 to 45 heats. Clay crucibles can be used but once. For melting steel they will run from four to six times, and



THE BAROMOTOR.

longer if coated with a mixture of fire clay, plumbago, charcoal (or better, gas carbon), and silica (pure fine quartz sand). Care should be taken to remove slag from the surface after each melting. Old steel pots are freed from slag, ground up, and remanufactured into crucibles. The same "metal" used for crucible making is also formed into plugs or valves in the ladles used for conveying molten steel, made by the Bessemer process, to the moulds. Plumbago crucibles may

be generally employed, except in cases where a flux is used, as the flux would eat the clay from the lead. In using them, they should be kept in a dry place, the least dampness being fatal. It is well, for the first time of running, to put the crucible in the furnace at the time of lighting the fire, so that it heats up gradually with its surroundings. The pot should be placed in the fire and not on it, and the fire should surround it to the very top.

We shall shortly present another illustrated article derived from the same source, and describing the various processes of lead pencil making and other industrial utilizations of plumbago.

Tests for Copper Solutions.

The solutions of copper possess a blue or green color, which they retain, even when considerably diluted with water. With caustic potassa they give a light blue bulky precipitate, turning blackish brown or blackish brown or black on boiling the liquid. Ammonia and carbonate of ammonia produce a bluish white precipitate, soluble in excess of ammonia, yielding a rich deep blue solution. The carbonates of potassa give a similar precipitate to the last, but insoluble in excess of the precipitate. Ferrocyanide of potassium gives a reddish brown precipitate. Sulphuretted hydrogen and hydrosulphuret of ammonia give a blackish brown or a black one. A polished rod of iron, on immersion in an acidulated solution, quickly becomes coated with metallic copper.

THE BAROMOTOR.

The annexed engraving from the *Revue Industrielle* represents a new man power or treadmill. The pedals are pivoted to three levers which are journaled to the lower crosspiece of the frame. The rear arms of the pedal levers are shorter than the front arms, so that the operator is saved the fatigue of lifting the leg which is in rear to any excessive height. The mode of connection of the levers to the crank is plainly shown. To the latter is also attached a hand lever, whereby the operator steadies himself and also keeps the shaft over the centers. The inventor, M. Gaston Bozerian, states that a speed of from 28 to 30 revolutions of the fly wheel per minute can be maintained, developing about 133 foot pounds. He has given to the apparatus the above name.

The Balance of Trade.

There has been much muddying of the waters concerning the exact import of the phrase, "the balance of trade." We think that the whole difficulty in the proper understanding of this phrase grows out of the presumed necessity of applying a cast iron rule of interpretations to every country that has commercial intercourse with the rest of the world. There is, however, a vast difference between debtor nations and creditor nations.

The United States is a debtor nation. It owes large sums to other countries for money borrowed for various national, State, municipal, corporation and other purposes. If, now, in addition to owing the debts abroad, it should annually export less than it imports, undoubtedly it would be increasing those debts, and if this course were continued long enough the country would be bankrupted. It is because we have of late been exporting much more merchandise than we have imported, and thus decreased our debts abroad and our gold shipments, that we say the balance of trade is in our favor, and so it is, for we are paying our debts. Great Britain is a creditor nation. Other nations owe it large sums of money for all sorts of loans and investments. Much of this indebtedness was created generations ago, and some of it is of recent creation. In all cases the loans and investments were made from British savings, accumulated by means of her wonderful industrial policy. If, then, Great Britain should in any one year or in any series of years export less of her manufactured goods than she imports of the raw or manufactured products of other countries, it does not follow, because the balance of trade is nominally against her, that she is thereby growing poorer. Not at all. In the very excess of her imports over her exports may lie her prosperity, for this excess may represent the profits she is receiving upon her investments in foreign countries. Of course the more of her manufactured goods Great Britain can export, the more her commercial prosperity is enhanced;

but if her imports also increase the meaning is that her profits are increasing. The above is not the only explanation of the balance of trade problem that might be adduced, but it is the principal one, and for all practical purposes it is sufficient.—*Bulletin of I. & S. Assoc.*

When pure, gallic acid forms small, feathery, and nearly colorless crystals, which have a beautiful silky luster.

Mysterious Fires in Petroleum Refineries.

A serious fire of a mysterious nature, occurred at the extensive works of the Standard Oil Company, at Hunter's Point, Long Island, at 10 A.M., on September 1. About fifteen hundred barrels of petroleum had just been pumped from the stills into a large new agitator, made of heavy rivetted wrought iron sheets, lined with lead. The object of this vessel is to allow mechanical agitation of the oil, after sulphuric acid has been added, to further complete purification; and the leaden lining was to protect the iron from the acid. It is stated that the workmen turned into this vessel "a stream of cold water or steam," and immediately the oil inflamed, and could not be extinguished by all the efforts of thirteen fire engines, which soon arrived. By throwing water, however, on the outside of the tank, the rivetted seams were prevented from opening, and in the meantime about 200 barrels of oil were drawn off to another tank. This saving was soon stopped by the choking of the pipe with the melted lead. The loss in oil was about \$10,000 to \$15,000, and the cost of the agitator tank \$20,000.

It appears from the reports of the workmen in the various petroleum refineries that fires often break out in them in spite of all precautions, and without any visible cause. Persons familiar with the refining of petroleum also say that, if cold water is poured on warm oil for the purpose of cooling it, the oil will sometimes suddenly ignite. It is unfortunate that, in this case, it is not certain whether it was water or steam which was applied, but if the fire arose from chemical action, the composition of the two substances was the same, only the high temperature and vastly expanded condition of the oxygen in the steam might have caused it to unite rapidly with the carbon of any of the more volatile portions of the partially refined oil, which might, by imperfect process, have been allowed to enter the agitator. Petroleum is not spontaneously ignitable in air under ordi-

nary atmospheric conditions, but it is well known that spontaneous combustion, though generally slow in inception, often occurs rapidly from the quick absorption of oxygen from water or damp air by highly carbonized substances, of which special instances may be mentioned in lampblack works, and places where charcoal finely pulverized is used.

In the former description of industry, care must even be taken, especially in cool weather, to wipe the inside of window glass, lest a few drops of condensed dampness should furnish oxygen sufficient to start a fire, from the avidity of combination which the floating, highly comminuted material has for oxygen. These and similar facts, considered in connection with the chemical constituents of petroleum, may yield perhaps a clue towards the discovery of the mysterious fires. Of course, there is another cause which may exist in the fumes of naphtha (which often travel long distances unsuspected), floating from the stills to the agitators, and there, by some means, becoming ignited.

Petroleum is a compound of several hydrocarbons, the average of the two elements being, say carbon 85 per cent, hydrogen 15 per cent. Water is a protoxide of hydrogen—that is, composed of two volumes of hydrogen to one of oxygen; but, by weight, there are in water eight parts of oxygen to one of hydrogen—the percentage being exactly, according to MM. Berzelius and Dulong, 88.9 per cent of oxygen and 11.1 of hydrogen. The latter gas is sixteen times lighter than oxygen.—*American Exchange and Review.*

HOW TO SOFTEN RESIN.—Melt the resin, and while in a state of fusion add tar. The proper degree of hardness can be ascertained by dropping a small portion of the melted mass into water.

The luster of morocco leather is restored by varnishing with white of egg.

ROOTS' BLOWER FOR MINE VENTILATION.

The Roots' blower is a rotary air-compressing machine, as distinguished from a fan which throws the air off by centrifugal action. In principle it is analogous to a blowing cylinder, with the difference that the air is expelled constantly in one direction and in four distinct volumes at each revolution of the blower; but with a blowing cylinder the direction of the current of air is altered at each end of the stroke.

Blowers of a capacity of 100,000 cubic feet per minute had been constructed, and one of this capacity was employed for working the Beach Pneumatic Railway under Broadway, New York city. The leading feature of Roots' blower consists of two duplicate rotary pistons, fixed upon separate shafts and working in a casing, which is provided with inlet and outlet openings either at the top and bottom, or at the sides, according to the position in which the machine is arranged. The rotary pistons in revolving are maintained in their proper relative positions by gearing on the shafts, and they revolve closely together, but not in actual contact with each other or with the casing.

As a ventilator for mines the blower is shown in the accompanying cuts, for which, together with description, we are indebted to *The Engineer*. This ventilator has been fixed at the Chilton Colliery, near Ferryhill, belonging to the South Durham Coal Company, England, and was started at the beginning of this year, it having been in constant work up to the present time. It consists of the two rotary pistons, A A, Fig. 1, which are each 25 feet diameter and 13 feet wide, and are built up upon steel shafts. Upon each of the shafts are keyed five cast iron disk plates, C C, Fig. 3, having flanges at their circumference which are all turned to exactly the same diameter. In each disk plate there are three wrought iron bars, D, Fig. 2, fixed on each side of the centre, and reaching to the outside of the rotary piston; planed recesses are provided in the disk plates to receive the bars which are

Fig. 1.

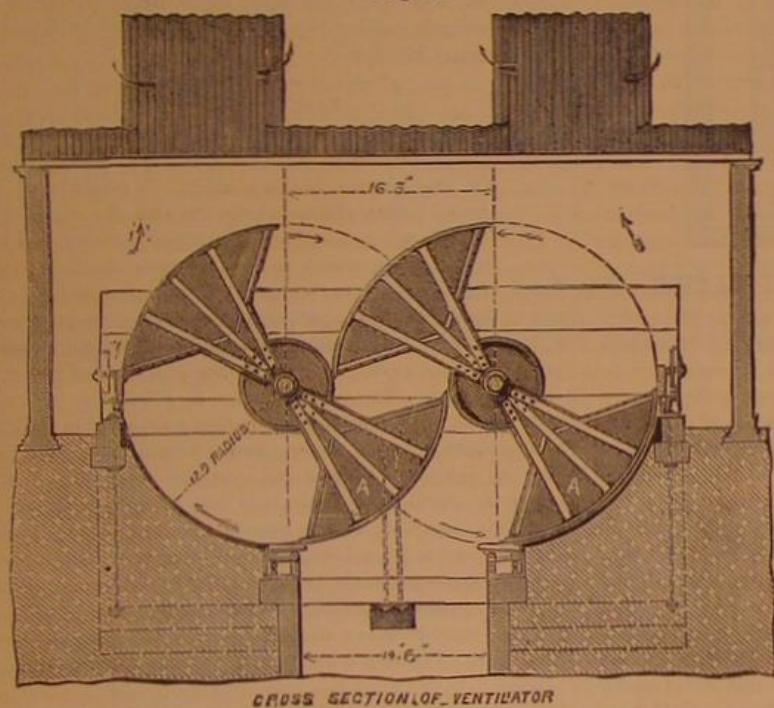


Fig. 2.

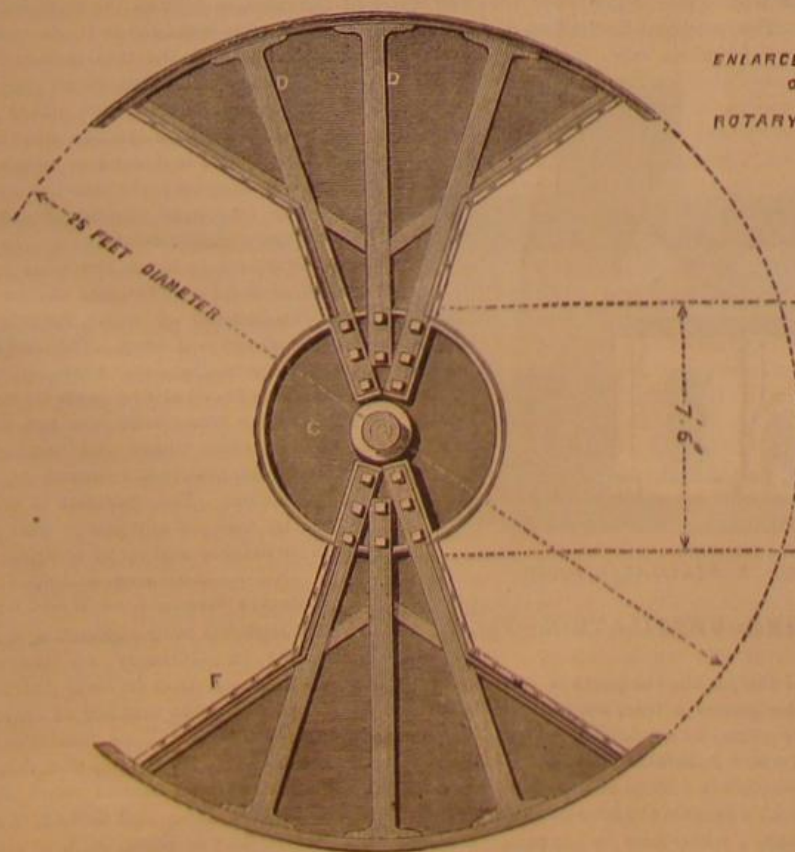
ENLARGED DETAILS
OF
ROTARY PISTON

Fig. 4.

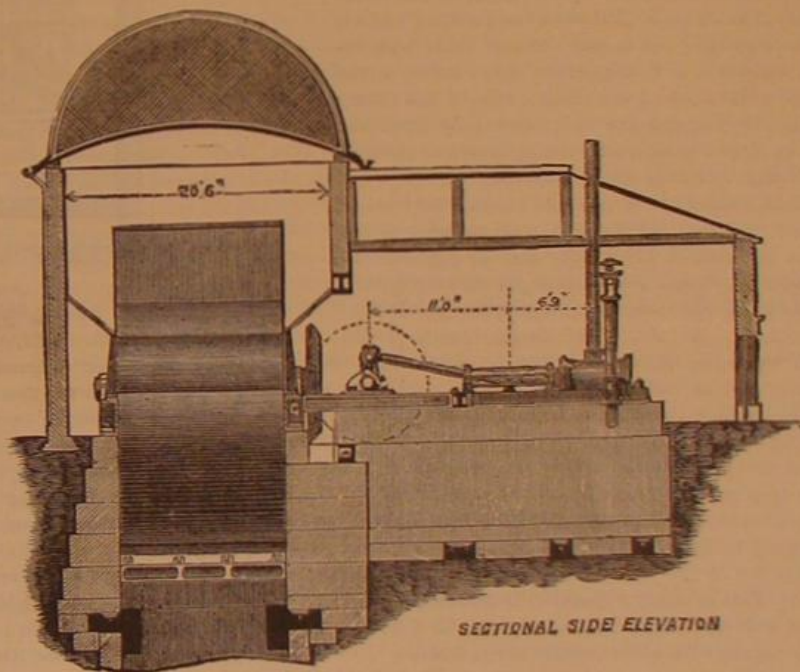
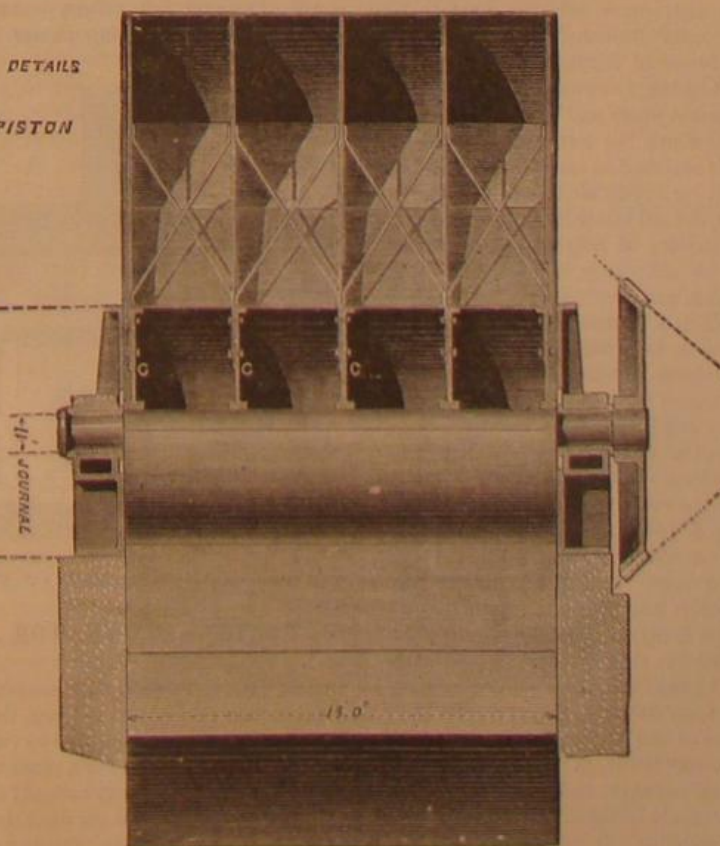
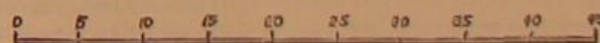


Fig. 3.

SCALE



ROOTS' BLOWER FOR MINE VENTILATION.

also secured to the disk plates by bolts turned to fit. The outer ends of the bars are widened, and marked off and slotted to the radius of the outer circle. Angle irons bent to the radius of the outer circle are riveted to the extremities of the bars, and are covered with $\frac{1}{2}$ inch sheet iron plate; the center circles are also covered with $\frac{1}{2}$ inch sheet iron plates on the turned flanges of the disk plates, C C. The sides, F F, of the pistons are covered with wood, and the ends with sheet iron. These rotary pistons revolve in bearings fixed upon deep cast iron girders, which form the framework of the ventilator pit, and are connected at each end of the ventilator by cross girders. The girders and the cast iron side plates above them are planed on their inside surfaces, and the stonework of the ventilator pit is dressed off level with the planed girders. The engines to drive the ventilator are a pair of 28 inches cylinders, Figs. 4 and 5, with 4 feet stroke, and provided with adjustable cut-off valves. They are placed at right angles to the ventilator, and are connected to it with bevel wheels 9 feet 2 $\frac{1}{2}$ inches diameter, two bevel wheels being fixed upon the crank shaft, each gearing into a bevel wheel keyed upon the end of the ventilator shafts. The engine beds are carried along and fixed upon a stay girder, securely keyed and bolted to the main girder, G. The main girders are fixed 13 feet $\frac{1}{2}$ inch apart, therefore the clearance between the rotary pistons of 13 feet and the sides of the ventilator pit is only $\frac{1}{2}$ inch on each side. At each end of the ventilator pit, and at the bottom on each side of the inlet from the upcast shaft, adjustable packing blocks of timber are fixed upon hinged iron frames, and can be adjusted with screws and nuts; these blocks are set up quite close to the periphery of the rotary pistons within $\frac{1}{2}$ inch. The clearance between the periphery of one of the rotary pistons and the center circle of the other is also the same, and thus in any part of the ventilator the clearance for loss by returning of the air is not more than $\frac{1}{2}$ inch. Between the packing blocks, I I, the ventilator pit is dug out and lined with cement; but there is considerable space between the layer of cement and the outside circle of the rotary pistons, and dependence is placed only upon the packing blocks to maintain the tightness of the pistons with the ends of the ventilator pit.

Chilton Colliery is a new pit raising 800 tons of coal per day, and the present requirements in the way of ventilation are amply met by running the ventilator at fifteen revolutions per minute, giving a calculated displacement of 87,000 cubic feet of air per minute. At this speed better results would be obtained by using only one cylinder, and letting the other engine stand, as will be done in the case of repairs; the two engines are only intended to be used when the ventilator is working up to its full maximum quantity of 200,000 cubic feet of air per minute. The arrangement of the engine house and ventilator building is shown in Fig. 5; the discharged air escapes through perforated openings in the roof, and owing to the very large area of outlet from the ventilator—the top of the ventilator casing being left entirely open—the air that is being exhausted from the pit must necessarily be delivered into the atmosphere at a lower velocity than is usual with other ventilating machines.

These blowers are manufactured by P. H. & F. M. Roots, Connersville, Indiana. S. S. Townsend, general agent. Cooke & Beggs, selling agents, 6 Cortlandt street, New York city.

Curious Proclivities of Insects.

This strange distinction between beautiful and hideous plants was curiously illustrated by Sir John Lubbock, during a recent address at Brighton. We find an abstract in the *London Telegraph*. Bees, it seems, are fond of pleasant odors and bright colors, and affect plants in which we ourselves take pleasure. If a bee is watched in its progress through a garden, it will be found hovering over mignonne, the roses, the tall white lilies, the lavender, and all other flowers of bright color or sweet scent. Flies, on the other hand, prefer livid yellow, dingy red, and very unpleasant smelling plants. The bee is a fastidious insect of sensitive tastes. The fly is a species of insectoid vulture, with a natural proclivity for carrion, or anything resembling it. Any one who takes a couple of plates and places them on the lawn, a yard apart, putting on one a specimen of the abominable underground fungus, the "stink-horn," and on the other a glass of moss roses, will see that in a few minutes the foul-odored fungus will be covered with flies, while the bees will flock to the roses. It is to this love of bees for beautiful colors and pleasant smells that we owe our choicest flowers. Flowers, as Sir John Lubbock pointed out at some length, and as is now generally known, are principally fertilized by insects. The bee flying from flower to flower carries the golden grain from the anthers of one to deposit it on the pistil of the next. Crossing in flowers tends, as in all other living things, to improve the size, strength, and beauty of the species. Flowers which are "cross-fertilized" by insects reach the highest state of excellence. Self-fertilization, according to Sir John Lubbock, tends to dwarf the specimens. Indeed, in

the case of a convolvulus, it has been shown by actual experiment that when self-fertilized it only grows to a height of five feet, while when cross-fertilized it will reach seven feet and a half. So far, bees and flies perform the same work, the difference between them being that the bees, as we have said, love beautiful colors and fragrant odors. More than this, each bee appears to have its proclivities, or at any rate, its habits. Sir John Lubbock himself taught a bee to go to a certain place for honey on blue paper for some days consecutively. After his winged pupil had paid several visits to the blue paper, some honey was placed on a piece of orange-colored substance. The little insect was at first in doubt, but after hesitation of a few seconds, it rejected the jaundice-lined repast, and dashed at the blue paper. From these tastes and fancies on the part of bees, it has in the course of long years come about that the plants

who must exercise a judicious choice on his own account. Nothing is more remarkable than the results which could be effected in floriculture by those who have time and attention to bestow upon it. There is no better instance than that of the calceolaria. The ordinary calceolaria has a little yellow blossom, three of which would lie upon a shilling. By careful selection, plants can be produced of the most exquisite and variegated hues, and of which a single blossom would entirely cover and hide from the view a two shilling piece. Here we have done for us in the course of a few generations what nature, by the aid of her workers, the bees, might possibly have accomplished in the course of ages. Indeed, the possibilities of floriculture are so infinite as to make it matter of regret that it should, like cookery and costume, have been allowed, for want of that dignity which attaches itself to a recognized science, to remain little more than a trade.

If, for instance, the same care were taken with the cultivation of the water-lily that is bestowed on the rose, what might not be the result? Why should we not grow water-lilies the size of soup plates, with every leaf as mathematically perfect in dimensions and outline as the leaves of a prize dahlia? Why should not magnolias blossom in our hot-houses four, five, or even ten times larger than the present exquisite white flower with its tender flavor of citron? The actual wants of life come before its pleasures, in spite of the sneer of the Epicurean, who said that if he only had the superfluities of this world, he could do very well without its necessities. Flowers are as much a superfluity as are pictures, or statuary, or Brussels lace, or mediæval furniture, or Japanese china. Beyond all these things, however, they have about them a bright, fresh, and wholesome influence of their own. If half the money that is now wasted on mere freaks of fashion were spent in systematic floriculture, the earth at any rate would be made more beautiful, and a reasonable and healthy occupation would be found for many idle hands.

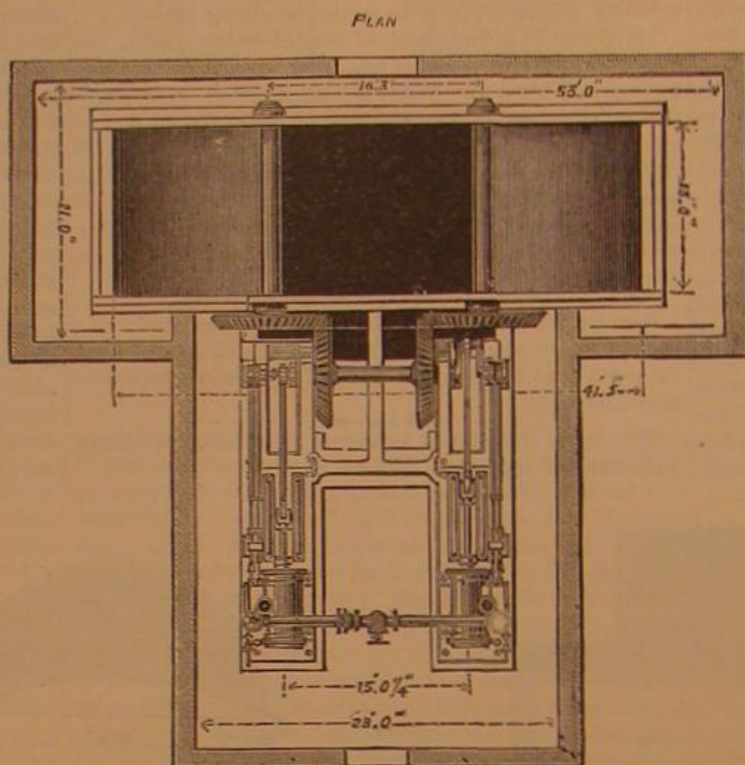
New Tests for Milk.

Dr. Heusner, of Barmen, has recently devised a simple apparatus called a *lactoscope*, which is based on the opacity of pure milk. It consists of two round plates of glass about the size of a watch crystal, placed parallel and held about $\frac{1}{2}$ inch apart by a metal strip, which passes between them, dividing the space between them into two sections. In the lower section is placed and secured some pure milk, or, better, some permanent white fluid of precisely the same opacity as pure milk. On one of the glass plates are some fine black lines. The upper section is filled with the milk to be tested, and secured by an elastic band. On holding the apparatus between the eye and the light, the black lines being on the side opposite the eye, the black lines will be seen more distinctly through the less opaque medium. If the milk to be tested is less opaque than the normal liquid, as shown by the lines being more distinctly visible through it, the milk has probably been watered or skimmed. Alone this little apparatus, which sells in Hamburg for \$1.87, is of little use, but can prove useful in connection with the lactometer, both to be followed, in doubtful cases, by a chemical analysis.

In regard to the chemical analysis of milk, which is the only reliable test of milk, Professor Lehmann, of Munich, proposes the following modification to save time: A weighed quantity, say 9 or 10 grammes of milk, is diluted with an equal weight of water, and poured out in a thin layer upon a porous plate of burnt clay, very dense and fine-grained. The water of the milk, as well as the milk sugar, albumen, and a portion of the salts dissolved in it, are absorbed by the clay plate, while the total amount of fats and casein in the milk remain on the plate in the form of a thin skin or film. This film is easily removed with a horn spatula, and then dried and weighed. If it is desired to determine the fats alone, this film may be extracted with ether, and thus the two most important constituents of milk very quickly determined. In many cases it is sufficient to know the total weight of the principal solid constituents of the milk, hence also the amount of water, for which scarcely two hours are required. This method also possesses the advantage that a great number of samples can be tested at once without much trouble. It also does away with the use of numerous costly platinum dishes and troublesome water baths, which are always getting dry if not carefully watched. The operation is so simple that it can be used by any person who possesses an accurate balance and set of weights.

Relative Strength of Wood and Iron.

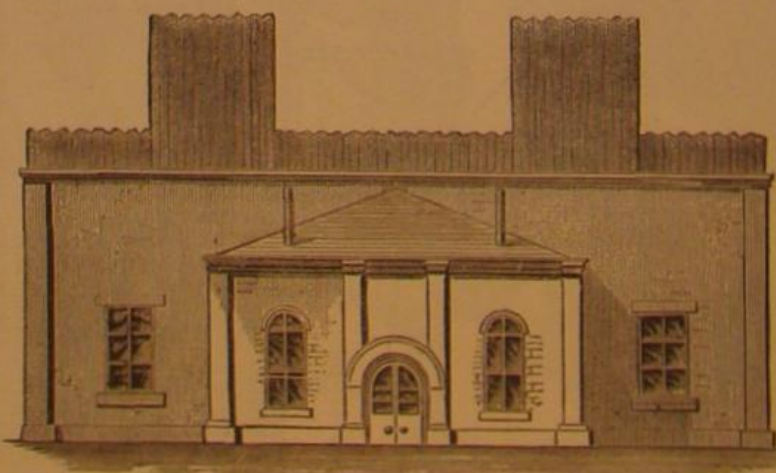
Herr Hirn has been conducting a series of experiments in Germany on the comparative strength of wood and cast iron in their different applications, and finds that in a great number of cases the former has the advantage. Professor Hirn finds the strength of wood to be in direct ratio to its density, and this strength is increased by immersing the pieces of wood in linseed oil, heated from 185° to 212° Fah., and letting the wood thus immersed remain for two or three days, or until partially saturated.



ROOTS' BLOWER FOR MINE VENTILATION.—Fig. 5.

which bloom by day have bright colors and a sweet smell. Similarly night plants, although as a rule colorless, are yet often powerfully scented, the reason being that they are fertilized by nocturnal moths, which have a sense of odor fully as delicate as that of bees, and, like bees, are fond of honey.

Sir John Lubbock's researches lead him to the conclusion that these causes have been through countless ages acting and reacting upon one another. The most lovely flowers have attracted bees, and consequently the finest blossoms of the year have been cross-fertilized each by the other. Thus, for century after century, flowers have been growing more and more beautiful; while, strangely enough, a similar process has been going on in the case of those plants which are affected by flies, and their unwholesome and disagreeable qualities have become intensified. When we consider the law hereby indicated we gather from it a practical rule, of which the skilled gardener ought to avail himself. Many centuries have passed since the blind bard of Hellas assured us that "such as is the race of blossoms, such is that of men." Blossoms there are which the wind tosses to the ground, but others, again, the wide wood bears when the season of spring comes on. The practical distinction be-



FRONT ELEVATION OF ENGINE & VENTILATOR HOUSE

ROOTS' BLOWER FOR MINE VENTILATION.—Fig. 6.

tween flowers and ourselves is that, while the years of man are threescore and ten, the blossom, as a rule, has a life of a year only, and that in twelve years, by artificial selection, you can effect for a plant that which natural selection in the case of man may possibly accomplish in a score of centuries. In our gardens Sir John Lubbock's friends the bees do their work admirably. But in hothouses, where bees do not penetrate, everything is due to the skill and care of the gardener,

Communications.

Our Washington Correspondence.

To the Editor of the Scientific American:

The trade circular recently issued from the State Department to our diplomatic and consular officers has had considerable effect in causing those officers to make renewed efforts for the enlargement of our commerce in their several districts. The consul at Liverpool writes to the Department that he thinks that, besides the trade in American beef, a large trade could be done in American poultry, by exporting it to England either alive or dead. He gives the prices of turkeys, at wholesale, at fifteen cents per pound, and chickens at sixteen cents. He states that the American poultry is far superior to the English, and would therefore sell readily.

The consul at Amsterdam sends an interesting report on the leather manufacture of his district, in which he states that, instead of being exporters to America, as formerly, one of the largest of the leather houses now imports American goods into Holland. He also states that not content with importing leather, the same house had also begun to import New England shoes, for the European manufacturers cannot compete with the New Englanders either in price or quality, and that, besides sending large orders for shoes, the junior partner of the house referred to was about leaving for the United States to perfect and enlarge their business relations with American manufacturers.

In response to the same circular, an interesting report has been received from the United States consul at Frankfort-on-the-Main, on the prospects for an extension of American trade in eastern, central, and southern Germany. He appears to be of opinion that the present time is peculiarly favorable for the introduction and sale of American productions in that part of Germany; that although the people generally are disinclined to accept innovations, yet this obstacle will readily yield to the great law of profit and pecuniary interest which governs commerce; and that the existing plethora of grain, the languishing state of skilled productions, and the low rates of duty prevailing, especially invite our producers and manufacturers to find a profitable market there.

The consul at Havre reports, in reply to the same circular, that he has continually endeavored to induce shipments of our products, such as hides, pork, bacon, corn, etc., into his district. As an example of what a consul can do in forwarding the commerce of the country he represents, he states that, by inducing a few of the people of his district to feed Indian corn to the cattle in lieu of the small native grains, the trade in that article to Havre rose from a few samples in 1875 to 46,278 bushels in 1876, and for the first seven months of this year to over half a million of bushels; some of which was raised in the Mississippi valley, floated down that river to New Orleans, and shipped from thence direct to Havre. If this course was followed by the majority of our consuls, our trade with foreign countries would increase to such proportions as to soon cause us to bid farewell to "hard times," especially if their efforts were seconded by corresponding attempts of our manufacturers and merchants to follow out their suggestions.

The fact that Congress failed to make any provision looking to the participation of the United States in the French Exhibition has given rise to considerable apprehension lest those Americans who were desirous of exhibiting would be deprived of this pleasure and its anticipated profit; but it seems that a way has been opened by which applications for space at the Exhibition can be made and granted without waiting for the action of Congress, which may not be taken until after the opening of the regular session in December. It is stated that about one thousand applications have been sent to our legation in Paris, which the French Government have heretofore refused to consider because they had no official endorsement by our government, but the authorities have now consented to waive this formality, and these applications and all others received through the legation will be received and acted upon. This seems to be as effective, in opening the doors of the Exhibition to our inventors and manufacturers, as a formal acceptance by our government of the invitation of the French Government would be. There is plenty of time for such formal acceptance hereafter.

There has been in this city for the past week a large delegation of Indians, who came to hold one of their semi-occasional "pow-wows" with their "Great Father," to protest against being removed from their reservations, and to request aid towards the civilization of their race. Some of the Indians had never come in contact with civilization before, and consequently made their wants known in rather peculiar demands; but there appears to be no doubt as to the genuineness of the wishes of some of them for the benefits of civilization. That some of the Indians are improving very fast in this direction is very evident from a recent report of the Board of Indian Commissioners, that is quite gratifying to the friends of the red men, for it shows that in 1868 the houses occupied by Indians numbered but 7,476, while in 1876 they numbered 54,717. There were then on the reservations but 111 schools; there are now 344. There were then 4,718 pupils attending school; there are now no less than 27,215 native scholars. Out of about 260,000 Indians, the Board estimates that over 100,000 wear citizens' dress. The Indians raised then 126,117 bushels of wheat and 467,363 bushels of corn; in 1876 they raised 463,054 bushels of wheat and 2,229,463 bushels of corn. They owned

in 1868 but 2,683 sheep and 20,890 swine; in 1876 they owned 417,295 sheep and 214,076 hogs. All this is certainly very encouraging, and proves that under a proper policy, which shall hold out some inducements to them to follow peaceful pursuits, a large per cent of the red men may be saved to civilization.

On or about November 1, the Tybee (Georgia) beacon light will be exhibited from a new iron skeleton structure, erected forty feet southeast by south from the old beacon. The focal flame will be 28 feet above mean sea level, and the light will be visible ten nautical miles.

Washington, D. C.

OCCASIONAL.

Titusville Gravel Pit Oil wells.

Mr. John F. Carll, assistant in charge of the oil districts, Pennsylvania, writes as follows in *Stout's Petroleum Reporter*: In August, 1859, just 18 years ago, the quiet little hamlet of Titusville was electrified by the report that petroleum had been found in large quantities at a depth of 70 feet, in the Drake well. Since that time probably 30,000 oil wells have been sunk, and great improvement has been made in the art of drilling. An ordinary 1,500 foot well is put down to-day with more ease and dispatch than was this little 70 foot well in 1859. We are not even surprised to learn that the Watson well, within two miles of this first venture, has been carried down to the great depth of 3,553 feet, for we have become prepared for almost any achievement of the drill.

But now appear new claimants for our notice. The pick and shovel to-day step forward to take the place of the drill. A 15 foot gravel pit assumes to supersede the 1,500 foot drill hole. And, curiously enough, this happens on the same creek-flat, and within a mile of the old Drake well.

The gravel-well district of Titusville is the latest wonder of Oil-dom—at least it has been made such by the exaggerated reports and astonishing theories in relation to it, that have gained currency through the daily papers.

Let us see what are the geological facts concerning it, and what the relations it bears to the regular oil-producing rocks of the district.

Titusville is situated in a broad, irregularly outlined basin of erosion between hills more than 300 feet high, at the junction of Pine creek and Oil creek. The "flat," or old water plain, contains perhaps 100 acres, having its greatest length in a northwest and southeast direction. Oil Creek enters it at the northwest angle, and, sweeping around to the east and south, leaves it at its southwest angle. Pine Creek falling from the northeast and east, enters at the southeast angle, and joins Oil Creek near the outlet. Church Run from the north, Shaffer and McGee Runs from the south, and several other minor runs likewise empty into it. "Watson Flats," a locality renowned in the early history of petroleum developments, is included within these outlines.

The new oil pits are near the Pleasantville plank road, which passes along the northeasterly side of the basin before crossing Pine Creek. More than 100 oil wells have been sunk on these flats in the usual way since 1859, and by the length of drive pipe required to reach the bed rock, they conclusively demonstrate the fact that the channel of the old stream, once flowing between these hills, was a hundred feet or more below the present surface. Within a rod or two of some of these oil pits, 53 feet of pipe was driven through these superficial deposits, a little farther out towards the center of the basin 80 feet, and in the center about 100 feet. As the oil pits are only from 15 to 18 feet deep, it will be seen at a glance that the oil is not obtained from the stratified rocks, for the old wells referred to show that they lie much deeper, and have not been reached by the pick.

This basin, then, as it existed in pre-glacial times, must have been at least one hundred feet deeper than it is at present. It was occupied by a stream whose birth could scarcely have antedated the close of the carboniferous period, and whose great age can only be surmised from the evidences it has left behind in the magnitude of work performed. At this point it has already cut down through the solid rocks to within fifty feet of the first oil sand. This would be equivalent (if the rocks originally lay here as they now lie at Pittsburgh), to a vertical excavation of 1,900 feet. It is quite probable that it flowed to the north (as did others of these northerly streams at that day), delivering its waters into the Lake Erie basin.

But now a great change occurs. The glacial epoch comes on. A thick ice-sheet covers all the northern country; slowly advancing and holding in its icy grasp fragments of rocks, gathered along its track, all the way from Northern Canada, it levels off the hill-tops, widens out the valleys, and plunges into the old river beds its burden of mixed transported debris. The northern outlets of drainage are all covered with ice and obstructed; and when long afterward, under a modification of climate, a recession of the glacier commences, pools and lakes of water accumulate in front of it; they fill up and overflow at the lowest depressions in the hills at the south. As these new outlets gradually deepen, the lake surfaces lower, the lake bottoms fill up with detritus brought in by the melting ice, and finally, when the ice disappears, we find the old river beds at the north filled up hundreds of feet with drift, the valleys almost obliterated, and a new direction given to all the drainage of this section of the state. This is but a brief and partial statement of the probable sequence of events during this epoch. It may serve to show, however, that the beds of gravel or sand from which these pick and shovel wells ob-

tain their oil could not have been deposited until near the close of the glacial period, for they lie very near the tops of the drifts. A careful examination of the sand or gravel shows that it is composed of a mixture of water now comminuted particles derived from the primary rocks, the Silurian limestones, and the local measures of the surrounding hills. It is a comparatively recent deposit, filling up an old deeply excavated channel in the sedimentary rocks, which channel had previously been the bed of a stream ages on ages before.

There is no marked difference between the deposit here and thousands of other drift deposits, scattered all across the country in this latitude. They were all laid down in the same era, and by similar agencies. The fact that this particular spot produces oil, while others, apparently just as favorably located, do not seem to indicate that the oil is not indigenous to the gravel bed itself. It is evidently derived from some other source, the gravel bed acting only as a reservoir for its reception and storage.

Many stories are afloat concerning the bursting of a pipe line near these pits, and the leakage of storage tanks formerly located in this neighborhood, and some affirm that the oil has leaked into the gravel bed from these sources. Others contend that it has ascended from the regular oil sands below through the old abandoned bore holes on the flat. But we think a much more probable explanation of the phenomenon can be found in the operations of natural agencies alone unaided by the accidents or interventions of men.

The gravel bed (the thickness of which is not at present known, as it has not been dug through) is capped by a sheet of tough, impervious blue clay, varying from four feet to twelve feet or more in thickness. This clay seems to cover the gravel bed like a hood, and the retention of oil in the gravel bed is no doubt due to the peculiar shape of the clay sheet.

Oil formerly issued with the waters of springs, and through the gravel of the creek bottom, in many places along the valley of Oil Creek. The Drake well, and some others of the early wells, struck oil before reaching the first oil sand. But it is now well understood that this oil came up from the first oil sand, which was in these places surcharged with oil. In the same manner, no doubt, the gravel beds have been supplied with oil. The first oil sand lies, as has been stated, only 50 feet below the bottom of the drift deposit. For ages the oil has been slowly escaping into the drift and working its way to the surface. In the locality of the gravel pits it was obstructed by an impervious sheet of clay lying immediately over a good deposit of coarse sand and gravel. In this almost hermetically sealed reservoir it collected, and here it remained until set free by the piercing of the clay hood above it.

How considerable the deposit of oil may be in this locality of course no one can tell. The agencies depositing the clay and gravel were wide spread and general in their action, but extremely variable in their local results. An examination of any railway cutting through a gravel bank will illustrate this. Small boulders, gravel, sand, and clay, will be found in many cases to be almost indiscriminately mixed, and no one class of material can be traced for any great distance. We should not, therefore, expect this peculiar structure of a clay-capped sand bed, which seems to be the requisite basis of a paying gravel well, to extend continuously over a very wide area. The whole question may be briefly resolved thus:

Given the clay sheet without the sand bed, the sand bed without the clay sheet, or the clay and sand in reversed positions, and no oil could be obtained. So also, given the clay and sand in good condition and proper position, but in a locality where there is no oil-producing sand beneath, and the same result would follow.

If, then, the success of a gravel well depends upon the rare and rather accidental conjunction of the several necessary conditions above mentioned, we need not apprehend any danger of an overflowing of the storage tanks, or an overstocking of the oil supply from the products of these drift deposit wells.

Boiler Explosions arising from Grease and Lime.

A late number of the *Annales des Ponts et Chaussées* states that a commission appointed to report on a boiler explosion at La Villette, Paris, attributed it to an insoluble deposit, composed chiefly of a calcareous soap, which formed near the opening close by the water feed pipe, and which was due to the nature of the waters used. Some of the water containing calcareous matter was furnished by the city; some came from condensers, bringing fatty particles, arising from the lubrication of the machines. The commissioners cite numerous accidents which have occurred within the last fifteen years, all of which are attributable to the same source. They therefore think it important that manufacturers should be warned of the danger, and if they are obliged to use such a mixture of waters, they should take all possible precautions, such as the purification of the calcareous waters by carbonate of soda; the filtration of the condensed waters by passing them through wool or felt; the skimming of the grease from the surface of condensing cisterns, and frequent drawing off of the surface of the water in boilers.

TO MAKE MODELING CLAY.—Knead dry clay with glycerin instead of water, and a mass is obtained which continues moist and plastic for a length of time. This removes one of the greatest inconveniences that is experienced by the modeler.

NEW SURFACE PLANING MACHINE.

In the experience of manufacturers it is often found necessary to abandon old methods of construction, and adopt new methods combining qualities of strength and utility not before recognized as being essential for the perfect operation of the machine or tool.

There are many apparently non-essential parts or adjustments of parts of machines, the indispensable utility of which are forced upon the experimenter, only through actual contact and by personally superintending the construction and operation, so that the practical difficulties may be observed and means provided to overcome them.

In this connection, we illustrate a surface planer for wood, designed and constructed by J. A. Fay & Co., wood-working tool manufacturers, Cincinnati, Ohio. It is quite novel in design and construction, and shows a considerable departure from examples heretofore exhibited.

The machine represented in the engraving is designed for surfacing only, and smooths but one side in its operation, the lumber passing between two pairs of rollers, under the pressure bars, and being gauged to an accurate thickness by passing over a smoothly finished table which is adjustable to the required thickness. The frame or column of the machine is a continuous casting, having the crosspieces, sides, and bearings for the cylinder all combined in one piece, forming an inflexible frame, being superior in this regard to the ordinary frame with independent crosspieces, the latter being much more liable to disarrangement. The cylinder is of wrought iron, arranged so that the knives (of which there are two) can be made to cut the roughest lumber without tearing the fiber of the wood or disturbing knots. The feeding rollers are strongly geared and readily started and stopped while the cylinder is revolving. The table or platen is cast in one piece; it is provided with friction rollers and adjusted by a hand wheel and screws connected by bevel gearing, and the thickness of the stuff being planed is indicated by a finger and graduated plate. The pressure bars are arranged closely to the periphery of the cutting edge of the cylinder, the bar before the cut swinging from a center as it rises to the thickness of the rough material, the bar, after the cut, being slightly flexible and adjustable to the wear of the different parts. The proportions of the bearings, to the cylinder, the gearing, feeding rollers, and other parts, are larger than is usual in this class of surfacing planers, thereby producing a substantial and reliable machine, and one evidently that will give entire satisfaction within range of its powers.

This machine is constructed in three sizes: 16 inches, 20 inches, and 24 inches in width, and will plane lumber to 5 inches in thickness, and is adapted for surfacing either hard or soft wood, and will be found of great utility in any wood-working establishment in the land.

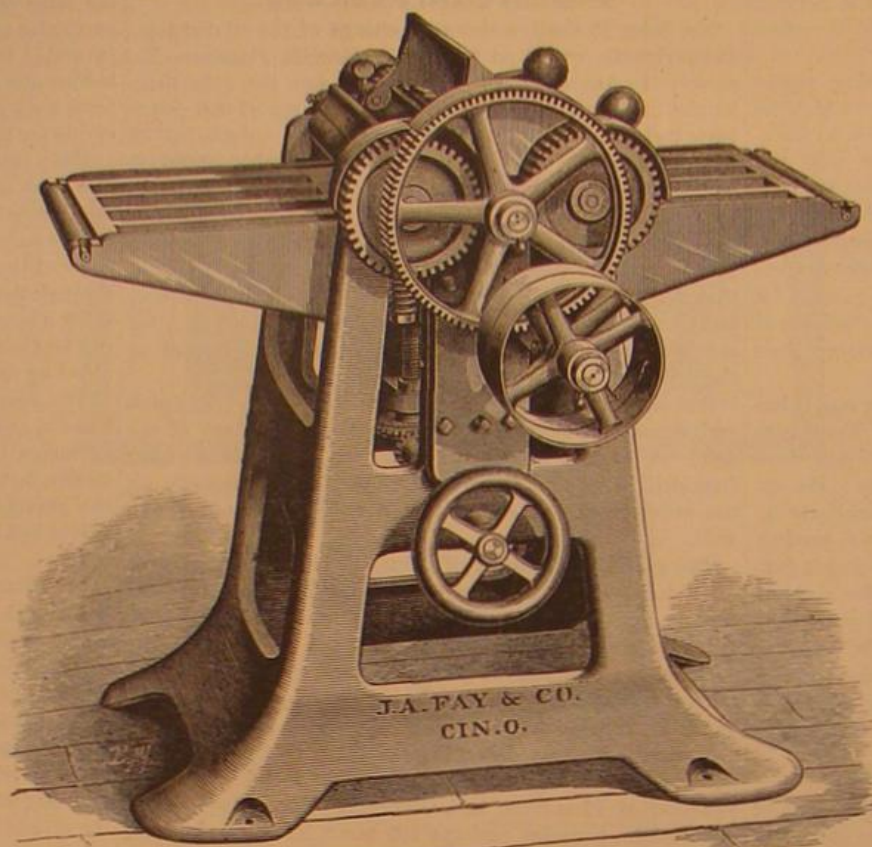
We have already noted the fact that Messrs. J. A. Fay & Co.'s extensive exhibit at the Metropolitan Exhibition in New South Wales received both complimentary and meritorious premiums in competition with other machines. Any further information can be obtained by addressing the manufacturers as above.

IMPROVED AUTOMATIC FIRE EXTINGUISHER.

The accompanying engraving shows how a room can, it is claimed, be made secure against fire by a new automatic fire extinguisher, which consists of a dry chemical compound, which, when ignited absorbs the oxygen of the air and smothers the fire by evolving gases that are antagonistic to combustion. The invention is especially adapted in all places where the usual fire engines and other extinguishing devices are not immediately applicable. It obviates the necessity for water and the damage frequently incurred thereby to the goods. To make the compound self-acting, the boxes, A, containing the extinguishing compound, are placed on shelves near the ceiling of the room and connected by means of a fuse, B, which is proof against water and danger from rats: this fuse, being exposed to the flames wherever they may originate in the room, conveys the fire to the compound, and causes a simultaneous action, and extinguishes the fire without the aid of human assistance.

When the extinguishing compound is to be used by hand, the fuse is ignited and the mass, which is enclosed in a suitable box, thrown into the burning room. The fumes developed penetrate every available space, and smother the fire by evolving fumes of sulphurous acid and carbonic acid gas.

The affinity of the sulphurous acid for the oxygen of the air, which it seeks to extract for the purpose of forming sulphuric acid, prevents, it is claimed, every other process of oxidation in the room, while the carbonic acid checks the progress of the fire and stifles it. This joint action of the sulphurous acid and carbonic acid gases renders the compound especially effective in cases where large quantities of coal oil, turpentine, spirits, grease, and similar substances, become suddenly ignited. It is especially well suited for use on board ships. The manufacturer informs us that over forty practical demonstrations have been made with this extinguisher in this country, and in various European states.



NEW SURFACE PLANING MACHINE.

its use has been made compulsory by state and municipal authorities.

For further particulars, address the patentee, Mr. Armin Tenner, 203 Vine street, Cincinnati, Ohio. The Unexcelled Fireworks Company, 112 Chambers street, New York city, are manufacturers and general agents for New York, New Jersey, and the New England States.

Colored Inks for Stamping.

The following are commended for the colors most frequently wanted for stamping purposes:

Red: Dissolve $\frac{1}{4}$ oz. of carmine in 2 ozs. of strong water



AUTOMATIC FIRE EXTINGUISHER.

of ammonia, and add 1 drachm of glycerin and $\frac{1}{2}$ oz. of dextrin. Blue: Rub 1 oz. of Prussian blue with enough water to make a perfectly smooth paste; then add 1 oz. of dextrin, incorporate it well, and finally add sufficient water to bring it to the proper consistence.

TO MAKE COMPOSITION ORNAMENTS FOR PICTURE FRAMES, ETC.—Mix whiting with thin glue to the consistence of putty. Have the mould ready, rub it over with sweet oil and press the composition into it. When a good impression is produced, take it out and lay it aside to dry. If it be desired to fit the ornament to a curved or irregular surface, apply glue and bend it to the place where it is to be attached before it gets dry.

On Feeding Horses New Hay and Oats.

The question whether horses are injured by being fed on new hay and fresh oats has been made a subject of investigation by a French military commission, who have been experimenting upon cavalry regiments. The *Kamerad* reports that the results of the experiments prove that the health of the horses was not essentially injured by new hay if they received the ordinary regulation ration along with other fodder. Some animals were at first rather less active and more quiet, they sweated more freely, and the excrements were somewhat softened; but in a short time this ceased. In general, the horses ate the new hay more willingly than the

old. They retained the same strength and corpulence as before. The hair kept bright, the health perfect. Of 150 horses from 4 to 13 years old, with which the experiments were instituted, 37 gained in fatness, and 18 in strength and endurance. Only 18 lost flesh, and 8 lost strength, while 79 remained unchanged. A second series of experiments upon 150 horses gave the same results. On the other hand, another series of experiments was less successful, where 74 horses, from 4 to 13 years old, were fed exclusively with new hay, the quantity being increased until it equaled the regulation ration of old hay, straw, and oats together. On this feed there was no real sickness, but a general weakness, frequent sweat, loss of appetite, digestion disturbed, diarrhoea, relaxation of the muscles, weariness, etc.

The decision of the commission was that new hay can replace old hay in the regular rations without injury, and perhaps with advantage, but that to feed them exclusively on new hay is injurious to the horses.

Experiments were made upon 1,800 horses by feeding them on new oats, and were attended with favorable results, inasmuch as the animals nearly all increased in bulk and strength, from which the commission concluded that new oats can be substituted for old ones with advantage, and hence it is useless to wait two months after the harvest before permitting the use of new oats. These experiments refute most positively the prejudice that still prevails in many places that feeding on new hay and oats is injurious to horses.

On the other hand, it cannot be denied that horses, to which new hay is given, are frequently exposed to colic. The danger is only present, then, when the horses receive no definite rations, but have put before them as much as they can eat. In this case they not only eat much more new hay, but they also eat much more eagerly and greedily, which can be so much more injurious, as experience proves that those very horses which are most inclined to the colic eat most greedily.—*Industrie Blätter*.

The Velocity of Light.

M. Fizeau, whose name as an investigator of light is well known in the photographic world, has been followed up in his researches, it seems, by M. A. Cornu, so far as the determination of its velocity is concerned. M. Fizeau has made the subject of light quite his own, and in the early days of daguerreotype, he did much towards improving and elaborating the process. He it was who first of all distinctly comprehended the fact that so long as only one image could be secured by the daguerreotype process, the application of the latter must be very limited. It was his endeavor, after an image had been once secured, to produce therefrom other duplicate images—a problem which Fox Talbot had already solved in his process, which permitted of the production of negatives instead of positives. Fizeau's daguerreotype engraving process, by which he sought to convert the daguerreotype plate into a printing block, from which impressions might be printed in the press, although a singularly ingenious one, turned out of little practical value, since it was impossible to produce

half tones by its means in any degree of perfection; and the strides made at the same time by the application of collodion and glass plates to photography at once placed M. Fizeau far behind, and he abandoned a line of research which, at one time, bade fair to ensure him considerable reward. But he did not forsake the shrine at which he had so long worshipped; he simply devoted himself to some other portion of the vast subject which he had made his own. This was to ascertain the velocity with which light travels, a matter which, as everyone who has studied light knows, is beset with peculiar difficulty. According to M. Fizeau's experiments, the velocity of light was 185,157 miles per second; and when we mention that, after some very elaborate researches undertaken by M. Cornu, this gentleman

finds that the velocity is represented more accurately by 185,370 miles per second, we can only wonder at the accuracy with which M. Fizeau conducted his investigation. Unfortunately, in a delicate research like this, it is impossible to exclude errors of all kinds, and we must take, therefore, both the results of M. Fizeau and M. Cornu as approximate truths only; still they are both so near one another that we may, at any rate, conclude that light travels in any case at the extraordinary velocity of more than 185,000 miles per second. We have no such trustworthy data in respect to the velocity with which electricity travels, for in this case the estimates made by various philosophers differ widely from one another. Thus Fizeau estimates the velocity of the electric spark through iron at 62,100 miles per second, and through copper at 111,780 miles; while Wheatstone's results seemed to prove that the velocity was as much as 288,000 miles per second. Kirchhoff, the German philosopher, tells us that the motion of electricity in a wire where it meets with no resistance should be 192,924, which is the same as light *in vacuo*. Photographers may be interested to know how it is possible to determine the rate of traveling of so rapid a medium as light, and we therefore will try to explain the method adopted by M. Cornu in a few words as possible. There is a toothed wheel which revolves at a rapid and known velocity. A powerful ray of light, which may be termed pin pointed, is allowed to pass through one of the niches in the wheel, and as the wheel revolves the point of light is obscured whenever a tooth passes. We will imagine the wheel at rest for a moment, and this ray of light shining through one of the niches. By having recourse to suitable lenses and a reflecting surface upwards at the proper angle, this ray of light is sent on a journey of 10,000 meters—in fact, from the Paris Observatory to the Fort Valerien, beyond the Paris fortifications. Arrived at this station, the ray is reflected back again whence it came, and with such accuracy that it touches the wheel in the same spot that it emerged from. The wheel is now set to revolve, and when at its full speed it may be found that two or three teeth pass in the interim of the light being passed and received back again, when it remains only to be calculated how long these two or three teeth were moving through space. As we have said, the rate at which the wheel revolves is well known, so that the time taken by that portion of it which is represented by two or by three feet is easily found, and this corresponds with the period which the ray of light took to travel the 20,000 meters to Fort Valerien and back again. This was M. Cornu's plan of examining the velocity, M. Fizeau, in his earlier experiments, having recourse to a much more restricted field of operations. Still, with all this difference, there is, as we have seen, but very little to choose between the results of the two French philosophers, and they are far better agreed upon the velocity of light than others upon the velocity of electricity.—*Photographic News*.

SMALL GEARED LOCOMOTIVES.

We illustrate herewith a pair of small geared locomotives designed and built at the works of Mr. Stephen Lewin, Poole, Dorset, England, for Messrs. Guinness & Co., Dublin.

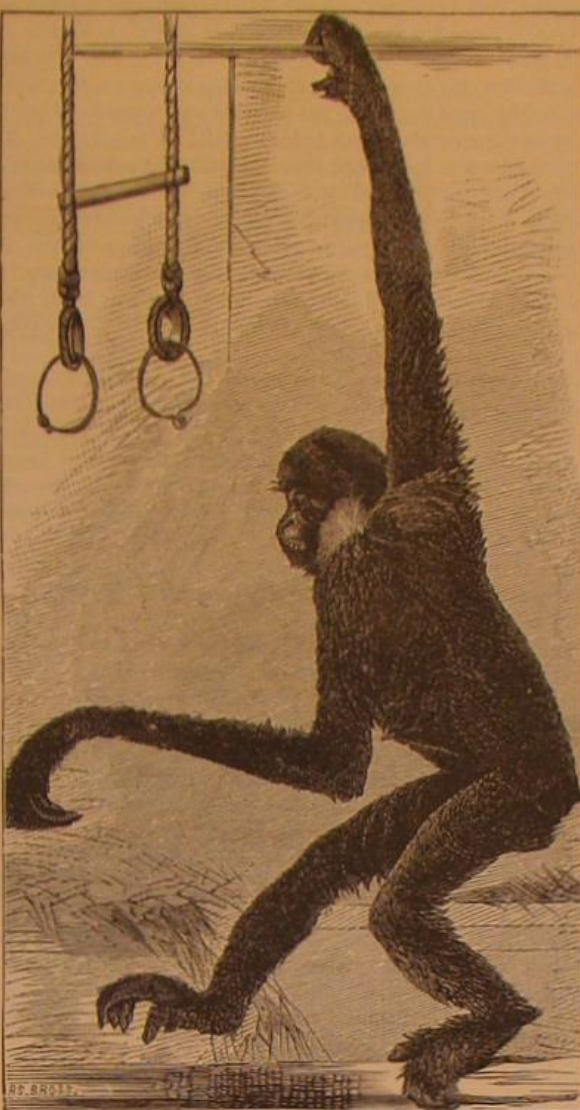
The engines are in every respect similar except in name; the pair being shown in order to give both elevations. Each engine has but one cylinder, 6½ inches in diameter, and with a stroke of 8 inches. The motion of the engine is conveyed by steel gearing to the traveling wheels, which are also of cast steel. When running at 280 revolutions per minute the speed of the traveling wheels is six miles per hour. A wrought iron clutch gear is arranged on each engine, so that they can be used for driving other machinery on the premises. The piston, valve rods, and all pins are of steel. The engine is carried on a strong bed-plate, fixed to wrought iron brackets riveted to the boiler, and suitable provision is made to allow of the expansion of the boiler. The regulator and other gear are all on the outside, and very easy of access. The boiler is made with double riveted longitudinal seams. The ordinary working pressure of steam is 140 lbs. per square inch. At the front end of the engine two buffers are fixed in the ordinary way, but the back or foot plate end is made semicircular, and is provided with a radial draw, to enable the engine to pass with the wagons round the very short curves which are frequently met with on the brewery premises; the sharpest of these is 12 feet radius; the gauge is 23 inches. There are also several inclines on the line, the steepest being 1 in 30, and up to this a load of 16 tons is frequently taken, the engines being capable of pulling a load of about 40 tons on the level.

To suit Messrs. Guinness & Co.'s requirements the foot plate has been arranged to be easily taken down, so that the engine could be placed in their hoist and lifted to another level. The total width of engine does not exceed 4 feet over

all, and the height, from top of rail to top of chimney, 6 feet; and the length with foot plate removed, 8 feet. The water is carried in tanks fixed between the frame plates and the coals in a bunker bolted to the side, as shown in the illustrations.

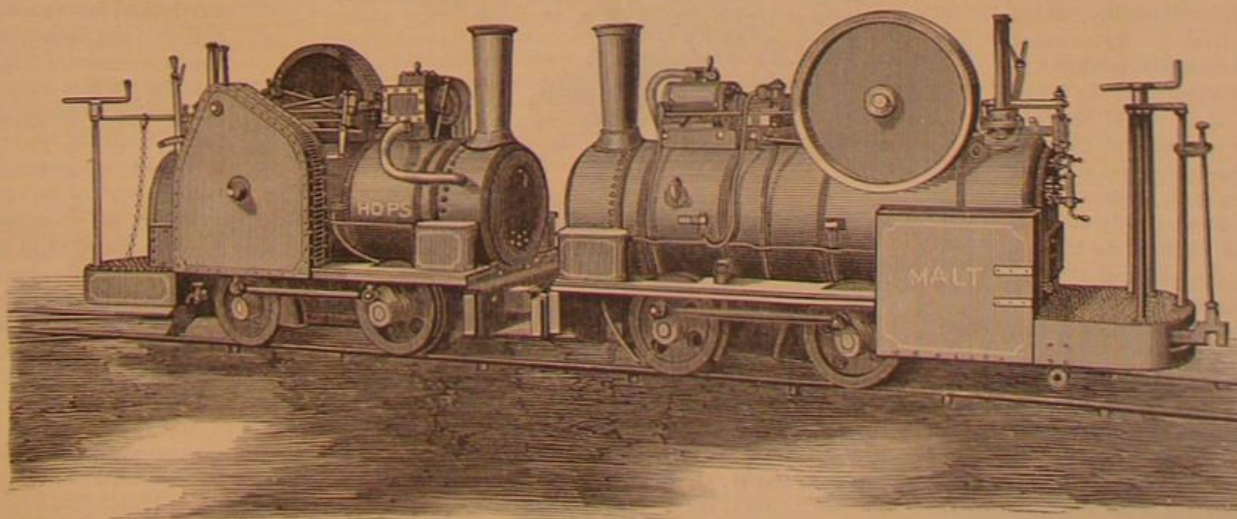
THE WHITE CHEEKED GIBBON.

The Gibbon belongs to that species of apes which have been called wood walkers, from their agility in swinging from tree to tree. They seem to form the connecting link



between the apes and the baboons. The arms are of enormous length, almost reaching to the ground when standing erect, and when extended are twice the length of the body. In height the gibbon rarely exceeds four feet, and many are less than three feet. The fingers and toes are long, flexible, and deeply serrated from one another. The thumb or anterior finger is completely opposite to the other four, as well on the hind as the fore limb. Thus their hands and feet are equally well formed for grasping, and can be used indiscriminately.

The gibbons are the most active of the quadrumana in the trees, but are very awkward on the ground. They are very shy in their native haunts, but in captivity are very



SMALL GEARED LOCOMOTIVES.

gentle and docile. In their wild state they generally live together in pairs. The animal from which our cut is taken is termed the white cheeked gibbon, and is an inmate of the Zoological Society's Gardens, of London, England.

Colored Cigars.

Our readers seem greatly interested in the preparation of tobacco for use, and to some of them it may be of interest to know how the Havana cigar of commerce is dyed or colored to suit a peculiar taste for dark cigars. F. W. Haase, of Bremen, says that the artificial coloring of cigars is in-

creasing almost daily in importance and extent. It is an established fact, he says, that the greater part of the smoking public prefer dark to light colored cigars. From statistics collected in Haase's business it appears that 76 per cent of the buyers order dark colored and only 24 per cent light colored cigars. It is, moreover, a well known fact that most smokers prefer a cigar of uniform brown color to uneven, red, pale, or spotted cigars. The color of all raw tobacco inclines more to light than dark, and the different poor crops of the past years have furnished much tobacco of a bad color. Under these circumstances, and with the large demand for finely colored and dark wrappers, and the small importation of such, a large stock of light colored and poor colored tobacco has been accumulating. In many places goods of a light or especially bad color can readily be obtained at very low prices, and hitherto the only question has been how to sell these old stocks for good wares and at good prices.

To help this need, stains for coloring light or bad colored cigars were offered some time since in various places under the name of "Havana brown," "soft brown," "condensed sauce," etc., which were purchased and used by a large number of manufacturers and dealers in cigars. The article has already an extensive sale, and the results which can be obtained by artificial dyeing are very profitable. Haase volunteered to prove it by sending to those who desired it samples of dyed and undyed tobacco leaves for comparison.

The different stains, remarks Haase, although they all consist of tolerably harmless ingredients, are neither especially appetizing nor justifiable, as they are mostly dilute extracts of dyewoods in ammoniacal solution, and do not contain any of the natural coloring matters of the tobacco, hence cannot replace them. An analysis of the so-called "Havana brown," made by Dr. L. Janke, in Bremen, showed that it consisted of a solution in ammonia and water of a vegetable dyestuff, which contained no material coloring of tobacco, but could be obtained from any colored wood. Dr. Hager suggests that it may be obtained by extracting peat with ammonia. Other stains gave similar results.

This artificial dyeing of cigars has as yet attracted but little attention among smokers, and is conducted very quietly and is apparently harmless, yet under all circumstances it should be condemned. Every artificial change of a natural product like tobacco, to give it a better appearance, should of itself be branded as improper. Then we must take into consideration the fact that the natural color of the cover has an essential influence upon the strength of the cigar, and consequently most smokers place great value on the color. By artificial coloring, on the contrary, the judgment is deceived, and it makes it impossible to determine the quality of the cigar from the color of the cover; for every dealer now has it in his power to make splendid dark cigars from his very light ones without any trouble. But we have especially to notice that now poor colored and refuse cigars may acquire a fine color and be sold for good ones. On all these grounds, dyeing cigars must be ranked as an adulteration for the purpose of swindling the public. Unfortunately no means has yet been devised whereby the people can distinguish such cigars in all cases from the genuine. All we can do at present is to call attention to the fact and recommend caution in the matter.

A Brave Engineer.

A little railroad accident recently occurred at the Cincinnati, Hamilton and Dayton Station, which might have been serious but for the prompt action of Engineer Whalen. The theatre train was standing in the station nearly full of passengers, and the engine, detached, standing some distance in front of it, when a freight train was, by some blunder, backed down at a rapid rate directly toward the passenger train. Fortunately, Billy Whalen, the engineer in charge of the engine, saw the situation, and, understanding the danger, sprang at once into the engine, which was yet detached from the passenger train, and, turning on full steam, shot her ahead into the rear of the coming freight train. The shock was a terrible one. The trucks of the rear car

of the freight train climbed up the front of the engine; the head-light of Whalen's locomotive was smashed and considerable other damage incurred. The bold Billy was badly shocked, but the force of the freight train was checked, and though it struck the passenger train, driving it back to the rear of the depot and shaking up the passengers at a pretty lively rate, none of them were seriously injured, for all of which they may thank the quick-witted and brave Billy Whalen. Such an action requires more true heroism than is embodied in a thousand strikes.—*Cincinnati (O.) Enquirer*.

Heat, Light, and Actinism.

We may apparently have heat without light, and light without heat, says Dr. Draper in *Harper's Magazine*. In the darkest room we cannot perceive vessels filled with boiling water, yet the warmth we experience on approaching them assures us that they are emitting radiations. Is not this heat without light? If we stand in the rays of the full moon, we cannot detect any decrease of temperature. Is this not light without heat? It is true that in this latter instance we are mistaken as to the fact; but overlooking that—for the heat to be detected in the moonbeams requires the most sensitive apparatus—do not such observations assure us that heat and light are independent of each other, physical principles having an existence separate from each other?

Such were some of the arguments on which were sustained the hypothesis of the intrinsic difference of light and heat. In this no account was taken of the optical functions of the eye. Qualities were incorrectly attributed to radiations which, in truth, were due to peculiarities in the organ of vision.

The great service which the diffraction spectrum has rendered to science is the abolishment of all these imaginary independent existences—heat, light, actinism, etc.—and the substitution for them of the simpler conception of vibratory motions in the ether. The only difference existing among the radiations that issue from a grating, in the manner we have been describing, is in their wave lengths, or, what comes to the same thing, in their times of vibration. The diversity of effects produced depends on the quality of the surface on which they fall. If on a dark surface, and the more so in proportion to its blackness, they engender heat; if on the retina, they are interpreted by the mind as light; if on photographic preparations, they produce decomposition, designated actinic effects.

Heat, light, actinism, are, then, not natural principles existing independently of each other, but effects arising in bodies from the reception of motions in the ether, motions which differ from each other in their rapidity. Of those that the eye can take cognizance of, the most rapid impart to the mind the sensation of violet light; the slowest, the sensation of red; and intermediate ones, the intermediate optical tints. Colors, like light itself, are nothing existing exteriorly. They are merely mental interpretations of modes of motion in the ether, and in this they represent musical sounds, which exist only as interpretations by the mind of waves in the air.

THE WHITE BRUGMANSIA.

All who aim at making the greenhouse or conservatory beautiful and picturesque with the smallest amount of trouble have a valuable aid in this well-known plant. Planted out in a bed or border of any kind, and without any special culture beyond allowing it plenty of root room and water, it quickly becomes a handsome bush. It is also generally so healthy and vigorous that year after year it is a source of pleasure. The long and fine white fragrant trumpets are produced plentifully, and are seen to advantage among the soft and ample fresh green leaves. They last a long time in flower, often appearing till nearly the end of the year. It is fitted for walls in certain positions as well as for beds and wide borders, and it is particularly valuable in large cool houses where more natural verdant effects are sought than are obtainable by means of plants in pots.

Improved Method of Plastering.

Mr. Hitchings, of Stoke Newington, England, has introduced a new method of forming ceilings and other plaster work which, for durability, saving of time, and cleanliness, is unrivaled. By means of this system the plaster is prepared beforehand in slabs, which are fixed expeditiously to the joists, forming the ceiling at once as it would be when lathed and plastered with the two coats of lime and hair in the old process. The slabs or sheets are made in the following manner: A layer of plaster of Paris in a moist or plastic state is spread evenly on a flat surface surrounded by raised edges of the form to produce the desired bevel of the edges of the slab or sheet, and upon this first layer of plaster is laid a sheet of canvas or other woven fabric of proper size, or a thin layer of loose fibers, which is made to embed itself into and adhere to the plaster. Two laths are then laid along two opposite edges of the canvas, upon which another layer of plaster is spread evenly, and before it sets a rough broom is passed over the surface of this second layer of plaster to form a key for the finishing coat. When the plaster is set the slabs are nailed to the joists, as before mentioned, and the joints are made good with plaster of Paris. The third or finishing layer of lime and plaster is then applied to the ceiling in the ordinary way. Besides the advantages derived from rapid fixing, with the minimum of dirt and inconvenience, the new ceiling is practically unflammable, and very economical to put up. Moreover, unlike the old plaster ceilings, it can never become detached from the joists; in fact, besides being self-supporting, it braces and strengthens all partitions and slight timbers.

ALUM and plaster of Paris, mixed with water and used in the liquid state, form a hard composition and a useful cement.

Progress of the Patent Purifier.

The war instituted by the Cochrane patent owners, known as the purifier ring, against the millers has now become general throughout the whole country, so says the *Mill Stone*. Emboldened by their temporary success in the case of J. A. Christian & Co., at Minneapolis, the American Middlings Purifier Company have, during the last two months, commenced a large number of similar actions for preliminary injunctions against the leading millers in every part of the country. By bringing a number of such suits simultaneously in various parts of the country, and creating the impression that they can compel all the principal millers, as well as the smaller ones, to either shut down their mills or furnish bonds ranging in amount from \$50,000 to 100,000, the purifier ring seems to aim at securing as many settlements as possible, and gather all the prestige and "sinews of war" they can from such source before a trial of their case on its real merits can be forced upon them. We say this seems to be their policy, and it is so regarded by the leading millers and their associations, all of which are gaining strength daily and becoming more and more determined to contest the matter, directly through the courts, even up to the court of last resort, notwithstanding any and all of the numerous and industriously circulated reports of the ring and its agents to the contrary.

In Missouri and Indiana the war is already fairly inaugurated; and instead of having the effect of weakening the defensive associations, as anticipated by the ring, it has had exactly the contrary effect, the millers throughout those States having at length become fully awake to the importance of sustaining each other and making common cause against the demands of the ring, which they consider not only extortionate, but based upon fraud of the worst character, and which they regard it a matter of principle as well as vital interest to defeat.

In their application for an injunction against the Haxall-Crenshaw Company, Cochrane *et al.* give the history of the Cochrane patents, which the *N. W. Miller* condenses as follows:

In 1863 Cochrane, assignor unto himself and Warder & Child, was granted three patents, one of which was for an improved method of bolting flour; the second and third for improvements in bolting chests.

In 1873 Cochrane assigned one half of his remaining undivided interest to Rodney Mason.

In 1874 Child assigned his interest to Warder.

In 1874 Cochrane, Warder & Mason surrendered these patents and obtained reissues (for altogether different claims).

In 1874, April 27th and August 26th, Benj. H. Warder assigned all his interest to Wm. Warder.



THE WHITE BRUGMANSIA.

August 18, 1875, Cochrane, Warder & Mason assigned an undivided one third interest in the original and reissued patents to Chas. F. Peck, J. M. Van Buskirk, J. A. Evans, W. S. Cox, and W. H. Phillips.

March 22, 1877, the alleged Cochrane, Warder, Mason, Peck, *et al.* formed themselves into the American Middlings Purifier Company.

In this connection it may be said that Cochrane and Warder had failed utterly to make the machine for which the original patents were granted of any use; and that its use has been discontinued in the only mill where it was ever tried; and that the so-called American Middlings Purifier Company has never, to our knowledge, says the *N. W. Miller*, built, put in operation, or sold a middlings purifier, nor instructed a single miller in their "process" of making flour.

CEMENT FOR COATING ACID TROUGHS.—Melt together one part pitch, one part resin, and one part plaster of Paris. The ingredients must be perfectly dry.

THE MODERN HYPOSULPHITE OF SODA.

BY RUDOLF WAGNER.

The confusion which for some time past has begun to slip into the technical periodicals, in regard to the designation of two oxysulpho compounds of sodium, induces me to make the following notice.

Until very recently we understood, by the term hyposulphite of soda, the sodium salt of the acid $H_2S_2O_3$; this compound was also called sodium dithionite, sodium hyposulphite, and the author designated it, in the *Pharmacopoeia Germanica*, published 1872, as *natrum subsulphurosum*. (The same term appears in the German *Pharmacopoeia* translated by C. L. Lochman, published by Edler & Co., Philadelphia, 1873, page 188). On account of its use in bleacheries and paper mills to remove the excess of chlorine, the (old) hyposulphite of soda is called antichlor, although, since the Vienna exposition of 1873, several German manufacturers have sent their sodium bisulphite into the world under this name.

The name of hyposulphurous acid for the compound $H_2S_2O_3$ has become impossible since the discovery of the acid H_2SO_3 or $SO_2 \cdot H_2O$, by P. Schuetzenberger (*Comptes Rendus*, 1869, LXIX, 169). To this is added the important circumstance that the acid $H_2S_2O_3$ is no longer regarded as S_2O_3 , H_2O , that is, as a lower degree of oxidation of sulphur, standing below the sulphurous acid in the series, but as sulphuric acid in which 1 atom of oxygen is replaced by 1 atom of sulphur, hence its formula is: $SO_2 \cdot \begin{matrix} OH \\ SH \end{matrix}$, and all the decompositions of the acid and its salts harmonize with this supposition. Hence it is no longer possible for it to retain the name of hyposulphurous acid, but must be called, as is already done here and there, thiosulphuric acid. The (old) hyposulphite of soda, therefore, must retain in future the name of sodium thiosulphate, or thiosulphate of soda. I would like to suggest that in manufacturing industries and among chemical dealers the soda salt be called simply "thiosulphate," just as sodium sulphate is called "sulphate" for short, and, to avoid any confusion in ordering or using it, to restrict the name of antichlor to sodium sulphite. The name of sodium hyposulphite, the (old) hyposulphite of soda, naturally disappears, while the designation dithionite is permissible, or, at least, not incorrect.

The acid of the modern hyposulphite of soda belongs to the same series as the other technically important acids of sulphur, and fills a previously existing gap, as will be evident from the following arrangement:

SO , sulphur monoxide, or $SO \cdot H_2O = H_2SO_2$.
 SO_2 , sulphur dioxide, or $SO_2 \cdot H_2O = H_2SO_3$.
 SO_3 , sulphur trioxide, or $SO_3 \cdot H_2O = H_2SO_4$.

The first of this series is the hyposulphurous acid of Schuetzenberger, which the discoverer named hydrosulphurous acid (*acide hydrosulfureux*) and thereby gave impetus to error and confusion. K. Kraut gave to this acid the name of water-sulphurous acid (*Wasserschweflige Säure*). There is no doubt that this acid is hyposulphurous acid. Berthelot recognized this fact in a paper published within a few months upon the thermal properties of the new acid, in which he said "in a rigorous nomenclature we are compelled to reserve for this acid the name of hyposulphurous acid." In the new textbook of chemistry published by H. E. Roscoe and C. Schorlemmer, Professors in Owen's College, Manchester, England, the name of hyposulphurous has already been introduced for the acid discovered by Schuetzenberger. In Fowne's "Chemistry" the names are also employed in this manner.

It is surprising that the hyposulphurous acid was overlooked for so long a time, although many reactions from distant and recent times indicate that the experimenters had the new acid in their hands, especially where sulphurous acid came in contact with active reducing agents. As early as 1789, Berthollet made the observation that metallic iron dissolved in an aqueous solution of sulphurous acid, without any gas being evolved; and nine years later Fourcroy and Vauquelin noticed that zinc and tin likewise dissolved in sulphurous acid without gas being liberated. In 1850 Schoenbein brought an aqueous solution of sulphurous acid into contact with phosphorous acid; he obtained a liquid which reduced indigo blue, probably because the phosphorous acid had reduced the sulphurous acid to sulphur monoxide. By warming the phosphorous acid with sulphurous acid, no hyposulphurous acid was formed, but beside phosphoric acid also sulphydric acid.

As already stated, P. Schuetzenberger in 1873 was the first who discovered the (new) hyposulphurous acid, and sought to make use of its powerful reducing properties in the arts. It is prepared by digesting granulated zinc, or zinc dust, in a closed vessel, with a cold saturated solution of sulphurous acid in water. The zinc dissolves without any evolution of gas, and in the solution will be found hyposulphite of zinc:

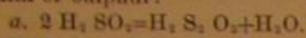
$a. H_2SO_3 + Zn = ZnSO_3 + H_2$
 $ZnSO_3 + H_2 + ZnSO_3 = H_2O$

Zinc sulphite. Zinc hyposulphite.

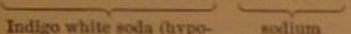
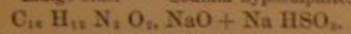
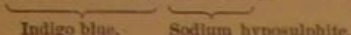
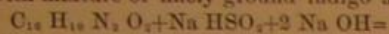
In preparing the sodium salt of the formula $NaHSO_3$ (the second atom of hydrogen is not replaceable by a metal), the zinc is digested with a cooled concentrated acid solution of sodium sulphite, and the solution allowed to stand over night in an ice chest, when a double salt ($ZnSO_3 + Na_2SO_3$) crys-

talizes out. The liquid remaining over the crystals will, if cooled more and left standing a long time, yield a crystalline mass consisting of colorless needles, which must be pressed out and dried in a vacuum. Aluminum likewise produces a hyposulphite by digestion with aqueous sulphurous acid. The reaction of hyposulphurous acid to magnesium is very peculiar, for this metal dissolves with an abundant evolution of gas (hydrogen but no sulphydric acid). The process, about which I reserve further communication, seems to be a complicated one.

The aqueous solutions of hyposulphurous acid and its salts greedily absorb oxygen from the air and then pass into acid sulphites: $\text{NaHSO}_3 + \text{O} = \text{NaHSO}_4$. A hyposulphite solution when kept a long time goes over partially into thiosulphate: $2 \text{NaHSO}_3 = \text{Na}_2\text{S}_2\text{O}_3 + \text{H}_2\text{O}$. An aqueous solution of hyposulphurous acid likewise decomposes in a few days, forming milk of sulphur; at first this sulphuric acid is formed, but this at once splits up into sulphurous acid and milk of sulphur:

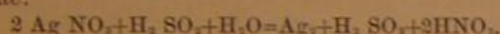


DeLande and P. Schuetzenberger first made use of its important reducing properties in the preparation of hyposulphite vat, by mixing a solution of hyposulphite of soda with mixture of finely ground indigo and sodium hydrate:



The hyposulphite vat is used in the place of the vitriol vat in dyeing as well as printing with indigo.

Hyposulphurous acid precipitates the metals from solutions of silver and mercury salts, for example, from silver nitrate:



Chloride of silver, when freshly precipitated, is reduced to silver by long digestion with sodium hyposulphite, a reaction by which the hyposulphite is distinguished from the thiosulphate. I cannot confirm the statement that copper is separated as regulus from copper salt solutions by hyposulphite; the black precipitate which forms after some time consists of sulphide of copper.

A solution of permanganate of potash is immediately decolorized by hyposulphite.

It is evident that the hyposulphurous acid and its alkaline salts will still find many valuable uses in the province of chemical technology and chemical technical analysis.—*Dingler's Journal*.

NEW BOOKS AND PUBLICATIONS.

INDUSTRIAL DRAWING. By D. H. Mahan, LL.D. Revised and enlarged by Dwinel F. Thompson, B. S. John Wiley & Sons, 15 Astor Place, New York. Price \$3.50.

Dr. Mahan's work has been a standard text book for so long that it is hardly necessary here to refer to its particular merits. The present reviser has, however, made many important improvements, notably in rewriting the chapters on drawing instruments and their uses, and adding others on tinting, shadows, shading, isometrical drawing, oblique projection and perspective. The value of the book is thus materially enhanced.

THE THEORY AND ACTION OF THE STEAM ENGINE. By W. H. Northcott, C.E. Cassell, Petter & Galpin, Publishers, London and New York. Price \$3.50.

To students, to the general reader who wishes to avoid technical dissertations, and to the professional engineer who desires a handy book of the A B C of his calling wherewith to refresh his memory, we can cordially commend this work. It is one of the clearest, best written treatises that have ever come under our notice. The author not only fully comprehends his subject, but he possesses the rare faculty of not letting his own knowledge blind him to the needs of others not so well versed or wholly unversed therein. Beginning with a chapter on the theory of combustion, he proceeds to its practical consideration, taking up one by one, and capably elucidating them, the various considerations affecting the steam boiler. Having discussed the generation and properties of steam, he proceeds to motive power derived therefrom and concludes with chapters on varieties of engines, their relative efficiencies and how to test them. The arrangement is logical, the explanations must be clear to any one of average intelligence, and taken altogether we know of no similar work which we should prefer to place before the young student as a text book and guide. There are plenty of illustrations and numerous useful tables.

PRACTICAL HINTS FOR THE SELECTION AND USE OF THE MICROSCOPE. By John Phin. Second Edition. Industrial Publication Co. New York city. Price 75 cents.

"The object in view of the preparation of this book," says the author in his preface, "was the furnishing of a cheap manual for those who cannot afford the more expensive books of Carpenter, Beale, Frey, and others." It is a work of nearly 200 pages, well illustrated and containing the practical information which beginners in the use of the microscope especially need. Dr. Phin is a microscopist of deserved reputation, and the first edition of his book was generally commended. The present edition has been materially enlarged and improved.

A SYSTEM OF VOLUMETRIC ANALYSIS. By Dr. Emil Fleischer. Translated by M. M. Pattison Muir, F.R.S.E. Illustrated. Macmillan & Co, 22 Bond Street, New York. Price \$2.50.

This work divides volumetric analysis into a few great groups, points out the principles underlying each, illustrates such principles by practical examples, and in general inculcates the necessity of studying this method of analysis as a branch of the science of applied chemistry. A distinctive feature is the plan for the estimation of bases without previous separations. The translator has judiciously condensed the original, added some new processes and tables and the new chemical formulae, and otherwise better adapted the book for practical use, rendering it in English, as it already is in German a standard work upon its special subject.

Inventions Patented in England by Americans.

From September 11 to September 17, inclusive.

BAYONETS.—E. Rice, Cambridge, Mass.
BINDING BOOKS.—A. Boehmer (of Philadelphia, Pa.), London, Eng.
IRONING MACHINE.—H. Monk, Troy, N. Y.
PINCERS.—A. F. Stow et al., Worcester, Mass.
PROJECTILES.—J. G. Butler, West Troy, N. Y.
SEWING MACHINE ATTACHMENT.—W. Gay, Troy, N. Y.
SPINNING MACHINERY.—J. M. Pursey et al., Wilmington, Del.
TESTING CHECKS.—F. Grafelman, Middle Village, N. Y.
TOY MATCHES.—J. G. Powell, Philadelphia, Pa.
WINDOW BLINDS.—A. E. Wemple (of New York city), London, Eng.

Recent American and Foreign Patents.

Notice to Patentees.

Inventors who are desirous of disposing of their patents would find it greatly to their advantage to have them illustrated in the SCIENTIFIC AMERICAN. We are prepared to get up first-class wood engravings of inventions of merit, and publish them in the SCIENTIFIC AMERICAN on very reasonable terms.

We shall be pleased to make estimates as to cost of engravings on receipt of photographs, sketches, or copies of patents. After publication, the cuts become the property of the person ordering them, and will be found of value for circulars and for publication in other papers.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED VEHICLE RUNNING GEAR.

George R. Duval, Oregon City, Oregon.—This invention relates to an improved construction of gear for vehicles of all kinds, which admits the employment of iron or other metal for all the parts, and produces a strong and substantial supporting and connecting gear thereby. The axle may be formed of hollow pipes, with interior truss rods, when extra strength is required, the seats carrying in outside grooves the thimbles, which are securely attached by outer screws. To the arch of the front axle is attached the fifth wheel, that is bolted thereto to support the front of reach, through the end of which the king bolt passes in the customary manner. The front bolster is constructed of arched parallel plates or bars supported in end seats or lugs, and braced by a curved stiffening rod and screw nuts at the ends, and acts in the manner of a truss, and is supported in the center by the head of the king bolt. The wagon body rests on front and rear bars, and between the uprights or standards, which are bent of flat iron, braced by cross studs, and secured rigidly to the ends of the bars by fastening bolts and nuts. The reach is made of iron tube or gas pipe of suitable strength, and clamped in suitable manner to a coupling sleeve or thimble by collars and set screws, being capable of adjustment to different length by means of the adjustable collars and screws. In this manner a strong, substantial, and firmly braced iron running gear for farm, lumber, and other wagons requiring a certain strength is obtained, which may, by slight modifications, be also used for vehicles of all description, imparting to them a light and pleasant appearance in place of the clumsy and heavy wooden wagons at present in use.

IMPROVED FASTENER FOR THE MEETING RAILS OF SASHES.

Henry L. Clark and Augustus B. Smith, Chester, N. Y.—The object of this invention is to provide a simple and inexpensive sash fastener to be applied to the meeting rails of window sashes, which cannot be unfastened from the outside, and will prevent the window from rattling. When the window is closed it is fastened by turning a lever down into a horizontal position over a plate and swinging the latch over it, the curvature of the lever being such as to permit the notched part of the latch to slip over it. It is impossible to move either the latch or lever from the outside of the window, therefore the window cannot be opened from the outside.

IMPROVED FRAME BUILDING.

William R. Morris and Joseph Slanser, La Rue, O.—This invention relates to improvements in the method of constructing frame buildings by the use of planks of suitable length and thickness, so that the entire building may be finished in its several parts, and finally put up in strong and reliable manner and without skilled help. The planks are placed at some distance from each other and bolted firmly to the beams, which are made of several planks interposed between the upright planks of the posts, so as to form therewith a compound plank construction that gives strength and rigidity to the building. The lateral post connecting girders are passed through mortises of the plank posts and secured rigidly at the meeting ends or joint of two girders by a recessed key, that is first passed through the mortises of the post and then placed in position, the girder ends being then inserted and connected by a second recessed top key, of less width, which keys are both spiked to the girder ends, to unite the same. The keys and girder joint are finally rigidly locked to the mortises of the plank post by two wedge keys running in opposite directions to each other. In this manner the construction of the compound plank frame buildings is perfected and rendered stronger and more durable.

NEW TEXTILE INVENTIONS.

IMPROVED FABRIC FOR CARPET LINING, ETC.

Daniel G. Rollin, New York city.—This invention has for its object the production of an improved elastic fabric, which is useful for a great many purposes where a fabric possessing strength and elasticity is required, as, for instance, carpet lining, insoles for boots and shoes, etc., and is composed of vegetable or animal fibers, or of vegetable and animal fibers combined. The following is the process usually employed in the manufacture of the new fabric: The inventor gives in manufacture this formula: For making, say, one square yard of the fabric, take about one and a half ounce of cotton waste, about one fourth of an ounce of glue made into a sizing, and a sufficient quantity of water to perfectly saturate the fibrous mass. To this add particles of sponge, cork, raw cotton, or other suitable elastic substance; also about one sixteenth of an ounce of alum, acid, or any other astringent. The cotton waste should be finally reduced by pickers suitably adapted to the purpose. The wet mass is passed between wire cloth aprons and dried, when it is ready for use.

NEW AGRICULTURAL INVENTIONS.

IMPROVED GUANO DISTRIBUTOR.

Joseph P. Baker, Madison, Ga.—This is an improved device for distributing guano and other similar fertilizers. In construction it consists of a spout having a flared upper end containing a removable hopper, and having two free rollers geared together and operated by a crank. One of the rollers is grooved or fluted and co-operates both with the hopper to shake it and with the other roller to pulverize and feed the fertilizer, the whole forming a light and convenient portable hand-distributor.

IMPROVED STOCK FEEDER.

Osman M. Hayden and George A. Knowles, La Porte City, Iowa.—This invention is intended for the purpose of feeding ground or other feed to hogs, cattle, sheep, or colts in an economical manner, without deteriorating the feed by impurities or the breath and saliva of the animals, so that other animals are kept from it; and the invention consists of a trough with feed hopper having adjustable slide piece and stirring lever or levers. The feeder may be arranged for different animals by being made of different width and height, forming, however, in all cases an economical feeding trough, as there is no waste of feed nor soiling of the same by the animals, the feeding being readily interrupted, when one set of animals is fed, by dropping the slide piece, the next set taking readily the feed as it is delivered in fresh state to them by opening the slide.

IMPROVED COTTON HARVESTER.

John E. Watkins and Morris Sale, Smithfield, Ky.—This invention has relation to machines for picking cotton in the field, and the nature of the invention consists, first, in a novel combination of devices with an exhausting fan and a picker, whereby one of the transporting wheels, when rotated, operates continually to wind up a spring, which, in turn, gives rapid motion to a fan and picker; second, in applying the exhausting fan and

picking devices on the end of a frame which is vertically adjustable on the main frame; third, in combining picking nippers with a nozzle which communicates with the fan case, which nippers will pick the cotton from the pods, deliver it into the nozzle, and keep the same clear. In practice a governor to regulate is used to regulate the speed of the fan. Steam may also be used to run the machine. The convolute spring that drives the fan is employed to get a reserved force for use while stopping to gather the cotton where the pods are thickest.

IMPROVED HARROW.

George D. Miles, Cairo, Pa.—The handles of the harrow are attached by screw bolts to the side sections in such a manner as to be detached for being both placed on one side section, when the same is used as a cultivator. The handles serve to raise the side sections in passing a stump, rock, or other obstruction, which is a great advantage in harrowing new ground or an orchard, while the coupled side sections without the middle section may be readily used for harrowing corn. The side sections or wings may also be provided with wheels turning on center pins attached by straps, the front wheel being made like a caster, so as to turn below the wings and admit the easy transportation of the harrow to and from the field. The middle section is first lifted up and the wings drawn by slight side draft under it, to be conveyed as sled or vehicle. The harrow is in this manner adapted in superior manner for the purposes of the farmer, as it may be more conveniently handled and applied for different work.

IMPROVED FRUIT DRYER.

William W. Ferguson, Healdsburg, Cal.—The object of this invention is to furnish an improved machine for drying fruit, which shall be simple in construction, convenient in use, and effective in operation, drying the fruit evenly and rapidly, and which may be constructed at comparatively small cost. The case of the machine, which is designed to be placed over or connected with a furnace, has a pipe inserted in a hole in its top to allow the moisture from the fruit to escape. In the front and rear sides of the case are formed large doors for convenience in putting in and taking out the fruit pans, and to enable the machine to be cooled off quickly when the fruit is to be taken out. To the upper and lower parts of the sides of the case are pivoted two shafts, to each of which are attached two chain wheels, around which are passed two endless chains, to which are attached fruit pans for receiving the fruit to be dried. The machine may be driven by steam power or horse power, as may be desired or convenient.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED CAR MOVER.

George W. Leek, Terre Haute, Ind.—This invention is intended to provide an easily operated yet powerful device for moving cars on the track, and it consists of a wheel with lateral concave knives, driven into the grooved circumference and biting into the railhead, said wheel turning, by a center pivot, in a forked lever arm, that is secured to the platform of the car. The knife wheel is turned and car moved by a pivoted spring pawl of a hand lever engaging a fixed side ratchet wheel of the knife wheel. The forward motion of the hand lever gives a purchase on the ratchet, which thereby turns the knife wheel, that bites, by the lateral knives, into the head of the rail, and transmits thereby motion to the car. The return motion of the hand lever passes the pawl back over the ratchet, so as to engage the same again by the forward motion of the hand lever. The car or cars are thus moved with ease by this simple and effective device to any point on the track or to the side track, as required.

IMPROVED RAILWAY GATE.

William I. French, Cainsville, Mo., assignor to himself and Peter Jacobs, of same place.—This invention is an improvement in the class of railroad gates which are suspended by rods and arranged to swing across the track, being operated by levers which are connected with movable track rails so as to be operated by a train approaching from either direction. The operation of gates thus connected with movable rails is liable to be hindered or prevented by ice, snow, stones, or other substances beneath the rails. This invention consists in suspending the gates by two parallel rods, and in operating the same by pivoted arms or levers, which are depressed by contact with the wheels of the locomotive. The operation is as follows: The wheels of the approaching train run upon and depress the levers, which draw down the short arm of these levers, and swing the gates so as to leave the track clear. The levers are of such length that they are constantly pressed downward by the wheels of the passing train.

IMPROVED LEATHER-ROLLING MACHINE.

Henry Hudson, Saltillo, Pa.—The object of this invention is to furnish an improved leather-rolling apparatus which shall be so constructed as to enable the pressure to be applied by steam power, and which shall be simple in construction and easily controlled. When the free end of the lever is pressed down, steam is admitted to the cylinder, which forces down the piston and applies pressure to the roller. When the foot is removed from the lever it is raised by the spring, which closes the inlet and opens the exhaust, and the piston and the roller will be raised by the spring. The bar is vibrated to roll the leather in the usual way.

NEW MISCELLANEOUS INVENTIONS.

IMPROVED PASSE-PARTOUT MAT.

Samuel Phillips, Paterson, N. J.—The object of this invention is to furnish passe-partout mats which shall be strong and durable. The body or foundation of the moulding is wood, and is made in long pieces or strips in the same way as other wood mouldings. To the face of the long pieces of moulding is glued torchon or other paper. The long pieces are then mitered into pieces of the proper length to form a mat of the required size, and the mitered ends of said pieces are firmly glued and nailed to each other. By this construction the paper in the angle of the mat will be even and smooth, and without any pull or tear, which cannot be the case when the paper is applied to the moulding after the frame is formed. The inside mat is placed in the rabbet formed in the inner edge of the back of the moulding to receive it and the picture. The outside mat is attached to the outward extension of the moulding. When the mat is small the extension may be a solid part of the moulding; but when the mat is large the extension may be a separate piece, securely nailed to the moulding. After the moulding has been put together to form the mat the paper upon the moulding and the inside mat are coated with French zinc, mixed with water and enough gelatine to cause it to adhere firmly to the paper, a little ultramarine blue being added to make the color a pearly white. This preparation gives a pure white color to the moulding and mat, and greatly increases the beauty of the mat.

IMPROVED MUCILAGE HOLDER.

George B. Wight, New York city.—This invention relates to such improvements in those mucilage bottles in which the mucilage is applied by means of a sponge attached to the cap of the bottle that the required quantity of mucilage is supplied directly to the sponge on turning the bottle, and the sponge kept moist for use by a small storage receptacle formed in the cap at the base of the sponge. The invention consists of the flanged cap of a mucilage bottle, having a central perforation and outer rim, that forms, with a circumferential flange of the cap, a space for fastening the base of the conical sponge, which is attached by a toothed ring, over which the flange is drawn. The interior of the sponge is conically hollowed out to admit the easy passage of the mucilage, and the shedding of the same into the space or reservoir between rim, flange, and ring when the bottle is placed in upright position after use.

IMPROVED APPARATUS FOR DEODORIZING GASES FROM RENDERING TANKS.

Charles J. Trotter, Chicago, Ill.—A vertical cylindrical shell or drum is provided and is closed at both sides by suitable heads, the lower one of which rests upon any suitable foundation. A receiving pipe is screwed into the drum near the lower head, and another pipe is screwed into the opposite side of the drum, a short distance from the lower head. An exit pipe extends through the upper head for conveying away the gases after they are treated in the apparatus. To a condenser connected with a sewer, and having a sewer trap for preventing back flow of gas, a funnel is provided for introducing the deodorizing agent, and an air cock for the escape of air from the apparatus. The manner of using the apparatus is as follows: The drum is filled with a suitable deodorizing liquid up to the pipe, and the pipe, being connected with the cooking or rendering apparatus, conveys the gas and vapor from thence to the drum, where they are forced through the deodorizing liquid contained in the drum and escape through the exit pipe to a condenser connected with the sewer, being freed from disagreeable smell. The escape pipe may be connected with a sewer, when the fumes of the deodorizing liquid which escape with the gas may, or the gas may, be conducted to the furnace of the cooking or rendering apparatus, when it will be consumed.

IMPROVED BRONZING MACHINE.

Laurent Polier, Paris, France.—This invention relates to improvements in machines used for bronzing or applying any kind of colors, in a state of powder, to sheets or paper, sheets of metal, fabrics, etc.—that is to say, to apparatus for applying colors, in a state of powder, to any kind of sheets printed by any mode of inking, by means of mordant varnish, as, for instance, in lithography, copper plate printing, typography, etc. The bronzing or powdering cylinder is covered with velvet, flannel, etc. On the other extremity of the shaft of this cylinder is fixed a toothed wheel, transmitting its movement to a pinion dependent on another shaft, on which is mounted the friction cylinder, the movement of which is thrice as rapid as that of the bronzing cylinder. The friction cylinder completes the bronzing, and gives the bronzed surface the polish and brilliancy.

IMPROVED MACHINE FOR PRINTING ON GLASS, PORCELAIN, ETC.

Friedrich W. Heuer, Vienna, Austria, assignor to Emil H. Neymann, New York city.—The object of this invention is to produce an effective machine for printing in quick and cheap manner labels, pictures, ornamental designs, etc., in one or more colors, on glass, porcelain, earthenware, and other rigid bodies of cylindrical surface, the colors being fixed thereon, so that the prints resist the influence of moisture, and dispense thereby with the paper labels or pictures applied or painted thereon by hand or in other manner. The invention consists of a machine in the nature of a printing machine, with adjustable revolving supports for the bottles or other objects to which the colors are to be transmitted. When the machine is set in operation, the bottle receives a rotary motion by the friction between the same and the printing block of the carriage, which friction is augmented by the adhesiveness of the color employed. The printing block is made of elastic material, and placed on a stiff wooden or other base plate, which is cushioned in suitable manner, so as to provide for the slight variations in the diameters of the bottles, and secure a uniform transfer of the color to the surface to be printed.

IMPROVED STOVEPIPE DRUM.

Moses P. Farnham, Kanawha, Cal.—The object of this invention is to furnish an improved drum which shall be simple in construction, easily applied to a stovepipe, and effective in use, enabling the most of the heat to be withdrawn from the smoke before it is allowed to pass into the chimney, and wholly preventing sparks from passing into the chimney. To a length of ordinary stovepipe are attached a number of longitudinal and radial flanges, to the outer edges of which is secured a larger pipe drum, the upper and lower ends of which are closed with rang plates or heads. The flanges pass upon both sides of the inlet holes down to the lower head, but do not pass up to the upper head. The next flanges pass up to the upper head, but do not pass down to the lower head. Between the end of the flanges that extend up to the upper head are formed the outlet holes. The flanges must be arranged to form an odd number of flues, and there may be one, two, or more sets of flues, as may be desired. With this construction the drum is designed to take the place of a length of stovepipe, so that there is no trouble in setting it up or taking it down.

IMPROVED WASHBOILER.

Moses Tanenbaum, Grafton, Ill.—The object of this invention is to furnish an improved apparatus for boiling and washing clothes, cooking food, and other similar uses, which shall be simple in construction, convenient in use, and will require but a small amount of fuel to operate it. The body of the boiler may be round or square, cylindrical or flaring, and of any desired size. It is supported upon legs of such a length as to raise it to a convenient height. In a hole in the center of the bottom of the boiler is secured the lower end of a pipe, which is open at both ends. The part of the pipe within the boiler is surrounded with a larger pipe, placed at the distance of a quarter of an inch or more from the pipe, and perforated with numerous holes. The larger pipe prevents the clothes or other objects being boiled from coming in contact with and being scorched by the hot pipe. This pipe also acts as a steamer to project small streams of water and steam through the clothes, which washes them quickly, and renders it unnecessary to use a washboard. The boiler is provided with a closely fitting cover, which is made in two parts or halves, having half-round notches formed in the centers of their inner edges to form a hole for the pipe to pass through, so that the cover can be removed without its being necessary to remove the section of pipe from the upper end of the pipe. The section of pipe is provided with a damper, to enable the draft to be controlled as desired. A compartment or vessel is so formed as to fit into the space between the side of the boiler and the perforated pipe, and which is provided with a closely fitting cover and flange. By the use of flange and head, the two being placed in corresponding position on the vessel and boiler, the vessel is very conveniently supported and at a suitable elevation.

IMPROVED COMBINED FISH TRAP AND BUCKET.

James M. Lasater, Manchester, Tenn., assignor to Robert L. Lasater, of same place.—The object of this invention is to furnish an improved device for catching and carrying minnows and other small fish, which shall be simple in construction and convenient in use. The invention consists in the combination of the glass vessel provided with the funnel-shaped top, the shaft, the bait hook, and the cord, the perforated vessel provided with the slides and the eyes, the rods, and the ball with each other; and in the combination of the glass vessel provided with the funnel-shaped top, the shaft, the bait hook, and the cord, the perforated vessel provided with the slides and the eyes, the bucket provided with the eyes, the rods, and the ball. When the device is used as a trap the glass vessel is placed upon the top of the perforated vessel, and is secured in place by rods. When the device is used for carrying the fish the glass vessel is placed in the bottom of the bucket, the perforated vessel is placed upon the top of the glass vessel, and the three are secured together by rods, the glass vessel being thus protected against accidental breakage.

IMPROVED VENTILATOR IN THE WINDOWS OF BUILDINGS.

Lorenzo D. Harvey, Sheboygan, assignor to himself and E. J. Stewart, Genesee, Wis.—This invention consists in hinging a deflector to the sill of a window, which, when the window is open, directs the rushing current of air toward the ceiling. It also consists in applying a flexible deflector to the upper rail of a window sash and to the window casing, to direct the current of air admitted through the upper portion of the window toward

the ceiling. When not in use the deflector lies upon the window sill. When the lower sash is raised the rushing current of air is directed toward the ceiling by the deflector, where it unites with the warmer portion of the air in the apartment, and becomes tempered before coming into contact with the persons in the room. When the upper window sash is drawn down so as to admit air, the inflowing current is directed upward, as in the other case. The flexibility of the deflector permits the required latitude of motion in the upper window sash. The advantages of this plan of ventilation are obvious. Drafts are avoided, while thorough and complete ventilation is secured.

IMPROVED MEASURING AND REGISTERING DEVICE FOR ASCERTAINING THE QUANTITY AND QUALITY OF DISTILLED LIQUIDS.

Carl Robert Wedelin, Göteborg, Sweden.—This invention has for its object to produce a simple and efficient means for ascertaining the quantity and quality of distilled liquids, thereby facilitating the work of inspection, and enabling a reduction in number of the inspectors. The invention consists in the combination, with the still, receiver, or vessel in which the liquid, on being distilled, is collected, of a larger measuring tank and a smaller testing reservoir, so constructed and connected together by pipes and valve mechanism that the filling of the measuring tank from the receiver will set apart a small quantity for testing the grade or quality of the liquid, which small quantity, on emptying the measuring tank, will be discharged into the testing reservoir—a register connected with the valve mechanism at the same time indicating the number of times the measuring tank has been filled and emptied, and thereby the quantity of liquid distilled. By the application of this invention the now frequent attention of inspectors is rendered no longer necessary; but one traveling inspector may be able to alone discharge the duties now imposed upon a number of local officers.

IMPROVED BILLIARD CHALK HOLDER.

Henry L. Wharton, Youngstown, O.—This invention relates to an improved chalk holder for billiard cues, by which the chalk may be conveniently applied to the tips without getting on the hands or clothes, and without breaking and scattering when dropped on the floor. The invention consists of a chalk-holding casing, with detachable lid and sliding chalk, placed on a spring-acted base plate or follower, having projecting teeth or roughened surface. The chalk holder supplies chalk to the tip merely, and not to the cue, preventing thereby the marking of the billiard table by the cue. The chalk is inserted by pressing down on the same with the finger passed through the hole of the lid until the lid is in position. When the lid is to be detached the chalk is retained in similar manner until it is taken off.

IMPROVED CHECK VALVES FOR OIL PUMPS.

Amos M. Terrill, Petrolia, Pa.—The object of this invention is to provide a check valve for attachment to the working barrels of oil pumps that will retain the fluid and relieve the piston from the column of fluid contained by the well. As the piston rises the upward pressure of the liquid lifts the valve, and the liquid escapes through the apertures under the valve face to the tubing of the well. When the piston descends the valve closes, and prevents the return of the liquid to the pump barrel.

IMPROVED FAN ATTACHMENT.

George S. Riggs, Micanopy, Fla.—This invention relates to an improvement in fans for attaching to tables, and it consists of an oscillating fan supported by a standard attached to the center of a table and driven by means of a treadle through a suitable arrangement of levers and rods. When the treadle is worked by the foot the rod is oscillated, and the wings create sufficient motion in the air to drive off flies.

IMPROVED FIRE ESCAPE.

George S. Staples, Sherman, Tex.—The object of this invention is to provide a simple, inexpensive, and portable fire escape, that may be used for letting persons directly down from buildings, or for carrying them from the upper stories of buildings to other buildings at a distance or to the ground, as circumstances may require. A belt is provided to be clasped or buckled around the waist of the person desiring to escape. The block is provided with a hook, by means of which it may be attached to any fixed object in the burning building, and another block is provided with ropes, by means of which it may be attached to any solid object below or across the street, or to a building conveniently near the fire. The manner of using the fire escape is as follows: The block is attached by means of its hook to any convenient object having sufficient solidity. The other block is attached to any convenient object below, or to the upper or lower stories of a building. The belt is fastened around the body, and the clasp secured to the rope. The person either lowers himself by taking the rope in hand, or is lowered by persons from below.

IMPROVED PROCESS OF COLORING PHOTOGRAPHS.

Den Chamberlain, Winona, Minn.—This invention relates to an improved process for coloring photographs, by which the pictures are given a mellow tone and a life-like color without impairing the likeness. By attaching to the back of the picture a backing on which is applied certain mixtures to produce the effect. The pictures can be framed in the usual way.

IMPROVED COMBINED LETTER BOX, BELL, AND DOOR PLATE.

Costello B. Geer, Union City, Pa.—The object of this invention is to so combine a door bell, name plate, and letter box as to form a single simple device, in which the several features retain their separate functions and also co-operate for joint use. The improvements consist in general in hinging the door plate to the slot or letter hole in the door so as to cause it to fulfill both the functions of a door plate and a cover to said hole. It also consists in connecting the hinged door plate with a bell, so that when the cover is raised and a letter dropped into the letter box the bell is simultaneously rung and the occupants notified, and so that also when a call is made and the bell is not answered, the visitor may drop a card into the letter box within.

IMPROVED HORSE DETACHER.

George W. Atkins, Noble's Lake, Ark.—This invention is an improvement in the class of detaching apparatus in which the traces are attached to curved pivoted bars or levers having a spring catch or locking device, which may be retracted to release said bars or levers, and thus allow the traces to become detached and free the team from the vehicle. The detachment of the traces is effective in this case by means of a cord which extends through the carriage front or around the dasher, and is hence easily accessible to the driver. For peculiar construction and arrangement of the detaching apparatus proper, see patent.

IMPROVED PREPARATION OF CHEWING GUM.

Robert Cotter, Houston, Tex.—This invention relates to the novel treatment of Mexican gum (gum sapata) to adapt it to be put up as a merchantable chewing gum. The process of treatment consists in first pulverizing the brittle gum, then sifting the same, and afterwards subjecting it to a gentle heat to reduce it to the proper consistence. A little sugar is incorporated with the gum when in a pulverized state to make it palatable, while the pure but inert and plastic character of the native gum used as a basis renders it well adapted for the purpose without objectionable or harmful effect to the consumers.

IMPROVED SADDLETREE.

Henry C. Still and Joseph R. Still, Austin, Tex.—This invention relates to an improvement in riding saddles designed to secure greater strength in the pommel and fork, and it consists in forming the fork of the saddle tree and the pommel from malleable cast iron, and in one and the same

piece, the neck of the pommel being cast hollow for greater lightness, with the upper end of the casting open, which opening is closed by a surmounting cap of wood or other material which furnishes the pommel.

IMPROVED REFRIGERATOR.

George Collins, Springwells, Mich.—This invention relates to an improved construction of freezing apparatus designed for the manufacture of ice and for the preservation of meats, fish, game, etc. It consists in constructing the hollow door of the apparatus with an opening at the top through which the space in the door may be filled with a refrigerating material from the same opening at the top of the refrigerator through which the freezing mixture is changed to the other three sides.

IMPROVED VAGINAL SYRINGE.

Dr. Robert H. Woodward, New York city.—In the local treatment (by astringents, etc.) of menorrhagia or prolapsus uteri, where it is essential that the patient shall be kept in a recumbent position, the syringes ordinarily used have proved defective or inefficient in operation mainly because no means have been provided for supplying air to take the place (to a greater or less extent) of the liquid when being removed from the vagina. The object of the patentee is to remedy this defect, and to this end an air-tube attachment is provided and used in connection with the syringe.

IMPROVED NURSING BOTTLE.

Moses A. Michaels, McKeesport, Pa.—The object of this invention is to improve the construction of nursing bottles, that are required to be kept sweet and clean, and which are difficult to be cleaned, so that they can be readily cleaned, and thus kept sweet and pure. The invention consists in a bottle made in two parts, and provided with a screw coupling for connecting said parts detachably with each other. The screws may be cast upon, soldered to, or otherwise connected with the two parts, as may be convenient, or as may be most suitable for the material of which the bottle is made. This construction enables the bottle to be taken apart and easily and thoroughly cleaned, so as to be kept sweet and pure.

IMPROVED HEATING ATTACHMENT FOR LAMPS.

Charles I. Payne, Binghamton, N. Y., assignor to himself and John W. Burnett, of same place.—This invention consists of a sheet metal chimney having a cast iron base and top piece, and provided with a mica window and a slide for covering the same. A sheet metal portion that is apertured centrally receives the lamp burner, which is provided with apertures for receiving the springs of the burner that are usually employed for holding the glass chimney. By removing the base piece the sheet metal portion may be placed on a larger burner, the springs of which slip over a bead and hold the metallic portion securely in its place on the burner.

IMPROVED OIL CAN.

William Y. Horne, St. Paul, Minn.—The object of this invention is to furnish an improved oil can, which shall be strong and durable, and not liable to be injured by careless handling or during transportation. A sheet iron case or jacket is made of such size as to receive within it an ordinary oil can and leave a narrow space between it and the can. The can is inserted in the jacket from the lower end. A wooden bottom is then inserted in the lower end of the jacket to rest against the bottom of the can, and the lower edge of the jacket is turned down upon it.

IMPROVED HYDRO-PNEUMATIC FIRE EXTINGUISHER.

Charles C. Hearle, Montreal, Quebec, Canada.—This invention relates to portable fire extinguishers, which are designed for throwing water by the elastic force of compressed air. This machine is designed to supersede fire extinguishers which depend for their power upon chemicals. By a simple but effective arrangement, air pressure to any amount required is produced, which will throw a stream of water fifty feet horizontally, and it has been fully proved to be a very efficient fire extinguisher. It has the further advantage of being suitable for such uses as watering sidewalks, lawns, or gardens, washing carriages, or for any purpose for which a stream of water is required. It is also claimed for it that it is cheaply made, requiring no special machinery for its manufacture, is not liable to get out of order, and, all its work being outside, its operation is easily understood; in all these particulars being a decided advance on any machine of the sort heretofore exhibited.

IMPROVED FOLDING WORKSTAND.

Ervin G. Gollner, New York city.—The object of this invention is to furnish an improved ladies' and children's workstand, which shall be so constructed that it may be folded into a compact form for storage or transportation, and which shall be light, simple in construction, and neat in appearance. The top of the stand is provided with a cord, chain, or other handle for convenience in moving it from place to place. The stands may be provided with baskets, the upper one of which rests upon the upper ends of bars, the middle one rests upon pins or small brackets, attached to the bars near their central pivots, and the lower one rests upon the upper ends of the feet, or upon pins or brackets attached to said ends. With this construction the stand may be folded into a very compact form for storage or transportation, the baskets being nested.

IMPROVED CIGARETTE MACHINE.

William Davies, Henderson, Ky.—This invention relates to apparatus or appliances for giving form to the filling core or bunch of tobacco to be shaped for cigarettes, cheroots, and cigars, and also for inclosing the same in paper or leaf wrappers when the finished articles are of cylindrical or nearly cylindrical or tapering form: and it consists essentially of a slack flexible apron or band secured at the ends, but adjustable as regards its length, and of a roller or bar, with side handles, for operating the same along an inclined or level platform. The flexible band has sufficient slack to allow the formation of a double fold. The tobacco filler or bunch is made by placing the tobacco in one turn of the fold and the roller or bar in the other, and moving the roller along the platform toward one end of the same, so as to revolve the filler or bunch on the band and give it the required shape, the wrapper being rolled on by the same movement, and secured by gum or otherwise.

IMPROVED TOILET MASK.

Nanette S. Emerson-French, New York city.—The object of this invention is to furnish, for the purpose of beautifying the complexion, removing moth, tan, and sunburn, curing eruptions and inflammation of the skin, and softening and healing the skin, an improved toilet mask, that fits neatly and yieldingly to the face, and forms a protection for the same against external influences. The invention consists of a toilet mask formed of an outer layer of suitable pliable fabric, and an inner layer of heating or medicated fabric. The toilet mask is to be worn at night, not being annoying on account of its pliability, and exerting a quickly healing and softening influence upon the pores of the skin, so as to remove impurities and beautify the complexion, and form, furthermore, a protection against the influence of the sun and the bites of insects in summer, and against cold winds, chapping, and frostbite in winter.

IMPROVED SECTIONAL PACKING BOX.

Gilbert Robinson, Jr., New York city.—The object of this invention is to furnish an improved packing box, which shall be so constructed that it may be readily taken apart and packed in a small compass for shipment, and which shall be so strong as to withstand the outward pressure of the goods and the strain of handling. The improvement consists in making the edge pieces, which have heretofore been a single strip of angular sheet metal, in two parts or double, riveted to the outer and inner sides of the part of the box to which they are attached, and their free edges, that form the overlapping flange, riveted to each other. This construction greatly strengthens the box, and enables it to safely withstand the strain of the goods and of handling.

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Notes & Queries.

(1) E. D. N. asks: What will take coal oil and black ink out of a board floor? A. To remove the oil, provided the floor does not contain an excessive quantity of it, sprinkle the boards with good benzine and cover the parts with fine dry pipe clay for several hours. Repeat this treatment if necessary. For the ink (if writing ink), after removing the oil moisten well with muriatic acid diluted with 3 or 4 parts of water and cover with pipe clay as before, but have it warm.

(2) A. M. asks: Is it injurious to health to have growing plants in one's sleeping room, during the winter? A. In close rooms some plants are undoubtedly capable of exerting pernicious effects, but if the number of plants is not great, and the apartment well ventilated no danger need be apprehended.

(3) G. B. says: In the process of sugar making I am using cypress cisterns, to receive cane juice, which have been through a process in contact with sulphurous gas. What kind of paint, varnish, or other covering can be applied to the inside of the cistern, leaving the cistern in a clean condition after washing? A. If you can make paraffin adhere firmly, this will offer most efficient protection—it may be melted and a thin coating applied with a brush to the perfectly dry wood. The cisterns should be occasionally cleaned and, if necessary, dried and recoated.

(4) G. N. L. says: In making an induction coil capable of throwing the spark 1 inch, how many feet and of what size wire will I require for the primary coil? How many thousand feet and of what size should be used for the secondary coil? Will cotton covered wire answer if each layer is insulated? Will a dozen 1/4 inch soft iron wires, 10 inches long, answer for the core? A. Make the core about 18 inches long and 1 inch in diameter, of small (No. 26), well annealed iron wires. Use for the primary coil No. 16 cotton covered copper wire, enough to make the thickness of the helix 3/4 inch. For the secondary coil use No. 36 silk covered and well paraffined wire, enough to bring the outside of the coil 2 inches from the cover. Cotton covered wire may be used, but silk covered is best.

(5) N. S. R. asks: 1. What per cent of acid and water to use for battery for plating? A. Where other salts are not used add one twentieth part oil of vitriol to the water. 2. Also what percentage of blue vitriol, acid, and water for solution? A. Make as strong a solution of copper sulphate as possible. Do not use acid. In starting the battery a little zinc sulphate may be added to the zinc solution instead. 3. Is acid used to clean the form so that it will not blurr? A. No.

(6) E. N. asks: Can asphaltum be prepared cheaply to be pliable in freezing weather and in summer not to melt or run? A. No.

(7) P. R. asks: What book gives full information to make batteries and electroplate? A. Gore's "Electro-Metallurgy" is the latest publication.

(8) H. A. S. asks: Have any experiments been made to ascertain if carbonic oxide will pass through the walls of soapstone stoves? A. No.

(9) A. S. N. R. asks how to inlay a word in silver, on a flat gold ring? A. Engrave or stamp the design in the gold, then cover all except the portions to be silvered with wax, and deposit the silver by electroplating.

(10) J. N. P. asks how to make a fuse or slow match? A. Ordinary cotton cord soaked in a solution of saltpeter.

(11) I. N. G. asks how to transfer printed matter? A. Moisten the printed matter with a solution of caustic potash in alcohol and transfer by pressure.

(12) E. H. S. asks how to construct a simple apparatus suitable for distilling or condensing in a small way palatable fresh water from sea water? A. The simplest contrivance consists of, 1. A tin boiler as large as can be used over the fire available. 2. A rubber pipe leading from the steam space to a worm made by coiling said pipe in a tight cask kept replenished with cold sea water. 3. A reservoir at the delivery end of the pipe to receive the condensed steam. The quantity of water distilled depends on the size of boiler that can be used.

(13) J. R. says: A friend has a spring seventeen rods from his house; difference in level 28 feet (that is, spring lower than pump at house). He wishes to pump from the spring through a pipe laid according to the configuration of the ground, which is ridgy and uneven. Will it be a paying investment? A. No.

(14) A. J. G. asks how to mount maps? A. Stretch the cloth as tightly as it will bear on a frame of the required size. Rub over the surface a sufficient quantity of well cooked paste, made of equal parts of wheat flour and starch until the cloth is thoroughly wet. Lay the map upon the pasted surface and cover it with a piece of clean paper, rubbing back and forth, until it is smooth and fast. If desired, varnish with white copal varnish.

(15) W. A. T. asks: 1. How the peculiar grayish mottled appearance seen on rifle lock plates is produced? A. By casehardening. 2. How is the black blue finish given to the barrels? A. The work is highly polished or burnished. Placed in charcoal dust over a fire until the peculiar color appears.

(16) W. D. H. asks how to obtain a high polished surface on steel tools with emery wheels? A. Set the wheels with flour of emery to use as the last polish. A little tallow may be rubbed over the wheel as a finish. If the wheels are of small diameter, run them about two thousand revolutions per minute.

(17) W. G. says: I have a column 600 feet long and 12 inches in diameter in use for draining the water out of a coal mine. Sediment from the mine water has collected in the pipe, reducing the diameter to less than 6 inches, which causes a heavy strain on the joints. Is there any way of loosening the sediment so

as to cause the water to wash it out, and so avoid the expense of taking the pipes apart? A. If the lead of the pipe admits of it, try to pass a chain through. Cutting projections might be fastened to the links to knock off the scale. To send the cord through the pipe where-with to pull the chain through, if other means fail, attach a thread to a rat and drive the animal from end to end of the bore. Then pull the cord through by the thread. A steam jet might possibly be of benefit.

(18) J. H. McL. & Co. have paid out a large amount of money in trying to tan the skins of fresh water sturgeons without success. Have had some of the best tanners in the country trying to make some use of them. Can any correspondent suggest how to tan or handle sturgeon skins so as to make them useful?

(19) J. B. asks: Have vessels been built that could be propelled under water? A. Yes; the Ersson, Lay and Whitehead torpedo boats. A submarine boat carrying a crew blew up the U. S. S. Housatonic during the war, but the crew were all lost. Numerous submarine boats have been patented.

(20) D. W. F. and J. W. P. ask: Of the colored glasses, which is the best for use in goggles to protect weak or sore eyes? A. The dark shade of carbon glass is perhaps preferable; it diminishes the intensity of light without perceptibly interfering with the colors. Colored light is of no special benefit to sore eyes.

(21) I. A. C. asks: How many feet No. 34 insulated copper wire will it require to make the magnets in either engine described in SUPPLEMENT No. 197? A. The rule is to make the thickness of the wire helices equal to that of the core. The amount of wire to be used will depend upon the size of core. It is advisable to use a larger wire—about No. 22. 2. How large a battery will it require to run the locomotive, size of the engraving? A. One cell of the bichromate battery will probably suffice.

(22) C. D. N. asks how to make a fluid that will remove the color of black cloth pants faded or stained by perspiration, etc.? A. In such cases it is advisable to have the article washed and re-dyed. The following is sometimes used as a restorer: Galls, 1 lb.; logwood, 2 lbs.; copperas, 1/2 lb. Crush, mix, and boil in five gallons of water until reduced to one gallon, and strain.

What will remove dandruff? Have used flowers of sulphur. A. Apply a solution of borax with a stiff brush.

There are several names for coal oil, such as benzine, kerosene, petroleum, etc. What is the difference between each? A. Kerosene, benzine, naphtha, etc., are all products of distillation of petroleum. When petroleum is heated in the retort, the lighter oils, such as gasoline and naphtha, distill over first, and are condensed in pipes surrounded by cold water. At a higher temperature oils of greater specific gravity (heavier) such as naphtha, benzine, etc., come over; as the temperature increases, kerosene distills. The residue in the retort contains tar, paraffin, and lubricating oils.

My watch case, keys, etc., turn black in my pocket in warm weather. What is the cause? A. The discoloration is due to sulphur compounds, either excreted with the perspiration, or existing in the atmosphere of a locality frequented.

How can I stop a hole in an india rubber foot ball? A. Use rubber cement.

What will drive mosquitoes out of a room? A. Oil of pennyroyal is often used. Almost any strong smelling (harmless) essential oil will answer.

(23) J. S. asks how to make a matrix of plaster of Paris? A. Use fresh calcined plaster mixed with water about the consistency of cream. Pour it slowly over the matrix and let it remain until it is hardened. Oil the matrix lightly before pouring. 2. Is there anything that will toughen the plaster? A. Mix with weak alum water instead of water, or use a solution of 2 ozs. of gum arabic to 1 pint of water. Or for common purposes a weak size of glue may be used.

(24) W. F. M. asks the number of heaped bushels contained in a wagon box whose length is 120 inches, width 40 inches, and depth 24 1/2 inches? A. Size of wagon box 117,600 cubic inches, or about 44 heaped bushels.

(25) S. D. B. asks the number of cubic feet it takes to make a ton of hay? A. Any figures that can be given will only be approximate. Ordinary meadow hay, freshly stacked, contains from 260 to 280 cubic feet per ton, and becomes somewhat compressed after remaining in a large stack for some time. New clover hay occupies about 300 cubic feet per ton.

(26) B. & C. ask: How many cubic inches in a bushel (heaping measure) of green apples, Irish potatoes, etc.? A. A heaped bushel contains 2688 cubic inches, the additions being one fourth of a struck bushel. The standard bushel is the internal contents of a cone having a base diameter of 18 1/2 inches, and 6 inches high.

(27) E. N. asks: What battery is the best for plating purposes? A. For small work a copper sulphate-zinc-copper battery, of the gravity form, is perhaps most convenient. Since cells with carbon negatives, also the more powerful bichromate or carbon battery, are in common use where magneto-electric machines are not employed.

(28) M. D. asks: About how many square feet of heating surface are required in Ericsson's calorific engine to the horse power? A. From 8 to 10, in the small sized engines.

(29) T. D. B. asks: Would a vessel containing a vacuum be more buoyant than the same vessel filled with hydrogen gas? A. Yes. One hundred inches of pure hydrogen weigh a little more than two grains.

(30) G. W. S. asks: Is a local battery unhealthy if kept in use in the same room occupied by the operator? Is the vapor, if any, arising from the materials used unhealthy? A. If of the ordinary type—zinc and copper in solution of sulphates of these metals—no. The metallic salts used are not volatile at ordinary temperatures. The only exhalation is aqueous vapor—provided the materials used are not excessively pure.

(31) J. W. W. asks: 1. What is the cause of the evolution of heat when alcohol and water combine? What is the cause of the contraction which takes place when alcohol and water combine? A. It is due to contraction or a limitation of the atomic vibration. 2. Do the molecules of the alcohol and water when combined form intermediate molecules, or do they lay side by side with small shot? A. It has not been determined, probably the former. 3. Is the combination of alcohol and water chemical or mechanical? A. Chemical. 4. What is the greatest gravity of water? Some writers place it at 4° 1' C. or 39° 38' Fah., or for practical purposes, 39° 4' Fah. Others 40° or 39° 2' Fah. Which is correct? A. According to the latest authorities, maximum density of water is at 39° 2' Fah. (=4° C.)

(32) G. F. S. asks: 1. How many feet of 1 inch pipe (heating coils) are required for heating every 1,000 cubic feet of air, in rooms exposed to northwest winds; and how many square feet of heating surface (boiler) are required for supplying every 100 feet of pipe in such rooms with good draught for boiler fire? A. From 7 to 9 of radiating surface, and 5 to 7 of boiler heating surface.

(33) J. P. asks: Which will require the most power, to raise water from a reservoir by setting the pump above the same, or to force the water out by setting the pump inside of the reservoir near the bottom thereof, the depth of the reservoir to be less than 25 feet? A. There will be no essential difference, all things being equal.

(34) A. K. asks: If the strength of the electric current produced by a magneto-electrical machine be "H" for a given velocity, how much electricity will be produced by running the machine double, and how much by running it four or six times that velocity? Has any formula been worked out by which to calculate this? A. The production of electricity by any dynamo or magneto-electric machine increases about as the motion increases, until a certain maximum is reached, which depends on the capacity of the machine; and then any increase of speed will not improve the current. No rule can well apply in this case; it is simply a matter of test; if your machine is driven by a steam engine, throw off the governor belt and speed up until you get the best result: then count the number of revolutions per minute.

(35) I. C. H. says: I use a telegraph key in a room where it is very moist and warm, in fact full of steam, and I have a good deal of trouble with it. It is very slow and will quite often miss a dot or a dash. What is the matter? Has the steam anything to do with it? A. Be sure that your battery is in good condition, then clean the contact points of your key; if then you find difficulty, then there must be an escape; carry your office wire entirely clear of the wall, and see that the base of your key insulates well.

(36) A. B. asks: Would there be any gain in the attractive power of an electro-magnet of the horseshoe form, by cutting it apart at the bend? That is, would the totality of power of all the poles thus created be more than equal to that of the magnet before the cut, battery power and coils remaining the same in each case? A. No, there would not; the attraction of a magnet depends on its tendency to close a magnetic circuit, and the best result is obtained by having that circuit, as nearly as possible, complete and uniform. Cutting the magnet as you mention, makes two electro-magnets, each one half of the original size, and with opposite, and therefore attractive poles together; and the only advantage as compared with its first form is that it will more readily lose its magnetism when the current is broken.

(37) V. A. S. asks if the white fish of the lakes will bite a hook? A. No.

(38) W. A. H. asks: 1. How many 1/2 gallon bichromate of potash batteries would it take to run a boat 18 feet long, of very fast model, at 5 miles per hour? A. Of course our answer must be regarded as approximate; about 35 cups. 2. What style of engine do you think most suitable and easy to construct? A. There is no particular choice. 3. About what would it cost to run it per day? A. About two dollars for battery and material.

(39) — asks: Is there any such thing as having too much battery power for an electric bell? One cell will work it easily (though not very loud) while four cells will not work it at all. The battery is composed of lead and zinc, sulphate of copper and sulphate of zinc. What is the matter? A. Not in the case you mention; the fault is in the battery. Test each cell with the bell before you place it in circuit.

(40) R. P. S. asks if a wall (sea wall) laid in Portland cement would be a sure remedy against washing out in winter. It is all right in summer. A wall well founded, and built of dressed Maine granite laid in Portland cement, makes the handsomest and most durable sea facing; but of course it is very expensive. As your question is, we can only answer that enough of it, used judiciously, is the best remedy against washing out; but we could not give an opinion without seeing the place or knowing more of the circumstances; it may be that the stones are of poor shape, or too small.

(41) J. P. H. asks: 1. Is a single cell of Daniell's battery large enough to copper or electrotype articles two or three inches square? A. Yes, if it is clean and in good condition. 2. What is the cost? A. About \$2.25 for a cell, complete, and with connectors.

(42) W. B. says: If alcohol be used in place of water in a hydraulic press there will be no trouble experienced from rust from the tank getting under the valves.

(43) J. L. F. asks: 1. Why the magnetic needle points to the north pole? A. It is caused by currents of electricity passing around the earth, in lines nearly parallel with the equator; this may be easily proved by winding 30 or 30 turns of insulated wire around a globe on lines about parallel with its equator, and sending an electric current from one or two cups of Grove's through the wire, when a magnetic needle placed on any part of the globe will point to the north pole of the globe, obeying the law that a magnetic needle

tends to arrange itself at right angles to an electric current. 2. Can there be an electric light more brilliant than the sun? A. It is possible to produce a light of the same intensity, but never of the same quantity as comes from the sun.

(44) W. A. H. asks whether the new electric candles (2 carbon points lying side by side) require as great a number of elements as the ordinary electric light? A. No.

(45) S. B. G. asks: What is meant by the "harvest moon," and how often does it happen? A. It has been observed at the near approach of the autumnal equinox (September 22) that the moon, instead of rising as it usually does, later on one day than on the preceding one, rises on three or four successive evenings just as the sun sinks out of sight in the evening. This phenomenon is owing to the fact that the moon is in Aries when the part of the ecliptic below the horizon makes the least angle with it. In former times husbandmen, not doubting that it was so ordered on purpose to give them an increased supply of moonlight for their greater convenience in reaping the fruits of the earth, gave the name of "harvest moon" to this particular full moon.

(46) C. J. asks: What is the method by which the mould boards of plows are hardened? A. In some instances an iron pattern is placed in the sand mould when the mould board is to be cast, and the contact of the molten iron with this iron mould renders the casting very hard. In other instances different kinds of iron are melted together, the union of which produces a hard alloyed iron.

(47) G. G. P. asks: If a covering of brick with a layer of plaster of Paris under it serves a good purpose in retaining heat in a locomotive boiler? A. The plan is a very good one. Common wood ashes have been used in place of plaster and covered with brick in the manner you propose.

(48) F. A. F. asks how to make shoemaker's ink? A. Alcohol 1 pint, tincture of iron $\frac{1}{4}$ oz., extract of logwood 1 oz., pulverized nutgalls 1 oz., soft water $\frac{1}{2}$ pint, sweet oil $\frac{1}{4}$ oz. Put the sweet oil into the alcohol before adding the water.

(49) H. A. K. says: 1. I have a well and building 40 feet apart. I wish to put a pump in the building. What will be the difference in the power required to discharge a gallon of water in the building or at the well, the height being the same in both cases? A. The same power will be required for either arrangement. 2. Would it make any difference in the flow of water if the pipes turned at right angles or on a curve? A. It is much better to use curves with large radii.

How much water will a 12 horse engine require to be evaporated per hour for each working horse power used? A. From 30 to 100 lbs., according to construction and arrangement.

(50) H. L. B. asks for a method of fixing pencil drawings on paper to prevent blurring by rubbing? A. Take the white of one egg; mix thoroughly with one quart of water. Filter through a fine cloth. Flow the drawing with the albuminized water and let it dry.

(51) P. B. asks: Can brass be united to lead with a soldering iron or copper? A. Yes.

1. Can waterproofing alum solution be applied to wall paper? A. Yes. 2. Can I kalsomine over a whitewashed ceiling, the whitewash of which rubs off? A. Yes.

(52) A. G. says: We have a tug boat with a return tubular boiler, 5 feet shell over all; grate bars $22\frac{1}{2}$ feet, heating surface as follows: furnace 40 feet, draught flue 16 feet, return tubes 247 feet, comb 7 feet. Top of fire chamber at the end of draught flues, 7 square feet, 18 inches. In burning bad coal or wood we cannot keep up more than 65 lbs. steam. We have also a locomotive boiler, 5 feet shell, 16 $\frac{1}{2}$ feet from end of tube to outside of firebox, grate surface 22 feet, heating surface as follows: Tubes 595 feet, firebox 70 feet. We wish to burn wood altogether. Would we get more steam with the locomotive boiler? A. Yes, probably. But the data are hardly sufficient to give a decided opinion.

(53) C. L. M. asks for a recipe for making black ball and blue stencil paste for marking with stencils? A. For black ball use beeswax 8 oz., tallow 1 oz.; melt and add powdered gum arabic 1 oz., and lampblack to color. For stencil paste, mix the required color with dextrin or gum arabic, moisten with water, press into cakes and dry thoroughly.

(54) L. S. writes: I have constructed a galvanic battery, using zinc and carbon with diluted sulphuric acid. It produced a very strong current till lately, when it almost ceased working. By examining the battery I found that the carbon connections, consisting of brass clamps, were all covered with a thick layer of verdigris, and almost corroded by the acid. I would like to know whether these connections could not be made of a metal less affected by the acid, say lead or some other composition? Will not lead weaken the galvanic current, and will the carbon be always of the same strength by always leaving it in the fluid, while the zinc plate is arranged to draw out of it? A. Lead is used for this purpose, but where the connection is exposed to acid, nothing seems to deliver the current to the carbon as well as a connector made or faced with a noble metal, platinum, or gold. A brass clamp connector will answer very well if you have it 4 or 5 inches above the surface of the solution, so as to be above the reach of the solution drawn up by capillary attraction. Clean your battery, and use less solution; or you may use more solution if you protect the carbon connection by varnishing it (after it is well connected) with shellac varnish, or dipping it about an inch below the surface of melting beeswax. In either case the carbon must be dry and warm.

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

H. S.—It consists principally of metallic iron. Owing to the limited quantity of sample, other constituents were not determined.—N. S.—It is a piece of glass.—S.

A. T.—It is lignite in a sandstone gangue, which is of very common occurrence. It is sometimes called mineral charcoal.—J. V. H.—It is a variety of traprock.—A. H. McC.—You should send a specimen of the mineral.—J. L. P.—It is sesquioxide of iron or a ferruginous clay mixed with wax and oil.—J. S. C.—What you refer to is probably quartz—crystallized silicic acid. Its presence is not specially indicative of other minerals.

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 Meteor. By J. E. H.
On a Wheel with no Dead Center. By F. P.
On Cancelling Postage Stamps. By E. W.
On a New Method of Smelting Iron. By M. H.
On Cases of Lead Poisoning. By L. L.
On Stellar Systems. By G. R. C.
On How to True up a Crank Pin. By I. R.
Also inquiries and answers from the following:
G. A. G.—C. W. F.—W. H.—J. S.—M. H. R.—G. W.—F. F. O'K.—W. C. McN.—W. H. S.—H. D. O.—W. B. S.—H. D. L.—A. R. C.—W. V. P.—A. H. B.—G. A. M.

HINTS TO CORRESPONDENTS.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

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

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

Hundreds of inquiries analogous to the following are sent: "Who manufactures machinery for making flower-pots? Who makes and sells an article for preventing or removing scale in steam boilers? Who sells books on tanning, leather finishing, and copper smithing? Who deals in rosin?" 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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A complete copy of any patent in the annexed list including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

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10,235.—SPEAKING TRUMPETS.—E. Cairns, Morristown, N. J.
10,236 and 10,237.—EMBROIDERY PATTERN.—E. Crisand, New Haven, Conn.
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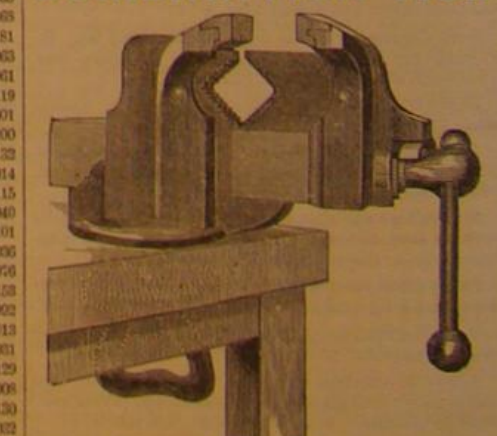
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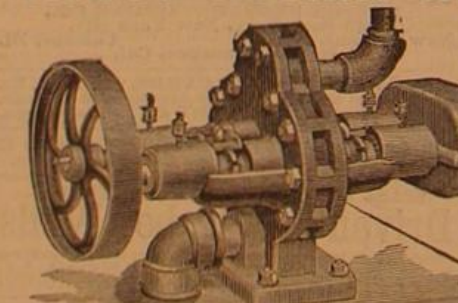


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IMPROVED AUTOMATIC FIRE ESCAPE.

The accompanying engraving represents a new fire escape, whereby a person may escape from a burning building without the help of any one else, and with no exertion on his part beyond the buckling on of a simple belt. The device is entirely automatic, and is claimed to let down heavy or light weights without change of speed. Its mechanism is positive and free from springs and catches, and its construction is sufficiently strong to guard against accident by breakage.

The lowering rope to which the belt which the person escaping buckles around him is attached, is wound upon a drum, on the shaft of which is the bevel gear wheel shown. Meshing with this wheel is a bevel pinion (not exhibited in the engraving) on the vertical shaft, A. The upper portion of the standard, B, in which the drum shaft is journaled, and in which also steps the shaft, A, is flared to receive the bevel pinion. The latter engages with the gear wheel through an opening in this flared portion. On a sleeve which traverses on the shaft, A, is formed the inverted cup or hollow conical frustrum, C. Also on the sleeve is attached the crossbar which receives the lever arms of the ordinary ball governor shown.

It will be obvious that when the drum is caused to rotate by the drum unwinding as a person descends, the governor will likewise be revolved, and the balls will fly out more nearly horizontal as the speed augments. But as the balls move outward their levers carry downward the sleeve on shaft, A, and consequently jam the cup, C, over the stationary flared portion of the standard. The cup thus acts as a brake which is the more closely applied in proportion as the velocity of descent increases. The machine is intended to be bolted on the floor inside the apartment and hence is protected from the weather. After the rope has been unwound it can easily be wound up again by a handle, or the drum may be made double as shown at the right of the engraving and have two ropes upon it—either hemp or wire as indicated—wound in reverse direc-

tions. Then when one rope is unrolled, the other is rolled. Belts with simple buckles are attached to each.

Patented August 28, 1877. For further information address Mr. Charles Leavitt, 453 Prospect street, Cleveland, Ohio. E. Dunbar, agent, 31 Courtlandt street, New York.

Effect of Salt Water on Candles.

Some candles which had been sunk in the wreck of a vessel off the Spanish coast for about 173 years have been examined by Professor Gladstone. The wicks had all rotted away,

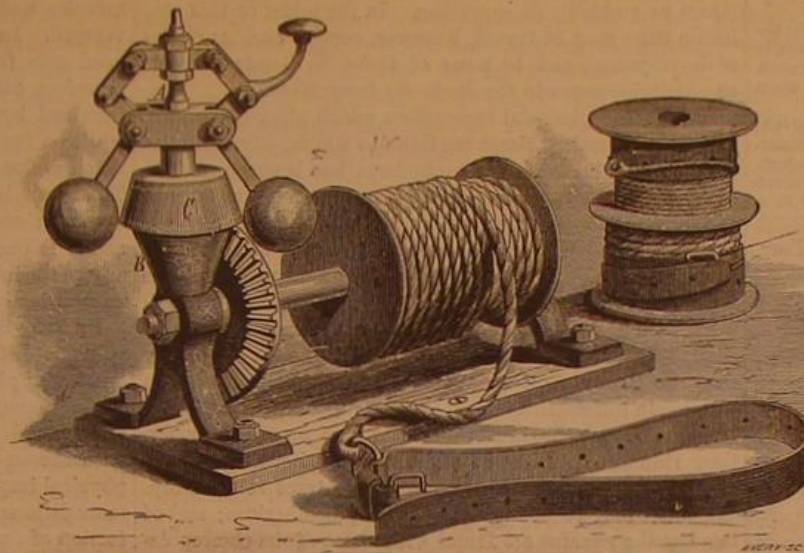
length of time the fat had been exposed, the reaction had only been about one half accomplished.

AN OBELISK AT SEA.

We have already described the manner in which Cleopatra's needle, the obelisk presented by the Khedive of Egypt to the British Government, has been built as it were in a vessel, and so made ready for the voyage to England. The annexed illustration represents the Cleopatra, as the vessel containing the stone is called, *en route*. The following particulars of the launch of the ship we take from *Engineering*. The cabin recess of the ship was filled with old rails to balance the eccentrically placed obelisk, and the cylinder was lagged with 6 inch planks for a length of about 12 feet at each end, in order to protect the iron skin against possible injury from the stones on the sea bed. Some half dozen screw-jacks were ranged along the cylinder to start it down the incline, which had been formed of quarry rubbish from the shore to the point where the cylinder would float, and a couple of lighters with winches were moored ahead to haul on the wire hawsers, which were wound five times round the cylinder at each end. The screw-jacks were manned, and the ship went slowly and surely ahead, making in the course of the day two attempts to run off to sea, amidst the cheers of the lookers-on, but stopping each time after about a quarter of a turn had been made, so that at sunset the cylinder had advanced into but 3 feet of water.

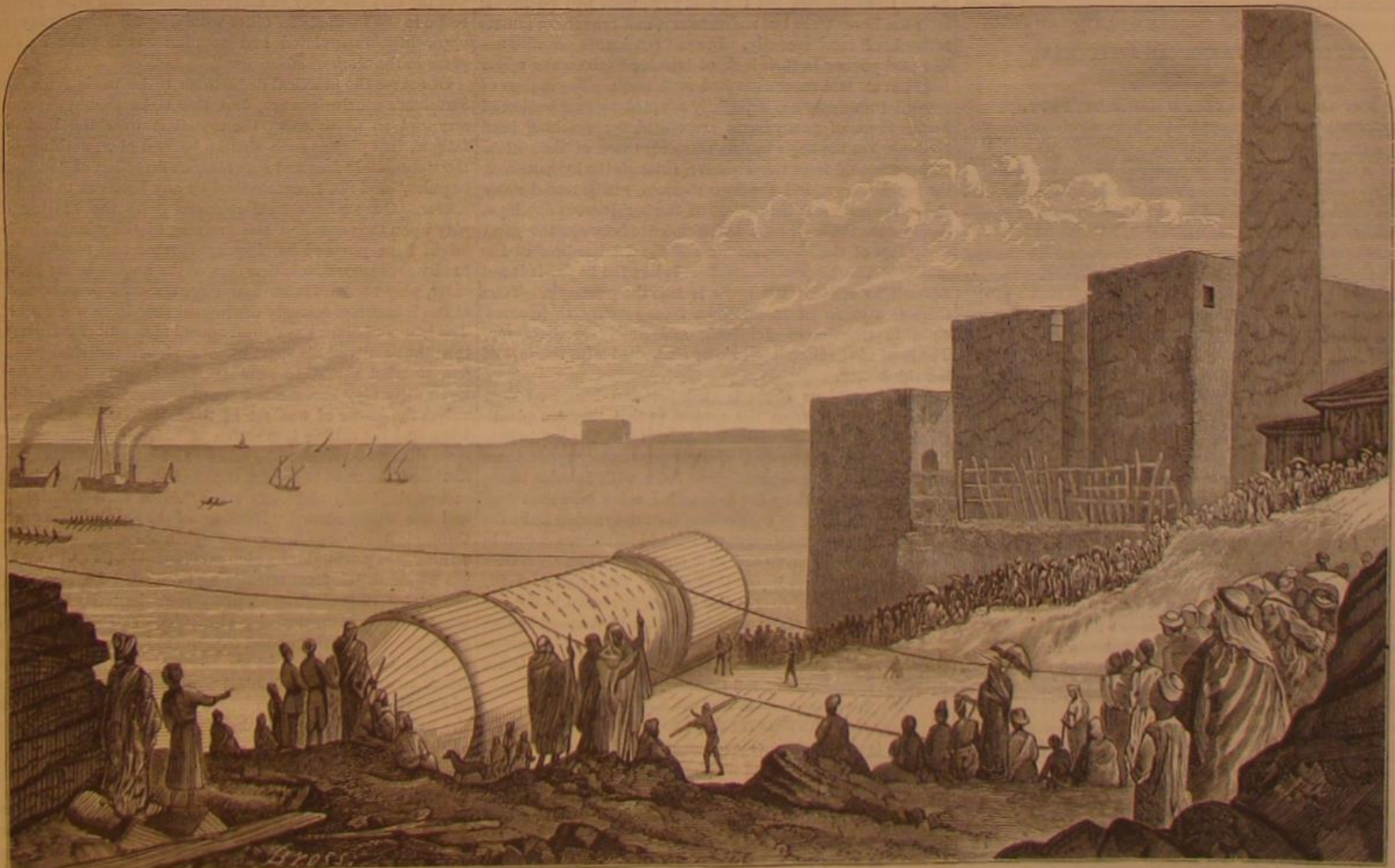
On the morning of the second day the jacks were set to work again, and with the help of the tugs the cylinder took a fine roll into about 7 feet of water, and then to the disappointment of all again pulled up. The tugs were backed and ran at the hawsers again and again, until towing tackle and almost everything was smashed, except the splendid steel wire hawser. It was then discovered that the cylinder was full of water, and the manhole covers being downwards, it was considered probable that one of them had been torn

[Continued on page 258.]



AUTOMATIC FIRE ESCAPE.

and the fat had been converted into a heavy substance of a dull white color by the action of the salt water. After the fat had been removed by ether, there remained carbonate and chloride of calcium and sodium, with traces of potassium and magnesium. The calcium, though less abundant than sodium in the ocean, had apparently the greatest influence in effecting the change noted; but notwithstanding the



CLEOPATRA'S NEEDLE.—LAUNCH OF THE OBELISK AT ALEXANDRIA.

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NEW YORK, SATURDAY, OCTOBER 27, 1877.

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VI. MISCELLANEOUS.—RUDOLF L. C. VINCOW, 1 engraving.
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CURIOUS ANIMAL RELATIONSHIPS.

As paleontological discoveries multiply, they reveal to us in a constantly increasing degree the mobility of the beings of which our earth has seen the successive development. All living creatures of past ages have been ephemeral, and those whose histories are the shortest seem curiously enough to have been the ones which possessed the greatest strength. Such monsters as the dinotherium, the dinoceras, the bronchotherium, etc., existed over but a comparatively brief period; and it might almost be conceived that, because these giants expended vast quantities of vital energy, the quicker was the same used up.

Among these fossil beings, the mammals which have characterized the third great phase of the history of nature, called the tertiary epoch, offer conditions particularly favorable for the study of questions relative to evolution. At this epoch they formed a striking contrast with the rest of animate creation. The plants then belonged to present genera; their generic transformations were accomplished, and modification was restricted to species and races. The great traits of the invertebrata were nearly all defined; their species varied, their genera and families likewise, but in degree. The fishes had reached their highest development, the reptiles had passed theirs and were diminishing. But the mammals were then in full evolution; and in the enormous multitude of species—a new form almost for every instant of geological time—some were suddenly appearing, others as suddenly disappearing. In the midst of this confusion there may be traced, however, certain curious chains of development, and to some of these, M. Gaudry devotes an admirable paper in the *Revue des Deux Mondes*.

Among the placental mammals which played a prominent part in tertiary times are those to which, on account of their thick skin, the name pachyderm has been given. At the present time they are scattered, and between the various species there seems little or no relationship. The hog, the rhinoceros, and the tapir, for example, differ widely. But when we go back to the fossils, we find that preceding the hog of to-day there has been a whole succession of fossil hogs, then animals of a genus closely related, called hyotherium; this in turn is related to the paleochoerus so closely that the two are often confounded. The paleochoerus in turn again differs little from the choeropotamus and dichobune. Now the present rhinoceros was preceded by tertiary rhinoceri. Between these and the hornless animal known as the acerotherium, it is easy to trace relationship. The latter may be connected with the paleotherium; and of this last the remains are found with those of the choeropotamus in Montmartre gypsum, and thus the connection between the rhinoceros and the hog is established. Similarly a chain of relationship can be found between these animals and the tapir.

But the signs of transition are not merely apparent between pachyderm and pachyderm, but between the pachyderm order and that of the ruminants. It would hardly be supposed that the light and graceful antelope bears any relationship to the unwieldy rhinoceros; yet paleontologists are supplying the connecting links. The majority of ruminants differ from the pachyderms, in that the former have horns on the frontal bones, but the first ruminants had no horns; later the horns were but rudimentary, and branching antlers arrived still more recently. Present ruminants are also unlike pachyderms in their lack of incisive teeth on the upper jaw, but ancient ruminants had such teeth. The molars of present ruminants are especially adapted to mastication of herbs, those of pachyderms are suited for crushing hard bodies. Yet the hog's molars resemble those of the anthracotherium, and from this creature, through the hyopotamus, the lophiomeryx, and the dorcatherium, can be traced every step of transition to the molars of the herbivorous antelope. Again, take the feet; note the difference between the great splay foot of the hippopotamus and the delicate hoof of the gazelle. The hippopotamus' foot is like the hog's; it is not difficult to see that the hog's is like the peccary's. Then there is a chain of resemblance from peccary to hyomochus, to tragule, to steinbock, and finally to the sheep. The hoof of the horse can also be connected with the foot of the rhinoceros.

Another curious chain is that between bear and dog. Bears now differ from the canines in that they are plantigrade, and in the size of their tubular teeth, the last indicating their omnivorous diet. But in the tertiary epoch there existed amphicyons—plantigrade dogs with tubular teeth; these were replaced by the hyenarctos, more bear than dog. Then there is a hyena connection, for the cynodon links the dog and the civet. Of three species of ictherium, found in Greece, one was half hyena half civet, one more civet than hyena, and one more hyena than civet. The relation of the lemur to the pachyderms is also strikingly shown in the fossils. Remains of small pachyderms have been found having monkey dentition, and M. Gervais has discovered an animal which he calls cebochoerus anceps, or, to use Patent Office parlance, combined pig and monkey.

THE SCIENCE OF PLAY.

There is not much obvious connection between the homely couplet "All work and no play makes Jack a dull boy," and Schiller's hypothesis of a "Spieltrieb," or sport impulse which he recognizes as existing in human nature, and to which he traces the origin of all fiction, and especially that of a poetic and dramatic character. Yet both ideas express truths which need but to be blended together, to bring before us a realization of the absolute necessity of play in a

practical and physiological light. The first may be taken as referring to the physical gambols of the young animal; the second, to that which in one sense may be mental relaxation, in another, not so; affirmatively if the exercise of the sport impulse involves a total change of thought and idea, negatively if no such change takes place.

Play is an instinctive faculty, inherent in all animals. It is as much an instinct as the desire to seek food when hungry; and to regard it as a mere aimless and trifling species of exertion is a total mistake. The gambols of a child emerging from babyhood, or of a kitten, are due to precisely similar reasons. At this period of life the purpose of play in man and brute is the same; in after years the difference vastly widens through the introduction of the intellectual element in the actions of the child, and of course its total absence in those of the brute. The games and playthings of youth are not those of childhood; but the play of an old dog—though more rarely occurring—is nevertheless the same as that of a young puppy. The object of play in young life is exercise. It is the peculiar exercise which Nature prompts the organism to undertake; and it may be said that it is the only possible form of exercise which is at once attended by pleasure, and is able to mould the frame of the growing animal in the direction of its perfect development. Its antithesis is task work, which, though it may not involve one tithe the exertion, nevertheless passes quickly into fatigue, and thus results in straining some muscles unduly while others are left comparatively undeveloped. In play alone, the instinctive sense of physical need gets full scope; its spontaneity and aimlessness are therefore only apparent, and its nature and amount are determined by the sense of pleasure in the exercise itself; while on the other hand, a strictly natural limit is imposed on all undue exertion by obedience to the sense of fatigue. The result is an equable and harmonious development of muscular energy and nutrition in every muscle and fiber; and it is one attainable in no other way—certainly not by any prescribed routine of exertion—or save by obeying a natural instinct.

Dr. John Strachan, of Edinburgh, has recently published a valuable little treatise, physiologically inquiring into the bearing of play upon education and training; and after adducing conclusions substantially similar to those above enumerated, he proceeds further and states that the law of spontaneous development through play does not end with physical improvement, but that, after a time, the higher and more differentiated faculties come to be required for the perfection of the animal, and that the same law presides over their evolution. Play, he explains, that is apparently aimless, or, at least, not consciously directed exercise, is the means of securing the equable development of the brain and its faculties—memory, imagination, hope, wonder, and even special kinds of intellectual and moral activity, according to the endowments, and perhaps also the accidents, of social position in the individual. "Exercise is accompanied by pleasure up to the limit of fatigue; beyond this limit, by pain or uneasiness. Special endowments or faculties brought into prominence by accident and after exercised are more, others are less, developed. But in every case there is a limit, and the only sure way of ascertaining the limit is by giving scope to the instinct; in other words, by allowing 'play' or apparently unregulated and spontaneous impulse its due place in the work of education."

Of course the practical deductions to be made from Dr. Strachan's conclusions are, first, that tasks should never be arranged so as to carry the organism over the limit of fatigue, that play as such should be real play, nothing but the "absolutely free and spontaneous direction of the sport impulse," and not circumscribed by any limits as to kind or nature. Our author's treatment ends with the bearing of play upon the education and training of the young, else he might have pursued his inquiry further and reached the hardly avoidable conclusion that, as the human being grows older, play becomes more and more a mental process, until at last it becomes scarcely distinguishable from work itself. The labors of almost any professional man will demonstrate this; the results of his sport impulse viewed individually are due to what would to another man involve hard labor. Eventually play becomes merely difference in work, and involves the disuse of one set of tired brain molecules, as it were, and the calling into action of a fresh series, and the more different the labor the greater and more enjoyable, and doubtless the more beneficial the change. The author of that supremely funny children's story "Alice in Wonderland," and the wildly absurd "Hunting of the Snark," is a grave theological professor in a great English university—and both writings are productions which professional wits and humorists would shrink from attempting to rival. So, also, hard physical work presenting a still wider dissimilarity to mental labor becomes comparatively play. The ex-Prime Minister of England finds his greatest enjoyment in hewing down the trees on his estate. And we know of many an instance where an amateur's mechanical workshop adjoins the office of a physician or lawyer, or where the artist's easel furnishes the necessary play to a brain closely engaged in scientific study.

Specific Heat of Water.

According to new experiments by Munchhausen, of Moscow, the specific heat of water taken at unity at 32° is at 212° Fah. 1.0302, as against 1.013 found by Régnault, and 1.122 determined by Jamin. The investigations were made with the greatest refinement of accuracy.

THE DUTIES OF THE COMMISSIONER OF PATENTS AND THE SUPERVISING POWERS OF THE SECRETARY OF THE INTERIOR.

SARGENT'S CASE.

Our readers will remember our notes on Sargent's case published in a previous issue: how, pending Sargent's application for letters patent for "an improvement in time locks," five interfering applications by as many different parties were filed; how each interference was decided in favor of Sargent; how one of these interfering applicants, namely, John Burge, filed a bill in equity in the Supreme Court of the District of Columbia, against Sargent, praying that the former might be adjudged entitled to a patent for the invention which had been the subject of the said interference; how the Commissioner of Patents, on application of Burge, suspended the issue of a patent to Sargent, until the final determination of the said equity suit commenced by Burge; and how the Secretary of the Interior, on the application of Sargent, reversed this order of the Commissioner. We are now enabled to lay before our readers the reasons upon which the decision of the Secretary of the Interior was based. These may be briefly stated as follows:

As an executive officer, the Commissioner of Patents has the authority to exercise such powers and functions as are conferred upon him by the statutes creating his office and defining his duties, together with those which may be prescribed in the rules and regulations adopted, with the approval of the Secretary of the Interior, to facilitate the business of the Patent Office. These duties are in part quasi-judicial, and in part administrative, or ministerial and directory. In the discharge of his judicial duties, the Commissioner is to hear and determine the rights of the parties within the statute, governed by the same rules as a court. In the discharge of his administrative duties, whether of a ministerial or directory character, the law must be executed according to the letter and intent.

Letters patent for an invention are not to issue until the right thereto is clearly established, in accordance with the law and the rules and regulations of the Patent Office; but when this is done, and all of the conditions and requirements of the law, as well as the rules and regulations of the Office, have been fully complied with, they cannot be withheld. The duty of the Commissioner in this respect is clearly and explicitly defined in Section 4,893 of the Revised Statutes. If the applicant is adjudged to be entitled to a patent for the invention claimed, and has fully complied with the law and the rules and regulations of the Patent Office, in the payment of fees, etc., he is entitled to demand that the patent shall issue to him, and there is no right, legal or otherwise, which will justify withholding it. If there be an interfering claim, then it cannot be said that the applicant is "justly entitled" to a patent, until the issue raised by the interference is determined, in accordance with law and the regulations governing the Patent Office, although such applicant may have made an important invention and discovery, and would otherwise be entitled; but if after a fair consideration of such interfering claim, it be decided that he is entitled to a patent, his right is unchanged, and he may demand that the patent issue. This right is not affected by the words "may issue," in Section 4,904 of the Revised Statutes, which prescribes the course of procedure whenever an interfering application is filed; for the well settled construction of the word "may" in similar statutes is that it is the equivalent of "shall." Nor does the provision in Section 4,915 of the Revised Statutes, providing a remedy for the defeated applicant by bill in equity to establish his right to a patent for the invention claimed, authorize the Commissioner to withhold the issue of a patent, merely on the ground that a decision final in its character in one of the departments of the government should be held in abeyance to await the determination of the same question in a co-ordinate department of the government. Burge's suit in equity is a proceeding *de novo*, and is in no sense an appeal from the Commissioner's decision.

The above grounds, and the fact that all the interfering contests were decided in Sargent's favor, the Secretary of the Interior believes, warrants him in concluding that, at the time of making the order of suspension, there was no legal reason why the patent should not have been issued, and that there was no duty to be performed by the Commissioner except the ministerial duty of preparing and issuing the patent, and that in the performance of those duties the statute was mandatory.

In this view of the case, it became important to know what the duty of the Secretary of the Interior was in the premises. Had he the legal right to direct the Commissioner to issue a patent to Mr. Sargent? The Secretary of the Interior is satisfied that he has such a right. In the first place he is charged, by Section 441 of the Revised Statutes, with the supervision of certain branches of the public business, among which is "patents for inventions." By Section 481, it is provided that the Commissioner of Patents, under the direction of the Secretary of the Interior, "shall superintend or perform all duties respecting the granting and issuing of patents directed by law." Section 4,893 provides that "all patents shall be issued in the name of the United States of America, under the seal of the Patent Office, and shall be signed by the Secretary of the Interior, and countersigned by the Commissioner of Patents." The Secretary of the Interior is led to the conclusion that the supervision and direction with which he is charged means something more than an approval of the act of the Commissioner of Patents. That the responsibility of seeing that

the work is properly done by the Commissioner of Patents is with the Secretary of the Interior; and that this duty of the latter relates to the negative as well as affirmative acts of the former. Thus, if the Commissioner neglects or refuses to perform any duty required by law to be performed by him under the direction of the Secretary of the Interior, or performs a ministerial or administrative duty improperly, the Secretary of the Interior, by virtue of his supervisory power, may direct him in its performance; for, to be charged with the responsibility of the supervision and direction of any kind of work or business, by law, and not be able to require that it shall be in accordance with the law, would be anomalous indeed.

In accordance with these views, the Secretary of the Interior directed the Commissioner of Patents to prepare and issue the letters patent for said invention to Mr. Sargent.

INFLUENCE OF THE SPINAL CORD ON BODILY TEMPERATURE.

Since the thermometer has been brought into active use as a clinical aid, numerous instances of unusual and surprising variations in bodily temperature have been recorded which could be ascribed to no other cause than a lesion of the nervous centers. No generally accepted theory explaining the phenomena is in existence; but it is at least conceded that of all the regions of the nervous system the spinal cord seems to play the chief part in these anomalous variations in animal heat. Some new investigations into the subject have recently been made by M. Parinaud of Paris, an account of which we find in the *Lancet*. He states that he was led to the inquiry by observing, in a case of fatal epileptiform convulsions, that the rise in temperature which occurred *pari passu* with the fits did not cease with the cessation of the fits, but continued to mount till death, which occurred six hours later, when it reached 108° F., and soon after death 110°. The experiments were made upon rabbits, and the results reached were that transverse sections of the spinal cord in the cervical or dorsal region led to a fall in the central temperature of the body, even when the surrounding air attained a heat of from 82° F. to 86° F. This lowering of the central temperature appeared to be due to the cooling of the paralyzed parts, the deep temperature of which remained during the whole experiment at a lower level than in the regions still under the influence of the spinal cord. But in the paralyzed parts there was a rise in the surface temperature of the extremities, probably owing to transient vaso-motor paralysis, as it passed away in time and depended for its degree upon the initial temperature of the skin and surrounding atmosphere.

M. Parinaud states his belief that the spinal cord influences animal heat by means of nerves distinct from the vaso-motor system, and which he imagines may have an action quite contrary to that set of nerves. At the same time, says the *Lancet*, he does not think it necessary to invent a distinct system of calorific nerves, but believes those nerves to be sufficient which regulate the processes of nutrition and secretion, of which calorification is simply the physico-chemical result.

AMATEUR OBSERVATIONS OF THE NOVEMBER METEORS.

On the 13th and 14th days of November, the earth makes its annual passage through the second of the great meteor belts which intersect its orbit. The thickness of this belt at its thickest part is estimated by Professor Proctor at some 100,000 miles, and it is supposed that the denser portion of the system or "gem of the meteor ring" contains at least one hundred thousand million meteors. These however, Herschel has calculated to be extremely small, rarely exceeding a few ounces in weight. It has further been determined that the November meteors mostly radiate from the constellation *Leo*, and the aphelion of their orbit is somewhat beyond the planet Uranus.

Late investigations have pointed to the identity of the orbit of some of the comets with the orbits of different groups of meteors. The path of the meteors, for example, which are usually seen from August 9 to 14, coincides with that of the bright comet of 1862, and both Peters and Schiaparelli independently discovered some time ago that Tempel's comet of 1866—a body visible only with the telescope—has elements which may be regarded as absolutely identical with those of the November belt. It is not definitely known, however, what connection exists between the comets and the meteors, though it appears that the latter have paths as eccentric as those of the cometic orbits, and hence it is deduced that the earth encounters no less than 56 meteor systems, thus affording proof that the total number of these systems in the universe must be estimated by billions.

It will readily be seen that a knowledge of the elements of the paths described by the meteors is of considerable astronomical importance. While, as already stated, the general direction or radiation is from the constellation *Leo*, it has been observed that often on the same night many distinct centers of radiation may be traced. It is by the determination of these centers that the elements above referred to may be calculated. Then by comparing the results with the elements of the orbits of known comets, it becomes possible to discover which comets, by rupture, according to one theory, probably gave rise to the various groups of shooting stars. Hence observations made with the naked eye, which fix the exact point in the heavens whence the meteors appear to radiate, may prove of value.

It is necessary first to note the region of the heavens

whence the meteors appear, and then to observe specially those bodies which seem to have the shortest trajectories. These will, of course, be the ones nearest the center of radiation, and in this way the location of the latter can be quite accurately determined. Look also for a pale light something similar to the aurora, which is often present about the radiating point. It is also useful to note the color and brilliancy of the meteors. The latter may be estimated by comparison with Jupiter and Venus, the brilliancy of these planets being taken as the maximum. If the meteors leave a trail behind them, note the fact, and also observe how long the trail remains visible after the star disappears, also whether it has any backward motion. A field glass may be advantageously employed to recognize any special peculiarities of the trail. These observations, if carefully made, will be acceptable at any astronomical observatory. Meteors also appear from the 27th to the 29th of November, and from the 6th to 13th of December, but not in such numbers as upon the above-mentioned dates.

ANOTHER TRAVELING EXPEDITION.

A scheme has been started in England which differs from the Woodruff scientific expedition in that, while the latter subscribers pay \$2,500 and travel themselves while somebody else makes money, in the other they pay \$500 and don't go, but then they make the money out of other people who do. The name of the concern is "The Hadjik or Pilgrimage to Mecca, Syndicate, Limited," and its object is the benevolent purpose of transporting devout Mahometans to the aforesaid holy city. There is a glowing prospectus, picturing the delights of the trip, which estimates that at least 170,000 pilgrims will go to Mecca this year, and if each one of these can be made to come back under the company's auspices at an average of 35 dollars per head, this "would place at the disposal of the syndicate a gross sum of nearly six million dollars," of which one million seven hundred thousand will be clear profit plus also gains by freight, etc. There are only 100 shares at \$500 each, and consequently it appears for investing the above sum, the subscriber is going to make at least \$17,000. Our British cousins evidently know more than we do regarding the financing of traveling expeditions.

IMITATION TERRA COTTA.

The *Magasin Pittoresque* gives the following original recipe by which it is stated plaster casts may be made to imitate terra cotta ware with great fidelity. The following colors are necessary, brick red, lamp black, zinc white, and yellow ochre, all in powder. The object to be treated is first carefully rubbed over with "00" sand paper so as to remove all roughness of the surface or ridges indicating where the parts of the mould have been joined. The mixed color consists of yellow ochre 2 parts, brick red 2 parts, and black 1 part. These are well rubbed together. Then 3 parts of zinc white are separately mixed with a little milk to a paste. All the ingredients are then combined in a mortar with 8 or 10 parts of milk and the resulting mixture is passed through a fine sieve to remove any particles of the white. A soft brush is then used to spread the stain over the object, care being taken to lay it on evenly. After 24 hours drying a second coat is applied. When the article is completely dry, rubbing with the finger will eliminate brush marks.

Russian Remedy for Hydrophobia.

A correspondent in *Land and Water* gives the following Russian remedy for hydrophobia: In Saraton the inhabitants collect the larva of the rose beetle (*cetonia aurata*) which are chiefly found in the wood ants' nests. The grubs are gathered in the spring, placed in earth, and their change or metamorphosis watched for. When this takes place, they kill the beetles and dry them. The powdered insect must be kept in hermetically sealed bottles, or the dried beetles may be kept in sealed pots and reduced to powder when wanted. Three beetles, powdered, is considered a dose for an adult, given immediately after the bite. One for a child and five for an adult in which the disease has declared itself. The effect is to produce a long sleep, which must not be interrupted. The bite is also treated surgically.

The beetles caught on flowers are not so beneficial; they must be secured in the larva stage, and killed directly after they attain the imago. Some of the Russians give their dogs occasionally half a beetle as a preventive.

Ancient Mode of Moving Large Stones.

M. Eugene Robert, having found in the neighborhood of a Celtic dolmen in France a ball-shaped mass of sandstone about a foot in diameter, suggests that it might, with other stones shaped like it, have been used as a roller to facilitate moving the immense masses of rock wherewith the ancients constructed their monuments. He thinks that by this means the large granite rock which supports the equestrian statue of Peter the Great in St. Petersburg, was brought from Finland.

DEATH FROM CHLOROFORM AVERTED.—A correspondent of the *British Medical Journal* communicates the interesting observation, that in a case of syncope during the administration of chloroform, where the usual treatment was without effect, and death seemed imminent, the application of some lint saturated with nitrite of amyl to the nostrils was followed almost immediately by restoration of the pulse, and the subsequent recovery of the patient.

[Continued from first page.]

off in jerking the hawser, but, as subsequently proved, a large and hard stone had cut through the iron skin forward of the end bulkhead, and since (as usual) the doors of the different bulkheads had been left open, the whole vessel was filled with water. A timber crib about 9 feet square was then filled with old rails and stones. This was hauled forward against the cylinder by a chain attached to it and passing under the cylinder, and with the help of a couple of hydraulic jacks working on the top of the crib the cylinder was once more in a few hours rolling seawards. As soon as the bottom plates came to the surface a patch was secured over the hole made by the stone, the vessel was pumped dry, and it only remained then to recall the tugs and let them haul off the ship, which they easily did. This obelisk will be erected in some prominent locality in London.

According to the *New York World*, the Khedive of Egypt has offered to present a monolith similar to the "needle," to the City of New York. The shaft now stands erect and is some seventy feet high. The English contractors who are now transporting the English stone are said to have offered to transport the Khedive's gift to this city, and to erect it in any location which may be chosen, for \$100,000. It is proposed that this sum be raised by subscription among the citizens of New York.

A NEW ACID.—A new acid of phosphorus and oxygen has been discovered by Herr Salzer, of Worms. According to the old notation it consists of one atom of phosphorus and four atoms of oxygen. It has been named hypophosphoric acid.

IMPROVED DOUBLE SHEDDING HARNESS JACQUARD LOOM.

The annexed illustration of Ainley's double shedding harness jacquard loom, as manufactured by Messrs. Hutchinson, Hollingworth & Co., Dobcross Iron Works, Saddleworth, England, we copy from *The Textile Manufacturer*, with description of the chief movements employed. The first point which it is necessary to direct attention to is the fact that the jacquard machine is altogether independent of the general framework of the loom, being fixed upon beams at a proper elevation. This is a great advantage, since it avoids a very large amount of vibration to the jacquard. The double shed is produced as follows: The main lever at the left hand side, working upon a central fulcrum fixed to the top rail of the loom, is the common medium of motion. This is actuated in the ordinary manner by the shell wheel below, making one motion for each pick, precisely as the common loom.

Connected with this are the other horizontal levers, one above and the other below the jacquard machine. The lever above lifts such hooks as are selected by the pattern card to be raised. The remaining hooks, supported on the descending footboard, are brought down by the other lever at one and the same time; the descending footboard being connected to the horizontal lever frame by two upright rods, one in front of the harness and one behind.

The rod shown at the right hand, from the top of the loom up to the jacquard, is for the purpose of opening and closing the card cylinder, and is worked by an eccentric on the main shaft of the loom. The rotary motion to the card cylinder is communicated by the upright shafts connected by bevel and pinion wheels with the picking and box motions in such a manner that on turning the loom either backwards or forwards the whole of the motions relating to pattern cards, shuttles, boxes, and picking are kept in their correct relative positions, an advantage which will be fully appreciated by the practical weaver.

Another great advantage is obtained by the graduated hooks and the harness tied in a beveled instead of level position, whereby the back part of the shed opens first, and consequently opens to a larger extent than the front part, thereby giving a greater and clearer space for the passage of the shuttle.

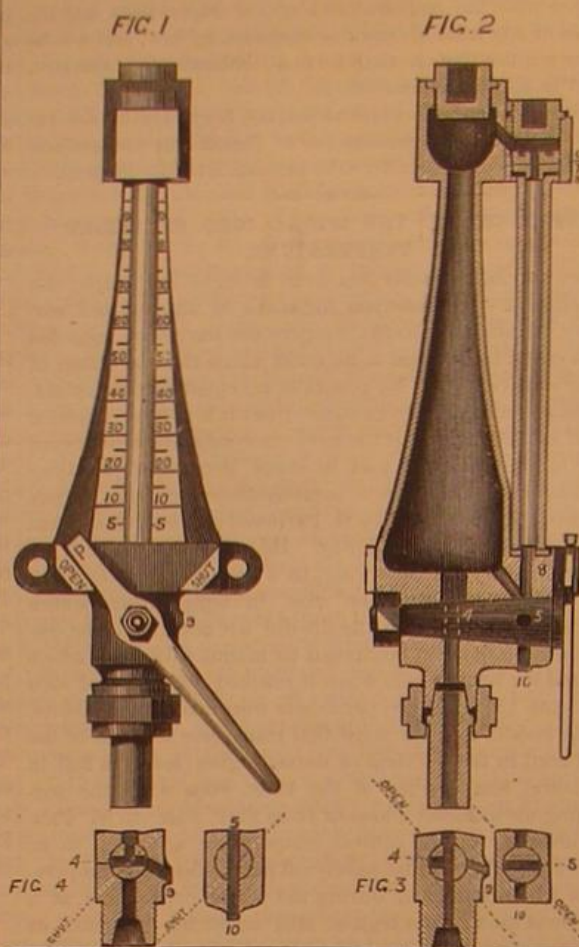
It will be at once noticed that, as the hooks in lifting have only to move half the distance of the shed required, the motion is very steady and the friction reduced to its lowest point; greater facility thus being given for speed, wherever that is desirable, combined at the same time with a perfection in the work otherwise unattainable.

Another lever fixed on the left hand of the loom under the top rail is, by a catch arrangement, brought into action when the sheds are very variable in weight, as, where one or more picks of weft are upon the surface of the cloth, and the next on the back of the cloth. This lever,

with a weight attached, is lifted with the light shed, so as to enable the loom to bring back with ease the large portion of the descended shed, thus equalizing the working motion of the loom under any varying circumstances.

ALLAN'S PRESSURE GAUGE.

We illustrate from *The Engineer* an improved form of the Allan gauge, as simplified by Mr. Alexander Allan, Jr., of



Scarborough, England. The principle on which this gauge works consists in indicating pressure by the compressed condition of a measured volume of air within the gauge tube; this is acted upon by water—condensed steam—as a piston, contained in a bent pipe attached at one end to the gauge, and at the other to the boiler or vessel whose pressure is to be indicated. The gauge is a hollow pillar of brass of a differential internal capacity, connected by passages at top and bottom to a glass tube in which the surface water line indicates the pressure opposite a graduated scale. There is, as we have said, but one cock on the gauge worked by a handle with pointer, P, moved over a quarter of a circle only between two stops. The pointer, P, at "open" is open to

the boiler to show pressure, and at P is "shut" for admitting a new spring of air into the gauge by apertures opened to the atmosphere. On the lower part is the usual screw union for connecting the gauge with the steam space of the boiler, by the exposed bent pipe, which will collect clear water by condensation. In order to work the gauge it is necessary to begin with the pointer, P, at "shut;" the exposed bent pipe will soon condense steam to give a supply of water, which will be known by the reduced temperature of the pipe. When sufficient water has been collected in the bent pipe, the pointer is turned to "open," when the water will rise until its level shows the pressure. The first indication may not be correct from the presence of some air in the bent pipe over the true measure; by again turning the pointer, P, to "shut," the incorrect spring and water will leave the gauge and a new spring of air will be admitted. On re-opening the cock the true pressure will be shown in the glass tube opposite the index. With a supply of water in the bent pipe this test or correction can be repeated hourly, but it is not necessary to change the air spring for months.

In the accompanying engraving, Fig. 1 is a front elevation of the gauge, showing the glass tube, part index on pillar, stops "open" and "shut," handle and pointer, P, at "open" to show pressure; Fig. 2 is a side elevation in section showing passages connecting the gauge with the glass tube, the nut, 5, washer, 7, india rubber rings, 8, cock and passage, 4 and 5, and the position of 5 to 10, with pointer, P, at "open." Fig. 3 gives end sections of cock and plug at 4 and 5, in the plug, to 9 and 10, with the pointer, P, at "open;" the angular line shows the direction of the handle and pointer, P; Fig. 4 gives similar sections, and shows the position of the passages, 4 and 5 to 9 and 10, changing the air spring, and the angular line showing the direction of handle and pointer, P, at "shut."

This simple and ingenious gauge deserves more notice and popularity than it has received. The old Allan gauge has been worked with great success for many years, and the new gauge is much better in every respect.

Simple Tests for Flour Adulterations.

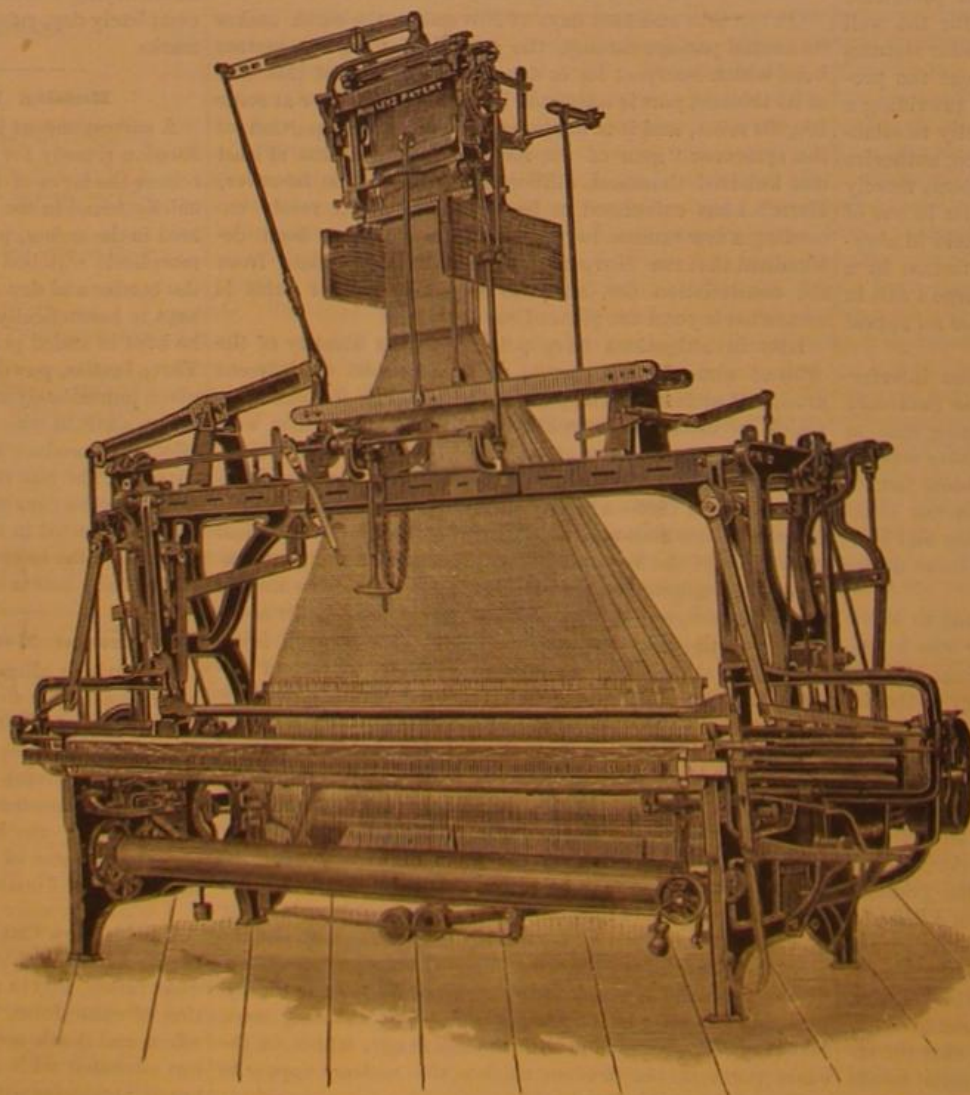
Dr. Himly, Professor of Chemistry at the University of Kiel, has suggested a method by means of which any person of ordinary intelligence may test the amount of adulteration of flour. It is based upon the fact that chloroform is specifically lighter than nearly all the substances usually employed for these adulterations, such as lime, chalk, barytes, plaster, marble, bone-powder, etc., while the genuine flour is again lighter than chloroform, in which none of the above named substances are soluble. The testing process is simple, and all the apparatus required is a small test tube about $\frac{3}{8}$ inch in diameter, and 4 or 5 inches long. A teaspoonful of the flour to be tested is placed in the test glass and chloroform poured on to fill the vessel to about three quarters of its length, when it is well shaken, and then placed in a upright position, so as to remain undisturbed until the various substances mixed together have had time to find the level assigned them by their specific gravity, the flour swimming near the surface at the top of the vessel, while the mineral bodies will sink to the bottom. It should be observed that unadulterated flour often shows a slight filmy deposit of a grayish or brownish color, which it must be supposed is stone-dust, produced in grinding. A white deposit, however, will invariably indicate an adulteration with one or another of the substances mentioned above. If the materials are weighed before and after separation, the amount or degree of adulteration may be pretty accurately ascertained.

Artificial Ivory.

L'Union Pharmaceutique gives the following recipe for making artificial ivory: Two parts of caoutchouc are dissolved in thirty-six parts of chloroform, and the solution is saturated with pure gaseous ammonia. The chloroform is then distilled off at a temperature of 85° C. The residue is mixed with phosphate of lime or carbonate of zinc, pressed into moulds and dried. When phosphate of lime is used the product possesses to a considerable degree the nature and composition of ivory.

An Immense Block of Granite.

There was recently quarried without the use of powder, at the Barre granite quarries, for the use of the Oliver Granite Works, of Rutland, a block weighing about six hundred and eighteen tons, being forty feet long, seventeen feet high, and ten feet thick. This immense stone is said to be perfect in every respect, and is believed to be the largest block of granite ever quarried in the State.—*Rutland (Vt.) Herald*.



AINLEY'S DOUBLE SHEDDING HARNESS JACQUARD LOOM.

A NEW DREDGING APPARATUS.

In the dredging apparatus represented in the engraving, propellers driven by suitable motive power work partially in the material or sand bank to be removed, so causing whirlpools and bringing the mud or sand into a state of suspension in the water, where the current washes it away. The propellers are carried at the ends of beams, which, at their opposite ends, are hung to a lateral frame of a barge or vessel. The ends of the beams carry back of the propellers rollers to run upon the mud or sand, and prevent the propellers and beams from entering too deeply into it.

In the engraving, A A are the beams, of suitable construction and length, that are hung at the upper ends to a shaft A¹, that is supported in bearings of a lateral frame, A², of a suitable barge or vessel, and driven by a steam engine on board of the same. The driving shaft, A¹, revolves, by beveled gear wheels, the shafts, B¹, that turn in bearings of the beams, and are provided at their lower ends with a propeller or propellers, B. Each propeller or stirrer, B, consists of a four-bladed screw of unusual strength, with two blades set in advance of, and being somewhat longer than, the other two. The propellers are lowered to the bottom of the river or canal, or other water courses, and then revolved to work on the sand bank or material to be removed, so as to stir up the same and bring it into a sufficient state of suspension in the water to admit of its being carried away by the current. A roller or rollers, C, are arranged back of the propellers, turning in suitable bearings of the beams, A, to prevent the propellers from entering too deeply into the mud so as to break or get stuck.

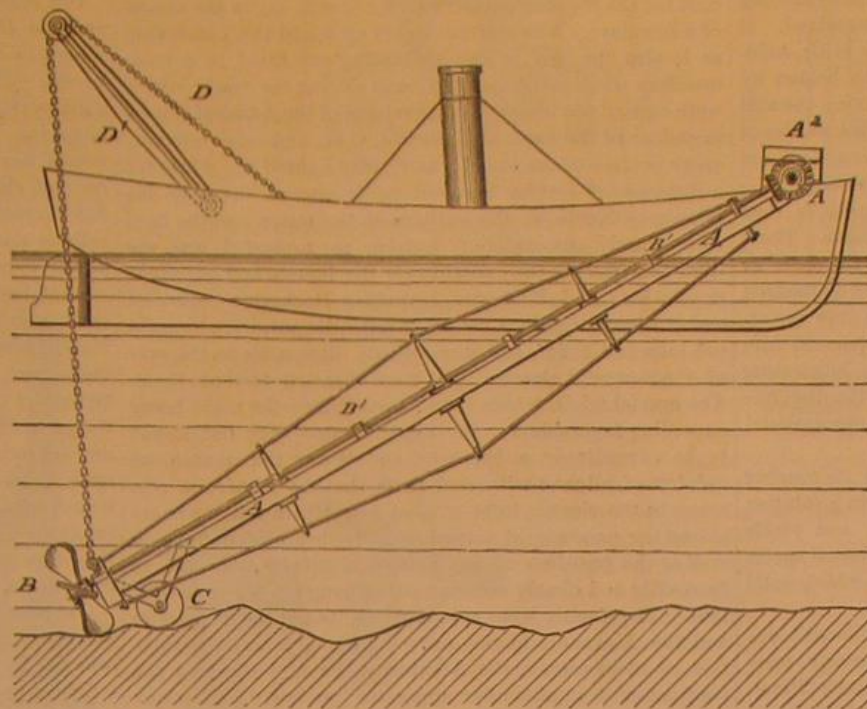
The propellers and beams are lifted by means of chains, D, and crane, D¹, into position alongside of the vessels, when the work of removing the sand is to be interrupted, the propellers serving then to move the vessel.

This invention was patented through the Scientific American Patent Agency, November, 7, 1876, by Messrs. J. J. Van Rietschoten and W. Houwens, of Rotterdam, Netherlands.

IMPROVED SHIP'S SPEED INDICATOR.

We illustrate, from *The Engineer*, a ship's log or speed indicator, patented by Mr. W. de Normanville, of Bridge-road, Hammersmith, England. Fig. 1 is a longitudinal section of the apparatus; Fig. 2 is a transverse section; Fig. 3 is a plan with some of the parts removed; and Fig. 4 represents separately the dial and index. *a a* is the case of the instrument; it is constructed of cast iron, and is provided with a hinged lid, *a*¹, immediately beneath which there is a plate of stout glass secured in a watertight manner. Lugs are provided, by which the instrument is secured to the rail of the ship or vessel; *a*² is a stuffing box in the side of the case to receive a spindle, *b*, carrying a universal joint, *b*¹, through which the connection with the rotator is made; *a*³ is a screw plug in the bottom of the case, which, when taken out, leaves a hole admitting of the introduction of a turn-screw to insert or remove the small screw pin, *b*², by which the spindle, *b*, is held in a socket, *c*¹, at the end of the axis, *c*. The frame which carries the axis, *c*, and the other working parts of the instrument is fixed to the bottom, *a*², of the case, so that the whole of the mechanism comes out with the bottom when that is removed; *c*² is a disk on the axis, *c*; it bears against friction rollers, *d d*, mounted on the frame so that the axis may revolve freely, notwithstanding the strain to which it is exposed in towing the rotator through the water; *c*³ is a pinion on the axis, *c*; it drives a wheel, *e*¹, on an intermediate axis, *e*, on which again is a pinion, *e*², driving a wheel, *f*¹, fixed on an axis, *f*; *f*² is another similar wheel on the same axis, but able to turn upon it. It is fixed to the spring box, *g*, in which is a coiled spring, having one end fixed to the axis and the other to the interior of the spring box. This arrangement constitutes a regulating apparatus; the spring, being wound up by the action of the rotator, is the maintaining power driving the indicating instruments, to which it imparts a regular velocity free from sud-

den changes. The wheel, *f*¹, drives a pinion on the axis, *h*, on which is also a spur wheel, *h*², gearing with a pinion on the main axis, *i*. In the middle of the axis, *i*, is a pin, which serves as an axis for the two weighted arms, *k k*; they have weights at their ends arranged so that the divergence of the arms is not affected by the pitching of the vessel. *l l* are links connecting the arms, *k*, with the sliding collars, *m m*. When the instrument is in use the centrifugal action of the weighted arms compresses the springs, *d n*, more or less, according to the speed of rotation. On one of the collars, *m*, there is a disk, *m*¹, against which a friction roller, *o*¹, carried by the lever, *o*, bears. The lever, *o*, carries at its upper end



DREDGING APPARATUS.

an arc, attached to which is one end of the fine chain wound round a barrel at *q*¹, on the axis on the index. *r* is a light spring surrounding the axis, *q*², and attached to it at one end, while the other end is fixed to the frame; it serves to hold the index back against the action of the lever, *o*, to keep the chain, *p*, always tight, and to hold the roller, *o*¹, against the disk, *m*¹. The dial is graduated to indicate the speed of the ship in knots per hour. The prime motor of this instrument is a small screw or rotator similar to that used in other logs, drawn after the vessel by a line some 150 feet in length. The shaft of the rotator is about 12 inches long by about 1 inch in diameter, made of such specific gravity that if left to itself it would slowly sink, but it is easily kept up by the

line to which it is attached, drawing it through the water, some 8 feet below the surface. This rotary motion of the screw is conveyed by the line to the rest of the mechanism.

A New Autographic Process.

Autography is a long known process by which manuscript, or drawings, made on common paper by means of a peculiar kind of ink, may be transferred to a lithographic stone and then printed.

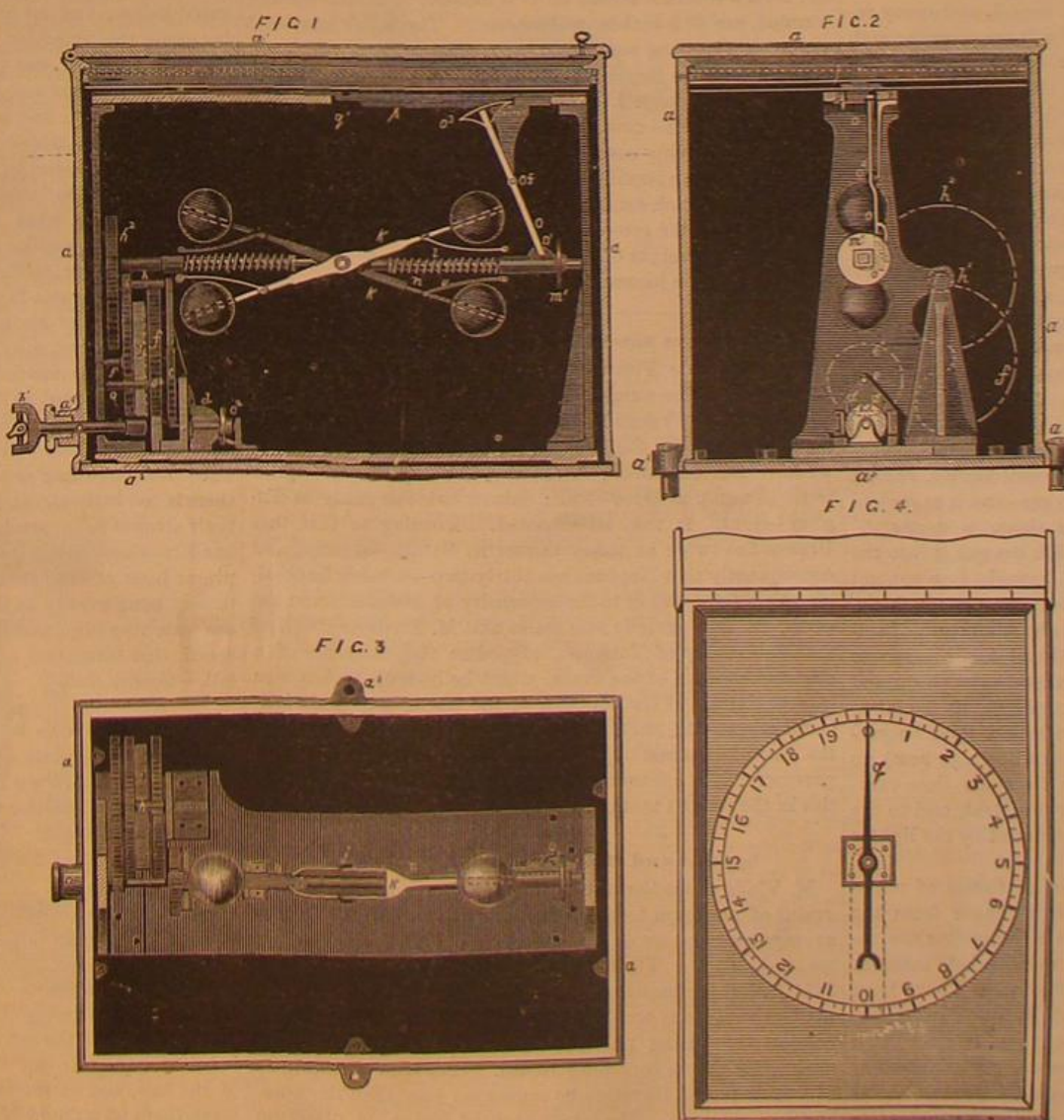
A new method, which is said to be both simple and cheap, is described by Professor G. O. Sars, of the University of Norway, in the *American Journal of Science and Arts*. The drawing is done on common letter paper, which, on one side (where the drawing is to be made), has been coated, by means of a sponge, with a thin film of starch. As it is not well for the shading to use quite glossy paper, it is a good way to give it a granulated surface by pressing it against a lithographic stone. By using for this purpose stones with more or less smooth surface, the paper will assume any degree of smoothness required, according to the character of the drawing. The next process is to fasten the paper to a sketching board or a piece of pasteboard; the drawing is then made by means of the lithographic crayon.

The paper must be cut to the size intended for a full plate, and the drawings arranged in the same order as they will have to appear in the printed plate. The method is the same as in common drawing with lead pencil, or rather crayon. The figures should, however, first be sketched in outline on common paper and then transferred to the prepared paper in the usual manner, by means of transparent paper and plumbago paper, blue paper, or, still better, red paper, the transferring being done with a lead pencil that is not too soft. The details of the figures, the shading and finer structural conditions, may be drawn off-hand with the crayon on the prepared paper, after the outline has been transferred. Any correction or change in the drawing can easily be done by erasing with a fine scalpel, taking care only that the starch film be not injured. When the plate is finished to satisfaction, it is transferred to a common smooth lithographic stone, in the following simple way: The back of the paper is moistened with water containing a small portion of nitric acid; and, after having been put for some time between moistened soft printing paper, the plate is laid, face downward, on the stone, which then for a moment is put in the press. To make more sure of it the outside of the paper may be slightly rubbed with the finger; if then the paper be stripped off, the drawing and the entire film of starch will remain on the stone, the figures being reversed. Now the

stone is to be treated in the common way with gum arabic and a weak etching, and will then be ready for printing. The whole process of transferring the drawing from the paper to the stone is simple, but requires practice and great care. This should, therefore, be left to the charge of a professional lithographer. This process is especially well adapted to the uses of zoologists, microscopists, and naturalists generally, as it enables them to prepare their own illustrated plates at minimum expense.

Potato Bug Cure.

Many different means have been tried to destroy the beetle, but without effect, until the present method was found, and this method is so effective and so cheap, that he must be a very careless farmer who still lets his potatoes be ruined. It is the following: Take 10 lbs. of lime and mix it well with 1 lb. of Paris green, which is in no way deleterious to the potatoes, giving 11 lbs. of mixture for each acre. Get a small wooden box, 10 inches by 8 inches, and 6 inches deep, and nail a piece of millcloth, as used for sifting by wheat millers, instead of a wooden bottom beneath, also a piece of lath across the middle of the open top as a handle for shaking the box. Every morning from 5 to 9 o'clock or longer, as long as the dew is on the plants, this mixture has to be applied. Children of 8 to 12 years can easily do it, by putting about one pint into the box and sprinkling it as dust by slow shaking on the leaves of



NORMANVILLE'S SHIP'S SPEED INDICATOR.

the plants. I guarantee that if this is done at the beginning of the growth in spring, as soon as the first insects are seen, the plants will remain perfectly free. Within two days all the beetles will have disappeared, and this result is quickly arrived at, even if the field has been real ady completely devastated, and only the stalks remain covered with the insects and their larvae. The cure never fails, and it has already been proposed by our farmers in the papers to compel all potato growers by law to apply this mixture on all their fields, for then, within two years, the bug would be entirely destroyed.

Distillation of Crude Petroleum.

The crude oil to be treated is first placed in large settling tanks, to allow the subsidence of any water intermixed. It is next pumped into large upright cylinders, or stills, holding about 12,000 gallons, and these are generally heated by steam alone. In the iron worms proceeding from the still cupola and surrounded by cold water, the various grades of naphtha, constituting about 15 per cent of the crude oil, are condensed, *separatim*, and conducted to separate tanks.

The crude oil remaining in the naphtha stills is then pumped into stills heated by direct fires underneath. These charges are distilled to coke, which remains in the stills, or to a thick residuum, which is drawn off and used in making fertilizers, etc. The uncondensable gases pass into the atmosphere, and the oils are condensed and separated into crude burning oil, intermediate oil, and crude lubricating oil. Each of these products is redistilled, and the distillate from each separated, as before, into lighter, intermediate, and heavy oils.

Number one from this second distillation is thoroughly agitated with strong sulphuric acid, and then with a solution of caustic soda. It is afterwards redistilled, and yields about 80 per cent of finished kerosene and mineral sperm oil, and nearly 20 per cent of dense oils, from which solid paraffin is obtained.

It was in the agitator described, and after the second distillation, that the strange fire occurred, as recently mentioned in the SCIENTIFIC AMERICAN, at Hunter's Point. Most probably the usual quantity of 5 per cent of sulphuric acid had been added to unite with the remainder of the lighter products, and those substances causing the unpleasant odor of crude or partially crude petroleum. The important question here arises: Does the inattention or ignorance of workmen ever allow an undue quantity of the dangerous hydrocarbons to pass into the agitator, there to come in contact with great heat and strong chemical action? We know but too well that there is scarcely a manufacturing process of any kind that is free from such irregularity, and in extensive refineries the impossibility of managers being always at hand, and the necessary frequent engagement of new hands, might easily occasion such a difficulty and such an opportunity for unexpected chemical combinations.

It has been already stated that there is doubt as to whether it was a stream of cold water or a jet of steam which was turned into the agitator. It is much more probable that it was steam than water, because one of the first efforts in the distillation is to get rid of all water in the oil, and many refiners, I am informed, blow steam at high pressure through the crude petroleum, to aid in eliminating the naphtha, before the oil is run into the fire stills. Whether steam thus introduced is a safe process, or whether unlooked-for circumstances may not develop a danger always slumbering amidst such violent action, is a question for grave consideration. In the case in point I do not know whether an excess of the lighter hydrocarbons were allowed to enter the agitator, but if it were so, and high pressure steam admitted—and there could also be too much pressure and heat for safety—danger might well be feared, although it, like an impending steam boiler explosion, might long be averted.

In the lighter and more dangerous hydrocarbons the quantity of carbon ranges from 89.55 to 92.31 per cent, and hydrogen only 7.69 to 10.45 per cent. As the chief danger from fire is known to arise from these lighter products, it is evident that the carbon in them, and not the hydrogen, is the dangerous substance. Carbon, as is well known, cannot inflame except by the presence of oxygen, and it is reasonable to believe that, when oxygen in steam is vastly expanded and attenuated by the heat which has put it into the form of steam, and when the latter is brought into contact with a substance so rich in carbon—the latter also much elevated in temperature and expanded by the admixture of sulphuric acid—there are furnished additional facilities, so to speak, of combination between the oxygen in the steam and acid and the carbon of the lighter products, if the latter exist in too great proportion. There would then be mechanical division of oxygen (by expansion through heat), to promote chemical action, the latter at the same time varying, in an unknown ratio, to the heat equivalent, and to the quantity of carbon unintentionally introduced by the lighter products.

Besides this danger from the ignition of fumes of naphtha, already mentioned, there may be a danger from the sudden evolution of electricity, which is sometimes generated in large volumes in the most unexpected manner. Should this happen, the chemical combinations I have been considering might be hastened, or made at untoward times. Two volumes of hydrogen and one of oxygen, if placed in a tight vessel, can be condensed into water, with explosion, by the passage of an electric spark, with the production of a great amount of heat. Perhaps, in a similar manner, electricity, suddenly evolved, might cause instantaneous combi-

nation of the oxygen in steam or water with the carbon of certain of the petroleum products—the heat consequent upon such combination inflaming the whole of the oil.—*American Exchange and Review.*

The Electric Light at Sea.

The *Téméraire*, eight, 8,412 tons, 7,000 horse power, Captain M. Culme-Seymour, ironclad double turret ship, having been fitted with the electric light, a number of experimental trials were lately carried out on board in the repairing basin, Chatham dockyard, with the object of enabling the authorities to be satisfied as to the official working of the light previously to the vessel taking her departure from this port for the Mediterranean, which she will do in the course of a few days. The electric lights on board the *Téméraire*, as is also the case in the *Alexandra*, are fitted in a commanding position of the ship; and during the trials, which were carried out under the supervision of the Admiral-Superintendent of the yard, C. Fellowes, C.B., and other officials, every portion of the vessel was vividly lighted up, while for a distance of several hundred yards around the ship the minutest objects on the surface of the water and the land were clearly discernible. Indeed, so powerful was the light that during the experiments the houses and buildings in Chatham and Rochester, including Rochester Cathedral and Rochester Castle, a couple of miles distant, were brought out into full relief, and were clearly discernible as the rays of the powerful electric light were directed towards them. The crucial trials, which lasted some time—the night being exceedingly favorable for the experiments—were considered to be exceedingly satisfactory, and it was the unanimous opinion of all who witnessed them that the *Téméraire* possesses in the electric light a most powerful auxiliary in enabling the presence of torpedoes and other obstructions, as well as the positions of any vessels, hostile or otherwise, to be readily and clearly ascertained, although some miles distant. The electric light apparatus on board the *Téméraire* and the *Alexandra* having proved such a valuable acquisition to those vessels, the Admiralty has now directed the contractors to put similar apparatus on board the armor plated turret ship *Dreadnought*, which is now fitting for sea at Portsmouth.

Compound Locomotives in France.

M. Mallet has submitted a report to the French Academy of Sciences relative to three compound locomotives recently built at the Creuzot Works for the railroad between Bayonne and Biarritz. There are two exterior cylinders acting relatively at right angles. Ordinarily the smaller cylinder first receives the steam, and the latter then passes into the larger cylinder in the usual way; but when the engine is started, or when a heavy grade is to be surmounted, a special valve arrangement allows of the steam entering both cylinders directly from the boiler, so that the engine works no longer on the compound principle.

The locomotives weigh from 19 to 20 tons each. The two cylinders are respectively 9.3 and 15.6 inches in diameter, with a uniform stroke of 17.5 inches. The four wheels, coupled, are 46.8 inches in diameter. The boiler has 481.5 square feet heating surface.

The road from Bayonne to Biarritz is 4.8 miles in length, and has a grade over 1.8 miles of .015 to 1. The locomotives have traveled over 24,000 miles in all, and the results obtained are highly successful. There was no lack of stability even when running at 24 miles an hour, a high speed for wheels of such small diameter. With regard to expenditure of fuel, the gross amount was 148 lbs. of Cardiff coal per mile—the weight of the train being from 40 to 75 tons, exclusive of the locomotive.

More Satellites to be Discovered.

M. Wilfred de Fonvielle writes to the London *Times* to point out that the number of the satellites of the heavenly bodies probably varies in geometrical progression, of which the ratio is two for the great planets from the earth. Thus we have but one moon, Mars twice as many—two; Jupiter twice as many as Mars—four; Saturn twice as many as Jupiter—eight. It may be supposed, according to this, that Uranus has twice as many moons as Saturn—sixteen, and consequently that Neptune has thirty-two—it being impossible to see these owing to the immensity of distance from the earth. M. de Fonvielle also states that M. Frederic Petit, of the Observatory of Toulouse, advocates the existence of a second satellite of the moon, which he believes he has seen several times. If the diameter of the satellites of Mars is as small as reported, such bodies could easily revolve round the moon unnoticed by astronomers on the earth, and their presence might account for some of the known irregularities in the moon's motion.

Specific and Melting Heat of Platinum.

M. Violle states that the quantity of heat yielded by 15.4 grains of platinum from the melting point to 59° Fab.—the average temperature of the calorimetric liquid in the experiment—is 166.4°. The temperature of fusion of platinum is 3234.2°, but the increase of specific heat of the metal with the temperature is accelerated, doubtless, in the neighborhood of the fusing point, the platinum passing through a pasty state before becoming liquid. The true temperature of fusion should therefore be somewhat less than the number thus obtained. The latent heat of fusion of platinum is 80.8°. The melting point of silver is 1749.2°.

The Horse's Back.

The first thing to observe in judging of a horse, so far as his back is concerned, is the length of it. A long back is a weak back the world over, and in every instance. By superior excellence of structure in other respects, the weakness of the back may be, in some measure, made up; but the horse can never be the horse he would have been had his back been a shorter one. We do not care how short a horse's back is; for it is a sure evidence that he can carry or drag a heavy weight a great distance, and not tire; neither, if he be speedy, will two or three seasons of turf experience break him down, as is the case with so many of our speedy, long-backed horses.

Old Morrill and Flora Temple are instances in the past; and the famous grandson of Old Morrill, Fearnought, and Taggart's Abdallah, are good illustrations among later horses. This conformation of the back was, in our opinion, a grave objection against Young Morrill and Rysdyk's Hambletonian. In spite of all their excellence both of them would have been decidedly better horses had they been coupled shorter and more strongly on the back. If Young Morrill had had the back of his sire—one of the most marvellous specimens of perfect bone structure and muscular power ever bred—he would never have gotten so many swayed-backed colts as now stand to his charge. The same was the case in even greater measure with Rysdyk's Hambletonian. We know what he did in the stud. We know that, crossed on mares of a certain pattern and blood, especially on the daughters of American Star, the son of the great Henry, he gave us trotters of the highest speed, and second to none in endurance. But all this was true in spite of his back, not because of it; and where he sired one colt closely and strongly coupled up in the back and loins (as every colt should be) he sent forth five or ten without this admirable construction, nay, representatives of the other form.

One may attend the fairs of the country, and eight out of every ten of the Hambletonian stallions exhibited will present to the eye this unfortunate peculiarity. In reply it will be urged that these long-backed horses have an "enormous stride." We grant that they do stride a great distance, but we also notice that their feet stay under the sulky a long time. The power to "twitch their feet out from under the wagon," as an old driver once expressed it, does not belong to them. One never finds it in connection with a long back. We wish to breed colts with an "enormous stride" as earnestly as any one; but we wish that these colts blessed with an "enormous stride" should have the knack also of gathering quickly.

But, in respect to the length of the stride, we have this to say—that it is not in any way the result of the length of back, but the position of the pasterns, the slope of the shoulders, and the position of the great bones of the hind-legs. There must be length somewhere, of course, or else the horse cannot stride far; or, if he attempts it, will be forever "over-reaching," or "forging," as the phrase goes. But where should the length be located? That is the question to be answered; and we say, the length should be located below, and not above. The length should be put in between the shoulder joint and the hams of the horse. There is where it was put in Flora Temple, and which gave her so tremendous a stride for so small an animal; and there, too, is where you find it in Dexter, Fearnought, and Taggart's Abdallah, whose stride on a sandy track we have measured and found to be twenty feet! If that is not an "enormous stride" enough to satisfy any one, we should be pleased to know what is; and yet Abdallah had a short, muscular, Morgan-like back, as his sire, Farmer's Beauty, and his grandsire, Gifford Morgan, had before him.

There never was a falser theory, or one calculated to beget more mischief among breeders, than this—that we must breed long-backed colts, in order to get length of stride. We have always noticed that the horses long in the back, and loosely coupled at the hips, are the horses that always come to the judges' stand padded and swathed with "pads," and "shields," and "protectors" enough to stock a small-sized horse-clothing establishment. The reason is, because there is too little strength in the back and loins to deliver their strokes in a straight line, or to "catch" quickly and handily when they "break." It is at such a time—the supreme hour of the animal's life, perhaps—when fame and money hang evenly in the balance, and ten thousand eyes are watching him, and the horse is going at the top of his speed, that formation and perfection of organic structure tell.—*Golden Rule.*

How to be a Successful Sawyer.

The following hints are given by Emerson, Smith, & Co., in the "Sawyer's Own Book":

- 1st. Acquire sufficient knowledge of machinery to keep a mill in good repair.
- 2d. See that the machinery and saws are kept in good order.
- 3d. It does not follow because one saw will work well that another will do the same on the same mandrel, or that even two saws will hang alike on the same mandrel. No two saws can be made that will run alike.
- 4th. It is not well to file all the teeth of circular saws from the same side of the saw, especially if each alternate tooth is bent for the set; but file one half the teeth from each side of the saw, and of the teeth that are bent from you, so as to leave them on a slight bevel and the outer corner a little the longest.

5th. Never file any saw to too sharp or acute angles under the teeth, but on circular lines, as all saws are liable to crack from any sharp corners.

6th. Keep your saw round so that each tooth will do its proportional part of the work, or if a reciprocating saw, keep the cutting points jointed on a straight line.

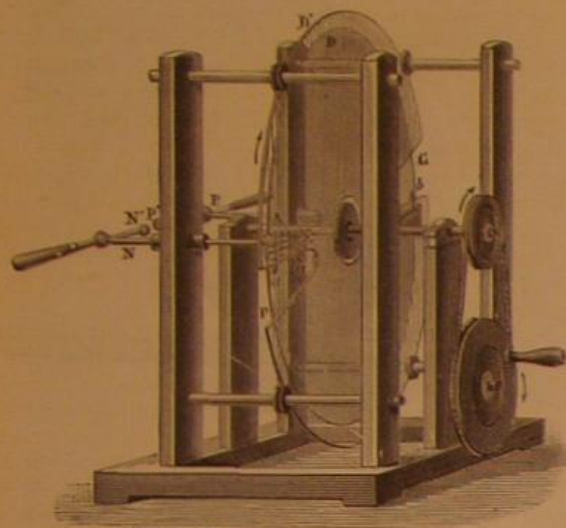
7th. The teeth of all saws wear narrowest at the extreme points; consequently, they must be kept spread so that they will be widest at the very points of the teeth, otherwise saws will not work successfully.

8th. Teeth of all saws should be kept as near a uniform shape and distance apart as possible, in order to keep a circular saw in balance and in condition for business.

NEW ELECTRICAL MACHINES.

In the accompanying illustrations, taken from a new work on static electricity, published in France by M. Mascart, are represented the latest forms of the Holtz, Carré, and Thomson electrical machines. The Holtz machine, Fig. 1, acts as a continuous electrophorus. It consists of a vertical plate, D, of thin glass varnished with gum-lac, which is

Fig. 1.

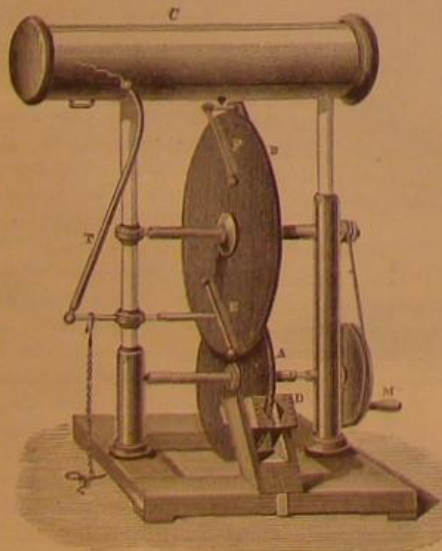


rotated at a speed of from 5 to 10 revolutions per minute. In face of this plate and at a short distance from it is a fixed plate, D', slightly larger and pierced with a central opening, through which passes the axis of rotation. In this plate are made two rectangular apertures, F and G, at the extremities of the same diameter. On one of the sides of each one of these apertures is attached a layer of paper, A, applied on both sides and having one or two projecting portions, a, terminating in the openings, F and G. The two layers, A and B, serve as inducers, and are symmetrically disposed with reference to the axis of rotation. The first is represented in dotted lines in the engraving, in order to exhibit the portions in rear of it. On the other side of the movable plate are placed two insulated conductors, P and N, terminated by combs, which are directed toward the paper layers. These two conductors may be united by a kind of exciter with ebonite sleeves, the arms of which may be approached or withdrawn at will.

When the apparatus is operated, the conductors, P and N, are connected by bringing in contact the balls, P' and N'. The movable disk is then turned in a direction contrary to that of the paper points, and one of the layers, a, is electrified. For the latter purpose a plate of ebonite, electrified by rubbing with the hand or with cat skin, may be used. The fluid, supposed to be carried to a, persists as long as the machine is in operation, but disappears as soon as the latter stops, so that to begin again it is necessary to prime the instrument anew.

In the Carré machine, represented in Fig. 2, this difficulty

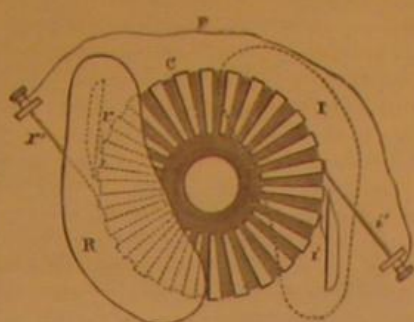
Fig. 2.



is sought to be avoided. The disk, A, of ebonite or glass passes between two leather cushions, D, and is carried directly on the axle of the crank, M. A pulley on the same shaft communicates, by means of a cord, rapid rotation to

another and larger ebonite disk, B. In face of the latter are two combs, E and F; the second of which is opposed to a fixed leaf of ebonite furnished with paper layers, terminating in points and designed to serve as a second inducer, as in the Holtz machine. The upper comb communicates with

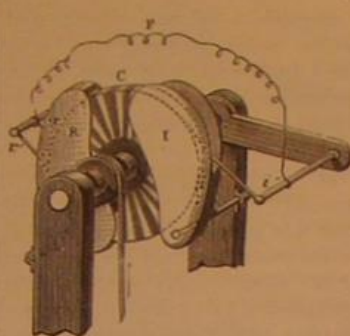
Fig. 3.



an insulated conductor, C, and the lower comb is also insulated, or communicates with the soil. An arm, T, serves as exciter.

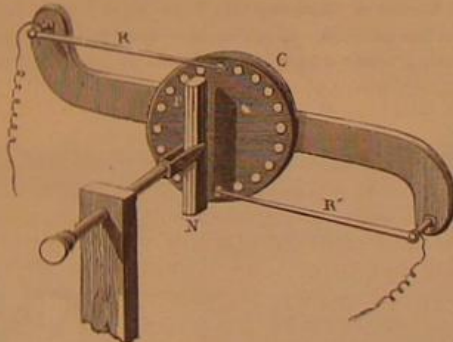
The remainder of our illustrations relate to the Thomson machines. Figs. 3 and 4 represent what is known as the charge reproducer. A wheel, C, of ebonite carries a certain number of insulated metallic plates, disposed in sectors on the two faces, and appearing at the circumference like the teeth of a gear wheel. Two metallic plates, I and R, bent so as to envelop completely half of the wheel (one of these is indicated by dotted lines), serve both as inducer and receiver, that is to say, they act by induction on an intermediary conductor, F, and then receive by effect of the motion the electricity so developed. Hence it results that the charge of each of them augments at first in geometric progression, as in all analogous apparatus. Two receiving springs, i and r, communicating separately with the metallic envelopes in the interior of which they are placed, receive the electricity carried by the different sectors and communicate it to the corresponding envelopes. Two other springs, i' and r', called conductors, placed behind the former ones with reference to the direction of rotation of the wheel, are connected by the wire F.

Fig. 4.



Supposing that one of the inducers, I, for example, be first charged with negative electricity. The corresponding spring, i, is then charged with positive electricity, which it communicates to the successive teeth of the wheel, which, by the receiving spring, r, transmit this electricity to the second inducer, R. The opposite spring, i', is similarly charged with negative electricity, which comes back by the sectors and by the receiving spring, r', to the first inducer, I.

Fig. 5.



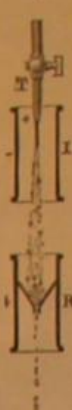
As constructed, the wheel is not more than 2 inches in diameter, and may be set in motion by the motor of a Morse telegraph instrument. A few seconds after it is started it produces brilliant sparks. A dry pile of 40 elements, the two poles of which were placed in communication separately with the two conductors, sufficed to charge the machine or suddenly to reverse the electrical signs.

Thomson's tension equalizer, Fig. 5, works like a series of contacts by a proof plane, in order to establish on a conductor the tension which exists in the surrounding atmosphere. A disk of ebonite, C, turning around a vertical axis, carries a certain number of metal pins, on which are applied two springs, R and R', in communication with the two electrodes of an electrometer. If one of these springs is submitted to the influence of an electrified body, the keys which detach themselves from it in succession carry continuously electricity of contrary sign to that of the inducing body, until the electric density at the extremity of the spring becomes null. If the two springs are at the same time submitted to the influence of two conductors at different tensions, equilibrium will be attained at the end of a certain time, and quite rapidly, because the electricity carried off at one of the springs is taken to the other. The difference of

tension of the two springs, or of the two electrodes of the electrometer, will be proportional to that of the two inducing bodies.

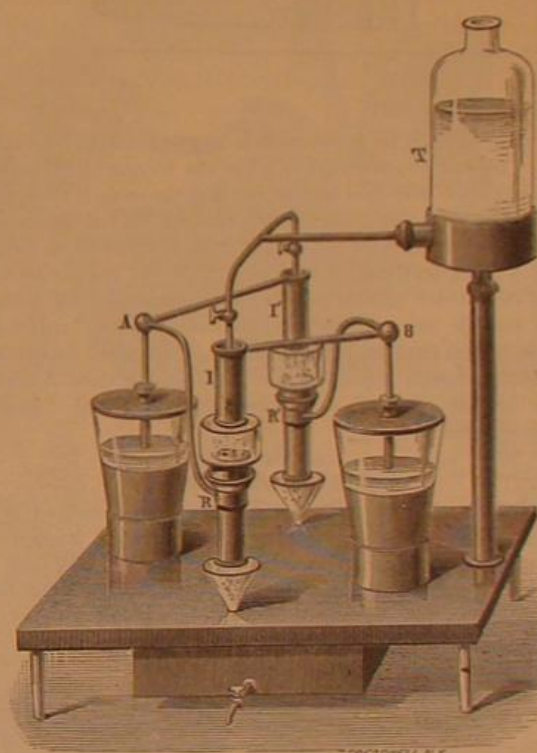
In Fig. 6 we represent another Thomson machine, in which T is a metallic tube, communicating with the soil. This is placed in the interior of a metal cylinder, I, which may be termed the inducer, having negative tension. This tube is electrified positively; and if liquid drops are allowed to escape therefrom, they carry with them contrary electricity, which is reproduced indefinitely. These drops fall into another metal cylinder, R, the receiver, which has a funnel within. The electricity of the drops expands over the surface of the receiver, and the drops escape in a neutral state from the spout of the funnel. The charge of the receiver then augments more and more until sparks are produced between the cylinders, or until the drops no longer fall into the receiver, on account of their being thrown off laterally by the electric repulsion which they encounter. Under such conditions it is necessary to maintain the tension of the inducer, I, by a foreign source. But it will easily be seen that two similar apparatus may be disposed so as to react one on the other, and to augment reciprocally their electric charges.

Fig. 6.



For this purpose the receiver, R (Fig. 7), of the first, communicates with the inducer, I, of the second, and the receiver, R', of the second with the inducer, I, of the first. The drops which fall from the second inducer, I', are then charged with negative electricity, which is collected in the receiver, R', which augments the charge of the first inducer,

Fig. 7.



I. Two conductors are united with the interior covering of two Leyden jars, A and B. These jars are covered exteriorly with tin, and contain a certain quantity of concentrated sulphuric acid. In the liquid are plunged lead rods terminating below with leaden plates. The rods are surrounded with glass tubes, and pass through an ebonite cover, so that the absolutely dry air contained in the bottles is not affected by the atmosphere. If the glass (Glasgow flint) is of good quality, the insulation of the bottles may be so perfect that the electric loss may not exceed one one-hundredth of the charge, in three or four days.

Under these conditions, one of the jars being electrified at a tension so weak as not to be appreciable but with a very delicate electrometer, the valves are opened in order to allow the water to escape drop by drop. These drops become subdivided into very small ones, which separate by their mutual repulsion. After a few minutes a rapid succession of sparks is produced in some part of the apparatus. It is stated that the loss of electricity in this apparatus is so small that a single drop falling from each tube every three minutes is sufficient to maintain the charge constant indefinitely.

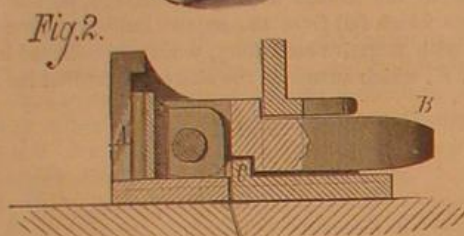
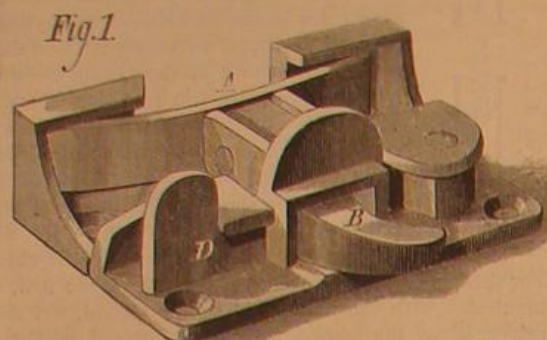
New Method of Preserving Fish.

The flesh of fresh fish, either raw or boiled, is cut in thin slices and plunged in a bath of water strongly acidulated with citric acid. After two or three hours soaking, the fish is removed and dried, either in the air or under moderate heat. In the latter case one hour is sufficient; in the former there should be an exposure of five or six days. M. D'Amelle states that fish thus treated will keep anywhere for an indefinite period, and that it becomes as hard as wood. To prepare it for use three or four days' soaking in fresh water is necessary.

MR. RICHARD HANKS, a coal miner, living near Galesburg, Ill., is reported to have dug out of the earth, fifty feet below the surface, the entire carcass of a petrified mastodon, sixteen feet long and nine feet high, in almost perfect shape.

IMPROVED WINDOW FASTENER.

The annexed engraving represents a novel and simple device for fastening the sashes of windows at the meeting rails, so that said sashes cannot be raised or lowered by any one from the outside. The ordinary form of spring catch is after some use apt to work loose and to be freely movable, and it has often been opened by burglars introducing a thin steel blade between the rails and thus pushing it back. With the present invention this is impossible. The portion A, which is attached to the lower rail of the upper sash, has lugs in which is pivoted the tongue, B, which is acted upon by the leaf spring shown. This tongue may be turned up vertically, so as not to be in the way of raising or lowering either sash, and is retained in position by the action of the spring. Pivoted in the portion of the device which is attached to



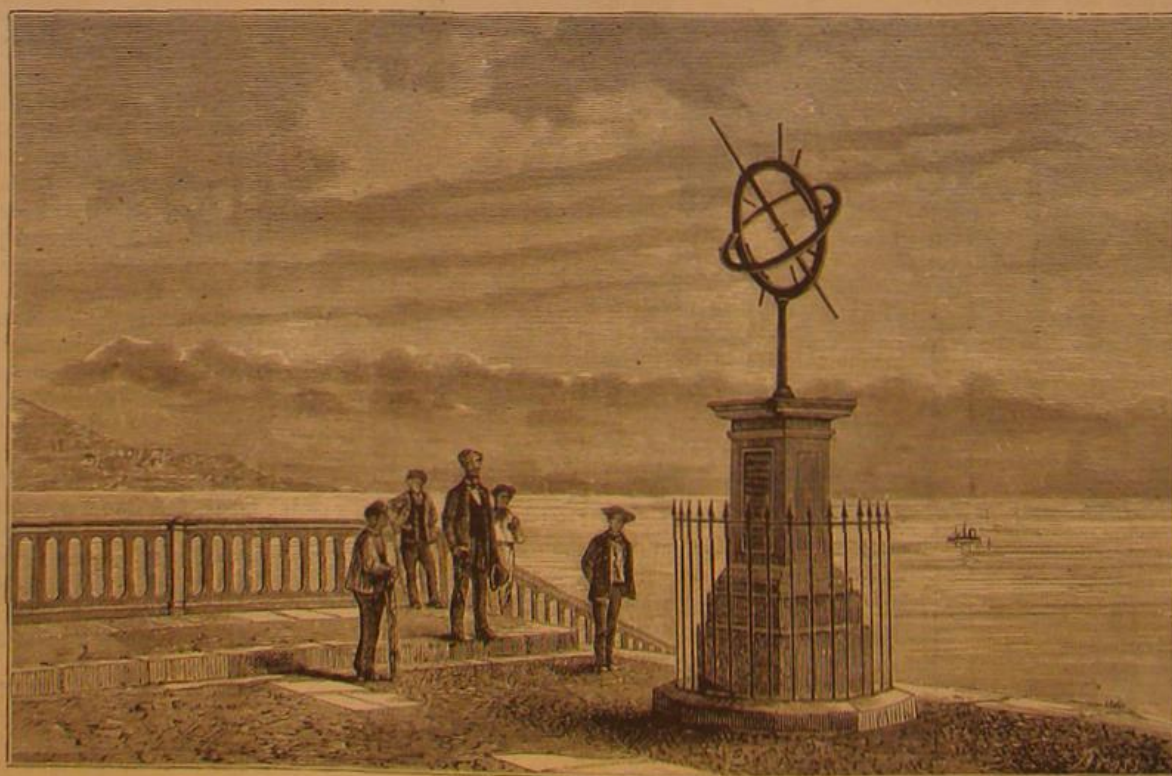
the upper rail of the lower sash is a spring clamp or catch, D. This has a recess which, when the tongue, B, is turned down, comes over said tongue, so that the same is thus prevented by the catch from rising or being moved sideways. A perspective view of the tongue thus secured is shown in Fig. 1 and a sectional view in Fig. 2. It will readily be seen that the device cannot possibly be tampered with by any one outside the window, as no tool can be introduced to reach and push back the catch, D. Patented September 4, 1877, through the Scientific American Patent Agency. For further particulars, address Clark & Smith, Chester, Orange county, N. Y.

THE COSMOGRAPH.

M. Riviere, of Marseilles, France, is to be credited with a capital idea for popularizing astronomical knowledge through the medium of a simple monument which may be set up in public squares, private grounds, or any other convenient locality. Several have already been erected in French cities, and our illustration, from *La Nature*, represents the one lately constructed at Nice.

The cosmograph, as the invention is called, shows, first, by a vertical circle, the plane of the meridian. A rod, directed toward the polar star, passes diametrically through the circle and shows the position of the earth's axis. A circle placed at right angles to the first indicates the plane of the equator. Of course the inclination of the axial rod varies according to the latitude of the locality. A small rod, placed vertically above the meridian circle, shows the zenith. Four other arms, fixed 23° above and below the equator, mark the tropics, and four more, placed at the same distance from the points of intersection of the axis, mark the polar circles. The graduation comprised between the tropics allows of the sun's movement in declination being followed, the solstices and equinoxes being observed, and the succession of seasons noted. The equator, divided into degrees and receiving the shadow of the axis, becomes a sun dial, an arc of 15° counting one hour. After a little practice it is easy to refer the curves of the cosmograph to the heavens, when the principal constellations may readily be found, especially those of the zodiac, through which passes the plane of the ecliptic or annual apparent path of the sun.

Inscriptions in relief show the names of the various portions of the instrument, and several useful astronomical facts and data are engraved on the pedestal.



THE COSMOGRAPH.

head adapted to carry the breech. Twenty shots were first fired with 9 lbs. of powder and a 40 lb. shell; then 10 shots with a shell weighing 47 lbs., and thereafter the charges of powder were successively increased by 1 of a lb. every ten shots, the shell remaining identical until the 100th shot was fired. On examination, no fissure of any kind in the metal was discovered, and the deformation of the chamber was found to be less than half the average in forged steel tubes.

Previous to this test, several pieces of the metal were cut perpendicularly from the axis of the tube. The average

The Ventilation of Passenger Cars.

If the agitation of this subject during the past few years has not been productive of the best results that could have been desired, it has at least awakened public attention to the importance of car ventilation, and stimulated inventors in their efforts to devise more effective means for securing it. It is no very difficult matter to keep passenger cars tolerably well ventilated in summer, so far as the requisite supply of fresh air is concerned. An abundance of it can be introduced through open doors and windows, and by the ordinary roof ventilators—sufficient at least to disinfect or replace that which has been contaminated by breathing.

In winter, however, the conditions are very much changed. For at least seven months in the year, in this latitude, an artificial temperature, high enough for comfort, must be maintained, and this kind of comfort the great mass of railway travelers insist upon having. If good ventilation can be had along with it so much the better, but a chilly atmosphere and direct drafts from the outside must be avoided at all hazards. These tell at once upon the physical sensibilities, while the breathing of warm and impure air produces no immediate discomfort, nor does it excite any very great alarm with most people, even when headache, lassitude, and faintness supervene.

If the owners of a car can afford to line it with costly cabinet woods and showy trimmings, they can afford to furnish the occupants with the needed supply of pure air which surrounds it in a vast volume on every side and presses for admission.

Car builders in their discussions of this subject have attached, as it seems to us, an undue importance to a scientific analysis of the vitiated air in cars, as if there was any question about its deleterious qualities. Whether carbonic acid gas and the organic poisons, exhaled with the breath or discharged from the pores of the skin, go up or down, or are diffused through the car, or whether they will kill at ten paces or fifty paces, is not very material. They are in the car, and the essential thing is to get rid of them in a quiet, automatic sort of way, so that passengers will not know that it is being done. Under the conditions of winter ventilation, this can only be accomplished by a constant process of expulsion, and the introduction of a corresponding supply of warm and uncontaminated air. A car full of bad air will not go out unless an opportunity is afforded, and some of it will not go even then unless forced; and the necessary force or motive power must be derived from the speed of the train, or an inflowing current induced by rarefaction, or both combined.—*National Car Builder*.

Strength of Steel made without Blows.

At the recent meeting of the British Iron and Steel Institute, at Newcastle, England, a paper was read by M. Gautier relative to some remarkable experiments made with artillery produced from steel fabricated without blows, or, in other words, metal which had been simply cast, tempered, and reheated. A tube 8 inches in diameter was made with a hole 5 inches in diameter, so as to leave but 1½ inches of metal on the outside. Nothing was done besides tempering or reheating, after which the tube was grooved and a screw

results of four trials were as follows: Limit of elasticity in tons per square inch, 23·35; charge of rupture, 39·67; lengthening per cent, 12·47.

IMPROVED SAFETY ALARM AND DOOR BELL.

The annexed illustration represents a new safety alarm which may be used by travelers to attach to the door knobs of their rooms in hotels, so that no one can enter without the fact being indicated by the ringing of a bell. The bell is attached to a steel spring which is secured in one of the two slits, A or B, on the standard by means of suitable set screws. The foot at the lower end of the standard is cross filed so that it will not slip on the knob when attached as shown in the engraving. To secure the device in place, a



rubber strap passes around the shank of the door knob and buttons on a screw on the standard. The knob consequently cannot be turned from the outside without the bell being caused to ring. The arrangement may also be modified so as to form an efficient permanent door bell. In this case a rod passes through the door casing and is rotated by a crank handle outside. The inner end enters a square hole in the standard where it is secured in a set screw. On a suitable guard plate are provided arms which extend on each side of the vertical standard and prevent its being turned down too far. The bell is adjusted, in accordance with this arrangement in the lower slit, B.

Housekeepers and business men generally will find the alarm device a useful means of protection, as burglars seldom venture in a room when the bell rings. If arranged on the chair round, the chair may be placed at an open window, and an attempt to move it will ring the bell. Farmers can attach it to outhouses, and if they wish, extend a cord or wire from the outhouse to the bed room, so that an attempt to enter will notify them, and the burglar, not hearing it ring, can be surprised and captured.

Patent pending through the Scientific American Patent Agency. For further particulars, address W. N. Patterson, Frankfort, Ky.

Spectrum of Candle and Gas Lights.

With the aid of the spectral photometer MM. Vogel and Müller have examined the most common sources of light with regard to their intensity in different parts of the spectrum, and have reached the following, among other results: The light of a wax candle is in the blue weaker than that of the stearin and paraffin candle. Petroleum shows in blue greater intensity than oil. A petroleum lamp with the wick newly cut emits more blue and violet rays than when it has burnt some time. A gas flame is in red and blue and violet brighter than a petroleum flame. The individual parts of flames which show a considerable

difference as to total intensity differ but little with regard to different parts of the spectrum. A petroleum lamp emits more refrangible rays than a Silber oil lamp, but the reverse is the case with a Silber lamp burnt with petroleum, as compared with the same ordinary petroleum lamp. A comparison of a petroleum lamp with a Drummond limelight led to the result that the Drummond lime light has a considerably greater intensity in the spectrum from green downwards, this being even doubled in the blue and violet colors.



1, *Platanthera bifolia*. 2, *Ophrys apifera*. 3, *Cypripedium calceolus*. 4, *Orchis Morio*. 5, *Oncidium lentiginosum*. 6, *Burlingtonia decora*. 7, *Vanda tricolor*. 8, *Phalenopsis amabilis*. 9, *Cattleya maxima*. 10, *Restrepia elegans*. 11, *Odontoglossum grande*. 12, *Dendrobium chrysanthum*. 13, *Coryanthes Albertinae*. 14, *Stanhopea ornatifolia*. 15, *Cymbidium aloefolium*.

GROUP OF ORCHIDS INDIGENOUS AND EXOTIC.—[See next page.]

A Curious Experiment.

We have now at Central University a singularly beautiful experiment in operation, showing the motion of the earth. It has been contrived and successfully completed by Professor T. W. Tobin, who has charge of the department of chemistry and physics in the University. The apparatus may be briefly described as follows: Upon an iron stand, about six feet in height, an exceedingly delicate pendulum is suspended; attached to the upper portion is some mechanism and a fine index needle. The apparatus was brought to a state of perfect repose, and then the pendulum, by means of a fine silk, vibrated north and south. In the course of six minutes the index showed that the normal relation between the pendulum and the earth had altered, and a longer interval indicated an increased variation. In 1851 Foucault, a French scientist, reasoned that while all bodies are governed by gravity, independent motion is not: that in virtue of inertia, a body moved will continue in motion forever; so a pendulum once started in vibration will continue to oscillate in the same direction until gravity and the friction of the air bring it to a state of rest.

The earth's revolution being a circle, there must be a variable relation between the two motions, namely, the circle and the straight line of the pendulum's direction. The apparatus now described shows this relation. An experiment was made by Foucault in Paris with a pendulum over 200 feet long; a similar experiment at Bunker Hill and then at Yale College prove the principle: but the apparatus employed was costly and cumbersome. The instrument at Central University is simple and delicate, and is calculated to create interest in scientific circles.—*Kentucky Register, Richmond, Ky.*

Hot Water for Tire Shrinking of Wheels.

The expansion of tires by hot water, though not claimed to be new, is believed by the author to be much superior to the ordinary method of using fire. As applied on the Moscow-Nijni Railway, an iron tank, one fourth filled with water, is fixed near a stationary boiler, a steam pipe from which is led through it, capable of heating the water to 212° Fah. Into this the tire is plunged by means of a portable crane, and after an immersion from ten to fifteen minutes, is taken out and immediately placed on the wheel. Three men only are employed, who will fix from twelve to fourteen tires in a day of eleven hours. The allowance for shrinking (the difference between the diameter of the skeleton and that of the tire) is 0.75 millimeter to a meter. This is ascertained by gauges of great accuracy, and, if deviated from, the tire will be either loose after cooling or too small to get on the wheel. When fire is used, the tire can never be heated equally or cooled equally in all parts, and in consequence is sure to be more or less oval in form, which is not the case in hot water. The above railway made a comparison between the two, the results of which are given. It appears that, during a six years' trial of fire-shrunk tires, 37 per cent ran loose and 5 per cent were broken; while during a three years' trial of water-shrunk tires less than 1 per cent ran loose, and only a single tire was broken. The liability to breakage in the former (produced by the irregularity in form) is much insisted on by the author as being, of course, more dangerous and costly than the loosening of the tire.

THE SATELLITES OF MARS.

We take from *La Nature* the annexed engraving of the planet Mars and its second satellite, as the same appeared through the great telescope at the observatory of Paris, at 10:15 P.M., on August 27 last. The first satellite moves around the planet in 15 hours, at an average distance of 9,000 miles; the second completes its course in thirty hours, and is distant about 15,000 miles. Both bodies are very small, and their observation requires powerful instruments. Judging, however, by its brilliancy, the diameter of the second satellite is estimated at only some 30 miles.

Future observation of their motion will lead to the exact determination of the elements of their orbit, and will show whether the revolution is relatively direct, as in the case of the moons of Jupiter and Saturn, or relatively inverse, as in the case of the satellites of Uranus and Neptune. It will also lead to more exact data relative to the mass of Mars.

In a former article on the discovery of these bodies, we noted the fact that while most astronomers did not regard it even as probable that Mars might have satellites, others had admitted the possibility, and had predicated their admission on certain physical characteristics of the planet itself. *Les Mondes* has recently published an extract from a work by Bérion, a French astronomer, entitled "Celestial Physics," and printed in 1867, wherein the author says: "Mars is distinguished from the seven other planets by its satellite, which no one has ever seen, although it exists, because Mars has thrown out jets of burning matter, to which are due, first, its rotary movement, and, second, the existence of two recesses which appear to be movable spots. It appears, incontestably, that these spots are due

to light reflected in different degrees by the slopes of these recesses, which are constantly being differently exposed to the sun and to the earth."

ORCHIDS.

The orchids constitute a beautiful family plant, so called from *orchis*, their ancient name. Popularly any one of the family, of whatever genus, is called an orchid. Their number is legion, and includes a veritable host of smaller flowering kinds, whose blossoms yield in nothing but size to their larger compeers; and their beauty and conformation, when looked for, is often more extraordinary and interesting.

The large illustration on the preceding page gives a com-

Fig. 1.



Fig. 2.



parative idea of some of the orchids, collected from different countries. For instance, the *Restioides*, Fig. 10; the *Burlingtonia*, Fig. 6; the brown and golden twisted *oncidium lentiginosum*, Fig. 5; and the brilliant *odontoglossum*, Fig. 11; are inhabitants of North America. The strangely tinted, blue, white, and brown *banda tricolor*, Fig. 7; the white *phalenopsis*, Fig. 8; the orange and brown *dendrobium chrysanthum*, Fig. 12; belong to Asia. South America gives the beautiful *cattleya maxima*, Fig. 9, with its varying colored lips; the curiously formed purple *coryanthes*, Fig. 13; and the large *stanhopea ornatissima*, Fig. 14; with its

Fig. 3.



Fig. 4.



sweet scented yellow and brown dotted blossoms. The Chinese *cymbidium aloefolium*, Fig. 15, with its yellowish brown blossoms forms, the link between the orchids of the tropics and the temperate zone.

In the lower group is given the modest flowers which are the parents of their larger and more grotesquely developed descendants. In this group are represented the lady's slipper (*cypridium calceolus*) Fig. 3, and the shoe-shaped *orphyrys apifera*, with a bee-like lip; the sweet scented meadow hyacinth, *platonthera bifolia*, Fig. 1; and the common *orchis morio*, Fig. 4, from which the class receives its name.

The distinguishing feature of the orchids is the column and it is embodied in them all, be they large or small. Figs. 1 and 2 give an enlarged representation of this column, Fig.

bear a great resemblance to various insects, for instance the butterfly orchid (*oncidium papilio*) which in form, size, and color resembles somewhat a gaudy butterfly.

The cultivation of orchids is a passion with many horticulturists, who spare neither time nor expense in their favorite pursuit.

A New Military Arm.—The Torpedo Hunters.

A correspondent of a German journal, writing from Erzeroum, gives the following account of the new corps of divers which has been organized by the Turkish government for the purpose of removing the torpedoes laid down by the Russians in the Danube and on the shores of the Black Sea:

The divers are Mohammedans from Lazistan, and a certain number of them are attached to each of the Turkish squadrons cruising in the Black Sea. When the ships arrive near a spot where the existence of torpedoes is suspected two of the divers row to the place in a very light boat, drawing so little water that there is scarcely any danger of its striking against the torpedoes. On arriving at their destination one of the rowers dives into the sea; if he finds a wire or rope by which the torpedo is attached he cuts it with a sharp instrument and returns quickly into the boat. The liberated torpedo floats to the surface of the water, the men pass a short lasso around it, take it in tow, and then row back to the ship as quickly as possible. For each torpedo thus captured the divers are paid \$45, and also a sum of money equal to one half of its value. Although the men have been often employed on this dangerous service, not a single accident has occurred to any of them.

Effects of Timber Waste.

Colonel Playfair, British Consul General for Algiers, has sent to his government a report which offers some striking instances of the injury done to a country by the reckless destruction of forests. He states that the principal cause of the decadence of the entire region of Tunis and Algiers and the exhaustion of the soil is directly owing to tree felling. Meteorological observations have been carried on in Algiers since 1838. During the first twelve years of the intervening period the rainfall averaged 32 inches annually, during the second twelve years it had decreased to 30.8 inches, and during the last fourteen years it has been but 25.5 inches. The decrease became apparent after the first serious clearings of wood in 1845, and during 1876 so exhausted had become the soil that a famine seemed imminent in Western Algeria.

Magnetization of Sheffield Steel Bars.

M. Gauguain, who for some time has been conducting investigations with the influence of heat on magnetization, has recently announced some very curious results obtained with Sheffield steel bars. He found that, when certain bars were magnetized at a high temperature and cooled, their magnetism entirely disappeared, and then changed sign: so that if a bar had been magnetized when hot in a certain direction, it was found to be magnetized in the opposite direction after returning to the ordinary temperature. When heated afresh, the inverse magnetism, which is always very feeble, vanished, and the primitive magnetism reappeared. The same change of sign is reproduced when the bar is again cooled.

Experiments with the Dynagraph.

The Springfield (Mass.) *Republican* of recent date says: A very interesting series of experiments have been in progress on the Boston and Albany road the past few days by means of the dynagraph car of the Eastern Railway Association, in charge of P. H. Dudley, which has been run between Springfield and Worcester on both freight and passenger trains, to test the relative amount of power required at different points along the road, especial reference being had to the Springfield and Charlton grades. The experiment on the Modoc train, leaving Springfield at 6.30 A.M., which, on the day in question, consisted of two sleepers, four passenger and baggage cars, and the dynagraph car, showed power required as follows: For the first 2,920 feet out of the depot the tension on the draw-bar was 6,526 lbs.; for the next mile 6,469 lbs., the rate of speed being 32 miles per hour; for the next, 6,200 lbs., the speed being 36 miles and for the last 1,100 feet, to the top of the grade, 6,250 lbs. The last mile required the engine to produce 19,625,800 foot pounds of power per minute.

In going up the grade from East Brookfield to Charlton, beginning at the station, the tension on the draw-bar for the first 3,880 feet was 5,732 lbs.; for the first full mile, the velocity being 37.5 miles, 4,280 lbs.; for the second mile, with 37 miles velocity, 5,232 lbs.; third, with 36 miles velocity, 5,450 lbs.; fourth, which contains a sharp curve, with 37 miles velocity, 5,612 lbs.; fifth, with 41 miles velocity, 5,230 lbs.; and sixth, which ran a little past the summit at Charlton, 4,356 lbs.

The engine had an 18 inch by 24 inch cylinder, and the track was in excellent condition. The maximum of the



MARS AND ITS SATELLITES.

1 being a front view, and Fig. 2 a side view, of the same of the indigenous orchid (*latifolia*) while Figs. 3 and 4 give the same views of the exotic flower.

Orchids are among the most valued of cultivated flowers, some for their beauty, others for their fragrance, while others are admired for their grotesque forms. The forms are sometimes wonderfully simulative. The flowers of one species resembling the mouth of a cuttle fish, others resemble a large spider, while in other species the flowers

Springfield grade is 60 feet to the mile, and the Charlton grade 51.47 feet. At the sharpest curve the grade is about 49 feet. Similar experiments were made on a freight train of 27 cars, drawn by the Adirondack, famous for her trials with the Mogul engine last summer, and showed that the tension on the draw-bar going up Springfield grade at a speed of 5.9 miles per hour, was about 16,000 lbs.; and the average strain going up Charlton grade at an average speed of about nine miles per hour, was 14,500 lbs.; the power required in the first instance being 84,840,000 foot pounds. Near the top of the grade the power of the engine was tested by applying the brakes, and it was found that, running at four miles per hour, the engine could exert a tension of 17,000 lbs. Beyond this point the drivers would slip and little progress was made.

Really, the most important experiments in which the association is just now engaged are in testing the quality of iron and steel used for bridges, rails, axles, and car wheels. Recent trials of the tenacity of iron used for various bridges and car axles indicate that much of the iron now in use will only stand about two thirds the strain which it is guaranteed to resist. For instance, some iron now being put into a new bridge at the East, which is supposed to stand a pressure of 60,000 lbs. to the square inch, breaks readily at 40,000 lbs., and a car axle, supposed to be equal to 110,000 lbs., snapped at 70,000 lbs.

When it is borne in mind that the calculations of bridge building engineers are based on the guaranteed strength of the iron, the reason for the fall of iron bridges becomes apparent at once, and instead of wondering at an Ashtabula horror, the wonder rather is that it is not repeated. The Eastern Railroad Association, which is making these experiments, represents all the railroads on the Atlantic coast north of Richmond, Va., and east of Pittsburgh and the Alleghenies, and was organized about ten years ago, having for its object the investigation of the validity of patents and claims to royalties for the use of the same. S. M. Whipple, of South Adams, is the general agent. The scope of the association has naturally broadened, and it has been for the past few years largely engaged in testing the merits of various railway equipments with the idea of getting the best in every department. The dynamograph car is a curiosity in itself, containing, besides the dynamograph, which is an ingenious instrument, registering exactly the amount of power required to pull a train, a chronograph, which records the speed of the train every $7\frac{1}{4}$ seconds; an anemometer, which registers the velocity of the wind, whether natural or caused by the motion of the cars; and a complete set of instruments for testing the hardness, tenacity, ductility, density, and the amount of carbon in rails, axles, etc.

The Use of Glue and Its Applications in Carriage Body Making.

The following suggestions are from the pen of Mr. John D. Gribbon, the veteran carriage body maker of this city: Glue is obtained by boiling the skins and hoofs, etc., of animals, also the skins and some other parts of fishes; but that from animals is considered the best, and that obtained from the skins of old animals is considered better for the purpose than that from young ones. The strongest glue of all—Russian isinglass—is made from the air bladders of a species of large fish found in the Russian seas, but its great price excludes it from use by the carriage trade, when other glues can be substituted. From experiment made it has been found that glue made from the sinews and skins of animals is superior to that made from their horny parts; but the latter, again, is found from actual observation in practice to be much superior to glue made from the skins, etc., of fishes, as it is not so subject, as the last named, to be affected by the atmosphere. Animal glue is, for the reason just named, unquestionably preferable to fish glue, although the latter is sometimes sold as first quality glue.

TESTING GLUE.—In the selection of glue, the testing of it, so as to form some estimate of its adhesive qualities, is a matter of first importance. All glue in the cake is subject to be influenced by the moistness or dryness of the atmosphere, becoming soft in damp weather and crisp in dry weather, but different kinds are differently affected, and hence it is better to purchase in dry weather, as that which is then soft is not of as good quality as that which is crisp; and it should be borne in mind also, when purchasing, that the most transparent is generally the best. It is always advisable, before purchasing, to submit to experiment a sample of the article offered. To do this, take a cake of glue, place it in a pan, and cover it with water; when, after some hours, if it be good glue, it will swell but not dissolve. While, if bad, it will partly if not wholly dissolve in the water. Another test is this: After being dissolved by means of heat, that glue is best which seems most cohesive, or which is capable of being drawn out into thin filaments or strings, and does not drop from the brush or glue stick as water or oil would, but rather extends itself in threads, as it falls from the brush or stick; and if the glue possesses the requisite properties, this will always be found to be the case.

PREPARING GLUE.—The preparation of glue is very simple. It is first broken up in small particles and put into a vessel, covered with cold water, and left to soak for a number of hours, the length of time required for soaking being generally governed by the strength of the glue, the strongest glue taking the longest time. After being soaked until it all swells and becomes soft and gelatinous (avoid oversoaking) it is then placed upon the fire to cook, being kept stirred until it is thoroughly dissolved and appears stringy,

as we stated above. It is then ready for use; but in factories where a large quantity is employed, it is then poured out in a large flat pan and left to cool; and the workman, when desiring it for use, cuts off the required quantity and heats it. I would remark here that it is a bad habit for workmen to allow the glue pot to remain on the stove after they are done using it, as a very prolonged heat will destroy the adhesive qualities of the glue.

In some of the large carriage factories of the United States, where steam is generally used, a steam jacket is provided to receive the glue when it requires to be warmed, and, in connection with this jacket, a pipe heated by steam is generally added, on which panels may be warped bent, which proves a very expeditious and convenient process for both the purposes named, and preferable in every way to the use of a stove.

As a novelty in the way of preparing glue, the pulverized article, which has recently been introduced to the trade, merits mention here. In passing along one of our thoroughfares my attention was attracted, not long ago, by a sign on which the words *pulverized glue* were prominently displayed, and being curious to see the article and learn its advantages, I went in and asked an explanation from the proprietor. It seems that the pulverized glue is recommended for its convenience, being more quickly prepared for use than that which is in cakes, the latter requiring several hours to soak, whereas the pulverized can be soaked just as thoroughly in a few minutes; and this is a great advantage, particularly in warm weather, when glue put to soak is often liable to spoil. Again, if a workman's cooked glue runs out, he can in a short time prepare more from the pulverized, and this is often a great convenience, as every workman knows, especially when quitting time is near at hand.

We would say further in regard to glue in the pulverized form that it avoids the serious injury by salt air that affects glue in the cake in crossing the ocean, and it is for this reason particularly adapted for exportation.

APPLICATION OF GLUE.—Referring to the letter of your London correspondent, it is worthy of note that, with very few exceptions, no stoves or heaters are used in the English body shops, and, when a panel is to be bent or the glue to be heated, recourse must be made to the smith-shop to accomplish the object, but good gluing cannot be done under these circumstances, and particularly in a climate like the English, that is almost continually moist. In the United States, on the contrary, every carriage maker, even if he is doing business on the smallest scale, will have a stove for heating his body-shop in cold or damp weather, and also for bending his panels, shavings and waste stuff usually constituting the fuel employed. The heat of the body room is generally kept at a temperature of from 55° to 65° Fah., which is a comfortable one for the workmen to labor in, without becoming exhausted from the heat, and such a temperature will render the workman more cheerful, and cause him to accomplish more work than is the case (particularly common in England) of cold winter weather with an unheated shop, when the workman feels as if he touched ice when he takes hold of his tools, which feeling certainly does not expedite his labors, and when he feels glad at the approach of quitting time, that he can warm up at the tap, and take a drink of something warm.

There is no reason why in England bodies could not be glued together as well as here, provided the room were properly warmed and proper precaution taken. Some may raise the objection that glue will not hold so well on the hard ash here employed, but some years ago I saw bodies glued here in Mr. Charles Parker's factory, very hard ash and mahogany being used, and they held together quite as long and as well as any others having whitewood panels. The only difference in the case of using very hard wood is that the surfaces to be glued together should first be roughed with a tooth plane, or other tool, as a file or saw.

The following additional suggestions may be of value in applying the glue:

In all American carriage factories the side, back, and front panels are glued on, no nails being used, excepting one small tack in each corner to keep the panel in place while the straps and hand screws are being put on. In putting on the neck and bottom arch panels, some builders use both nails and glue, while others use glue without any nails, mitering these panels along the edges without nails, and where properly fitted and put on, no trouble is experienced from their giving way.

In the case of panels glued on, there is of course no fear of nails showing, while the latter is frequently the case on English carriages, even when the top quarters and back have been covered with leather, the nails showing through all. French carriage builders, until quite recently, have always nailed on the neck panels of boots, but the nails would always, in spite of the greatest care, show through the paint and varnish, and latterly they have been covering the necks of their boots with enameled leather, to avoid this trouble. It was the knowledge of this weakness in French carriages, in connection with the perception of its absence in American carriages, that, at the time of our Centennial Exhibition, first led some of their celebrated builders to look into the advantages of using glue to hold the panels on without nails.

When panels are glued on—properly on—there is no occasion to cover the quarters with leather. In the matter of roofs, some American builders cover them with patent leather, neatly nailed in a rabbit in the side-top and end rails, while others prefer to cover them with duck and paint in the same manner as the panels. Still others put on the roof

board in one piece (which is easily obtained since the new method has been introduced of cutting panels from around the log, whereby the width is limited only by the diameter of the tree), and closely block the same on the inside, no covering of cloth, leather, or other material being required, as was the case with the old method of putting the roofs on in narrow boards.

We will add two further suggestions in this connection, namely, in applying glue, where the part is end grain, first fill the pores of the wood with thin glue, and let dry; then clean off, and glue at the joint with strong glue. Many a job has been spoiled by reason of neglecting to fill the end grain in this manner. Next, in adding water to glue, it is best to give the glue a boil before using again, so that it may be evenly and thoroughly mixed.—*The Hub.*

NEW BOOKS AND PUBLICATIONS.

SANITARY ENGINEERING. By Baldwin Latham C.E. Published by George H. Frost, Chicago. Price \$3.00.

This is a reproduction of the English work published by Mr. Latham in 1873. It is a series of excellent and valuable papers forming a guide to the construction of works of sewerage and house drainage. It has heretofore been printed as a supplement to the *Chicago Engineering News*, from the stereotype plates of which the present book is made. Illustrations are abundant and good, and the work is sold at one quarter the price of the original English edition.

THE ELEMENTS OF DESCRIPTIVE GEOMETRY. By S. Edwards Warren, C.E. John Wiley & Sons, 15 Astor Place, New York city. Price 3.50.

This is a new work prepared we are informed to meet an evident demand for brief text books. The author explains clearly, arranges his topics logically and uses the fewest words possible, all excellent features, and in brief has compressed into comparatively small space as compared with other works on the subject, a very full view of the sciences. The plates accompanying the text are bound in a separate and handy volume, and thus rendered easier for reference.

BREAD AND CAKE BAKING. By Frederick D. Hauptmann. Price \$1.00. Published by the Author. P. O. Box 94, New Waterford, Ohio.

A collection of recipes, differing from those ordinarily found in cook books in that they are the work of a practical baker of experience and are especially intended for the trade.

PERFUMERY AND KINDRED ARTS. By R. S. Christiani. Price \$5.00. Henry Carey Baird, Publisher. 810 Walnut street, Philadelphia.

The climate of the United States, is so diversified says the author, and in many parts so well adapted to the cultivation of numerous plants, which are useful to the perfumer, that the author hopes by this treatise to awaken attention to the practicability of establishing flower farms and orange groves, as well as to the utilization of many indigenous plants now neglected for perfumery purposes. The work offers a complete encyclopedia apparently covering all branches of the subject. Descriptions are given of all the materials used in perfumery, of the laboratory and its requirements, and then follow a very large number of recipes for extracts and bouquets, aromatic and toilet powders, hair oils, pomades, hair dyes, essences, soaps, etc. In an appendix are instructions for making sugars, jellies, candles, cordials, etc. All the recipes have been carefully revised and many are the result of the author's long experience. The work will doubtless prove exceedingly valuable to the perfumer.

HOW TO DRAW A STRAIGHT LINE. By A. B. Kempe, B.A. Macmillan & Co., 23 Bond street, New York. Price 50 cents.

This is a continuation of the set of technical volumes, known as the *Nature Series*. It is a lecture on linkages, fully treating the subject and copiously illustrated.

Recent American and Foreign Patents.

Notice to Patentees.

Inventors who are desirous of disposing of their patents would find it greatly to their advantage to have them illustrated in the *SCIENTIFIC AMERICAN*. We are prepared to get up first-class wood engravings of inventions of merit, and publish them in the *SCIENTIFIC AMERICAN* on very reasonable terms.

We shall be pleased to make estimates as to cost of engravings on receipt of photographs, sketches, or copies of patents. After publication, the cuts become the property of the person ordering them, and will be found of value for circulars and for publication in other papers.

NEW MISCELLANEOUS INVENTIONS.

IMPROVED COMBINED SPRING SHACKLE AND STEP.

Reuben Doty, Wellsville, N. Y.—This invention consists in the peculiar construction of a shackle for coupling the springs of platform wagons, and in the combination of a step with the shackle. Portions of the shackle are secured to the ends of the wagon springs by bolts. These parts are similar, and consist of a round bar, from the ends of which the arms project at right angles and parallel to each other. At the ends of these arms eyes are formed for receiving bolts. The bars of the other parts are arranged at right angles to each other, and between them a bearing piece is placed, which covers half of the surface of each of the bars. From upper part of bearing piece an arm projects, to which a step is secured by means of a rivet or screw. The advantages claimed for this improvement are that the shackle is cheaply and easily constructed and applied. Friction is distributed over a large surface, so that the wear is reduced to a minimum, and the step is always kept in a horizontal position.

IMPROVED GAS DROP-LIGHT.

William R. S. Taylor, Westfield Township, N. J.—The nature of this invention is such an arrangement and application of flexible tubing to such drop-lights or chandeliers as will protect the tubing from injury by unnecessary coiling or rubbing and the heat of the lights when the chandelier or drop-light is in use, and will carry it out of the way when it is not in use. In this improved method of constructing chandeliers and drop-lights the tubing is to be attached to the lower parts both of the suspending and of the stationary parts of the fixture, and is allowed to hang or is estooned in a manner agreeable to its nature.

IMPROVED FEED BAG.

Thomas R. Lowerre, Mott Haven (Morrisania Station), N. Y., assignor to himself and Richard U. Wright, of same place.—The object of this invention is to furnish an improved feed bag for horses, which shall be so constructed as to allow the oats to pass down to the horse's mouth as fast as he eats them, and no faster, which will allow the horse to have plenty of air while eating, which shall be evenly balanced, so that the horse can eat comfortably, and which will prevent the oats from being thrown out by the horse. The body of the feed bag is divided by two partitions into three compartments—a central compartment, into which the horse's nose is inserted, and two side compartments, in which the grain is placed. The lower edges of the partitions extend nearly to the bottom of the bag, space being left beneath said edges for the grain to pass slowly into the bottom of the central compartment as fast as the horse eats it.

IMPROVED ATTACHMENT FOR CARPENTERS' SQUARES.

Jeremiah Danicle, Sharon, Wis.—This invention relates to an improved attachment for carpenters' squares, and it consists of a number of parallel bars that are secured to slotted end pieces that are clamped to the square by means of screws and nuts. The object of the invention is to provide a square that will facilitate laying out single and double mortises, tenons, and other operations in carpentry. The square is used by placing its longer arm against or upon the timber to be laid out and marking at the sides of the parallel bars for the sides of the mortises or tenons. The attachment does not interfere with the use of the square in the ordinary way, as the heads and nuts of the bolts are on a line with the inner edge of the square beam and serve to guide it. If the bars do not stand in the required relation to the side of the timber, the slots in the end pieces and the bolts afford a means of adjustment.

IMPROVED LINE FENDER FOR HARNESS.

Thomas J. Lindsay, Windfall, Ind.—The object of this invention is to prevent a horse, in double or single harness, from getting the lines under his tail, and the nature of the invention consists in a fender or shield which is made of wire or leather, and shaped to fit the upper portion of the tail of a horse, said fender or shield being provided with a tail strap, side pieces, and other means for properly fastening it to the harness.

IMPROVED BRACELET.

Julius Hackenberg, New York city, assignor to himself and Charles H. Graef, Edgewater, N. Y.—This bracelet is formed of a number of parallel rings, held together by cross stays, which are grooved exteriorly, so that the rings project above them, whereby, at a short distance off, the stays are not at all or scarcely noticeable, thus giving to the bracelet the appearance of a series of independent rings, while at the same time the rings are firmly united together.

IMPROVED MUSTACHE SPOON.

Roger Williams, Yonkers, N. Y., assignor to himself and Robert J. Anderson, New York city.—This invention relates to an improved spoon to be used by persons with mustaches, the spoon keeping off any part of the soup or other fluid from the mustache, while admitting the easy taking of the liquid, and also the convenient cutting of any larger part therein; and the invention consists of a spoon whose bowl is placed at a suitable angle to the handle, provided with a lateral mustache guard, extending at slight inclination across the front part of the bowl, and arranged with a cutting edge at the rear portion. The position of the bowl to the handle facilitates the taking up of the liquid over the rear part of the bowl and the ready conveying of the same into the mouth by a turn given to the handle, which tilts the bowl and empties the same of the liquid.

IMPROVED BELL PIANO.

William H. Wood, Port Rowan, Ontario, Canada.—The object of this invention is to provide a musical instrument in which bells are employed to produce the musical sounds. It consists in the arrangement, in a casing similar to that of an ordinary piano, of a number of bells of either metal, glass, or pottery, properly tuned, and in an arrangement of hammers operated by means of keys, and in dampers and softeners operated by pedals or stops. The softeners consist of pieces of leather, which are attached to bars that are moved by an arrangement of levers similar to those of an ordinary piano.

IMPROVED SELF-ADJUSTING EYE SHADE.

Thomas A. Platt, Brooklyn, N. Y.—The object of this invention is to furnish an improved eye shade, which shall be so constructed that it will adjust itself to the shape and size of the head, and may be worn without causing pain or annoyance to the wearer. The invention consists in an improved eye shade formed by the combination of the two springs with each other and with the shade. To the ends of the spring are secured, by rivets or other suitable means, the ends of a similar metal spring, to pass over the head of the wearer, and thus keep the shade in place.

NEW HOUSEHOLD INVENTIONS.**IMPROVED FRUIT JAR.**

Hiram Purdy, Burlington, Iowa.—The object of this invention is to furnish fruit jars which shall be so constructed that they may be closed perfectly airtight, and which will allow their covers to be easily removed. The cover, which fits into the mouth of the jar, is tapered, and has a wide shallow groove formed around it to receive the rubber band or packing. The jar is closed by pressing the cover down into place while the contents of the said jar are hot, and have thus expelled the air. To open the jar the upper edge of the band is drawn down to uncover the air hole and allow air to enter the jar. The cover is then drawn to one side, which forces the edge into the groove and allows the other side of the cover to be raised.

IMPROVED BED BOTTOM.

Germaine Luciani, Paris, France.—This invention relates to an improved elastic mattress, which is constructed chiefly of wood, and is designed to supply a cheap and useful article, having advantages which have hitherto only been obtainable at high prices. All elastic mattresses hitherto constructed, even those having lengths or laths of wood, have been provided with springs, and this invention is designed to avoid this costly and complicated arrangement, being based essentially upon the principle of utilizing the inherent elasticity of the strips of wood or laths, united by bands or straps fastened rigidly either to the strips of wood or to the rods, and are doubled and sewed with very strong thread, so that the said strips of wood and rods may slide freely, as in sheets or coverings, the capability of which is necessary to give elasticity to the whole apparatus, between which they slide.

IMPROVED RECIPROCATING CHURN.

Grover Goff and Henry Hardick, Stevensville, N. Y.—The object of this invention is to furnish for dairymen an improved churn motion, by which a uniform stroke is imparted to the dasher of the churn with little effort, the length of the stroke being readily adjusted as required. The pitman connection of the crank shaft with the elbow lever changes the rotary motion of the hand crank wheel into the reciprocating motion of the elbow, for working the dasher, the flywheels, and transmitting gearing, facilitating the working of the churn, so that the same may be run with but little effort, producing a uniform and effective stroke of the dasher, and facilitating and accelerating the churning operation. The device is readily applied to the churn, always in order for work, easily adjusted, and effective in operation.

IMPROVED CHURN.

Nelson W. Cone, Delaware, O.—The object of this invention is to provide a churn that will thoroughly and expeditiously cut and agitate the cream, and that is simple and inexpensive in construction. The cream receptacle consists of a rectangular box, having a suitable cover, and having grooves formed at its ends for receiving bars from which fingers or breakers project toward the center of the churn. The shaft is provided with a number of blades or paddles, which project radially from the shaft, and are of such width as to nearly fill the spaces between the breakers. The breakers and blades should be of about the same width, and the number of each should be proportioned to the size of the churn.

NEW MECHANICAL AND ENGINEERING INVENTIONS.**IMPROVED LIFTING JACK.**

Joseph S. Kirkwood, McKeesport, Pa., assignor to himself and Henry C. Myers, of same place.—The nature of this invention consists in combining, with a ratchet lifting drum, a lifting rack, which is guided by tapered grooves in two standards, in combination with one or more ad-

justing screws, which will allow the rack bar to be disengaged from the said ratchet drum whenever desired, and thus quickly raised or lowered by hand. Should the rack bar be raised, and it is desired to lower it quickly, this can be done by turning back the screws and disengaging the bar from its wheel. The ratchet wheel teeth, as well as the teeth on the rack bar, are pitched like saw teeth, so that they are very strong, and will stand considerable strain without fracturing.

IMPROVED MORTISING MACHINE.

William W. Green, Jr., Chicago, Ill., assignor to himself, E. N. Niegelsen, and J. M. Shields, of same place.—This invention has reference to a new construction of mortising machine, and consists of a revolving endless chain saw, formed of pivoted sections or links with cutting teeth, to which the proper tension is imparted by a grooved tension bar, the wood being fed and guided to the mortising saw by a movable treadle-actuated table or bench. Any thickness of wood can thus be exposed to the action of the saw, while, by stretching a chain with wider links on the rollers, a mortise of greater width may be cut. By feeding the stuff along the table the mortise is cut by the chain saw. The machine may be employed for mortising, sawing, and recessing lumber, as it is readily controlled by the movable table and worked in rapid and effective manner. To the sides of the tension bar may be attached, by studs or pins, wedge-shaped sections, which impart to the endless cutting chain a certain angle of inclination at both sides, and admit thereby the cutting of wedge-shaped mortises, when such are required.

IMPROVED RAG ENGINE.

Edward D. G. Jones, Pittsfield, Mass.—This invention has relation to engines which are designed for reducing rags to pulp fit for making paper. The nature of this invention consists, first, in novel devices for lifting or adjusting long spindles or cutting cylinders of rag engines, where the bars both arranged outside of the tub or vat, and supported independently thereof, the back bar being so placed, relatively to the tub, that the cutting cylinder can be driven by a belt applied directly to a pulley on the spindle, the two bars being adjustably simultaneously from the front of the tub; second, in a half-box bearing for the rear end of the cylinder spindle, which is supported upon the rear bar, and adjustable at right angles to the longitudinal axis of the spindle; third, in constructing the breast or back fall of the bed in a plane which is tangent to the arc of the concave beneath the cutting cylinder, whereby a free discharge is effected, and the pulp is not thrown back over the cylinder.

IMPROVED FLYING MACHINE.

James J. Pennington, Henryville, Tenn.—This invention relates to machines for navigating the air, and it consists in a fan of peculiar construction, which takes air in from the front of the air ship and forces it out at the rear. The object of this invention is to provide apparatus by which the air may be navigated with facility and safety. The apparatus is suspended by a balloon or upon a rope tramway, and is propelled by drawing the air into the conduits and driving it out of the discharge nozzle. When the apparatus is suspended by a balloon it is raised or lowered by auxiliary fans, and when it is desired to turn the apparatus in a horizontal plane a gate is turned so as to direct the air to one side or the other, as may be required. To steer the air ship vertically and to assist in propulsion a fan is employed having feathering blades, which are turned on their axis, as the fan is rotated, by a central cam. This cam, being movable, permits of reversing the action of the fan.

IMPROVED PUMP.

George W. Robaugh, Ottumwa, Iowa.—The object of this invention is to provide a piston for pumps that may be readily packed without removing it from the pump, also to provide an efficient valve and valve seat. The piston is provided with a flange, against which packing is pressed by the follower. The follower is sectional, being made of two parts. A nut holds these parts in place on the rod and against the packing. When the packing is to be removed the nut is loosened, and one part is removed from the rod by raising it upward and moving it sideways until it is free from the piston rod. The other part is removed in a similar manner. The valve casing or cage consists of a casting having upon each end a flange for connecting it with the other portion of the pump. This casting is of two diameters, the lower portion being the smaller, and having formed in it the valve seat. In the upper and larger portion there is a rabbit for receiving the grating or cover, which is held in place by the pump barrel. Below the grating there is an annular valve that is fitted to the valve seat, and to a seat formed on its upper surface another valve is fitted. The lift of the annular valve is limited by the grating, and the lift of the other valve is limited by the cage. The lift is thus divided between the two valves, and greater capacity is secured than is possible with a single valve unless the lift is unduly increased.

IMPROVED DEVICE FOR PROPELLING VESSELS.

William F. Morrison, Plattsmouth, Neb.—The object of this invention is to provide an improved device for propelling and steering vessels without agitating the water, the same to be used in canal, river, lake, and ocean navigation. The invention relates particularly to the combination and arrangement of parts for steering a vessel. The desired effect is produced by the expulsion of water from suitably arranged tubes. The water may be discharged through either upper or lower pipe, and the reaction or force against the closed end of the pipe caused by the discharge of the water along through the pipe produced the forward or backward motion of the vessel. The water surrounding the vessel is but little agitated, as the operation of supplying the water to the tank and the discharging of the same for propelling and steering purposes produces only a small effect on the same, the water being discharged at a very slow motion, while the internal reaction at the right angles of various discharge pipes, together with the recoiling force of the confined water on the closed end of the pipes, gives a very effective propelling and steering capacity.

IMPROVED FIRE ESCAPE.

Henry W. Chapman, Blue Rapids, Kan.—The object of this invention is to provide an improved fire escape which may be instantly made ready for use, and by which persons may easily and safely descend from the upper portions of burning buildings. The apparatus when not in use may be folded upon the floor of the room, and may be covered by some article of furniture. When it is required for use a triangular frame is set up in the window, and the person desiring to descend sits upon the seat and lowers himself by the rope or is let down by persons from below. If flame and smoke should issue from the lower portions of the building, the lower end of the rope may be carried away from the building, and the person, in this manner, may be conveyed to a distance from the building.

IMPROVED SEWING MACHINE.

William G. Cummins, Cookeville, Tenn.—This invention relates to improvements in lock-stitch shuttle sewing machines for general family use, which can be stopped or started instantly at the will of the operator without stopping the treadle. The bobbin may also be wound while the needle and feed motion is stopped, and be run by treadle or hand in convenient manner, the object being not only to extend the adaptation, but to simplify the construction, especially of those parts subject to wear and repair, and thus produce a low priced, reliable, and readily repairable sewing machine of wide range. The invention consists essentially of an improved connection of the bobbin winder with the driving shaft and clutch pulley, and by an elbow lever with the presser bar, so as to interrupt the operation of the sewing machine without stopping the treadle. The bobbin winder is retained in raised or lowered position by an elevator and clasp spring, as required.

IMPROVED DITCHING MACHINE.

John H. Rauch, Ida, Mich.—The frame of this improved ditching machine is composed of two parallel lines rigidly secured together at a suita-

ble distance apart by means of bolts and bracing tubes. The frame is mounted on two transporting wheels, one of which is applied on an axle and constructed with a flanged rim, for the purpose of preventing it from slipping on the ground. By means of a draft equalizer the team can walk on the outside of the ditch being dug and draw the machine direct. At the front end of the elevator frame is a gage drum, which is provided with sod cutters, and in the rear of this drum, and a little below it, is a shovel plow rigidly fixed to the elevator frame. The earth excavated by this plow is carried up by means of an endless apron attached to a chain and deposited upon another endless apron, which is arranged at right angles to the elevator chain. A drum rolls on the ground in front of the plow and gages the depth the plow should run. The excavated earth is carried up by the elevator apron and deposited upon an apron attached to the chain, which latter will carry the earth off laterally and deposit it in a wagon or upon the ground at a proper distance from the ditch.

IMPROVED CLUTCH FOR STOPPING AND STARTING MACHINERY.

Moses C. Johnson, Hartford, Conn., assignor to Willard Parker, New York city.—Upon a shaft a pulley is placed, the rim of which is bored out to receive a split ring, over which it freely revolves when the ring is unexpanded. A sleeve is placed upon the shaft, and to it a wedge is secured, which consists of a bar of iron or steel that is made flat and tapered at one side and left round upon the other side. When this wedge is forced between the follower and ring, the follower is forced outward, straightening the toggle and throwing the ends of the ring apart, so that the ring fills the rim. It is obvious that when the ring is thus expanded the disk will carry the pulley or the pulley will carry the disk, as may be required.

IMPROVED SHEET METAL ROLLER-SEAMING MACHINE.

Pardon A. Whitney, Southington, Conn.—This invention relates to the construction of the shaft journals and journal boxes. The shafts are of a uniform diameter from the burrs to the gears, so that they may slide through their journal boxes. The lower shaft is journaled in a fixed bearing at the front of the machine, and is turned at the other end, forming shoulders. Upon this portion, and between the shoulders, a cylindrical box is placed, which is split longitudinally and is placed in the frame, where it is clamped by a screw. When the screw is loosened the box, together with the shaft, may be moved longitudinally within certain limits. The front box of the upper shaft is solid, and is fitted to a rectangular opening at the front of the frame. A spiral spring bears this box up, and the screw passes through the cap and bears upon the top of the box. The upper shaft is turned down at its rear end and fitted to a box placed in the back of the frame, and is held in place by a pin that passes through the sides of the frame and forms a pivot, upon which the box swings.

IMPROVED WIRE FENCE TIGHTENER.

Chambers C. La Rue, Blairtown, Iowa.—This invention has relation to devices for tightening wire fences, and the nature of the invention consists in the combination of an angular lever with clamping jaws or pinchers and a connecting rope. The pinchers consist of two levers constructed with gripping jaws, one of which jaws is flanged, so that the other jaw, which is flat, can firmly bite and hold the fence wire. To prevent the wire from being flattened or kinked, the straight jaws of the pinchers are grooved, and in these grooves the wire will lie closely and be gripped by the flanged jaws.

IMPROVED STRIPING MACHINE.

Christopher Van Slyck and Henry S. De Forest, Schenectady, N. Y.—The object of this invention is to furnish an improved machine for forming ring stripes around broom handles, which shall be simple in construction, convenient in use, being easily adjusted to form the wide or the narrow stripes, and reliable in operation, forming the ring stripes with perfect accuracy. The handle to be striped is placed in notches in the sides of the upper ends of arms, the lower ends of which are rigidly attached to the end parts of the shaft, which rocks in bearings in the blocks, and to which is attached an arm which projects downward through a slot in the bed plate. The lower end of the arm is rounded off, and to it is attached a strap, to be connected with a treadle or other device, to enable it to be operated by foot or hand power, to bring the handle in contact with the cylinders by which its point is applied, by the revolution of which the handle is revolved.

IMPROVED LIFE-SAVING APPARATUS.

Walter S. Green, Long Branch, N. J.—This invention relates to apparatus for rescuing persons from wrecks of vessels and other inaccessible places, and it consists of a cart on which are mounted two reels, one for carrying a hawser and the other for carrying a line. The cart is also equipped with a mortar and other appliances. The mortar and balls are used for carrying the smaller line to the vessel. The smaller line is used for hauling the hawser to the vessel, the sand anchors are buried in the sand, and to them the shore end of the hawser is attached. Shear poles are arranged for holding the hawser up out of the water, and the boatwain's chair runs upon the hawser from the vessel to the shore, being hauled by the small line.

IMPROVED FIRE ESCAPE.

Annabella G. Knox, New York city.—This invention relates to an improved fire escape, which may be stored away in compact shape, is instantly ready for use, allows the convenient lowering of children, packages, etc., from upper stories, and forms, finally, a convenient communication with the ground from any height. The invention consists of a rope of suitable strength, having bolstered stops secured at suitable distance to the rope, which is secured to the floor or other support of the upper story, and provided with similarly bolstered loops or handles at the part passing over the window sill. The lower end may be closed to form a loop to be placed around the body of children or around packages and other articles. The fire escape may be stored away in a suitable box in the rooms, halls, or other suitable place, is instantly ready for use, packed into small space, and cheaply manufactured.

IMPROVED FIRE ESCAPE.

George N. Shishmanian, Galveston, Tex.—This invention consists of an air cushion, having a concave upper surface, in the center of which there is an opening of sufficient size to admit a person's body. The cushion is supported above a suitable car by standards that rest upon springs. The object of the invention is to provide apparatus for receiving without injury persons or goods falling from windows of burning buildings. When the apparatus is to be used it is drawn near the building, and beneath the window from which escape is to be made. The person desiring to reach the ground jumps into the concave surface of the air cushion and escapes through the central aperture to the car below. The momentum of the fall is broken by the cushion, and is arrested by the action of the springs. Goods may be thrown upon the cushion without fear of breaking them. The apparatus can be readily moved from place to place, and is more manageable and reliable than ladders.

IMPROVED PACKING FOR COMBINING TUBES OF INJECTORS FOR STEAM BOILERS.

James B. Harkins, Altoona, Pa.—This invention consists of a combining tube for boiler injectors, provided with a rabbit to receive packing rings and a follower, said rabbit being in communication with the passing stream of water through suitable openings extending to the inner surface of the tube, whereby the packing is expanded by the pressure of the water. When the injector is in use the outward pressure of the water and steam exerted in the inner surface of the rings throws them against the barrel of the injector and prevents water and steam from passing between the rings and barrel. The packing thus made and applied requires no adjustment, as it remains tight until it is worn out.

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Tin Foll.—J. J. Crooke, 163 Mulberry St., N. Y.

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Notes & Queries

(1) C. P. asks: What can be put on plow mould boards to preserve the polish and keep them from rusting, and will be easily rubbed off? A. Use a mixture of tallow and white lead.

(2) J. M. S. asks: What is wash blue? A. It is commonly a fine grade of Prussian blue mixed with enough oxalic acid or ferrocyanide of potassium to render it soluble in water.

(3) F. H. asks how to make the varnish used for transferring? A. Take mastic in tears, 6 1/2 oz.; resin, 1 1/2 oz.; pale Venice turpentine and sandarac, each 25 oz.; alcohol 5 pints. Dissolve in a clean bottle or can in a warm place, frequently shaking it. When the gum is dissolved, strain it through a lawn sieve and it is fit for use.

How can I make an ink that cannot be erased even

with acids? A. To good gall ink add a strong solution of fine soluble Prussian blue in distilled water. This addition makes the ink, which was previously proof against alkalies, equally proof against acids, and forms a writing fluid which cannot be erased without destruction of the paper. The ink writes greenish blue, but afterward turns black.

(4) H. F. asks: 1. Can you tell me how I can check rosin from setting almost immediately when cooling? A. No. 2. Is there a way to odorize the same? A. Use balsam of tolu, sandalwood, oil of anise, storax, powdered vanilla, etc. 3. Is the fume arising when melting by heat injurious to health? A. In a concentrated form, yes.

(5) P. B. asks for a process of transferring writing to type metal? A. Sprinkle the ink lines, while moist, with gum arabic in finest powder. When perfectly dry dust off excess, stretch the paper on a smooth level backing, and pour on the fusible metal.

(6) G. S. says: 1. I have a relay wound to 154 ohms resistance. It is wound with 5 oz. of No. 30 wire. How many feet of wire, same size, shall I add to make it 160 ohms resistance, and if I wish to increase the resistance still more, shall I add wire at the same ratio? A. With a given battery power, the resistance of wires of the same diameter are to each other as their length; thus, a wire twice as long as another has twice the resistance. We believe you have rated the resistance higher than it should be in the case you mention; the proper way is, as you are winding your coil, to compare its resistance from time to time with a standard, as we will explain in a future issue. 2. Is not common sheet zinc melted and cast into the desired shape just as good as the zincs made on purpose for battery use? A. No. It often contains lead. 3. I wish to galvanize a mile or two of wire; can I do it by drawing the wire through a tank of sulphuric acid into a tank of muriate of zinc, then through the melted zinc? A. Yes. Use sulphuric acid, with twenty or thirty times its weight of water. Let the wire remain in the acid water until the scale, if there be any on it, be entirely removed.

(7) A. K. says: I propose to make an induction coil on the following plan: Using No. 28 wire for the secondary coil, I intend to wind cotton yarn between the convolutions of wire, so that they cannot touch, winding it of course simultaneously and on varnished paper. Having completed one layer, I give it a coat or two of quickly drying copal varnish, and cover the whole layer with strong, varnished paper, varnished on both sides; when the paper is dry, I wind the next layer in the same manner, and treat it the same as the first, and so each succeeding layer till the section is finished. To avoid having layers of great and different tension of electricity too near together, I intend to compose the coil of three sections, each one completely finished, in the above described manner, by itself, and connected by a binding screw. Do you think the insulation will be sufficient? A. Your wire should be finer, say No. 32 instead of 28. The insulation you mention will not give a good result, because it takes too much room. Silk or cotton is the best, although, if you are careful, you can accomplish the result by passing your wire through any quick drying varnish or paint; then over a hot stove, and through cold air to the coil, laying a strip of thin paraffined paper between each layer.

(8) H. H. C. says: Would it be better to have the schoolroom of a second story on the north end and playground on south, or vice versa? How can we deaden the sound on the floor, so as not to have one school disturb the other? A. The schoolroom should be placed at the north end of the building. To deaden the floors at little expense, lay two thicknesses of building paper upon the floor joists under the planking.

(9) C. A. W. B. asks for a cheap filter to cleanse water from a roof before it enters a cistern? A. Let the water run through a cask or keg of charcoal.

(10) C. A. M. asks: 1. What is the best method of preparing an object of wax or other non-conductible substance for electro-deposit, so as not to fill up deep cut fine lines? A. Covering with plumbago or black lead. The ordinary article sold for household use is not good; purchase from some dealer in scientific apparatus. 2. When graphite is used, how is it made fine enough, and how is it applied, so as to adhere to the object? A. It is carefully ground in water, apply with a camel's hair brush, work in lightly and occasionally breathe on the surface if the powder does not adhere readily, and when this will not suffice, hold the spot for an instant over the mouth of a bottle containing spirits of wine.

(11) W. J. C. asks how to make a telephone? A. The cut we give on first page, No. 14, present volume, is to scale, and once, twice, or three times the size will work well. The spools are of copper wire No. 40. Silk insulation, and the armature is a circular disk of thin ferrotype plate, such as is used by photographers.

(12) T. N. says: 1. I have an induction coil containing 600 feet of secondary, which gives as much as a man thoroughly "pickled" in electricity can bear, with only half a square inch of zinc surface (bichromate battery). Is not this a very good result? A. Very good, if the man has not become sensitive by being "pickled." 2. Can a method of winding naked wire on helices be patented? A. Yes, though the principle cannot be. 3. Can a combination of leading and secondary wires be patented? A. Yes. 4. Can tin be copper plated without using an alkaline solution of copper? A. Yes, but it is troublesome and expensive. 5. What is the easiest way of removing the tin? A. By dipping it into strong sulphuric acid, and when the tin is removed washing with clean water. 6. Will you give me a formula for finding the resistance of primary coils? A. The proper way is to compare the resistance by means of a galvanometer and battery, with a standard of resistance, which may be purchased from the electrical instrument makers.

(13) J. P. asks for a method of making the purple precipitate of Cassius from pure gold of 24 karats, the same as is used for staining glass, etc.? A. Dissolve the gold in a warmed mixture of 3 parts hydrochloric acid and 1 of nitric acid, and evaporate the solution nearly to dryness. Dissolve 1 part of this in about 10

parts of water, and add to it protochloride of tin (stannous chloride) 1 part, dissolved in a small quantity of diluted hydrochloric acid, and 12 parts perchloride of tin (stannic chloride). Wash and dry the precipitate. Before adding the tin salts, the solution of gold should be filtered through a corner of fine white filtering paper in order to remove what chloride of silver remains mixed with it.

(14) Z. I. asks for a material for closing the pores of a large stoneware box to render it impervious to acids? A. What acids and of what concentration?

Please give me a cement to resist boiling water, suitable for mending the delicate handle of a china cup? A. Soak isinglass in cold water until it is soft, and then dissolve it in the smallest possible quantity of hot proof spirit. In 2 ozs. of this mixture dissolve 10 grains of ammoniacum, and while still liquid, half a drachm of mastic dissolved in three drachms of rectified spirit. Mix well together and bottle for use. This is the "diamond cement." To use it, stand the bottle for a moment in warm water to render the cement fluid, and apply to the fracture immediately. It resists water and moisture perfectly.

(15) —, from Jersey City, asks: Will it make any difference whether the electro-voltaic chain belt is plated aluminum, silver or nickel? Will not the silver be just as good? A. The only advantage of the aluminum is that it does not readily tarnish; but silver is a better conductor, and will answer as well.

(16) J. E. A. wishes to know: 1. Which will make the strongest electro-magnet, to coil the insulated wire around the core similar to thread on a spool, or to coil the wire from one end of core to the other, then carry straight back parallel with core to place of beginning, and coil as before? A. Same as the thread is on a spool. 2. Is it an intense or a quantitative current that will make the most powerful electro-magnet? A. An intense current will produce the best magnetic effect by means of a magnet wound with fine wire, having resistance; a quantitative current, by a magnet with coarse wire, having less resistance. 3. If a current of electricity is passed around a number of similar electro-magnets, would all of the magnets be of equal power? A. Yes. 4. If opposite poles of electro-magnets are brought together, will the attraction be greater than when an armature of soft iron is used in place of one of the electro-magnets? A. Yes. 5. If similar poles are brought together, will the repelling power be as great as the attracting power is when opposite poles are used? A. No.

(17) W. E. D. says: In making rubber stamps by Park's method, shall I immerse the whole form in bisulphide of carbon and chloride of sulphur, or remove the mould and rubber from the press and immerse it in the solution? How long a time shall I keep it in the solution? In vulcanizing by the dry process, how can I remedy the sticking in the mould? A. Remove the mould from the form. A few minutes' immersion, depending upon the bulk of the form, will usually suffice. Use powdered magnesia on the mould to prevent sticking.

(18) A. S. asks: By exhausting the air from a flask of water with an air pump, would it produce any considerable degree of coldness in the water without the use of sulphuric acid, as it is used in Carré's ice machine? A. Yes, if properly arranged, and the flask is covered with some non-conductor of heat. A large pump will be requisite.

(19) F. H. T. asks if alcohol is injurious to leather? A. It is not injurious unless applied in excessive quantities, in which case it may detract from the suppleness and durability of the leather by its solvent action on the natural oils and stuffing. In ordinary liquid shoe dressing strong borax water constitutes the solvent for the shellac instead of alcohol, as in the German preparation.

(20) W. H. asks if a shaft 4 1/2 inches in diameter, supporting a weight varying from 1 1/4 to 2 1/4 tons and running at a speed varying from 500 to 700 per minute, can be run on two friction wheels so placed together as to form a bearing instead of the ordinary box bearing? A. The arrangement is perfectly feasible. Make the friction wheels with diameter four or five times that of the shaft.

(21) R. P. S. says: A friend has a country residence on a beach; the lawn is even with the top of the wall against which the water rises. Every spring the wall is washed out. Now if the wall was laid in Portland cement, would it be a sure protection? A. If, in rebuilding the wall, time is afforded for the Portland cement to set before being submerged or washed by the water, it will then remain permanently. It is important, also, that the wall should have a deep foundation. If the wall is wet at all seasons at every rise of the tide, it would then be well to construct large blocks of it on the bank, where it would have an opportunity to become hard and cohere, and then at low tide lower these blocks into their places in the wall. Such a wall would not wash out.

(22) E. P. F. asks what sizing sign painters use for smearing purposes? A. Mix a stiff oil color as near the color of the smalts to be used as possible. Sift these on to the fresh paint with a fine sieve, allowing the work to lie in a horizontal position until sufficiently dry to retain them.

(23) A. I. W. asks how to restore to its former elasticity a quantity of rubber sponge, which, having lain unused for several years, has become quite hard? A. The rubber has probably suffered partial oxidation and cannot be restored to its former softness.

(24) W. W. says: I have built an icehouse above the ground, with hollow walls 11 inches thick filled with sawdust. I am now building one with hollow walls filled with slacked oyster shell lime. Is this any better than the sawdust? How would I ventilate it so I can keep ice during the summer months? A. Ice keeps well in houses built of wood above ground where the hollow space is 10 inches wide and is filled in with sawdust; a level ceiling over the ice 10 inches thick being also so filled in. The floor should be paved with concrete inclining to the center, where a trapped opening

should receive the water and discharge it into a drain beneath. Ventilation should be afforded by a tube or shaft about 6 inches square, extending from the center of the ceiling to a short distance above the ridge of the roof. The ice should be supported upon a tier of beams laid above the concrete bottom. The larger the quantity the better it keeps—a cube of 12 feet will keep well.

(25) C. E. A. says: If a building be sufficiently protected by lightning rods, will the fluid ever strike them with sufficient intensity to be heard, or will they be constantly drawing off so much of the fluid that enough cannot be collected in the vicinity to produce a report? A. They will draw off the electricity silently and harmlessly, if they are thick enough and well connected with the earth; if these requirements are not fulfilled, the house would be safer without them, as the electricity will choose other courses as well, according to the degree of their conductivity to the earth as compared with that of the lightning rods.

(26) F. A. P. & Bro. ask how to grind hard chilled metal castings? A. Use artificial emery wheels. State the kind of metal to manufacturers of such wheels; they will provide one suitable for the work.

(27) W. R. T. asks if it would have been practical to have driven the English channel twin steamer Castalia with one wheel, driven with the engine placed in one hull, or with one wheel driven with two engines, one engine in each hull, the engines attached to the same shaft? A. Yes.

(28) C. W. asks if the annealing process has a tendency to weaken metals. Is the cohesive or tensile strain less in soft than in hard metals? A. No.

(29) F. A. B. asks what kind of rubber to use in making rubber stamps? A. Use common gum rubber, obtainable at any of the larger rubber dealers. The gum rubber sold by druggists is often worthless, owing to long exposure to light and air.

(30) W. J. McG. asks: 1. What are the melting points of iron, lead, copper, tin, silver, and gold? A. Iron melts at 2786° Fah., lead at 612°, copper at 1966°, tin at 442°, silver at 1873° and gold at 2016°. 2. What degree of heat is required to convert these metals into gases? A. It has not been determined accurately—from 2,000 to 10,000°. 3. One pound falling through a distance of 10 feet exerts a force of 10 foot lbs. on the substance on which it falls. What would be the weight of a mass of material which would exert the same force, by pressure, when resting quietly on the substance? A. The weight would strike the surface with a force equal to $\sqrt{643\frac{1}{2}}$ lbs. pressure at the moment of contact. The mass must therefore weigh $\sqrt{643\frac{1}{2}}$ (= about 25.35 lbs.), since it must exert the same pressure.

(31) J. D. asks: How is phosphor-bronze manufactured? A. True phosphor-bronze is a combination, without intermediates, of copper with phosphorus. It is simply a phosphide of copper in definite proportions. The copper must be commercially pure, being exempt from arsenic, antimony, iron or zinc. The maximum and minimum percentages of phosphorus in the bronze are 2 and 4.

(32) A. M. C. says: I have a pump that has a tight foot valve and the water is always up to the barrel of the pump, but it will not start, after resting a while, without filling the air chamber and letting it remain for 3 or 4 minutes. A. It is quite probable that the piston leaks.

(33) C. J. & Co. ask: 1. What reduction in the grate bars is necessary when "slack" is to be burnt? A. They should be sufficiently close together to prevent material loss from unburnt fuel falling through. 2. Is there any existing patent in the use of a blower to burning of coal screenings or slack? A. No. 3. Would there be any utility in placing air jets back of the bridge wall to burn the smoke? A. No.

(34) B. F. B. asks for a remedy for a deposit that collects on the bottom of steam boilers. A. Use a feed water heater with sediment collector.

(35) W. H. S. says: We finish silk goods on a cylinder heated with red hot irons. Will it have any effect on the goods if the cylinder be heated with steam, so long as we get the same temperature? A. Probably not.

(36) G. B. D. asks: 1. What are the advantages of the oscillating steam engine? A. Fewer working parts. 2. What are the mechanical difficulties that hinder its coming into use? A. Unequal wear of the trunnions and packing of the same. 3. If these difficulties could be surmounted, would not this style of engine be preferable to the reciprocating? A. Probably, by many engineers.

(37) F. R. M. asks: How many square feet are there in the surface of the earth? A. We do not know that this calculation has ever been attempted. Branda gives the surface, on the assumption that the earth is a sphere, as 196,625,000 square miles.

(38) H. McK. asks: 1. What sized circular saw can I run with a steam engine 2 inches bore and 4 inches stroke, running 300 revolutions per minute, with boiler carrying 50 lbs. steam per square inch? A. Diameter 8 to 10 inches. 2. What will be proper speed for the saw? A. 3,500 revolutions per minute.

(39) J. T. asks: How many lbs. will 4 wrought iron round rods sustain, rods 15 feet long and 3 1/4 inches diameter? Will square rods sustain more pressure than round rods, length and diameter same? A. If you refer to tensile strength, it is from 40,000 to 60,000 lbs. per square inch. In the case of square bars, as their sectional area is greater, they are stronger.

(40) W. C. B. asks: Would it be practical to drive a grist mill with one or two horses, in this way: Build a large wheel 36 feet diameter, place the horses on the periphery, then gear for speed, as is usual in breast or overshot water wheels. Would I gain anything over the common horse powers in use? A. No.

(41) F. B. M. asks how to drill a hole through a watch crystal and not break it? A. Drilling from both sides with a common drill is a very good preventative of breaking. Work lightly and use turpen-

time as a lubricant. Or use a flat-ended copper drill supplied with coarse emery and water.

(42) E. A. D. P. says: I have heard it asserted that south of the equator the magnetic needle points to the south instead of the north. Is it true, and if so what is the cause? A. The statement is not correct. Local causes sometimes affect the needle so as to invert its polarity.

(43) R. G. B. asks how to clean a brass chandelier that is badly fly specked, so as to restore it to its former color? A. The treatment must depend somewhat upon the nature of the lacquer. Try a little fine rottenstone, slightly moistened and applied gently on a piece of chamois skin; or, if the lacquer will bear it, use warm water and the yolk of an egg.

(44) J. M. B. asks: What is the process of making dies in steel by sinking metal, softer than the steel hub, into the die? Is the process patented? A. No. See "How Greenbacks are Made," in Nos. 14 and 15 SCIENTIFIC AMERICAN, vol. 27, 1872.

(45) G. E. S. writes: I wish to lift a weight of 2 ozs. 1 inch high, once in every second; what size electro-magnet, and what size and length of wire do I require? A. Use a piece of soft half inch round iron, nine inches long, bent in the U form for the core, and 600 feet of No. 30 copper wire, cotton covered, for the spools; arrange your armature on a lever, with the 2 oz. weight at one end, so that the armature need only move a short distance to do the work. 2. What kind of battery would you recommend for working this for several months without attention? A. Use ten cups of gravity battery, which may consist of a disk of zinc and one of copper placed over, and parallel with each other, in a glass jar; the copper being imbedded in about 1 lb. of sulphate of copper in crystals placed at the bottom of the jar; the zinc is suspended about 4 inches above. The battery is set in action by pouring in a solution of sulphate of zinc, until the zinc is covered; the copper of one cup is connected with the zinc of the next, by means of a "kerite" or gutta percha insulated wire running through the solution and riveted to the copper disk.

(46) W. D. B. asks: Which is the heavier, 1 cubic yard of the air that we breathe on a damp and cloudy day, or the same quantity of the same air on a dry hot day? A. Air saturated with moisture is specifically heavier than dry air at a like temperature; but the total atmospheric or barometric pressure in a given locality is usually less in wet than in dry weather, the temperature being the same.

(47) D. K. says: I require for the benefit of my work a temperature of 75°, average temperature for the three winter months. I have to make 30° artificial heat, and it costs \$100. Suppose I am in a locality where the average temperature for those three months is 30° and have to make 45° artificial heat, how much more will it cost, other things being equal? A. This would depend much upon the arrangement and perfection of the heat radiators, and the character and tightness of the walls, etc. Probably a third more fuel would suffice.

(48) F. D. G. asks for a filling for a rice hulling stone that has been broken? A. Use pulverized stone and a strong solution of alum in water.

(49) J. A. J. desires to know what causes it to rain immediately after every large battle? A. The concussions of the explosions are supposed to cause the clouds to gather. The theory is very vague.

(50) C. C. asks: What is the fastest rate of speed attained by fast trains on American and English railroads? A. About 60 miles an hour.

How can I expand or diminish the size diametrically of a small brass tubing? A. By drawing.

(51) J. H. B. asks: What will prevent iron hoops on barrels from rusting? The barrels are stored in a very damp cellar. A. Cover the hoops with a thick coat of good paint or asphaltum varnish.

(52) J. S. F. asks: Can anthracite coal dust be used as fuel under a bituminous coal burning boiler by introducing a series of steam jets under the furnace bars? A. Yes, but it may be necessary to change the grate bars.

(53) H. A. L. asks: 1. Can water be compressed? A. The compressibility of water is found to be a millionth of its bulk for each atmosphere (=about 15 lbs. per square inch) of pressure. 2. How or in what way? A. Usually in strong vessels of glass by powerful screw pressure exerted on a piston of soft metal. A suitable glass flask with the neck drawn out into a fine tube is completely filled with hot water (pure distilled) and a little globe of mercury worked into the tube to indicate by its movements the change of volume of the water within. The flask is placed in the strong vessel referred to, surrounded by water, to prevent change in volume of the flask, and the pressure applied. The fall of the mercury globe indicates the compression of the water.

(54) I. B. K. asks if a flywheel resting in two balances and revolving, would the balances show any increase of weight? A. No.

(55) E. D. asks how to make an ink for postal cards, which will be colorless until heated? A. Sulphate of copper and sal ammoniac, mixed in equal parts, will become yellow if exposed to the fire. A weak solution of chloride of cobalt and chloride of nickel is turned to a green by heat. A solution of acetate of cobalt, with a little nitrate added to it, turns to a rose color by heat, and disappears when cold. The others are more or less indelible when once developed.

(56) D. A. asks how to enlarge or reduce a drawing from a square to a parallelogram of any given proportions? A. You can change the relative proportions by dividing the original design into small squares and transferring the parts contained in these squares to those of the desired form, and vice versa.

(57) W. S. W. says: We have two boilers connected at bottom by a mud drum with six inch openings. At the top by a steam drum with openings the same. We want to work them with separate fires,

where at times steam will be made faster in one than in the other. Will there be any difficulty in keeping the supply of water equal? A. Probably not.

(58) J. E. L. asks: Will I be obliged to take a license out to fire a boiler in New York city that does no work but furnish steam to pump water to the top of a hotel? A. Yes.

(59) J. W. H. asks where to cramp an exhaust on a high pressure engine to make it sound loud? A. At the end of the exhaust pipe.

(60) F. D. W. asks: What are the so-called seven wonders of the world? A. 1. The Pyramids of Egypt. 2. The Mausoleum, built by Artemisia, wife of Mausolus, king of Caria. 3. The Temple of Diana at Ephesus. 4. The Walls and Hanging Gardens of Babylon. 5. The Colossus of Rhodes. 6. The Statue of Jupiter Olympus. 7. The Pharos or Watch Tower built by Ptolemy.

(61) B. D. W. asks for the rule for increasing or diminishing the speed of machinery by shafting and pulley? A. See No. 12, p. 181, current volume. Is corn meal kiln-dried before or after it is ground? A. After.

(62) D. F. H. asks: In a steam boiler, where is the steam made? A. It is made at the heating surface.

(63) G. W. asks: 1. What kind of oil is used for tempering steel? A. Lard oil. 2. Can a circular saw be tempered without springing it? A. No. After being tempered, saws are put in proper shape by hammering.

(64) H. & C. ask how to prevent scale in steam boilers? A. Preventives depend upon the quality of the feed water. The use of heaters to precipitate solid impurities is recommended.

(65) W. McC. asks how to fix the warp in a hand loom for weaving? A. You will find information in Gilroy's "Art of Weaving."

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

E. P. S.—The powder contains silicate of alumina, lime, and magnesia carbonates, sesquioxide of iron, sand, traces of alkalis, and films of mica. It is probably the washings of felspathic and limestone rocks. It is not valuable.—L. T. S.—They are, for the most part, impure clays. Nos. 1 and 4 might be used for brick-making. They contain considerable quantities of sesquioxide of iron, lime, and silica (impurities). No. 2 is aluminate—a hydrous sulphate of alumina—mixed with a little clay, sand, and gypsum. It might possibly be used in alum making. No. 3, after washing, will answer for white table ware and pottery in general.—H. S. S. C.—The bright particles and the rock are mostly of iron sulphide—marcasite. It contains a trace of silver and probably a little gold.—Mineral from —, Derry, N. H. It is a variety of fluorapatite—fluoride of calcium.—G. G.—No. 1 contains chalcopryite—sulphide of copper—altered marcasite, and a trace of nickel. It probably contains enough copper to be of value as an ore of that metal. No. 3, quartzose with pyrites. No. 5, quartz containing hornblende, mica, and limonite. No. 6 is mica schist with limonite. No. 7 is talco-schist. No. 8 is specular iron ore. Nos. 2 and 4 are missing.—R. A. W.—They are crystals of tourmaline imbedded in quartz rock.—E. N. C.—It is a variety of pipe clay richly colored by sesquioxide of iron. It may be used for pipes, tiles, common pottery, bricks, etc.—I. M. P.—It is marcasite—composed of sulphur and iron.—J. W. F.—The packages should have been labeled; we cannot identify them.—J. F. S.—It is a limestone containing a large percentage of silica; the bright metallic particles consist of iron pyrites—see p. 7, vol. 36, of the SCIENTIFIC AMERICAN. The percentage of alumina is somewhat large.—N. L. L.—It is a clayey deposit showing considerable potash. An opinion of the value of a soil is dependent upon the results of a chemical analysis.

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 Sea in Sahara. By M. M.
On Locomotive Wheel Sliding. By J. F. A.
On Domestic Water Supply in the Country. By P. A. S.
On the Tides. By W. H.
On How to File the Scientific. By G. H. B.
On Patent Medicines and Secret Remedies. By V. N.
On the Congo River. By W. M. H.
On Anthrax-Epidemiology. By J. S.
On the Red and the Two-lined Salamander. By C. F. S.
Also inquiries and answers from the following:
S. C.—J. D. P.—F. C. S.—L. S.—A. G. S.—A. S. P.—H. M.—G. W. G.—L. H. M.—J. G. J.—S. O. & Bro.—R. M., Jr.—A. M.

HINTS TO CORRESPONDENTS.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

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

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

Hundreds of inquiries analogous to the following are sent: "Who makes steam pumps to be applied to sailing vessels? Who makes and sells dynamite powder?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

OFFICIAL.

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were

Granted in the Week Ending

September 18, 1877,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

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