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THE DELAWARE AND LACKAWANNA TUNNEL THROUGH BERGEN HILL, N. J.

About a mile from the west shore of the Hudson river, and forming a spine along the peninsula bounded by that stream and New York Bay on the east and Newark Bay on the west, there extends a range of irregular eminences known as Bergen Hills. These are a continuation of the Palisades; and as the extremity of the peninsula is reached, their height grows rapidly less. The ridge thus formed constitutes the great barrier between New York and the inland traffic of New Jersey and Pennsylvania; and an immense amount of engineering skill and capital have been directed toward surmounting it. Where the hills are low, open cuttings have been resorted to; and the tracks of the Pennsylvania and Newark and New York railroads are thus conducted through; but further to the north the elevation no longer admits of such an expedient, and tunnelling has been necessitated.

In 1860, the Bergen or Long Dock tunnel, 4,311 feet long, 23 feet high, and 30 feet wide, crossing the hill diagonally, was completed at a cost of some one million dollars. Since then, this bore has formed the only available pathway for the enormous traffic of both the Erie and the Delaware and Lackawanna railroads, which for a long period has greatly exceeded the capacity of the tunnel. As it is not permitted for one train to enter until another preceding it in the same direction has emerged, and the passage occupies some five minutes, and as the tunnel belongs to the Erie road, the other line has been under a disadvantage, not only in being compelled to purchase right of passage and to yield precedence to Erie trains, but also, as the annexed map plainly shows, to make an S-shaped *détour*, turning to the left to gain the mouth of the tunnel and then making another bend on emerging. The line through the new tunnel will be straight from the Hoboken terminus to the Hackensack river, gaining in point of actual distance 0·65 mile, and saving two stops now necessitated by the crossings of the Erie road, which together involved a loss of some ten minutes' time.

Work upon the tunnel began in September, 1873, and has since been simultaneously prosecuted in each direction at the bottom of the six shafts and at the two approaches, making fourteen headings in all. The character of the excavation presented no extraordinary features, as it was entirely through trap rock. Hand drilling, for reasons of economy, was chiefly employed. The first year's labor consisted in sinking the shafts to depths varying from 77 to 93 feet, and in opening 690 feet of tunnel. During the succeeding year, 2,922 feet of bore were finished, and finally on January 18, 1876, the last heading was connected and the rock was penetrated over the distance of 4,210 feet. In May, 1876, the last bottom was finished; and for the past year, the work has been in arching and enlarging the roof of the tunnel for the same. The total completed length, from face of ma-

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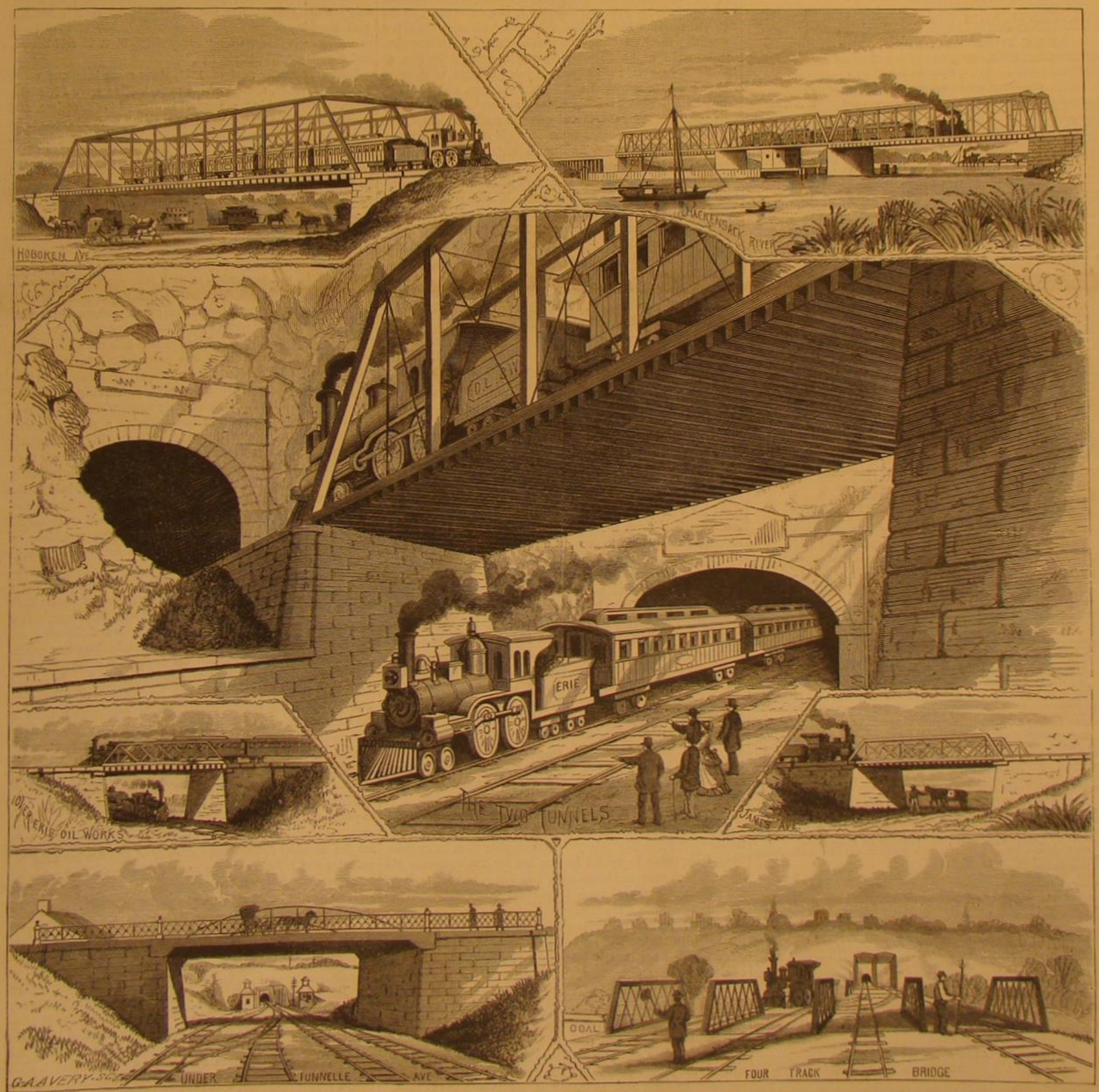

THE ENGINEERING WORKS OF THE DELAWARE, LACKAWANNA, AND WESTERN RAILROAD, HOBOKEN, N. J.

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VOL. XXXVI., No. 21. [NEW SERIES.] *Thirty-second Year.*

NEW YORK, SATURDAY, MAY 26, 1877.

Contents.

(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT,
No. 78,
For the Week ending May 26, 1877.

THE RISE OF THE SEWING MACHINE.

On the 8th instant, the patent granted to John Bachelder, first for fourteen years from May 8, 1849, and subsequently twice extended over periods of seven years each, expired. With this patent terminates the series under which a combination of sewing machine manufacturers have been enabled to sustain a monopoly to which the people have paid a colossal tribute. The period has therefore been attained when the sewing machine, in its fundamental and essential features, becomes public property. At some future time, we propose to publish a detailed history of the means whereby this great invention has been developed, and of the influences by which it has been controlled. At present it seems fitting to glance back to the circumstances of its production, to note the effect of the lapse of the patent above referred to, and briefly to review the benefits which the sewing machine has conferred upon the world.

As is the case with the majority of inventions which in course of time have become of immense value, the idea of making a machine that would accomplish the given purpose was by no means original with the inventors who contributed the devices which in the end proved fundamentally necessary to the practical apparatus. Doubtless the problem of producing mechanism capable of sewing has vexed the minds of inventors ever since man began to invent; and the meager records which we have of early atttempts in that direction doubtless afford no idea of the same in point of numbers or of frequency. In 1755, Weisenthal patented in England a needle with the eye in the middle, which was operated by hand. Alsop also, in England, in 1770, patented an embroidery loom; and in 1804, Duncan devised machine embroidery by a number of hooked needles. Saint's machine, dated July, 1790, is the nearest approach to the modern apparatus; but this was only adapted to leather sewing, as the notched needle which pushed the thread through could not have been used on fibrous material. In 1825, Thimonnier, a poor tailor of St. Etienne, France, conceived the idea of sewing apparatus, and for sixteen years labored to develop the same. He achieved substantial success; and in 1841, two hundred of his machines were at work, making army clothing. In 1848, the machines were made of metal, and could work at the rate of three hundred stitches a minute. The political revolution in France during that year, however, ruined the inventor, and he died in great poverty in 1857.

The above brief statement covers what was first accomplished in Europe. As early as 1832, Walter Hunt, of New York, claimed to have made a lock stitch sewing machine; but he did not seek a patent until 1854, and then his application was denied on the ground of his having abandoned the invention, and on account of Howe's patent obtained in 1846. In 1842, John J. Greenough contrived a machine having a double pointed needle, with an eye in the middle, which was drawn through the cloth by pincers. This never got beyond the stage of a model. Benjamin W. Bean, in 1843, patented a machine for making a running or basting stitch, the needle passing through corrugations of the cloth; and George R. Corlies devised an apparatus similar to Greenough's shortly afterwards. None of these machines were brought into practical use.

In 1845, Elias Howe completed his first machine, and obtained a patent thereon in September, 1846. His principle covers the forming of the seam "by carrying a thread through the cloth by means of a curved needle on the end of a vibrating arm, and the passing of a shuttle furnished with its bobbin between the needle and the thread which it carries." There are four other claims relating to the lifting of the thread to form a loose loop, a means for holding the thread on the bobbin to prevent unwinding after the passage of the shuttle, a stitch tightener, and a baster plate. This machine, the Patent Office examiners evidently did not think of enough importance to notice in their detailed reports, as no reference is made to it in those documents for 1846. The SCIENTIFIC AMERICAN, however, noticed its production, and in doing so said: "The inventor of it has struck out a track of its own; and it would be difficult, by any means heretofore known, to sew as fast or as well as can be done by this machine." It is indicative of the tendency of thought of the time, as well as of the closeness with which inventors scanned our pages, that we were at once besieged with letters asking for more information about that machine; but Mr. Howe was reticent, and he, almost immediately after obtaining his patent, went to Europe, so that our readers' curiosity had to be satisfied with such information as our paper had already afforded.

In Europe the inventor endeavored to obtain capital for the manufacture of his machine; but he was met by a skepticism even more obdurate and discouraging than he encountered from those to whom he applied for the necessary aid here; and he returned home after two years, in a sailing vessel, paying for his passage by manual labor and arriving literally penniless. He remained extremely poor until after his many legal controversies against infringers terminated in his favor in 1854. We can recall his weekly visits to this office to purchase the SCIENTIFIC AMERICAN, when his circumstances seemed to be such that the four cents, required at that time for each copy, could hardly be afforded. The difficulty with Howe's original machine, it should be noticed, lay in the absence of a suitable feed motion. His needle moved horizontally, and the cloth was attached to the moving baster plate and carried along before the needle to the end of the plate's motion. Then the machine was stopped, the parts brought back to their first position, and the operation begun again.

Inventors were quick, however, to find out about Mr. Howe's invention, and to understand its failings. How many schemes were then projected, which proved abortive, of course cannot be told; but six years after we find ourselves stating in this paper that we "have illustrated no less than seven sewing machines." A year after that of Howe's patent, Morey and Johnson devised a single thread chain stitch machine. It was the first invention of the kind this journal ever illustrated, and the first ever presented fully to the public. Its engraving adorns the first page of the SCIENTIFIC AMERICAN of January 27, 1849. "It sews about one yard per minute; and for upholsterers and bag makers is a valuable machine," we said. The feed motion was something like Howe's; the price $135. In the following issue, we illustrated a French machine, devised by M. Magnin. This had no feed motion, and our object in publishing it, if we recollect aright, was to exhibit its inferiority to the American machine. And the public did not form a very high opinion of the latter, which was about that time placed on exhibition in this city. We find ourselves a few years later telling our readers how we happened to be in an office on Broadway in 1848, when conversation arose regarding the new-fangled sewing machine. A committee of gentlemen went to the tailor's shop where it was exhibited to examine it, and, as was promised, it certainly sewed a very neat seam. But one of the party detected the operator in making a little knot on the thread after removing the sewn fabric; and watching his opportunity, he broke off the knotted portion and pulled the thread out—it being a single chain stitch, it all raveled out of course—and thereupon the committee laughed at the invention, pronounced it useless, and departed. Single thread chain stitch machines have become very popular since then; but after all, the hasty opinion of the committee, and probably of the public, was not without good results, for the next machine we illustrated (Lerow and Blodgett's) claimed as a great advantage that "every stitch in it is self-bound, and the seam will not rip out."

During the early part of 1849, there came into our office one day a quiet, spare-looking man, hailing from Pittsfield, Mass. After making a general survey of the premises, and convincing himself that he could trust us with his secret, he carefully untied a handkerchief and exhibited two models—one, a rotary steam engine, the other, a sewing machine. He could not afford, he said, to obtain patents for both, and he wanted to know which one was likely to prove most advantageous to him. We advised the sewing machine as the most promising of the two, although, if we remember correctly, we had but little faith in the latter at that time, and accordingly he authorized us to proceed. Our visitor was Mr. A. B. Wilson; and in the first crude model, which remained in our possession until a few years ago, was embodied the double pointed shuttle, making a stitch at each backward and forward movement; and perhaps there was also the germ of the second great sewing machine invention, namely, the feed motion. Even in this first machine, which we illustrated soon after it was patented, there is a novel feed device. Mr. Wilson's completed invention was the "four motion" feed, which consists in moving a serrated bar, in a slot in the horizontal plate upon which the cloth is fed, in the direction of the four sides of a parallelogram. The teeth carry the cloth forward while moving horizontally a short space above the surface of the plate; the bar then drops (the second motion), then passes backward horizontally beneath the plate (the third motion), and, rising, brings the teeth through the slot and above the surface (the fourth motion). In our issue of March 29, 1851, we find an extended notice of an improved Lerow and Blodgett machine, on which one girl could sew six overcoats in one day, and a very expert hand twenty pairs of pantaloons.

We have not space to enter into the details of other early sewing machines, most of which are represented in the back files of the SCIENTIFIC AMERICAN. Isaac M. Singer's first patent was obtained in 1851 for a method of tightening the stitch and other improvements in the single-thread or chain-stitch machine. Afterwards he devised the peculiar feed motion known as the wheel or continuous feed. It proved a most valuable invention. J. E. A. Gibbs, of Millpoint, Va., invented the rotating hook which produces a twist in the loop stitch. The first rotating hook was patented by Wilson in 1851. Charles H. Willcox invented the automatic tension; and in the Grover & Baker machine (1851–2) was first introduced the double loop stitch employing two threads, effected by a circular, horizontally moving needle. In some machines this stitch is made by the shuttle. It will suffice here to point out that the vibratory eye-pointed needle, the reciprocating shuttle, the rotating hook, and the four-motion feed are the essential foundation elements of the sewing machine patents; and it follows as a matter of course that whoever controls not merely all but any one of these devices must exercise a potent influence over the entire industry. For some time the owners of these patents exercised sharp rivalry; but eventually they settled their differences, consolidated their several interests, and thus formed a combination which has enjoyed, during the lifetime of the several patents under its control, an impregnable monopoly. In due time, one by one of these patents expired; and probably in the whole history of legislation cannot be found instances where more persistent effort or more powerful influence was exerted to secure extension after extension. Finally all lapsed except the Bachelder and the Wilson feed motion. The latter ended after two extensions in 1871. Every Congress since then has been besought to grant still further extension; and our readers will remember how persistently we have opposed the at-

tempts and explained their objects and bearing on the public interests. The last stronghold of the combination resided in the Bachelder patent, granted in 1848, and containing a claim sufficient to protect the feed motion. This patent the combination unearthed and purchased many years ago. It was twice extended; and, as we stated in the beginning, its demise marks the expiration of all the fundamental sewing machine patents.

In order to appreciate the effect of this event, its double influence must be regarded, first, as affecting inventors, and second, as affecting the public. So long as the combination controlled the features which are absolutely necessary to every sewing machine, they protected themselves against competition in their high prices, and also derived a large revenue from the royalties they imposed. In this way the inventor of a good and valuable improvement in the machine was at their mercy. They could prevent his applying his device by charging him a royalty so large that he could not afford to sell his machine at any attainable price, or else could compel him to sell out to the combination at their price. It is estimated that, since the grant of the Wilson patent, nearly half a million dollars has been expended by inventors on sewing machine modifications, much of which has proved a total loss. Now the inventors can employ the necessary elements referred to freely; and as a result we may look for still further improvements, and a large increase in the number of sewing machine manufacturers.

As regards the public, the influence of change is at once apparent in the decreased price of machines, the reduction in the case of some of them being already 50 per cent. This will be a great blessing to those to whom the sewing machine is a means of support.

It would be difficult to find a more significant commentary on the beneficial influence of our patent system than is embodied in the history of the sewing machine in the United States. For more than thirty years the people have paid out enormous sums, and have rendered those who devised and those who developed the important inventions connected with it royally wealthy. On the Bachelder patent alone, it is reported that the combination has made $4,000,000. A single company, the Singer, it is said, has $15,000,000 invested in the business, and the other great corporations have amounts of proportionate magnitude. Yet when the immense aggregate which has been paid for the sewing machine comes to be balanced beside the benefits the people have gained through that invention, there can be no question but that the cost to them is inconsiderably low. For the millions we have given, we have secured the establishment in the manufacture of the sewing machine of a new and vast industry, giving employment to thousands and opening up new utilizations of our resources. This great industry has in turn promoted minor ones. It has compelled the acquirement of the skill on the part of moulder and pattern maker to produce castings of extremely fine finish; and the benefits thus gained have made themselves felt over all the metal-working arts. The decoration of the machine has resulted in great improvements in the arts of japanning, inlaying, and electroplating. The necessity of the use of smooth strong thread has given rise to the manufacture of an improved material in immense quantities. The manufacture of sewing machine needles is also becoming almost a separate industry. Consider, besides, the immense multiplicity of attachments to the sewing machine which have been devised—the hemmers, braiders, tuckers, corders, fellers, improved treadles, etc.—all sources of revenue, and of employment—and the quantity of special machinery necessary for the production both of these devices and of the machine itself. And finally, for the millions that we have paid, the owners of the controlling patents have gone on and improved and developed the sewing machine with wonderful rapidity, and this is only one class of benefits. Who can estimate the value of the sewing machine to the people at large? It has revolutionized every industry wherein textile fabrics are made up into special forms. It has cheapened every variety of wearing apparel, from hats to shoes. It has furnished a means of livelihood to millions of our people, and has enlarged the field and increased the rewards of female labor, in fitting accordance with the demands of the hour. And all these vast advantages have been extended to no one people, but to all mankind. Can it be said that these gains, utterly inestimable as they are pecuniarily, have not been cheaply purchased at the cost of the few years' monopoly wherewith the laws have rewarded the inventors?

THE FATE OF THE LAST MAN.

In all the discussion which has agitated the world over the Mosaic and geological accounts of the creation, no question has been more argued than that of the origination of the race. There is *nothing* like variety, even in scientific argument; and we have heard so much disputation as to whether Adam or an anthropoid ape was our primal ancestor, that we are now impelled to turn to the diametrically opposite end of creation, and consider not the beginning of the first but the end of the last man. Speculation as to future events—especially if several billion or so years distant—is not particularly profitable; but if a personal originator of the race is to be made an object of present theory, similar theorizing as to the personal terminator of the race is certainly just as useful, both hypotheses being equal in the speculative nature of their basis: and it being certain that we cannot know anything more definite about the subject of the one than about that of the other.

M. Alphonse de Candolle points out that the terrestrial surface is constantly diminishing, and that elevated regions are being lowered through the incessant action of water, ice, and air. Besides, earthy matter, washed or ground away, is being carried into the sea, which is thus filling up; consequently in course of time the present configuration of the land will change. Continents will be divided into islands, and these will be gradually submerged. The human race will be driven by the encroaching waters from island to island. Finally the sun will rise on a vast waste of sea dotted perhaps with far-separated islets which once were mountain peaks. One by one these will be submerged until finally but one is left: Kunchainjunga, the loftiest summit of the Himalayas, perhaps; or more likely, some new coral reef which an insect to-day is laboring, down in the depths, to build up. Here will perish the last man, and the body of the last relic of our race will be washed away by the waves of the mighty flood. Therefore (1) *if the last man does not starve to death he will probably be drowned.*

Another theory is that of the periodicity of deluge, proposed by Adhemar, which depends on the fact of the unequal length of the seasons in the two hemispheres. Autumn and our winter last with us 179 days. In the Southern hemisphere, they last 186 days. These seven days or 168 hours of difference increase each year the coldness of the pole. During 10,500 years, the ice accumulates at one pole and melts at the other, thereby displacing the earth's center of gravity. Now a time, it is reasoned, will arrive when, after the maximum of elevation of temperature on one side, a catastrophe will happen, which will bring back the center of gravity to the center of figure, and cause an immense deluge. The inventor of this theory fails to consider the probability of the center of gravity returning as gradually as it was displaced: but with this defect, the hypothesis from another point of view goes to show that (2) *the last man will certainly be drowned.*

Every few years or so we have a comet scare; and when the flaming star appears in the sky, there are plenty of nervous persons who fret themselves over the chances of our earth coming in contact with it. It is, of course, not without the limits of possibility that such a collision should occur. If it did, our globe would plunge into an atmosphere of gas, which, mingling with the air, say those who predict this mode of death to our planet, would produce an explosion which would destroy every living thing. Such being the case, the person capable of breathing deleterious gas longest would survive the rest; and therefore (3) *if the last man is not suffocated by cometary gas he will be blown up.*

It is believed by many astronomers that there is a retarding medium in space, based on the fact that Encke's comet, in thirty-three years, loses a thousandth part of its velocity. If the ether resists our earth's motion in its orbit, then the centrifugal force will be constantly lessened, while the action of gravity will remain constant: so that the earth will describe a spiral path, always approaching the sun. The effect of this would be to convert the tropics into a desert, which would gradually expand toward the poles, from about which the ice and snow would be quickly melted. Finally the intense heat would turn the whole globe into one barren waste; but before then the human race would have disappeared. The probabilities in such event point to the supposition that (4) *the last man will be sunstruck.*

There are certain classes of rocks which are constantly becoming hydrated, and are thus occluding immense amounts of water. The theory has been broached that, in course of time, the seas will thus be dried up; and water being absent, our atmosphere will disappear, the earth becoming a waste similar to the moon. But before then, the atmosphere would probably become too rare for human existence. As the air pressure decreases, as M. Bert has shown, the privation of oxygen produces the deleterious effects experienced chiefly by aeronauts and mountain climbers. Consequently, in view of this theory (5), *the last man will be suffocated.*

Our sun itself may come to an end in two ways. First, as Mr. Proctor has recently very graphically explained, being but a variable star it may suddenly blaze up, and go out as other suns are known to have done. In this case, the intense heat of the colossal conflagration would destroy everything on the earth, and perhaps even vaporize the earth itself. Should this event occur (6), *the last man will be burned up.*

Or the sun may cool down. The glacial zones would thus enlarge, the race will be crowded nearer and nearer to the equator, by the encroaching glaciers coming from the poles. The small space will no longer support the life upon it, and in the terrible struggle for existence only the fittest will of course survive. Finally, after the earth becomes covered with the vast ice sheet, man with his wonderful capacity of adaptation to surrounding circumstances will probably subsist for a certain period, but in the end the constantly augmenting coldness will assert itself, and thus eventually (7) *the last man will be frozen to death.*

It has been suggested that the cooling of the earth will lead to the production of immense fissures in its crust similar to those already visible in the moon. The surface of the earth would thus be rendered extremely unstable, while the dwellers thereon for safety would be compelled to take refuge in caves. It is possible that the troglodytic remnant of the race might meet its fate in some great cataclysm or eruption, and hence it is assumable that (8) *the last man will be crushed in some subterranean cavern.*

Or supposing that the people adapted themselves to their surroundings and managed to live on the surface, until the time when the earth becomes so cracked and broken that, as predicted, it falls apart, flying off in fragments into space. Possibly a part may exist large enough to preserve its atmosphere. It may either be a satellite of the first larger body within whose sphere of attraction it may come: or it may fall into another world. In such case (9) *the last man will be killed by the crash of orbs;* but if he is not, and no one can tell to what extremes of resistance the race may develop, he will become an inhabitant of a new world. Evolution does not necessarily imply progress, and possibly the race may have retrograded until the human being possesses the nature of the plant louse; such being the case, this single inhabitant will spontaneously produce posterity of both sexes. A new race of men will begin, to continue *ad infinitum.* Hence (10) *there will be no last man.*

AMERICAN EXHIBITORS AT PARIS.

Mr. Joseph E. Holmes, well known to most persons who exhibited from this country at the first International Exhibition, in London, in 1851, and who has rendered service to our exhibitors at all the subsequent expositions, including the last two, at Paris and Vienna, quite laments that Congress should have adjourned without appointing any commissioners, or making any appropriation for the Great Exposition to be held in Paris next year. He thinks that, if Congress should take prompt action at the next session, it will be too late to get the contributions together and shipped in season to enable us to make a creditable show; and a letter from Mr. Holmes, which we print on another page, will suggest to persons wishing to exhibit their wares the necessity of bestirring themselves and providing for their requirements for space, etc., instead of waiting for the action of Congress, which is uncertain and, in any event, slow.

The Oldest Locomotive Engineer.

To the Editor of the Scientific American:

Your correspondent, I. Van Buren, of Clarksville, Ga., is not, as you suppose, the oldest locomotive engineer now living; for while he can only claim having operated a Stephenson engine in the year 1832, historical records show that the writer designed and superintended the construction of the first fast locomotive engine, the "Novelty," during the summer of 1829; and that, in the month of October, he ran that engine on the Liverpool and Manchester Railway against George Stephenson's "Rocket," beating the latter in speed fully ten miles an hour. The London *Times*, whose correspondent witnessed a preliminary contest between several locomotive engines on the road mentioned, said, regarding the Novelty: "It was the lightest and most elegant carriage on the road; and the velocity with which it moved surprised and amazed every beholder. It shot along the line at the amazing rate of thirty miles an hour! It seemed, indeed, to fly, presenting one of the most sublime spectacles of human ingenuity and human daring the world ever beheld." (See *The Times*, October 8, 1829.) This testimony disposes of Mr. Van Buren's claim to seniority as a locomotive engineer. His important statement that he can, although 77 years of age, "mount a horse as spry as when 45 years old," induces me to advert to the less momentous fact that I work at the drawing table regularly from 8 to 10 hours every day at all seasons. With reference to actual age, the locomotive engineer of 1829, having been born as late as 1803, of course yields precedence to the spry horseman of Clarksville.

New York city. J. ERICSSON.

The Columbia College Professorships.

At a meeting of the trustees of Columbia College, held on May 7, 1877, Professor William P. Trowbridge, of the Sheffield Scientific School of Yale College, was unanimously elected Professor of Engineering. Professor Trowbridge will be assisted by one adjunct professor and by an assistant in drawing. Dr. Charles F. Chandler, late Professor of Analytical and Applied Chemistry in the School of Mines, was at the same meeting elected Professor of Chemistry in the College and School of Mines. He will be aided in his duties by three assistants, to be called instructors, who shall give instruction practically and by lectures in the three departments of analytical chemistry. After the present year, no chemistry will be taught in the regular academic course of the college excepting a few lectures to the sophomore class. Elective studies will probably be introduced to compensate therefor.

A Conservatory on the Roof of a Hotel.

That excellent plan which we have so often advocated, of turning the tops of houses in cities into gardens, has been carried out by the Palmer House in Chicago; and a portion of the roof of that hotel is now covered with a magnificent conservatory. The structure is entirely of glass and iron; and as it is built on an extension, its location is such that it opens directly out of the fifth floor corridor of the main edifice, which rises some two stories above. A fine collection of tropical and rare plants has been provided, and the regular heating apparatus of the house supplies ample warmth. The conservatory is open to guests of the hotel, and furnishes a delightful resort.

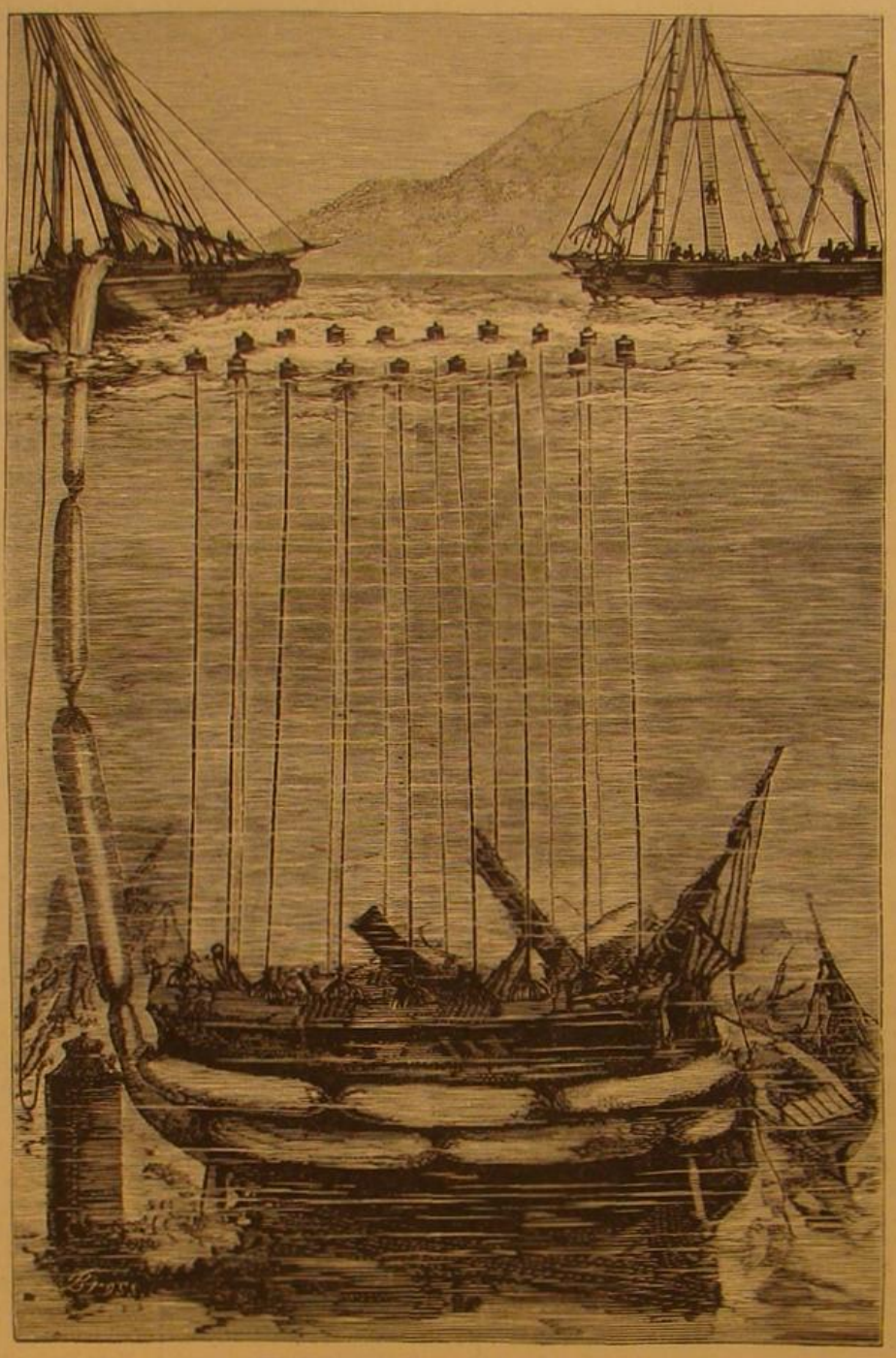
Bone Meal for Grapes.

The editor of the London *Horticulturist* asserts that among all the fertilizers proposed for the grape, none embody more of the necessary ingredients than bone meal. It should be applied as early in the season as possible. About a ton to the acre makes a dressing that will prove valuable for two or three years.

THE ALHYDRIC CHAIN.

M. Toselli is an inventor who for some time past has made a specialty of inventions for the raising of sunken vessels, treasures, and other bodies from the water. His ingenious grapples and submarine diving apparatus we have already illustrated. His latest device is represented in the annexed engraving; and its use is to raise heavy vessel sunk in depths too great for divers to work in efficiently. The apparatus is called the alhydric chain, and it consists of a number of strong impermeable canvas bags fastened together, like so many colossal sausages, by short copper tubes.

The engineer in charge of the operation of placing this chain about a sunken vessel descends in one of M. Toselli's submarine moles, which is self-moving, and from which the progress of the work can be seen. A telegraph line serves to transmit the directions of the occupant to those working at the surface. Directed in this manner, the people above lower grapnels which automatically fix themselves at the points indicated. From each grapnel a cord extends which terminates in a buoy which floats at the surface. It follows that, when several of these grapnels are attached, the buoys above become arranged in the exact outline of the vessel to be raised. This will be clearly understood from the engraving. This accomplished, the next step is to lower a very heavy grapnel, which is caused to attach itself to some strong part of the vessel, the keel of the bowsprit for instance; and to this grapnel is fastened the end of the alhydric chain, in lieu of the cord and buoy. The boat carrying the chain then moves around the line of buoys, so that the chain, as it sinks, becomes wound two or three times around the vessel below. A powerful pumping engine then forces air into the cylinders; and when these are filled, their weight, *plus* that of the ship, is less than that of the water displaced. The result of course is that they rise to the top with the vessel, and sustain the latter until the necessary repairs can be made, or until she can be floated to a place of safety.



TOSELLI'S ALHYDRIC CHAIN.

Lavœsium, a New Metal.

From a communication made to the Société des Sciences Physiques et Naturelles de Bordeaux, we learn that M. Prat has discovered a new metal, which, in honor of Lavoisier, he calls lavœsium. This new metal is of a silvery white color, and is malleable and fusible. It forms crystallizable colorless salts. The following are some of its reactions: When treated with potassa, a hydrated white precipitate is obtained, insoluble in an excess of the precipitant. Ammonia gives a precipitate very soluble in excess. Ferrocyanide of potassium gives a characteristic precipitate similar to the color of the petals of *rose du Bengale*. With hydrosulphuric acid a brown coloration is first obtained; the precipitate afterward changes to a fawn color. Tannin gives a deep yellow-green precipitate.

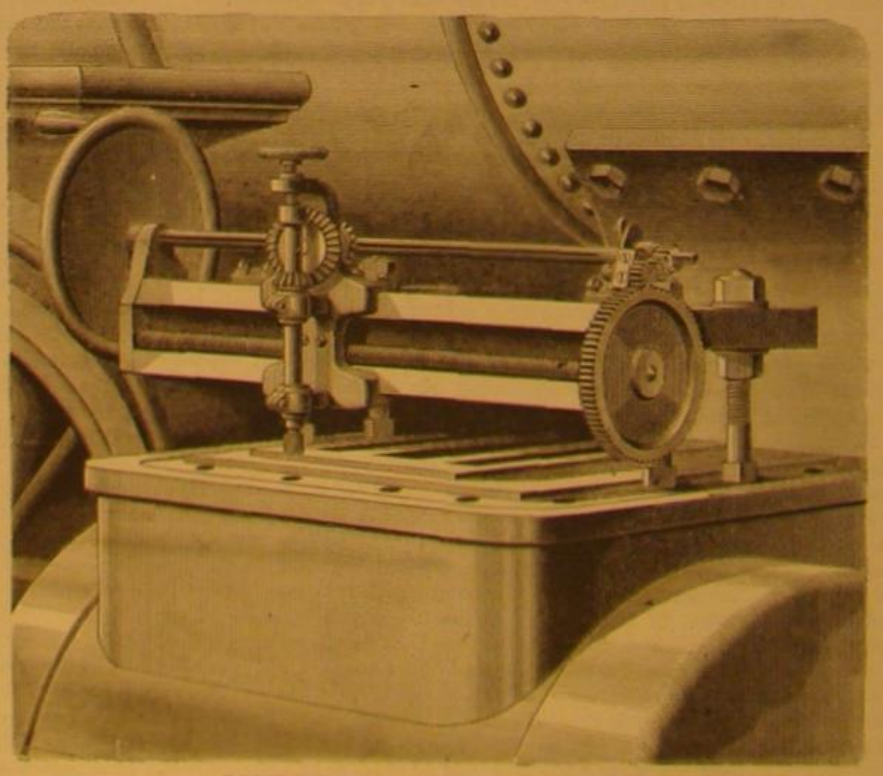
In the spectroscope the new metal gives: 1. In the indigo-blue, two sets of characteristic lines. 2. In the bright green, two other sets of simpler lines, also characteristic. 3. Some blue, violet, and green secondary lines; in all twenty-three lines. These characteristic lines exactly coincide with those of copper, which would seem to show that the new metal contains copper. Its silvery white color, however, and some of its reactions, especially those with ammonia and ferrocyanide of potassium, constitute properties which distinguish it from any other known metal. According to M. Prat, this body is much more common than he at first supposed, it having been found in many minerals, and especially in iron pyrites. If lavœsium really exists, its therapeutic action and its industrial uses remain to be studied.—*Le Monde Pharmaceutique.*

IMPROVED STEAM CHEST SEAT MILLING MACHINE.

Those acquainted with locomotive repairing know that the action of the heat in the steam causes the acid in the lubricating tallow to corrode the iron. This is especially noticeable as occurring in the vicinity of the valves and steam chest. In the latter case, the ledge which supports the steam chest is frequently corroded to such an extent as to require repair. To do this necessitates much time and labor, as a recess or groove has to be cut with the chisel; and then brass strips are driven in and trued up to effect a tight joint.

The object of the invention illustrated in the annexed engraving is to accomplish this work of grooving, then of truing off the inserted pieces, without skilled labor and in a short time. The machine is supported by four studs, as shown; and motion is imparted to the mill or cutter by a shaft on which slides a suitable gear, meshing into one on the tool carrier or crosshead, the latter being fed to the work, in either direction, by a screw and suitable gearing, shown on the end of the machine. The tool, in starting, is fed down by the small handwheel on top of the carrier. Motion is given by turning the crank; and when it is desired to feed in an opposite direction, the small gears are disengaged by moving the small lever and swivel to which they are attached. The machine is also used to cut out the ports on new work; and by replacing the cutter with a drill, holes can be bored for the studs.

This invention has, we are informed, been successfully used in the shops of the Pennsylvania Railroad at Altoona, and is there considered a very useful tool, saving both time and money. Patent pending through the Scientific American Patent Agency. For further particulars and rights to manufacture, address the inventor and patentee, A. H. Campbell, Box 1136, Altoona, Blair county, Pa.



CAMPBELL'S MILLING MACHINE.

Separation of Arsenic from Cobalt and Nickel.

Most of the common ores of nickel and cobalt contain a considerable quantity of arsenic; and perhaps on this account the crude metallic arsenic is sold in drug stores under the name of "cobalt." The usual method of dissolving the ores, and precipitating the arsenic by sulphuretted hydrogen, is objectionable on account of the disagreeable odor and poisonous properties of this gas. Professor Wöhler avoids this inconvenience by the use of oxalic acid. The ore, *kupfer nickel* or *speiss cobalt*, is dissolved in aqua regia, evaporated, if necessary, so as to expel the excess of acid, and precipitated while boiling hot with carbonate of soda. After washing, the still moist precipitate is treated with an excess of a concentrated solution of oxalic acid. Both metals are thus converted into oxalates, while the arsenic acid goes into solution along with the oxide of iron. The mixture of nickel and cobalt oxalates is thoroughly washed, and may be separated by ammonia according to Langier's process. If the ore contains copper, it should be precipitated by means of finely divided metallic iron that has been reduced by hydrogen. The dissolved iron must afterwards be oxidized to a ferric salt. Speiss cobalt can be deprived of a large portion of its arsenic by previous fusion, care being taken to conduct the operation in such a manner as to prevent injury from the poisonous white arsenious acid evolved.

The Seventeen Year Locusts.

Our exchanges from various parts of the country report that the seventeen year locusts have made their appearance in large numbers. A correspondent of the New York *Sun*, from Greenbush, N. Y., writes that they have also appeared in that vicinity: "They first emerge from the ground in the form of a large grub. The wings appear soon afterward, when the locust settles in the nearest tree. The noise made by the insects is a constant shrill humming. They do LOT eat growing crops, as many suppose, nor do they in any way resemble the ravenous locusts of the West. They devote their time to working in the branches and twigs of all kinds of trees. They plough little grooves in the limbs, in the tender bark next the wood. Their perforations in the trees kill the branches, and the foliage soon turns yellow. In 1860 the locusts did not appear until June, when the trees were in full leaf. In two weeks the woods looked as though they had been subjected to the frosts of November. From all appearances the locusts will be as thick as they were in that year. Stories of the poisonous nature of the sting of this curious insect, which did duty in 1860, creating much alarm, have been revived, but the seventeen year locust is harmless to man and beast. It is an inch and a half long when full grown. It comes out of the ground tail first, and has on its head white marks forming a perfect letter W. In 1860, believers in signs and superstitions declared that the appearance of this cabalistic sign denoted war. In that year the locusts did not entirely disappear until late in the fall. People still living here remember their appearance also in 1843. They were so thick then that the trees were thrashed with whips, and dead locusts carried away by the bushel. They do no permanent injury, but interfere greatly with the year's fruit crop."

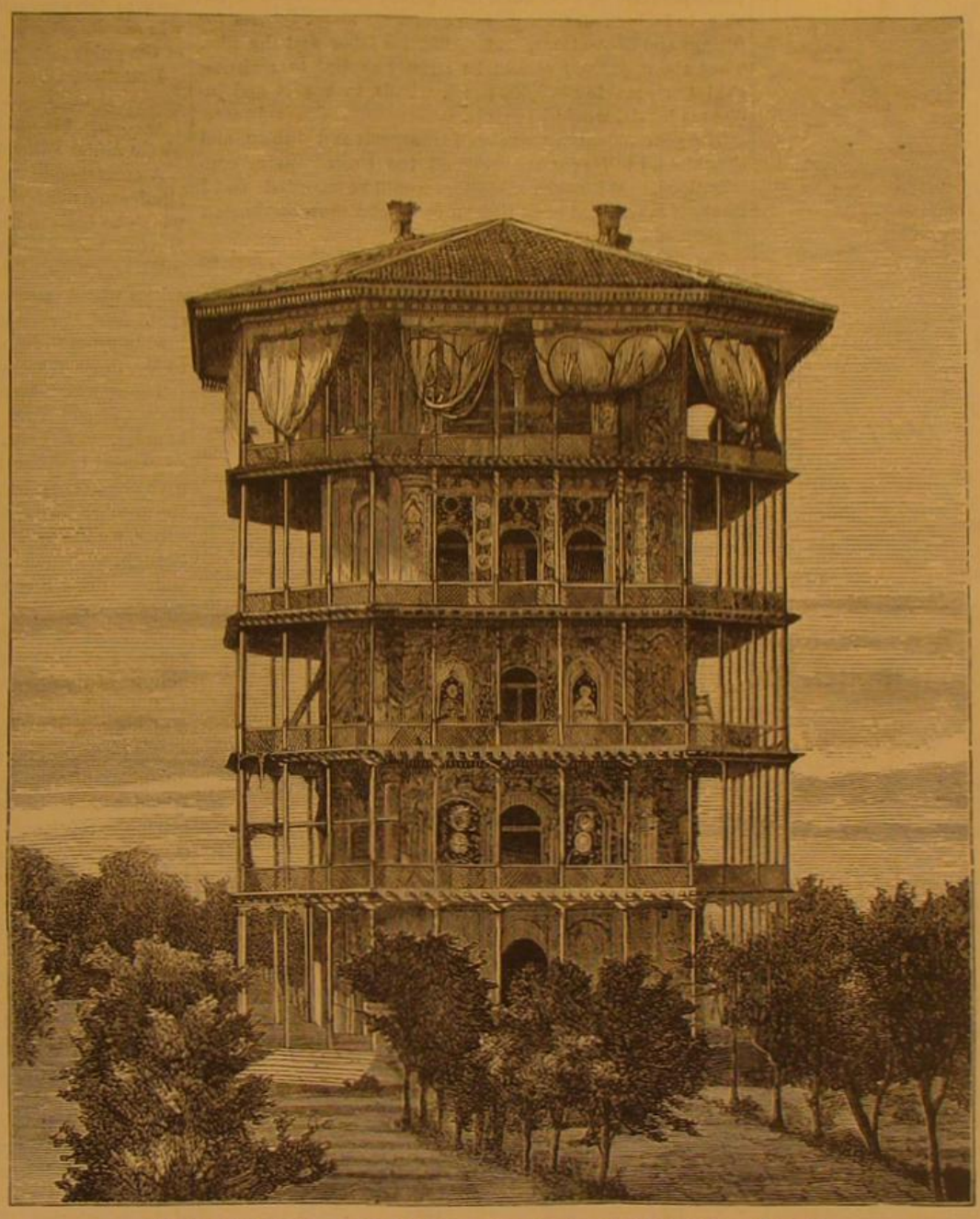
Powder Paper.

A substitute for gunpowder, invented in England, is called "powder paper;" it is paper impregnated with a mixture of potassic chlorate, nitrate, prussiate, and chromate, powdered wood charcoal, and a little starch. It leaves no greasy residue on the gun, produces less smoke and less recoil, and is less impaired by humidity, and it is ⅓ stronger than gunpowder.

A PERSIAN ROYAL PAVILION.

At the southeastern end of the Caspian Sea, not far from Resht (which is the only harbor accessible in stormy weather, on that part of the Caspian), is a village called Enseli. It is near the borders of Russia, and was selected by His Oriental Majesty the Shah as the locality for a temporary marine residence, wherein he could take a solemn leave of his dominions, and say farewell to his wives before his journey to Europe four years ago. We publish herewith an engraving of this structure, which was built in great haste and is very slightly put together. The material is chiefly adobe or sun-dried brick; and the clay was so poor that the building is already returning to dust, a fate which overtakes many buildings in that part of the world. The one-storied houses, which are common in Persia, of course suffer less than such a building as is shown in our engraving; and the danger to the inhabitants of the upper stories of the pavilion is obviously very great. So, with true Oriental sagacity, the upper rooms are allotted to the women of the family, an additional reason for this arrangement being that the roof under the blazing sun makes the top stories exceedingly uncomfortable from the heat.

In his journey eastward to Enseli, the Shah was accompanied only by a detachment of his wives, each of the ladies being carried in a tight box suspended on one side of a mule. With unusual forethought, a small opening had been made in front of the box to admit light and air; and each box was so tightly packed that the occupant was obliged to forego the use of her limbs, and could not even sneeze without disturbing the lady on the other side of the animal. A few carpets were all the furniture thought necessary for the ladies' accommodation; and an appearance of royal pomp was imparted by the presence of a few regiments of soldiers. When the solemn farewell ceremony was over, the wives were boxed up again and sent back, much to their disappointment, as they had indulged a hope of seeing Europe; but, it is stated, the Emperor of Russia objected to such a cavalcade crossing his territory.



TEMPORARY RESIDENCE OF THE SHAH OF PERSIA.

Staining Wood.

In most cases the staining of wood may be effected so as to produce very bright colors without any previous preparation, as, generally speaking, the mordants employed have a bleaching action on the wood. But in many cases, in consequence of the quality of the wood under treatment, it must be freed from its natural colors by a preliminary bleaching process. To this end it is saturated as completely as possible with a clear solution of 17½ ozs. chloride of lime and 2 ozs. soda crystals, in 10½ pints of water. In this liquid the wood is steeped for half an hour, if it does not appear to injure its texture. After this bleaching it is immersed in a solution of sulphurous acid to remove all cases of chlorine, and then washed in pure water. The sulphurous acid which may cling to the wood in spite of washing does not appear to injure it, or alter the colors which are applied.

Red.—The wood is plunged first in a solution of 1 oz. of curd soap in 35 fluid ozs. of water, or else is rubbed with the solution, then magenta is applied in a state of sufficient dilution to bring out the tone required. All the aniline colors behave very well on wood.

Violet.—The wood is treated in a bath made up with 4½ ozs. olive oil, the same weight of soda ash, and 2½ pints of boiling water, and it is then dyed with magenta, to which a corresponding quality of tin crystals have been added.

Blue.—Prepare as for violet and dye with aniline blue.

Green.—Mordant the wood with red liquor at 1° B. This is prepared by dissolving separately in water 1 part sugar of lead and 4 parts of alum free from iron; mix the solutions and then add one thirty-second of a part of soda crystals, and let settle over night. The clear liquor is decanted off from the sediment of sulphate of lead and is then diluted with water till it marks 1° B. The wood when mordanted is dyed green with berry liquor and extract of indigo, the relative proportions of which determine the tone of the green.

The wood, mordanted, as above directed, can also be dyed a fine blue with extract of indigo.

Yellow.—Mordant with red liquor and dye with bark liquor and with turmeric.

Besides the aniline colors cochineal gives a very good scarlet red upon wood. Boil 2 ozs. of cochineal, previously reduced to a fine powder, in 35 ozs. of water for three hours, and apply it to the wood. When dry, give a coating of dilute chloride of tin, to which is added a little tartaric acid, 1 oz. of chloride of tin, and ½ oz. of tartaric acid in 35 fluid ozs. of water. If instead of water the cochineal is boiled in a decoction of bark (2 ozs. bark to 35 ozs. of water), and the chloride of tin is used as above, an intense scarlet, and all shades of orange, may be produced according to the proportions.

Brown.—Various tones may be produced by mordanting with chromate of potash, and applying then a decoction of fustic, of logwood, or of peachwood.

Gray.—Grays may be produced by boiling 17 ozs. orchil paste for half an hour in 7 pints of water. The wood is first treated with this solution, and then, before it is dry, steeped in a beck of nitrate of iron at 1° B. An excess of iron gives a yellowish tone; otherwise a blue-gray is produced which may be completely converted into blue by means of a little potash.

Black.—Boil 8¾ ozs. of logwood in 70 ozs. of water, add 1 oz. blue stone, and steep the wood for twenty-four hours. Take out, expose to the air for a long time, and then steep for twelve hours in a beck of nitrate of iron at 4° B. If the black is not fine, steep again in logwood liquor.—*Dingler's Polytechnisches Journal.*

Boring for Coal in Switzerland.

A remarkable example of rapidity in deep boring has recently been furnished by the first bore hole put down by a company formed to search for coal in Switzerland. A depth of 1,422 feet was reached in two months, including the reboring of the upper 640 feet from 3½ inches to 7 inches in diameter. The work was done, including all delays, at a rate of over 1,000 feet per month, the highest speed being nearly 77 feet in 24 hours. The results obtained were negative, the section showing about 1,200 feet of Permian strata resting upon old crystalline rocks; but the trial is only the first of a series.

The Scientific American.

"This has been for years the best paper of its kind published in America, but it never was so attractive and useful before as during the year 1877. Every week there are from six to ten engravings of new machines and inventions, which are especially prepared for it, and which are not found in any other publication. Those who are engaged in any mechanical pursuit will find this paper of great value. In excellency of illustrations and matter, quality of paper, and mechanical execution, it surpasses all others of its kind; besides, it is a weekly."—*Missionary Visitor.*

Preparing Garments with Cotton Warps for Dyeing.

In many dye works articles before being dyed are cleaned with soap, and then rinsed. Although this treatment cannot be pronounced irrational or bad, it is not to be recommended to every dyer. An inequality in the manner of rinsing the washed garments often produces spots or shades during dyeing. In dye works not provided with soft water other means are used in place of soap. The best agent for cleansing is carbonate of soda. A somewhat concentrated lye generally removes the greater part of the spots.

To cleanse twenty garments for dyeing, a beck of the needful size is filled with water at 155° Fah., in which 4 lbs. 6 ozs. of soda crystals are dissolved. In this the goods, well spread out, are allowed to steep for four or five hours. At the end of this time the garments are taken out, one by one, and spread upon a very clean table close at hand. A strong and hot lye of soda is prepared in a pail, and such parts as are spotted with grease, etc., are treated therewith, with the aid of a hard brush, till they disappear.

To remove hardened spots of stearin, paraffin, tar, resin, etc., benzine (not benzoline) must be used. A rubber is steeped with it and applied to the spot till it is completely removed. The rubber, thus used instead of the brush, is formed of a piece of woolen cloth rolled tightly up, and covered with a small piece of cotton or linen. The whole must be large enough to be grasped firmly in the hand.

In well organized dye houses no garment is washed in rivers, but in properly arranged washing machines.

Green on garments with cotton warps (11 lbs.): Mordant for an hour at a boil, with 2 lbs. 3 ozs. alum, 8¾ ozs. tartar, 4½ ozs. sulphuric acid, 6¼ ozs. extract of indigo, 2 lbs. 3 ozs. fustic. Put it then in a fresh beck, containing 17½ ozs. alum, and the same weight of fustic. Work for an hour, lift, and enter in a fresh beck, with 2 lbs. 3 ozs. sumac. Leave it in this latter beck for two hours, turning it from time to time. Lift, wring, and dye in a fresh cold beck, with methyl green. For deeper shades extract of logwood may be added.

Brown on garments with cotton warps (11 lbs.): Make a decoction of 2 lbs. 3 ozs. catechu in water; decant the clear liquid, and add to it the solution of 5 ozs. bluestone. Enter the garment, spread out, and steep for an hour. Lift, press, and enter in a boiling beck, made up in the proportion of 1 lb. 10 ozs. argol, and 17½ ozs. bichromate of potash. Boil for half an hour, then lift, and dye for the same length of time with 2 lbs. 3 ozs. peachwood, and 17½ ozs. fustic. After boiling for half an hour, lift, and examine if the shade is as required. If not, it may be reached by an addition of peachwood, fustic, or logwood, keeping up the boil. If the cotton is not of the same shade as the wool, 3½ to 5½ ozs. of alum is added to the dye beck, and the goods are reentered, but not boiled.

Black on garments with cotton warps (11 lbs.): Dissolve 8¾ ozs. solid extract of logwood in boiling water, and boil the goods in this. Lift and boil for 45 minutes in a fresh beck, made up with 8¾ ozs. bluestone, and 12 ozs. copperas. Return to the first logwood beck, to which 5¼ to 7 ozs. of soda ash has been added. If the color is not full enough, add a little more extract of logwood. Sadden with 2½ to 3½ ozs. copperas.—*Teinturier Pratique.*

Testing Flour.

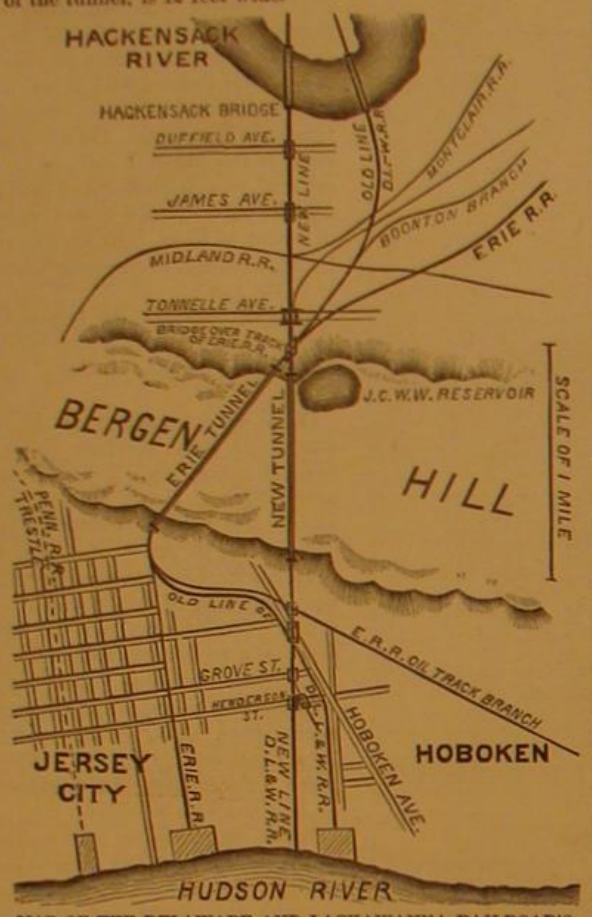
The rise in price of breadstuffs caused by the declaration of war by Russia against Turkey may lead unprincipled men to imitate the adulteration of flour practised in some foreign countries. An easy method of detecting such adulteration, according to Jegel, is to mix the flour with chloroform. The chloroform exerts no chemical action upon the flour; but being specifically heavier than flour and lighter than the earthy adulterants, the former floats upon the chloroform and the adulterant sinks. On shaking up a sample of flour in a test tube of chloroform and allowing it to settle, a sediment will indicate adulteration. On decanting the turbid liquor, the sediment may be washed and weighed or tested quantitatively.

A CORRESPONDENT, D. J. W., suggests that the line rockets used for communicating with ships wrecked on the coasts might be utilized, in cases of fire in the upper stories of tall buildings, to carry a cord into a window, to which a stout rope, or even a ladder, could be afterwards hauled up.

[Continued from first page.]

sonry at the east end to face of masonry at the west end, is 4,280 feet, there being 35 feet of arching constructed outside of the rock faces, in order to prevent loose earth, stone, etc., from falling on the track. The back arching within varies from 22 to 34 inches in thickness, and extends over some 3,100 feet, or about three quarters of the entire length. The roof was thus reinforced wherever it was considered not absolutely safe.

The east end of the tunnel enters the rock about 2,700 feet north of the entrance of the Bergen tunnel, with which its line forms an angle of 40°, the west end appearing on a higher plane and within some 50 feet of the older bore. It is 27 feet wide in the clear, and the total height is 20 feet 7 inches. Ventilation is secured by seven shafts, all (with one exception) brick lined. Three are elliptical in section, opening the full width of the tunnel in the long, and measuring 8 feet in the short diameter; one is 16½ feet by 7 feet, two are 6 feet in diameter, and another, opening the full width of the tunnel, is 12 feet wide.



MAP OF THE DELAWARE AND LACKAWANNA RAILROAD'S NEW WORKS.

Besides the actual excavation, considerable labor has been necessitated in the construction of approaches. The natural bog on the east side of the ridge has been filled in to support about three quarters of a mile of track. On the west side, a mile and a half of new road has been built to connect with the old line, passing through the Bergen tunnel. In both of these short sections, several fine bridges, which are illustrated in the accompanying engraving, have been erected. On the east side there are three bridges at Henderson street, carrying over seven tracks; at Grove street there is one four-track bridge. This last, together with the iron skew bridge of 193 feet span over Hoboken avenue, and the bridge over the Erie oil track, are represented in the illustration. On the west side, there is a fine iron skew bridge near the mouth of the tunnel, so that the line of the road passes directly over the Erie track. This will be found represented in the engraving, together with the bridges over Tonnelle and James avenues, and the celebrated skew structure across the Hackensack river. The last mentioned bridge is a triumph of engineering skill, owing to the difficulties offered by the marshy soil and destructive power of the river. It has two spans of 200 feet and one draw of the same length. The material is iron built upon masonry, which found a stable foundation only after 1,700 piles had been driven. The eastern abutment was washed away soon after completion, and wholly wrecked, despite the fact that it was built on over 300 piles, each a foot in diameter and each driven down forty feet.

The cost of the tunnel and approaches, as nearly as can be ascertained at present, was as follows: Excavation and shafts, $800,000; brick arching, $105,000; filling bog, grading, track laying, etc., on east side of ridge, $450,000; land, right of way, road, etc., on west side, $875,000; bridges, $557,000. The total cost was therefore about $2,787,000. If to this be added the outlay for the ship canal (now in progress), 3,000 feet long and 100 feet wide and 20 feet deep, designed to increase the dock facilities of the Delaware and Lackawanna Company, the entire expense of all the engineering work undertaken by that corporation reaches an aggregate of $2,850,000.

The engineers of the tunnel were Mr. James Archbald, Chief Engineer of the railroad, and Mr. Samuel Rockwell, Resident Engineer. The contractor was Mr. John McAndrew, and the bridges were mostly constructed by the Delaware Bridge Company. It is expected that the trains will pass through the bore for the first time during the present month.

Communications.

The French Exhibition.

To the Editor of the Scientific American:

If Congress should fail to make any appropriation for the proper representation of this country at the French Exhibition next year, there are men patriotic enough to give their services for such an end; and the sooner a commission is formed, and intending exhibitors invited to apply for space, the better. One chief commissioner, with two or three assistants willing to work, would be ample; and exhibitors would gladly pay their own expenses rather than depend on the favors they may get from such strugglers for place and power as have characterized our two last exhibition commissions abroad. A small appropriation of course would be desirable (to fairly pay the expenses of the commission), when judiciously applied, and for fitting the space allotted and keeping it clean; and the resolution making the same should specify that not more than $5,000 should be paid the chief commissioner, and not more than $3,000 each to three assistants, to include all their private expenses; about $20,000 for fittings and decorations, and $5,000 for labor and the like. Then about $10,000 should be strictly applied to assisting exhibitors, making $50,000 in all. This, in honest and judicious hands, would be ample.

The government has plenty of transports and seamen, and should send to Havre or Ostend all the United States' contributions. With this, exhibitors would be satisfied; and I think, if taken hold of in time, a very good show on the part of the United States would be made.

The SCIENTIFIC AMERICAN can bring this about, and so assist in the matter that the thing can be accomplished without a "fuss," as has been generally the case. When Congress failed (in 1861) to make an appropriation and the Cabinet continued to me the position of Commissioner, in place of the 24 who resigned, I took hold and carried it through; and because there was no money to quarrel about, we had a good and peaceful time; out of 109 exhibitors, we had 97 prizes awarded, and 59 of them first-class. Contributions from several wealthy Americans enabled me to fairly fit up and decorate the space allotted; and with a private expenditure of $1,700 we kept our credit good with foreign commissions, and came out of it, I believe, with the perfect goodwill of every exhibitor. My whole expenditure did not exceed $7,000, of which over $5,000 was voluntarily contributed, McCormick, Osborn, and Walter A. Wood each giving $150; Steinway and the Glen Cove Starch Company also did the fair thing. I would try it again rather than that we be behind time or shut out altogether.

I presume Mr. Corliss would accept the chief commissionership, if tendered him; and no doubt Charles Francis Adams, or perhaps Mr. Washburn, late Minister to France, if wanted. Let us have a good American exhibit. We surely shall not have if we wait till the end of October.

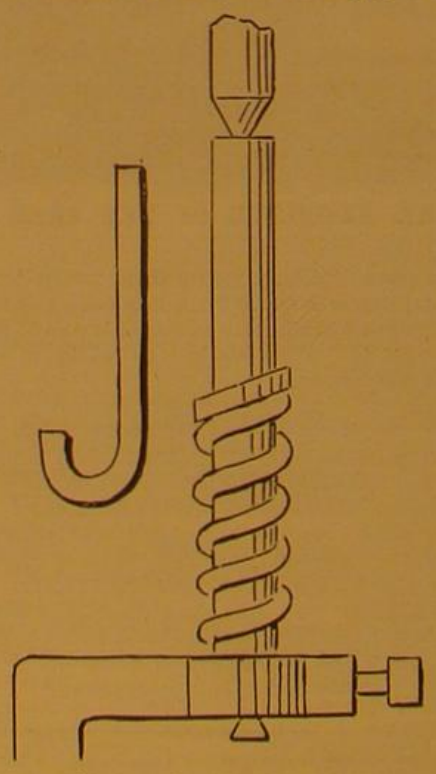
JOSEPH E. HOLMES.

1013 T Street, Washington, D. C.

Winding Spiral Springs.

To the Editor of the Scientific American:

Among the many excellent articles by Mr. Joshua Rose, appearing from time to time in the SCIENTIFIC AMERICAN and its SUPPLEMENT, I notice one on winding spiral springs.



Now as many of your readers who have lathes may not have the means of cutting a spiral, and others may want a spring for an odd job where it would cost too much to make a mandrel, I send you a sketch of the method we practice here. We simply take a common straight mandrel, or a centered rod of round iron or steel, a little smaller than the inside diameter of the spring is to be, place an ordinary dog on one end, and put it into the lathe; then we take the wire to be wound, and bend about ¼ of an inch at one end at right angles. This can generally be done by placing the end in the vise and bending cold. Insert this bent end into the dog, letting it rest against the screw, give the lathe about half a turn by hand, then put on the guide, which is an iron rod, preferably square and as thick as you want the spirals to be apart. Bend one end to form a hook that will pass over the mandrel freely, the other end being left long enough to pass down between the lathe shears to keep from revolving. Start the lathe, holding the wire against the guide with a slight pressure, and the spring will wind, feeding the guide along ahead of it. After the spring has been wound, turn the lathe backwards one or two turns, or enough to take the pressure off the spring, before it is relieved from the lathe. I have found no difficulty in holding No. 6 steel wire in my hand while being wound over a ¼ mandrel; but for larger sizes, especially if hard, a rest may be inserted in the tool post, and the wire allowed to pass over that. This rest, to prevent abrading the wire, may be a piece of hard wood of a size that will go into the post, and extending 10 or 12 inches, being supported on the outer end by a block. If a number of short springs are wanted, one can be wound as long as the strength of the mandrel or length of the lathe will admit, and afterwards cut into lengths. The short end of the guide hook is bent to conform to the spiral.

Hamilton, Ohio. J. T. G.

Steam Economy Computations.

To the Editor of the Scientific American:

A correspondent, W. A. Mussen, in your issue of May 5, alludes to a method of computing theoretical steam economy, which he finds in the circular of a manufacturing company. Having had something to do with the preparation of the rules he quotes, I deem it but just to the rules, and to the critics whose opinions he invites, to offer a trifle of explanation. The "constant number 859,375" is found by the following process, for which credit is due, so far as I am aware, to Mr. Jesse Warrington, now of Jackson, Mich.

The standard horse power is 33,000 foot-lbs. per minute. Hence $33{,}000 \times 60 \times 12 = 23{,}760{,}000$ is its equivalent in inch-lbs. per hour. This, it is evident, will be the displacement in cubic inches per hour of an engine which will give one horse power with 1 lb. mean pressure. Then taking the number 27·648 as the number of cubic inches per lb. of water, we have $23{,}760{,}000 \div 27{\cdot}648 = 859{,}375$ (and singularly enough, without a remainder), as such displacement in lbs. of water. From this point your correspondent gives the *rationale* of the process clearly enough; but when he makes an application of it, he takes for the volume of 16 lbs. (the terminal pressure of his diagram), the number 954, which is not the volume of that pressure by any table I know of. According to the authorities referred to, it is 1,515, and by the older tables, 1,576. Taking the former, his diagram would figure 22·304 instead of 35·46. So far as he has quoted the circular, no tables of volumes need have been referred to. It contained a table, in the preparation of which they were used, hence the reference; but this he has not quoted. This constant number may be used with any table of volumes which may be considered most accurate.

The method of determining the proper allowance for clearance and compression also needs a word of additional explanation. When the exhaust takes place above the return or counter pressure, a certain amount of loss takes place from the expansion of the steam in the clearance space. But when the compression pressure reaches that of the release, this loss is restored; and whatever percentage of the stroke remains to be made after that may be deducted from the theoretical rate. When the compression pressure does not reach that of the release, we may find, by extending the compression curve theoretically till it does so, how much further the piston must have traveled to have restored the release pressure, and add an equivalent amount to the result of the calculation.

Finally, it is not expected nor claimed that calculations of this kind can give very closely the actual consumption of any engine. Their chief value is for the comparison of different engines, and different conditions existing with the same engine. They also give the theoretical maximum economy, with which to compare the actual, in order to judge of the degree of perfection existing in the engine and its surroundings. No engine can ever reach it; but a large one, furnished with dry steam somewhat superheated, with well protected pipes and cylinder, may possibly come within 10 or 12 per cent of it, but the average loss is probably much nearer 30 per cent.

Like Mr. M., I cordially invite criticism and exchange of ideas on this and kindred subjects.

Salem, Ohio. J. W. THOMPSON.

The Water Consumption of Steam Engines.

To the Editor of the Scientific American:

In a recent issue, I notice an article entitled "Water Evaporated through Engines," in which was published a method of computing the water consumption per horse power per hour. As the method was furnished by myself, I will say that all that is claimed for the process is that it will give identical results with other more complex processes, in which the size of cylinder, number of revolutions per minute, total piston displacement per hour, and clearance are used as factors in the calculation. It does not depend for its accuracy on the fact that steam follows the Mariotte law of expansion. While it does not account for leakage of piston, or condensed steam that passes out of the cylinder as water, it does account for leakage of steam into the cylinder between the point of cut-off and release; and the supplement-

ary rule by the one process gives the correction for cushion and clearance. That the result as obtained by the rule was not expected to agree with that of actual measurement of the water passed through engine is evident from the following, which I copy from the circular in which it was printed: "It is not claimed that the theoretical rate of water consumption, as deduced from the diagrams, can ever be realized in practice. A certain amount will always be lost from condensation, leakage, and unevaporated spray in the steam, which no process of calculation makes allowance for." Your correspondent is in error in his calculation. The volume of steam at 16 lbs. pressure is 1515 according to Roper's "Handbook," and 1573 in the American *Engineering*, in lieu of 954. He has taken the terminal pressure about 2 lbs. too low, as I judge from appearances, not having means at hand to measure it.

Jackson, Mich. JESSE WARRINGTON.

Marbleized and Granite Ware.

To the Editor of the Scientific American:

My attention having been called to certain statements in the newspapers concerning poisonous enameled ware, known as "marbleized" and "granite" iron ware, I desire to state in your columns that, in order to arrive at the facts in the matter, I have made several analyses of these wares, obtained directly from the manufacturers and from dealers and agents in the city, with the following results:

Marbleized ware.—In No. 1 the enamel was found to be a silicate containing crude iron and a small quantity of lead. No. 2 was a similar vessel, obtained from another dealer; but it contained, besides the silicates mentioned in No. 1, a little arsenic (about 0·2 per cent). No. 3 contained considerable lead, but only a trace of arsenic. No. 4 was a small dipper or ladle, obtained directly from the manufacturers, contained neither arsenic, lead, or other objectionable ingredient. In five different analyses of the granite ware I found no trace of arsenic or other soluble metals. Some pieces of it, however, contain a little antimony, which, although generally considered an objectionable ingredient in such enamels, is not liable to produce any bad effect, under ordinary circumstances, in this instance. I have also made several analyses of white enameled ware; and in two cases out of three I have discovered traces of lead in them.

It has frequently been said that lead, in some form or other, is becoming an apparently essential ingredient in our daily nourishment. If we take lead in our drinking water, lead in our earthenware and crockery, lead in our tinned goods and solder, lead in our non-poisonous (?) enameled ware, lead in our paints and the wrappings of our cured meats, and if we are to place any confidence in the adaptation-to-circumstance theory, may we not expect to see, in the not far distant future, the average citizen take his food with an exquisite relish due to *sauce de plomb?* But at the present time many of us are not of the "fittest" in this respect, and we offer to our health officers a modest suggestion, that the plumbiferous and arsenical additions to our food be somewhat restricted.

It is, perhaps, in justice, due to the manufacturers of these marbleized and granite wares to say that the greater part of their goods—all, in fact, of the "granite" ware—now offered for sale in our markets are perfectly free from all deleterious substances, as is certified to by many of our best chemists—Professors Henry Morton, Drs. Wood, Hayes, Nichols, Silliman, Doremus, and others—and that the wares, as now manufactured, are as they should be.

New York city. W. H. FULLER.

PRACTICAL MECHANISM.

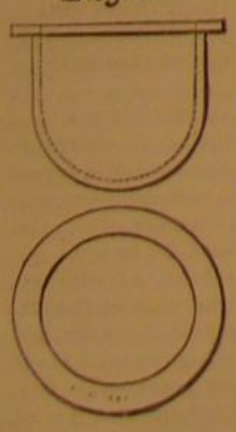
BY JOSHUA ROSE.

NEW SERIES—No. XXVI.

PATTERN MAKING.—SWEEP WORK.

The above title applies to a class of work, generally of large size, in which boards or sweeps fixed to a revolving spindle serve instead of patterns to form the moulds. This arrangement of course will only produce circular moulds; patterns may, however, be used in conjunction with the sweeps, as we shall endeavor to illustrate further on. The spindle above named is a light vertical shaft revolving in a step below and a bearing overhead: when a part of a mould has been swept up, the spindle can be raised out of the step sufficiently to enable the work to be removed and preparations for the next piece substituted.

Fig. 191.



Let it be required to produce a casting such as is shown in Fig. 191, a sort of pan or boiler, often used. Fig. 194 is a sectional view of the mould complete; it is formed of two parts, the lower being called the "seat," and the upper the "cope." Figs. 192 and 193 illustrate the method of forming each of those parts. The material used by the founder is called loam, a clayey, plastic composition, very soft. After a certain quantity of this material has been piled up, the sweep is revolved: it shears down the high places and indicates the holes or hollows. Into the latter more material is placed, and the sweep is passed round again, and so on until the job is perfected. It will be noticed in Fig. 194 that the two parts of the mould are retained in their proper position by a projection on one fitting into a recess in the other; this is the seat proper and is indicated throughout by S S. The pattern maker's part is to form the sweeps, which he does in the following manner: On a piece of board of the proper thickness for a sweep, the size of which depends on the size of the work, he draws an outline of the job, interior and exterior, from the center outwards; and beyond this he lays off his seat, as shown at Fig.

Fig. 192.

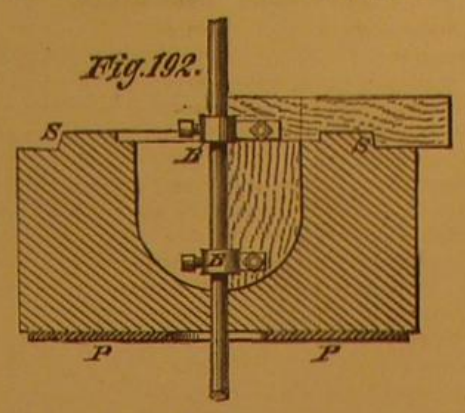
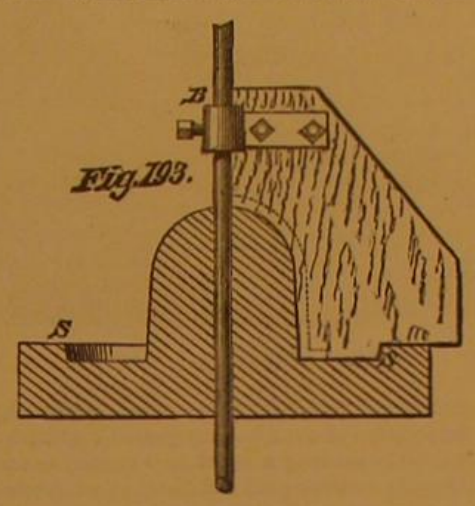


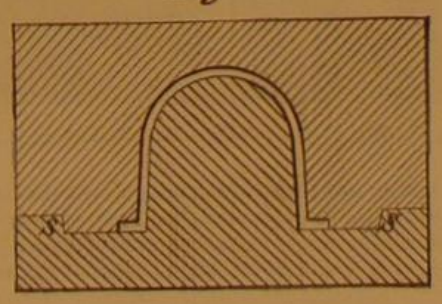
Fig. 193.



193, the dotted lines representing the interior of the piece. He has then simply to cut away to the interior line, and also the step at S, and one board is finished, unless he knows the diameter of the spindle and the position of the holes in the carrying bracket attached thereto, in which case he is supposed to cut off, parallel with the center line, a portion equal to the radius of the spindle, as a recess for the hub of the bracket, B, and to bore the holes for the bolts. The board, Fig. 192, when reversed, should fit that in Fig. 193 at the lower part, and be of a shape to coincide with the dotted line. Its length must be enough to extend to the center, *minus* the radius of the spindle, as shown in Fig. 192.

It will be seen by the lines showing the grain of the wood that the board in Fig. 192 is formed of two pieces, lapped at the corner to give strength: and to avoid too much cross grain, battens may be added when it is thought necessary. As I have already remarked, in striking up cores with a horizontal spindle the working edge of the board should be

Fig. 194.



beveled; and it is hardly necessary to say that the same is applicable in this case. P P, Fig. 192, is a circular plate of cast iron, used to support the mould while soft; it is not shown in Fig. 193. By the same method, only varying the outline of the sweeps, a large class of circular work may be produced, including vases, speed cones, etc. Sometimes it is necessary to cast brackets, pipes, or other projections upon the main piece; to do this patterns must be made of those projections, and as many patterns as there are projections. The height at which it is required to bed in these brackets, etc., must be indicated to the moulder by a small V cut into the sweep; this will produce, as the sweep revolves, a line upon the mould. For the rest, unless simple directions can be given, the pattern maker usually visits the foundry, and assists in placing, or at least in verifying, the position of the pieces. When the mould is sufficiently hard, and before it is baked, these patterns are withdrawn.

A good illustration of the manner in which pattern work may be used in conjunction with sweeps is furnished in the ordinary engine cylinder. Fig. 195 is a sectional elevation of a complete mould; Fig. 196 is a horizontal section of the same, on the line A B, showing the outlet for the exhaust steam. This mould is composed of four parts that are swept or struck up, namely, S S the seat, A B the body, C C the cope, and M the main core. The latter may be struck upon a horizontal arbor or formed in a box. In addition to the parts above enumerated are the two steam port cores and the exhaust port core, all formed in core boxes. The procedure is as follows: With a board shown in Fig. 197, the seat, S S, is struck up: upon this when dried is placed a flange of wood. It is set centrally; the seat is also carefully beveled

Fig. 195.

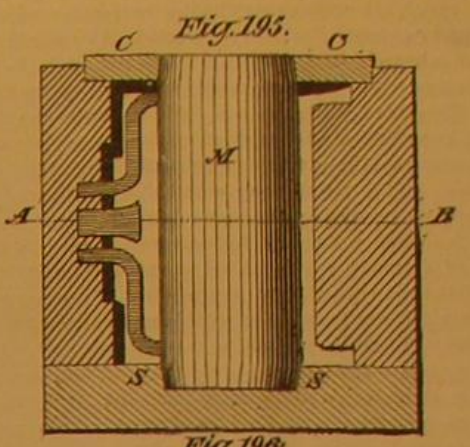
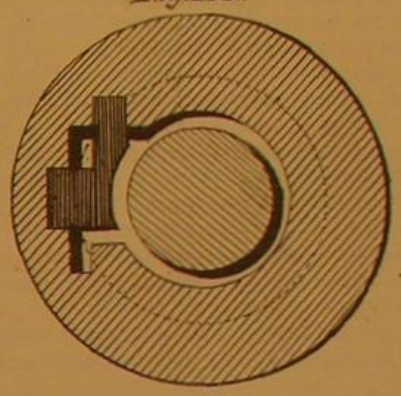


Fig. 196.



and set by the spindle. A pattern of the slide face, with the parts in which the steam and exhaust passages occur, is set in position on this flange; the top flange of wood is now added, and temporarily fixed to the slide face pattern, and shored up on the opposite side, so as to maintain it true and

Fig. 198.

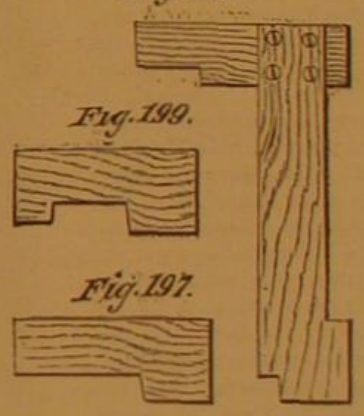


Fig. 199.

Fig. 197.

level. With the board, Fig. 198, is formed the body, A B; the shape of the exterior of the mould is not important; it is left rough, but some mark must be made so as to be able after removing it from the seat, to restore it to the position as before. When the body has dried sufficiently, the pattern flanges and slide face are withdrawn, the body being lifted from the seat for this purpose by means of bolts passing through it, and terminating in a cast annular plate at the bottom. The projecting flanges on the slide face are attached by wires or dovetails; otherwise the piece would be locked in the mould. The side print for the exhaust port is attached also by a loose wire. Fig. 199 is a board for sweeping up the cope, C C. The whole of these boards are represented as carried to the center of the spindle; allowance must therefore be made for the spindle and bracket. For very large cylinders, wood flanges are not used, the sweeps being made to a shape to perform the whole of the work.

Rye for Pasture.

A correspondent of the Elmira (N. Y.) Farmers' Club writes as follows: "Farmers who are in want of first-class pasture at least expense, for this season, should prepare a lot for the purpose and sow the same to winter rye; and they will soon have a pasture for sheep, calves, poultry, in fact any kind of stock; and for young lambs it cannot be excelled. Heavy stock will trample it into the ground, to some extent, if put on early in the season, but later they can be kept on it at a profit. Winter rye sown in the spring will not head out till the second year, but will stool out so as to cover the ground, producing a luxuriant mass of feed that will pay every experimental trial. It can be cut for soiling purposes the second year for grown-up stock, or it can be raised for pasture, as stated before, or it can be allowed to attain its growth and mature a crop to harvest. It will also stand drouth very well, and enrich the land. From one and a half to two bushels per acre should be sown, according to the wealth of the land."

THE EDSON RECORDING GAUGE.—A fully illustrated description of this important invention was published in No. 70 of the SCIENTIFIC AMERICAN SUPPLEMENT.

POMPEII.

To alight from a railway train, to purchase a ticket of admission, to negotiate with a guide, and then, after walking a couple of hundred yards, to find oneself transported back and brought face to face with the every-day life of eighteen centuries ago, is to experience a sensation which no subsequent visiting of famous relics of the past can ever efface from the mind. An ancient ruin is but a heap of stone, whether in Mexico or in Egypt. The massive blocks of Stonehenge or those of the Ephesian Temple of Diana mean nothing to those who, from their knowledge and imagination, cannot call up mental pictures of the circumstances under which they were erected; and it requires no small effort on the part of even those possessing the appreciative faculty to exercise it, when a locality hitherto surrounded with a halo of romance, sentiment, or historical interest, is for the first time viewed from the window of a nineteenth century railway train. Pompeii is perhaps the one exception. Tourists who have wearily ascended Pisa's leaning tower and thought of nothing but the steepness of the stairs, or who have "done" the Acropolis at Athens at sunrise, with the idea of breakfast uppermost in their minds, find in the exhumed city an interest which leaves no room for such incongruous feelings. It is the interest which attaches to all things personal, the same interest which induced thousands at the Centennial to turn their backs on the magnificent Castellani collection of antiquities and linger in the New England kitchen.

To reach Pompeii from Naples, a fifty minutes' journey by the railroad which skirts the bay is necessitated. The line cuts through the great lava stream of 1794, over two thousand feet wide and forty feet thick, at the base of Vesuvius, and passes a number of little villages, inhabited (in the face of constant danger from earthquake) on account of the great fertility of the soil. On reaching his destination, the visitor pays a small admission fee, and enters at once into the streets of the ancient city.

Fig. 1.—CLEARING A STREET

Pompeii was partly destroyed by two earthquakes in the year 63 A.D. Its inhabitants were still engaged in rebuilding the injured portion, when, on August 24, 79, a great eruption of Vesuvius overwhelmed the city and the adjacent towns of Herculaneum and Stabiæ. So sudden was the outbreak that the escape of the people was prevented. A dense cloud of black smoke burst forth from the crater, and settled thickly over the town, plunging it in complete darkness. A dense rain of thin light ashes followed, and then showers of hot stones, mingled with masses of lava giving off mephitic gases. Meanwhile great rivers of black lava poured irresistibly down the mountain sides, filling the streets and cutting off the exit of those who had taken refuge in cellars; while others, who were attempting to leave the city by the gates, were blinded by the drifting ashes and overcome by the sulphurous vapors. For three days this terrible infliction continued; and then, when the smoke dispersed, where once was a beautiful town was but an arid mass of ashes, pumicestone, and hardened mud.

Centuries went by. The rich volcanic soil became covered with a profusion of vegetation, and a new town sprung up over the buried city, only to be destroyed by earthquake four hundred years after the great eruption. Pompeii then existed only in tradition; and this located the lost city several miles from the uninhabited plain under which it was eventually discovered. In the middle of the last century, the finding of relics in the vicinity induced the government to undertake systematic excavations. An inscription was soon unearthed establishing the fact that the true Pompeii had undoubtedly been found; and since that time the work of uncovering the buildings has been slowly and carefully carried on.

A fine series of engravings, from "Italian Pictures Drawn with Pen and Pencil," presented herewith, give an excellent idea both of the appearance of the excavation and the manner of conducting the work. Fortunately the material which chiefly covered the city was not lava, which would have set like stone after probably burning paintings and melting objects in metal, but a fine light ash, which insinuated itself into the minutest crevices, and even through porous earthenware. The writer assisted in opening a large wine jar still bearing the seals placed over its mouth at the time of filling. The white ashes had replaced the wine, and had made their way through pottery of close texture and now harder than stone. Generally, however, the presence of the ashes has proved a positive advantage, because in opening a street for example, as shown in Fig. 1, they are easily dug out and removed; while by packing closely around perishable objects they have formed perfect moulds, retaining the form of the objects after the same have wholly decayed and disappeared. The work of removing the *débris* from a room is represented in Fig. 2. It is not frequently that articles are found at a height above four feet from the floor, as their weight naturally carries them downwards through the soft mass of ashes. The digging is therefore rapidly prosecuted until the above uniform level is attained. Then shovels and picks are put aside, and the ashes are taken out by handfuls, each workman carefully crumbling the material to powder before rejecting it. As soon as the experienced eye of any worker recognizes the indications of a mould being formed in the ashes, labor near that point is stopped, and tamping irons are cautiously inserted to make two or three vents in the cavity. Then liquid plaster is poured in; and after being left sufficiently long to harden, the ashes are taken away and the cast removed. Fig. 9 is from a photograph of casts thus obtained. The bodies are those of two women, apparently poor people, as on the finger of one an iron ring was found. The elder one has the limbs drawn up as if in agony; the other, a girl probably of fifteen years of age, is more composed. One of the hands is half open, as if holding something. The texture of the dress is exactly reproduced, even to the stitches of the seams.

Fig. 2.—SEARCHING FOR RELICS.

It is believed that of the inhabitants of Pompeii thousands perished Many hand in hand groped their way through the streets, and so escaped to the open country. At the chief gate there stood a sentinel, who sternly kept his post through the thunders of that dreadful day. He died in harness. Planted in his sentry box, he covered his mouth with his tunic, and held on against the choking and sulphurous shower. But the ashes fell and fell, and finally filled the box, and buried the soldier alive, still grasping his weapon in one hand and veiling his mouth with the other. There, after ages of rest, he was found—a grisly skeleton clutching a rusty sword.

Sad discoveries were made in the street leading to that gate. There were two skeletons locked in close embrace, the teeth perfect, indicating youth in its prime: skeletons of a young man and maid. They had fallen together in their flight, and death had wedded them. There was a mother with her three children hand in hand, who tried vainly to outrun death. Perhaps the mother singly might have done it, but she could not leave her children. Plenty of food for sad thought is furnished in remembering that six hundred skeletons have been already exhumed!—many in such positions and circumstances as to suggest very touching episodes accompanying the final catastrophe. Of the family of Diomed, seventeen persons were stifled in a wine cellar well stocked with amphoræ of wine, some of which bore the date of the vintage. The fugitives in their agony of fear stood all huddled in a corner. One swooning girl fell forwards on to the bed of ashes that had drifted in. She left the impress of her bosom in the drift like a seal in softened wax.

An interesting little circumstance is connected with one of these houses. The skeleton of a dove was found in a niche overlooking the garden. Like the sentinel, she had kept to her post, sat on her nest through all the storm, and from beneath her was taken the egg she would not leave.

The shops and taverns which have been exhumed are very interesting as illustrating the domestic life of the people. Fig. 5 represents the interior of a baker's shop. Eighteen hundred years ago, the baker, having placed his loaves in the oven, had closed the iron door, when he had to fly for his life. A few years since the batch was drawn. The loaves are jet black, and of stony hardness; but the marks of the baker's fingers show plainly on them. In an eating house were found raisins, olives, onions, figs, fish cooked in oil, and other articles of food, some retaining their natural appearance and all plainly recognizable. It is a curious fact that a precisely similar mode of cookery prevails in the modern Italian villages to that indicated by the utensils and prepared food found in Pompeii; and in some instances vessels have been found which might at the present day be put to their original use, as they differ little from those now employed. In one eating house, for instance, is a dresser of brickwork in which are large metal and earthenware vessels for soup, with furnaces to keep it warm and ladle to distribute it, precisely as are used in modern restaurants. Amphoræ of wine are marked with the year of the vintage, the characteristic quality, and the name of the wine merchant from whom they were purchased. Taverns are indicated by checkers on the doorpost, or by a sign painted on the wall. The streets are paved

Fig. 3.—THE GATE OF HERCULANEUM AND STREET OF TOMBS.

with solid blocks of stone worn in deep ruts by chariot wheels; and at one drinking fountain, where slaves stooped and drank from the flowing spout, on the edge of the trough is a spot worn smooth by the pressure of the many hands that rested against it.

The dwellings for the most part are small and low, few exceeding two stories. They have little ornamentation externally, and are well adapted to a people accustomed to pass most of the day in the open air. The upper stories, being of wood, with flat roofs, were speedily consumed; but as those portions of the house were generally used as storerooms or apartments for servants, their loss is of little consequence. The ground apartments have escaped serious injury; and on their walls some of the frescoes appear as brilliant as if recently painted. Figs. 6, 7, and 8 afford an excellent idea of the various objects found in the dwellings, as well as of their remarkable state of preservation. Fig. 6 shows a collection of cooking utensils. It is hardly necessary to call attention to the colander, the frying pan, and the forks and spoons, as being the same as those now used. Gold ornaments, copied from the designs shown in Fig. 7, are now quite common; and many of the terra cotta lamps depicted in Fig. 8 have served as suggestions for the patterns of modern gas fixtures.

Fig. 4.—TEPIDARIUM OF PUBLIC BATH.

The walls of the city, which have been traced throughout their full extent, indicate that an irregular oval area of about two miles in circumference was occupied. It has generally been supposed that the population was from 20,000 to 50,000, but according to Signor Fiorelli, the general superintendent of the excavations, Pompeii had not more than 12,000 inhabitants at the time of the eruption. Eight gates have been discovered, and the roads outside of them were lined on each side with tombs of considerable size and architectural pretension. The Street of Tombs, before the gate of Herculaneum, Fig. 3, was probably the principal burial place of the city; and the sepulchral monuments adorning it give evidence of the refined taste and great wealth of prominent Pompeiians. The streets, which for the most part run in regular lines, are with some exceptions barely wide enough to admit a single vehicle. The widest does not exceed 30 feet in breadth, and few exceed 22 feet. Five of the main streets have been partially or wholly traced; and with these a regular system of minor streets appear to have been connected. These thoroughfares, with a single exception, terminate in or traverse the western quarter of the city, which is the only part yet completely explored. The public buildings were profusely decorated structures, and included temples of Jupiter, Mercury, and Venus, besides two theaters. The *thermæ* or public baths —a room in one of which is represented in Fig. 4—were elegantly adorned.

Fig. 5.—BAKER'S OVEN, BREAD, AND FLOUR MILLS.

The most important paintings and objects of art discovered by excavation have been deposited in the National Museum at Naples. Until recently the excavations have proceeded slowly; but at present the Italian Government is liberally assisting the work. The space now laid bare measures about 670,000 square feet, or one third the whole area occupied by the city. Signor Fiorelli calculates that, making the excavations on an average 25 feet deep, and employing 81 laborers daily, the whole city will be unearthed in 1947.

Hindoo Snake Charmers.

Frank Buckland, the naturalist and writer, informs the readers of *Land and Water* that at the Westminster Aquarium, London, a company of three or four snake charmers have recently arrived from India. He states that not for twenty years have these curious people, with their wonderful tricks, appeared as exhibitors in London.

"The performance takes place in the northwest corner of the Aquarium. Convenient seats have been arranged so that every one can have a good opportunity of seeing what is going on. In order that there shall be no suspicion of trapdoors, etc., the platform on which the performance takes place is composed of solid earth. The performers are three in number: the principal actor is Seyed Emman, his assistant is called Gheesa. There is also present a very intelligent-looking slim boy named Moen Deer. This young gentleman keeps up a perpetual tapping on a tom-tom drum, while he keeps up an animated conversation with Emman and Gheesa. Seyed Emman is dressed in the Hindoo fashion; he wears a resplendent turban, a very handsome silver waistband, and massive silver anklets ornamented with bells; his assistants are also well dressed, their copper-colored skins contrasting well with the ornaments they wear. To heighten the effect, Mr. Gheesa had painted his forehead and arms in yellow ocher. Seyed Emman comes out on to the platform carrying his snakes suspended to a bamboo over his shoulder; the snakes are carried in baskets beautifully made of bamboo. He places the baskets on the earth, and dances round them frog fashion, all the time playing a curious Indian instrument that look likes a cocoanut with a penny whistle attached; this is called a surringhee. It appears that nothing can be done without formal incantations—frog dancings, and a great deal of talking and shouting. After Seyed Emman has sufficiently charmed the snakes in the baskets, he lifts off the covers of three of them, and dexterously twitches the living contents on to the platform. The first basket contained two specimens of amphisbena, or, as they are sometimes called, double-headed snakes; the next, a large lacertine; the others, cobras. While four of the snakes are crawling about the platform, the charmer pays especial attention to one of the cobras. The instant the lid of the basket is off, up rises the cobra as if impelled by a spring. This cobra is a large snake and prettily marked; he has especially brilliant eyes. It is very beautiful to see the wonderful way in which he expands his hood. This is beautifully marked at the back, the resemblance of a pair of spectacles. There are also patches under the throat. For a minute or two the cobra holds himself quite erect; the man sets down on his heels immediately in front of the cobra, and pipes at him furiously with his musical instrument. This seems to excite the anger of Mr. Cobra, who makes two or three very nasty spiteful lunges at him. The charmer then dances round the snake, which still remains in his basket—the shape of a common strawberry basket. The brute, following the man, with his expanded hood and threatening head, made several strikes at his naked legs, but he was never quick enough to hit him.

"I observed what I did not know before, that a person with a quick eye can tell when a cobra is going to strike. A cobra never strikes while his head is on the ground. Next, when his head is erect, he must draw back a little before he can make a dart.

"The anatomy of the cobra should be known to all our readers. When he is quiet and undisturbed, his hood does not appear at all. This hood is formed by a loose-skin immediately below the animal's head. It is erected by a beautiful mechanism formed by the ribs, which are so fitted to the vertebræ that they can be spread out at right angles, and so erect the hood. Hence the name cobra *di capello*, of the hood. The cobra that was made to dance, so far as I could see, was the *naja tripudians*, or 'naga.'

"Sir Joseph Fayrer, M.D., in his remarkable work, 'Thanatophidia, or Death Snakes of British India,' writes: 'Cobras are most deadly; they all have the hood, and they never attack without distending it; they raise the anterior third of the body from the ground, slide along slowly on the posterior two thirds, and with the hood dilated, remain on the alert, darting the head forward to attack when anything hostile approaches. The cobra is a nocturnal snake; it feeds on birds' eggs, fish, frogs, and insects. They are not unfrequently found in roofs of huts, holes, and old masonry, etc. The cobra is most deadly, and its poison quickly fatal: paralysis of the nerve centers takes place, and death occurs with great rapidity, sometimes in a few minutes, especially when the fangs have penetrated a vein and inoculated the poison instantly in the venous circulation. The number of deaths caused yearly in India by these snakes is perfectly appalling. The cobras are the favorites of the snake catchers, and it is astonishing with what ease and freedom the reptiles are seized and handled by these men, even while in possession of all their fangs.'

"The cobra has several (some five or six) poison fangs on each side at the edge of the roof of the mouth. These fangs are perforated, the hole being just large enough to admit the bristle of a hairbrush. In connection with the upper end of the tooth, there is a duct communicating with a poison gland the size of a large nut. The cobra may be said rather to strike than to bite. It does not lay hold, as does a dog, but it gives a quick and almost instantaneous stab with its teeth; the poison runs down —the word is rather injected—into the wound made by the tooth. I myself have had very unpleasant experience of cobra poison. I was dissecting a rat which had just been struck by a cobra. In skinning it, a minute drop of the poison got under the nail, and the symptoms were very unpleasant. I have examined the cobra poison under the microscope; it is colorless, slightly viscid, something like clarified honey. On two occasions I have watched the poison form itself into crystals when under the microscope. This had been seen and described a hundred years ago by Dr. Mead. Microscopists of the present day say that this crystallization is simply drying. I am of different opinion. I believe that these crystals are *sui generis*. The subject is well worthy of further investigation, though the operation of procuring the

Fig. 6.—POMPEIIAN COOKING UTENSILS IN THE MUSEUM AT NAPLES.

poison is somewhat dangerous; poison may, however, be procured from the fangs of living or recently killed vipers.

"The next trick performed by Seyed Emman is the conversion of the dried skin of a little animal into a living beast, which beast turns out to be a mongoose, and a fierce little animal is this mongoose. A dried skin of a cobra is next placed on the ground, the charmer dances round it and pipes on his cocoanut a stirring strain which reminds me very much of Highland bagpipes. He rolls this skin up and places it in a covered basket, from which basket in due time he produces a second living cobra, rather larger than the first. This cobra seems a very spiteful gentleman; he made distinctly two or three fierce lunges at the charmer, and I could distinctly see his mouth wide open when he made his strike. This experiment of converting a dried cobra skin into a living cobra is, I should fancy, a repetition of the trick we read of in Exodus: 'Then Pharaoh called the wise men and the sorcerers. Now the magicians of Egypt they also did in like manner with their enchantments, for they cast down every man his rod, and they became serpents.' The next trick is making a shrub grow into a small tree under a basket. A seed is placed in the ground. The first time the basket is lifted off the seed has grown into a small plant. At each taking off of the basket the plant is discovered to be larger and larger. The trick is very cleverly done, as the man is sitting in the middle of the stage, which is, as I said before, formed of earth. Other very ingenious tricks follow, and the performance is terminated by the celebrated basket trick. The boy, Moen Deen, is tied hands and feet, and then completely inclosed in a large cabbage net. The young rascal, grinning all over with apparent delight, is then dropped, like a pudding into a pot, into a very small basket, which seems hardly big enough to hold a brace of hares; the lid is then put down. Incantations are performed while the cloth is thrown over the basket; a sharp sword is then thrust through the basket in all directions. When the cloth is removed the boy is found released from the net, and jumps out of the basket unhurt. On another occasion, when I was present, the boy disappeared from the basket, and suddenly reappeared on the platform, whence or how I really cannot understand.

"Altogether this is a very interesting performance, and brings before our eyes scenes which most of us have heard, but few have had an opportunity of seeing. After the performance was over, I interviewed the charmers; they told me they were obliged to take very good care of their cobras as the weather was so cold. Dr. Lynn has telegraphed to India for more cobras, and some twenty or thirty more of these venomous brutes are shortly expected. It will then be an interesting sight to see Seyed Emman handle these newly caught specimens."

Photographic Bibliography.

Photography during its brief career has already had numerous applications—some exceedingly useful, but others less so. As a means of supplying facsimile copies of valuable documents it is unrivalled; and reprints, in facsimile, of original editions of the works of Shakespeare, Holbein, and other authors of past times, as well as copies of certain manuscripts of Burns and other modern authors, are now easily accessible. The forthcoming advent of the four hundredth anniversary of the introduction of printing into England has afforded certain writers an occasion for instituting comparisons between the wonderful extent of the circulation of the Bible compared with the sacred writings connected with other religious faiths. It has been stated that there exists a law of the Mohammedan religion prohibiting utilizing printing types in the reproduction and multiplication of copies of the Koran. The precise nature of the existing objection to the use of types in connection with the reproduction of the Koran we cannot at present ascertain, although we have made inquiries from those who are believed to be in a position to know. Hence up to the present period all copies of the Koran made use of by the adherents of the Mussulman faith have been laboriously produced by writing with pen and ink. That this has arisen from a desire to keep their "book of the law" free from error is without doubt, although, reasoning from strict analogy, this seems to be the very best means of introducing error.

It is pleasing to find that the high religious authorities of the Mohammedan faith have at length decided that although the typographic art, pure and simple, may not be applied to the reproduction of the Koran, the art of photography may be invoked to provide the means of disseminating their sacred writings. It is believed that if a copy of the Koran recognized as perfectly accurate be placed in the light, and another copy of its pages be obtained by photo-mechanical means, there will obviously be no chance of errors occurring in such reproduction. By means of photolithography and phototypography—the latter of which is suitable for working at a modern printing maching—it is not too much to say that in a brief period copies of the Koran in the original Turkish language may be as easily procurable in the towns and villages of Oriental countries as they now are in London,

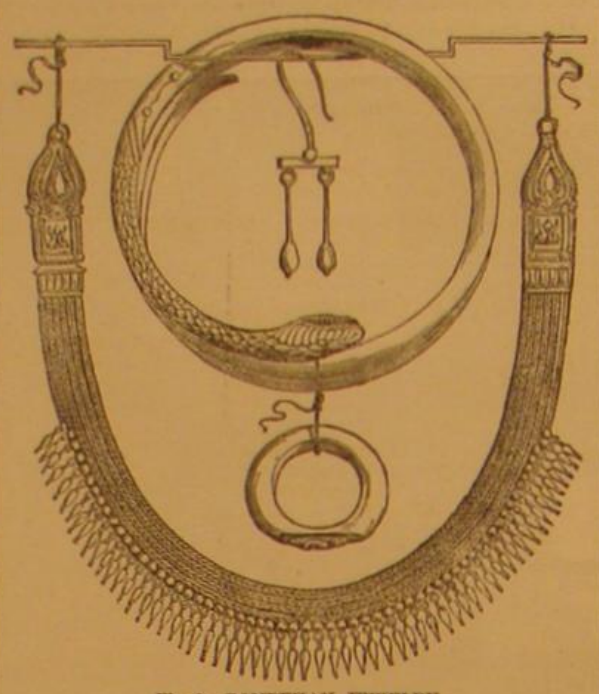


Fig. 7.—POMPEIIAN JEWELRY.

where the English translation may be obtained at any bookstall at a shilling per copy.

Of still greater interest would it be if the Russian Government allowed a photographic reproduction to be made of what is recognized as the oldest copy extant of the New Testament, to be found in the Imperial Library, at St. Petersburg, where it is only to be consulted under the strict surveillance of an armed guard. If this valuable work were reproduced with the degree of accuracy appertaining to photography alone, how many disputed minor points of doctrine might not cease to exist! It is well known among bibliographers who are students of the New Testament in the original Greek that, by the introduction in the copies of apparently trifling marks of no larger dimensions than a comma, the whole sense of a passage may be inverted or, at least, seriously modified, and it has frequently been insisted that such "marks" have been intentionally made or varied with the view of supporting special dogmas. By the production of one good photographic copy all such differences would cease to exist.

As public attention will inevitably, by the new and liberal policy of the Mohammedan religious functionaries, be directed to the reproduction of other works by similar agencies, we anticipate a rapid demand for facsimile reprints of rare works. For the most part, such reprints have hitherto been made by the aid of photolithography; and with such a work as Holbein's "Dance of Death" on our shelves before us, it would be unjust to say that this process is not equal to the task of facsimile reproduction. Still it is in phototypography that the art of reproducing scarce works will find its chief outcome, speed and quality being alike the concomitants of this method of printing.—*British Journal of Photography.*

Fig. 8.—BRONZE AND TERRA COTTA LAMPS.

Fig. 9.—CASTS OF HUMAN BODIES FOUND AT POMPEII.

New Drawing Scale.

An instrument for reducing or enlarging drawings, called a *planigraph*, has been invented by M. Marmet, of Versailles. It consists of a rule carrying two scales which have different graduations, and are placed end to end in opposite directions. At the common origin of the scales is a needle about which the rule can freely turn. Reading on one side, the vector radii of the different points of a given figure, and marking on the other side the points designated by the same numbers, you obtain a figure reduced or enlarged in the proportion resulting from comparison of the scales. These scales are fixed to the rule by screws. There are five for each side, among which choice is made according to the reduction required.

The Opening of the Permanent Exposition.

The Permanent International Exposition in the Main Centennial Building, Philadelphia, was formally opened on May 10. Speeches were made by the Hon. John Welsh, President of the Centennial Board of Finance, Hon. A. T. Goshorn, late Director-General, and Mr. Clement M. Biddle, of the Permanent Exhibition Company. The music rendered by a large chorus and orchestra, was nearly the same as at the Centennial opening. President Hayes declared the show open for the season, but forgot to touch the button which signalled to start the machinery, as it was intended he should do. The crowd was large and not very orderly; but the ceremonies passed off reasonably well. At present the condition of the exhibits is as usual—by which we mean incomplete, as is invariably the case in every fair of this description on the opening day. There is every indication, however, that the display will be a creditable one; and the new arrangement of the huge building affords excellent facilities for comparison and study of exhibits. When the Exposition is reduced to good running order, we shall lay before our readers whatever there is therein of novelty and interest.

The Fall of the New York Post Office Roof.

The verdict of the coroner's jury, after examination into the causes which recently led to the fall of a portion of the roof of the new Post Office building in this city, shows that, on the removal of a wall in the fourth story, the remainder of the same wall on the story above was left standing, but was supported by two light 15 inch iron beams, which were not deemed competent to sustain the load. Accordingly this superincumbent wall was removed, and an iron truss substituted for it, in order to uphold the roof. This truss, with the iron roof beams, not being strong enough to stand the stress, the fabric, under its load of concrete, fell. Ex-Supervising Architect Mullett is charged with fault in the matter; but that gentleman appeals from the verdict, which he says emanates from professional rivals, and asks that an examination be conducted by the Chief of Engineers, U. S. A.

Pitury, an Australian Rival to Coca.

Baron Von Müller, of Melbourne, has at length determined the botanical source of the "pitury," a stimulant long known to be in use by the aborigines of Central Australia, and said to be of marvellous power. After some years of efforts to obtain a specimen, he has with certainty determined them to belong to *Duboisia Hopwoodii*, a bush referred to the order *solanaceæ*. In the *Australian Medical Journal*, Baron von Müller states that the natives chew the leaves to invigorate them during their long foot journeys through the deserts, just as coca leaves are used in South America. It is carried about by them in little bags. It is also employed to excite courage in warfare. We shall probably soon hear concerning its therapeutic qualities.

The Achievements of Science.

Dr. Oliver Holmes, the poet, author, scientist, inventor of the popular stereoscope instrument, recently delivered an address before the Boston Microscopical Society. It was mainly an illustration of the progress of microscopy—in the construction of the instruments and in the discoveries by their aid. "To those of my generation," he began, "this modern world which most of you take as a matter of course, it being the only condition of things of which you have had experience, is a perpetual source of wonder—a standing miracle. Science and art have in our time so changed the aspect of every-day life that one of a certain age might well believe himself on another planet or in another stage of existence. The wand of Prometheus is in our matchboxes; the rock of Horeb gushes forth in our dressing rooms; the carpet of Arabian story is spread in our Pullman car; our words flash from continent to continent; our very accents are transmitted from city to city; the elements of forming worlds are analyzed in our laboratories; and, most wonderful and significant of all, the despotic reign of tradition received its deathblow when the angel of anæsthesia lifted from womanhood the worst terrors of the primal malediction."

Mind and Health.

The *Science of Health* says on this subject: "The mental condition has more influence upon the bodily health than is generally supposed. It is no doubt true that ailments of the body cause a depressing and morbid condition of the mind; but it is no less true that sorrowful and disagreeable emotions produce disease in persons who, uninfluenced by them, would be in sound health—or, if disease is not produced, the functions are disordered. Not even physicians always consider the importance of this fact. Agreeable emotions set in motion nervous currents, which stimulate blood, brain, and every part of the system into healthful activity; while grief, disappointment of feeling, and brooding over present sorrows or past mistakes, depress all the vital forces. To be physically well one must, in general, be happy. The reverse is not always true; one may be happy and cheerful, and yet be a constant sufferer in body."

Curious Electrical Experiment.

If an ebonite electrophorus be whipped with a fox tail, it is negatively excited, and the condenser gives positive sparks. If, again, the electrophorus be rubbed with leather on which is some mosaic gold, the ebonite disk is positively excited, and the condenser gives negative sparks. It is stated by M. Schlosser, however (*Poggendorff's Annalen*), that if the same ebonite disk be excited on one side with the fox tail, on the other with mosaic gold on leather, one may at any moment obtain from the same disk positive or negative electricity, according as the one or the other surface of the electrophorus is used as the source. The most important point in this double excitation is the very much greater length of spark, as is readily observed by the eye. On the other hand, considerably shorter sparks are obtained from the same electrophorus when both sides are similarly excited, for example, whipped with the fox tail.

NEW YORK ACADEMY OF SCIENCES.

A regular meeting of the Academy was held in its rooms, at 64 Madison Avenue, on Monday evening, May 1, 1877, Dr. J. S. Newberry, President, in the chair. The audience, drawn together by the announcement of an exceedingly important paper on a new and interesting subject by one of our leading chemists, was unusually large and intelligent, and included several ladies.

After the transaction of some routine business, Dr. H. Carrington Bolton read a paper on the

ACTION OF ORGANIC ACIDS ON MINERALS.

The speaker at first described the use of organic acids in quantitative analysis to prevent the precipitation of certain metals, and the use of tartaric acid in Fehling's sugar test, and to dissolve antimony, etc. The use of organic acids for decomposing minerals is, however, a novel one. While on a mineralogical tour in North Carolina, he had frequently felt the inconvenience and danger of carrying a bottle of mineral acid for recognizing the carbonates; and he determined, on his return, to try to substitute for it some crystalline organic acid To his surprise, the results were very satisfactory; and he extended his investigations to a dozen different carbonates, eighteen sulphides, twelve oxides, twenty-four silicates, and several miscellaneous minerals, in all 120 specimens, embracing 90 different species. The action of citric, tartaric, oxalic, malic, pyrogallic, benzoic, and other acids was studied. The following are a few of the points noticed: Organic acids act more slowly than mineral acids, and frequently some time elapses before effervescence begins. Citric acid acts most rapidly and satisfactorily; next to this is tartaric acid; oxalic acid acts in a similar manner, but more frequently forms insoluble compounds, which are sometimes characteristic of the mineral. Acetic acid does not have any effect on the carbonates; and when heated to boiling, the acid distils off, whereas the other acids are concentrated by boiling. Glacial acetic acid does not act unless somewhat diluted. Formic acid is more active than acetic. Propylic acid decomposes several carbonates; pyrogallic acid decomposes calcite. A few experiments were made with metals. Citric and tartaric acids dissolve iron; and citric acid, with zinc, can be employed to generate arsenuretted hydrogen.

When sulphides are subjected to the action of citric acid, sulphuretted hydrogen (H_2S) is evolved; carbonates yield carbonic acid, CO_2.

In the case of minerals not attacked by an organic acid alone, the experiment was tried of mixing citric acid with saltpeter (KNO_3), whereby nitric acid is generated on boiling. Chlorate of potassium was also mixed with the citric acid, but with less satisfactory results.

When silicates are boiled in a solution of citric acid, silicic acid ($Si O_3$), either pulverulent or gelatinous, separates.

By mixing citric acid with fluoride of ammonia (NH_4F) hydrofluoric acid is evolved, which is able to attack most of the silicates not otherwise decomposed, including all the constituents of our common rocks. The following table shows at a glance the

MINERALS DECOMPOSED BY CITRIC ACID ALONE AND WITH REAGENTS.

The mineral tested is to be in a fine powder.

In the cold.

A. Without evolution of gas.	B. With liberation of CO_2.	C. With liberation of H_2S.
Brucite.	Calcite.	Stibnite.
Anglesite.	Dolomite.*	Galenite.
Pyromorphite.*	Ankerite.*	Sphalerite.
Vivianite.	Gurhofite.	Pyrrhotite.
	Rhodochrosite.*	
	Smithsonite.*	
	Witherite.	
	Strontianite.	
	Barytocalcite.	
	Cerussite.	
	Malachite.	
	Azurite.*	

On boiling.

D. Without evolution of gas.	E. With liberation of CO_2.	F. With liberation of H_2S.
Zincite.	Magnesite.	Bornite.
Gypsum.*	Siderite.	Bournonite.*
Apatite.*	Pyrolusite.†	And those in C.
Cuprite.	Wad.†	
Limonite.*	Hausmannite.†	
And those in A.	Manganite.†	
	Psilomelane.†	
	And those in B.	

G. With formation of a jelly (SiO_3).	H. With separation of SiO_3.	
Willemite.	Wollastonite.	Analcite.
Datolite.	Chrysolite.	Chabazite.
Pectolite.	Chondrodite.*	Stilbite.
Calamine.	Chrysocolla.	Serpentine.
Natrolite.	Prehnite.*	Chrysotile.*
	Apophyllite.*	Retinalite.
	Rhodonite.	Deweylite.

I. Decomposed by boiling with citric acid + KNO_3.	K. Decomposed by heating with citric acid + NH_4Fl.	L. Minerals not decomposed by the above reagents.
Argentite.	Olivine.	Molybdenite.
Chalcocite.	Wernerite.	Cinnabar.
Pyrite.	Orthoclase.	Magnetite.
Marcasite.	Albite.	Hematite.
Niccolite.	Labradorite.	Chromite.
Smaltite.	Augite.	Franklinite.
Chalcopyrite.	Diopside.	Cryolite.
Ullmannite.	Hornblende.	Fluorite.
Arsenopyrite.	Kyanite.	Samarskite.
Tetrahodrite.	Talc.*	Muscovite.
Uraninite.	Spodumene.*	Biotite.
And those in F. and C.	Almandite.	Ripidolite.
	Epidote.	Tourmaline.
	And those in G. and H.	

The gases evolved are examined with acetate of lead test paper; the solutions with appropriate reagents.

The next chemical meeting of the Academy is to be held on May 14, 1877.

NEW BOOKS AND PUBLICATIONS.

DRAUGHTSMAN'S ALPHABETS. Price $2.00. New York city: A. J. Bicknell & Co., 27 Warren street.

An excellent collection of alphabets suitable for titles, etc., to drawings and maps. Many of the old styles of letters given are rarely found in books of this description, and in their quaintness and beauty form pleasing variety as compared with the fancy alphabets now conventionally employed. Modes of shading charts, and the various signs for meadows, woods, gardens, etc., used in chart drawing, are added.

AN OUTLINE OF THE STRUCTURE OF THE PIPE ORGAN. By William H. Clarke. Illustrated. Price $1.50. Boston, Mass: Oliver Ditson & Co.

There is very little literature on the organ suitable for conveying to organists, church committees, and musical students, a clear, simple, and comprehensive view of the instrument. Such, however, is the aim of the present work; and the author has accomplished his task with much success. To the student of the organ, the book can be especially commended, as it abounds in useful practical hints, and contains a valuable list of the best classical music for the instrument.

MESSRS. GEORGE P. ROWELL'S "AMERICAN NEWSPAPER DIRECTORY" for 1877 has been issued, and forms as usual a huge volume of over a thousand pages. The brief history of newspapers for the year, contained in the preface, is not a particularly agreeable record for publishers, since, instead of the steady increase in the number of journals which has taken place hitherto from year to year, during 1876 there has been a falling off of one hundred and ninety. This is one result of the unsettled state of public affairs due to the election difficulties, and of the general retrenchment and economy practised by all classes. It should not be supposed that there is any lack of newspapers, despite this diminution, as the total still aggregates 8,427; so that newspaper readers need not fear any lack of their favorite literature. The only question is, and we confess the problem puzzles us as much as any one, where the material all comes from to fill so many sheets. Perhaps statistics, showing how many times a given article is published in them by the 8,427 editors, would throw some light on the matter. The present "Newspaper Directory" is fully as good as its predecessors, possibly better, as, in addition to the facts relating to newspapers, the editor has added useful information concerning the population, etc., of the localities where they are published. Of course the volume is invaluable to advertisers. Messrs. Rowell & Co. have removed from 41 Park Row to 10 Spruce street, New York city.

MESSRS. S. M. PETTENGILL & CO.'S "NEWSPAPER DIRECTORY AND ADVERTISERS' HANDBOOK" for 1877 tells in compact and trustworthy manner about everything advertisers want to know concerning newspapers which they had best select for advertising their business. The work contains a complete list of newspapers and periodicals published in the United States and British Provinces, with the frequency and days of issue, the politics and other distinctive features, and in most cases a statement of the amount of circulation. For advertisers desiring to reach certain sections of the country, there is a carefully prepared list of periodicals arranged by counties. Catalogues of daily, weekly, religious, and agricultural papers are appended. To this is added much valuable information as to the peculiar advantages which each periodical offers to the subscriber or advertiser. The volume is handsomely printed and bound, and is embellished by portraits on steel of leading journalists. It is sent to any address for one dollar. Messrs. S. M. Pettengill & Co. have been our neighbors for several years, occupying offices in the same building with the SCIENTIFIC AMERICAN. We can speak well of their integrity and good ability in conducting their business with both advertisers and publishers.

*Feebly attacked. †The CO_2 evolved is derived from the citric acid.

Inventions Patented in England by Americans.

From April 10 to April 23, 1877, inclusive.

BREECH-LOADING GUN.—B. Fasoldt *et al.*, Albany, N. Y.
CARTRIDGE SHELL.—C. D. Leet *et al.*, Springfield, Mass.
CIGAR LIGHTER, ETC.—R. R. Moffatt, Brooklyn, N. Y.
CIGAR LIGHTER, ETC.—G. Selden, Erie, Pa.
COAL OIL STOVE.—J. A. Frey, New York city.
FIRE EXTINGUISHER.—H. S. Maxim, New York city.
FLUTING MACHINE, ETC.—C. M. Meserole, New York city.
FRUIT JAR.—A. Dickey, Middletown, Ohio.
HORSE CAR POLE, ETC.—S. A. Otis, Boston, Mass.
LIGHTING GAS, ETC.—E. Lindsley, Cleveland, Ohio.
PRINTING PRESS.—W. M. Clark *et al.*, Philadelphia, Pa.
LOOM.—J. V. D. Reed, New York city.
METALLIC PACKING.—W. H. Floyd, Boston, Mass.
PULLEY, ETC.—G. G. Lobdell *et al.*, Wilmington, Del.
PUMPING ENGINE.—G. F. Blake, Boston, Mass.
PUTTING UP POWDERS, ETC.—C. R. Doane, Brooklyn, N. Y.
REFRIGERATOR, ETC.—J. C. Mack, Brooklyn, N. Y.
REFRIGERATOR CAR.—W. H. Klapp *et al.*, New York city.
ROCK DRILL.—W. W. Dunn (of San Francisco, Cal.), London, England.
SHEET METAL.—C. D. Leet *et al.*, Springfield, Mass.
SUGAR MACHINERY.—F. O. Matthiessen *et al.*, Irvington, N. Y.
WINDING THREAD.—A. C. Carey, Malden, 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 MISCELLANEOUS INVENTIONS.

IMPROVED DIE FOR CUTTING LEATHER.

Albert Warren, Jefferson, O.—This die, which is made of steel, of the shape of the article to be cut, and a little smaller at its cutting end than at the other, so that the pieces cut may pass through it freely, is fitted into a hole in a block of wood, so that its rear edge may be flush with the lower surface of the said block. A block of wood having a hole formed through it of the same shape as the cutter serves as a base support for the die. In using the device, it is laid upon a table or counter, over a hole in said table or counter, for the pieces to drop through. The material to be cut is then laid upon the edge of the die and is struck with a wooden mallet. With this construction the whole force of the blow is expended in making the cut, as the die does not have to be moved by the force of the blow.

IMPROVED HARNESS PAD.

Miron V. Longsworth, Delphos, O.—The object of this invention is to improve the construction of the harness pad for which letters patent were granted to same inventor July 18, 1876, so as to make it stronger and more durable, and less liable to get out of order. The device consists in the crossbars upon the upper ends of the flanged pad plates to receive and hold the saddle strap.

IMPROVED ICE AX.

William H. Coleman, Salisbury Mills, N. Y.—This tool combines in a single instrument an ax for cutting ice, a pike for pushing it from place to place, and a hook for drawing it from the water.

IMPROVED CRAYON FOR MARKING ON GLASS.

Bernard J. Clarke, New York city.—This crayon is adapted for marking on porcelain, glass, or other smooth surface; and it consists in a composition formed by mixing a pigment with melted beeswax, suet, and oil of cedar. The marks made may be readily erased by rubbing.

IMPROVED PHOTOGRAPHIC BURNISHER.

James H. Ferguson, Leavenworth, Kan.—This consists in the combination of a bedplate, to which a burnisher is attached, a feed roll, and an adjustable frame for supporting the feed roll over the burnisher. The object of the invention is to provide apparatus for burnishing photographs, in which the burnisher may be heated without the common and annoying difficulty of the roll becoming moist from the condensation of the vapor from the lamp used.

IMPROVED STEAM TANK FOR COOKING FISH AND MEAT IN CANS.

Francis M. Warren, Portland, Oregon.—One end of this tank, which is of boiler iron, is left open, and around its edge is formed a rim having a groove to receive the edges of the door, and to it are pivoted a number of cams, which, when the door is in place, may be turned to press the said door to its seat steam tight. In the bottom of the tank is coiled a steam pipe, which is perforated with numerous small holes, to allow the steam to escape into the said tank freely. To the bottom of the tank is attached a track for the hand cars, upon which the cans are piled, to be run in and out upon.

IMPROVED TEN PIN BALL.

William Woods, Brooklyn, E. D., N. Y.—The object here is to improve the construction of ten pin balls, to prevent the balls from being chipped off or splintered around the finger holes, and to accurately balance the balls, so that they will roll perfectly true. To this end, metallic bushes are inserted in their finger holes.

IMPROVED APPARATUS FOR DRYING HIDES.

James N. Duffy, Newark, N. J.—This invention furnishes an improved means for drying and stretching hides. It is so constructed that the hide may be stretched in any desired direction and to any desired extent, and thus dried without fold or wrinkle.

IMPROVED CAST IRON EXTERIOR COFFIN OR VAULT.

Robert Beachman, Lyons, N. Y.—This is an improved individual vault or grave which shall be airtight, so as to keep the coffin and body from the air, and thus preserve them. It protects the body and enables the vault and body to be removed.

IMPROVED BUTTON.

Benjamin Bailey, Yale, British Columbia.—This consists of a button with recess for attaching a spring steel hook of the suspenders, the button being secured by a hook-shaped shank, nickel plate, and concaved spring plate, to the waistband of the pants.

IMPROVED VALVE NOZZLE FOR BOTTLE STOPPER.

Charles Cristadoro, New York city.—This relates to improvements on the valved nozzle for bottle stoppers; and it consists in forming on the upper side of the valve a spindle, which extends through the nozzle, and is provided with a head outside of the nozzle that retains the valve when the nozzle is removed from the stopper.

IMPROVED TOBACCO PACKAGE.

Pierre Cauhapé, New York city, assignor to himself and Ernest Greenfield, of same place.—The object here is to pack chewing and other tobacco in such a manner that the moisture is preserved, the deleterious influence of the humid sea air in ocean shipment prevented, and a waterproof protective package obtained. The package is covered by a layer of elastic gelatinous substance.

IMPROVED CORSET.

Elizabeth S. Weldon, New York city.—The part which supports the breast consists of a triangular tongue, attached at its apex to the body of the corset by means of a strip, through which two steel stays run. Stays diverge from a point near the apex of the triangular tongue, and run nearly parallel with the sides of said tongue to its upper edge. Transverse stays are also attached to the inner surface of the tongue, and are drawn in and confined at their ends, so that they cause the said tongue to assume a convex form. Curved gores connect the strip and the adjoining portions of the corset, and give a graceful form. To said gores triangular wings are attached, having their widest ends uppermost. These flaps overlap the tongue, and are provided with eyelets at intervals along their free edges for receiving a lacing.

IMPROVED ANTI-CROUP AMULET.

Noah W. Caughy, Baltimore, Md.—This invention relates to curative means for croup and other affections of the throat, and consists in a silken band with loops of the same material movable by the natural changes in the position of the head and neck, it being made to encircle the latter with the loops arranged in front. The gentle friction thus produced seems to promote a natural and healthy circulation in this delicate portion of the person, joining as it does the head to the trunk or body, and exposed as it is to currents of air and sudden changes of temperature. It is not only curative but preventive as well.

IMPROVED ICE MACHINE.

Daniel L. Holden, Carrington, Ky.—This invention relates to a novel form of ice machine constructed upon the general principle of the employment of a non-congealable liquid as a vehicle for conveying the cold, produced in a refrigerator, to a case where the temperature of the cooled liquid is transmitted to atmospheric air, and the latter thence directed into a congealing case where it produces the freezing effect upon the water contained in the pans. The invention consists in the construction of the refrigerator for facilitating evaporation to effect the cooling of the non-congealable liquid; the construction and arrangement of the case for imparting the temperature of the non-congealable liquid to the air circulating in the congealing case; the construction and arrangement of the congealing case and its adjuncts; a receiver and "purger" for containing the condensed volatile gas and removing the air from the gas circulating apparatus; and an automatic valve for feeding the condensed volatile liquid back to the refrigerator.

IMPROVED EAVE-TROUGH FASTENER.

Albert J. Gilbert, Honeoye, N. Y.—This invention is claimed to hold the troughs so securely that they will not be liable to be blown down by the wind, or forced down by the weight of snow or ice, or by snow sliding from the roof. It is formed of wire, bent to form a curve to receive the eave trough, the eyes to receive the spike or bolt, the shoulder, the hook points, and the eyes to receive nails, screws, or stables, whether the eye formed upon the shoulder and the offset to receive the roll of the eave trough be used or not.

IMPROVED BALE TIE.

James M. Pollard, New Orleans, La.—Cotton baled on the plantation is usually compressed or repressed, and thus reduced in size before being stored or shipped for distant or foreign ports. The bands used on the plantation bales are again used on the compressed or reduced bales, but the "button" or cleat buckle, forming part of the ties used on plantation bales, is not used, a plain slotted buckle being substituted for it. The ends of the bands are also slotted for four (4) feet of their length, but some two (2) feet thereof are cut off when the bands are used on the compressed bales. The chief results attained by the present invention are these: 1st, the buckle is so constructed as to adapt it for use on both the plantation bales and the compressed bales, so that the labor and expense of detaching the buckle and substituting a new one is avoided. 2d, the bands require to be slotted but two (2) feet instead of four, and is hence neither weakened nor unduly reduced in weight as heretofore.

IMPROVED PLAITING BOARD.

Samuel G. Otis, Springfield, Mass.—This apparatus is for forming different styles of plaits for trimmings; and it consists in the combination of hinged round and flat wires with a board grooved upon one side and plain upon the other, and in certain other features. The operation is as follows: The goods to be plaited are laid upon the board, and one of the wires is brought down into a slot of a bar; this presses the goods into one of the grooves. One of the wires is then passed under the goods and over the other wire, carrying the goods with it, and its inner end is placed in a recess. The outer end of the wire is then placed in the slot opposite the recess, bringing the two wires parallel to each other. The wires are withdrawn when the board is full, and the goods are pressed. The wires are now removed, leaving the goods on the board as pressed. The goods are now removed, and the operation can be repeated.

IMPROVED SKIRT SUPPORTER.

Charles V. Richards, Garland, Me., assignor to himself and Frank W. Swan, of same place.—This is a device for attachment to shoulder straps for supporting skirts; and it consists of a rectangular plate of metal, to one end of which an oblong loop is attached, and to the other end is attached a wire loop, upon which a pin is formed, that is engaged by a slide on the rectangular plate. The advantages claimed for the invention are, that it will not accidentally become loosened, that it will not wear holes in garments placed over it, and that it is simple and easily applied.

IMPROVED VAPOR BURNER.

Jonas G. Hobert, Syracuse, N. Y.—This is an improved vapor burner for gasoline and other light hydrocarbons, which gives an effective light, is readily cleaned and adjusted, and very economical in use. It is arranged with a notched or grooved stem of the supply valve, that may be readily removed for being cleaned of gummy sediments; also of a heating tube with regulating valve, a detachable shield or inclosing tube for admitting the cleaning of the heating and main tubes, and of an alcohol dish, secured vertically below and centrally to, the axis of the shield.

IMPROVED FEATHER RENOVATOR.

Joseph C. Divers, New Haven, Mo.—This is an improved machine for renovating feathers; and it consists in the combination of the flanged pipe and the adjustable holder with the hollow perforated shaft of the double walled wheel; and in the combination of the rod, provided with the head and the packings, with the hollow perforated shaft of the double walled wheel. In using the machine, the feathers are introduced through a door, and the screen and door are again secured in place. The steam is then admitted, and the wheel is slowly revolved. The dirt from the feathers is sifted through the screens, and is driven through them by the steam into the space between the screens and doors. When the feathers have been sufficiently steamed a plug is removed and a rod inserted, shutting off the steam from the interior of the wheel, and allowing it to pass only through the compartments of the double walls of said wheel. At the same time the doors are opened, so that cold air may be allowed to pass through the wheel, while the moisture is driven off by its heated walls. When this process has been continued a sufficient time the steam is cut off, and a few more turns of the wheel makes the feathers perfectly dry.

IMPROVED MIDDLINGS SEPARATOR.

Edward Dolman, Westville, Ind.—By this construction of this machine, the air enters tubes through the spaces between plates, passes through the middlings, and out between valves in numerous thin sheets. The upper sides of the valves serve for the second grade middlings that may be carried out from the tubes to slide down upon. At the upper ends of the tubes are formed small hoppers, into some of which the middlings are introduced from the bolts by spouts. The other hoppers are reserved to receive the second-grade middlings from the four tubes that receive middlings from the bolts. The purified middlings drop through small openings at the lower ends of the tubes into a receiver. The second grade middlings that slide down the valves drop into small chambers at the lower ends of the tubes, press down small cloths placed in the bottoms of said chambers, and escape through small openings into spouts, by which they are conducted into the well of an elevator.

IMPROVED HORSE BRUSH.

Charles W. Beiser, New York city.—This invention consists of a mitten woven from heavy cords made of horsehair, so as to present a rough exterior surface. The horsehair is twisted into heavy cords or threads, and then, by a process of hand weaving, formed into a mitten either with or without a thumb piece. Any style of weaving may be employed that will produce a knotty or rough exterior. The cleaner is placed upon the hand and used in the same manner as brushes. When the cleaner becomes filled and dirty it may be cleansed by washing it with water and soap.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED LOCK FOR FIREARM.

Ira Robbins, Hughesville, Pa.—This invention consists of a hammer that is alternately thrown forward on the release of the trigger by a spring and notched and studded disk, and thrown backward again by a spring-acted return lever that revolves at the same time the cylinder. A sliding and spring-acted bolt is released by the trigger and thrown forward so as to unlock the lock pawl of the spring disk, which has as many projecting studs as notches, which throw, at every unlocking of the disk, the hammer forward and the spring bolt backward, so as to relock the spring disk and reset the trigger. A separate trigger, back of the releasing trigger, bears on the spring-acted return lever, so as to admit the drawing back of the hammer when the repeating mechanism should fail to work.

IMPROVED CIRCULAR VALVE FOR STEAM ENGINES.

Hiram L. Tumy, Cincinnati, O.—This consists in the arrangement of steam engines in a circular valve by which the steam is taken directly through the passages in the valve; the object being to dispense with the steam room of the ordinary steam chest, and furnish a balanced valve.

IMPROVED VALVE FOR STEAM PUMPS.

James W. Mathieson, Brooklyn, N. Y.—The valves and valve seats extend from side to side of a chamber, and are made of V shape. Devices are provided whereby the valves may readily be kept tight. The general construction is such that the valves offer a minimum obstruction to the water.

HEATING AND FEEDING AIR AND STEAM TO FURNACES.

William Woolcock, Newburg, O., assignor of two thirds his right to Alfred Atkinson and John Woolcock, of same place.—The air and steam are first thoroughly heated in chambers preparatory to being mingled in the hollow fire bridges with which the chambers are connected by side openings. The intense heat in the firebox produces the decomposition of the heated steam and air, and throws the mingled gases through the issuing top holes into the fire gases, so as to produce a more complete and quick combustion of the same.

IMPROVED RAILROAD JOINT.

Charles Palm and John Fitzgerald, Cerro Gordo, Ill.—The object of this invention is to furnish a rail joint which shall be so formed as to prevent the wheels of the trains of cars from hammering, wearing, and splintering the ends of the rails, and to prevent noise when the wheels pass over the joints. The invention consists in the hard rubber block, made in the form of a short section of a rail, interposed between the adjacent ends of two rails, and kept in place by the fishplates.

IMPROVED PIPE WRENCH.

William Eberhard, Akron, O.—The shank of the stationary jaw is slotted longitudinally to receive the movable jaw, and has a number of holes formed through it to receive a pin, by which the said movable jaw is pivoted to it, so that the jaw may be adjusted as the size of the object to be held may require. The face of the jaw is made cam-shaped, and has teeth formed upon it, which teeth gradually increase in fineness toward the outer end. The upper prong of a forked lever passes up through the rear part of the slot in the shank of the stationary jaw, and is pivoted in place by a pin. The handle of the lever extends back along the handle of the wrench, so that it may be operated by the fingers to move the stationary jaw to or from the object to be held. By a suitable construction, by detaching the jaw and lever and attaching another lever, the instrument may be used for cutting off pipes.

IMPROVED HYDRAULIC PRESS.

Francis S. Kinney, New York city.—When the force pump is started, and as the water rises in one cylinder, the air contained in said cylinder is driven into a second cylinder. When the first cylinder is filled with water, valves are opened and the water is allowed to flow back into the water tank and the cylinder to be again filled with air. The stopcocks and valves are then adjusted as first described, and the air in the cylinder is forced by the water into the second cylinder, and so on until the air in the cylinder is put under the desired pressure. When the substance to be pressed has been arranged in the press box, the elastic force of the air in the upper parts of the cylinders forces the water in the lower parts of said cylinders into the press cylinder, which forces the follower down into the press box, instantaneously compressing the substance that may be in it.

IMPROVED CAR COUPLING.

Jacob Lips, Louisville, Ky.—This belongs to the class in which the entering link pushes to the rear a block which supports the coupling pin. The pin has a head on its lower portion which prevents its being removed from the upper hole in the drawhead.

IMPROVED MACHINE FOR PUNCHING SHEET METAL.

Thomas Rowan, Haverstraw, N. Y.—This consists of a vertically sliding bar, having a number of punching pins, which are forced into the dies by a swinging hammer block, whose arms raise automatically, by suitable lever connections, the punching bar out of the dies. An adjustable gauge and fixed end gauges admit the punching of any size of sheet metal.

IMPROVED SMOKEPIPE COUPLING.

Anson W. Decrow, Bangor, Me.—This is a coupling joint for smokepipes, to conduct the smoke of locomotive to the rear of the train over the cars, the said joint being tubes on the ends of the pipes, sliding together over flanges of the pipes, and fastening by spring catches. Packing at the lower half rests on the tubes, and rises and falls as the tubes work up and down. The upper half is packed by the tubes resting on the flanges of the pipes.

IMPROVED ADJUSTABLE ELASTIC BUCKET FOR CHAIN PUMPS.

Thomas Kenyon, Hamilton, O.—This bucket is so constructed that it can be expanded and contracted to fit the pump tube. It was fully illustrated and described on page 310, current volume.

IMPROVED MACHINE FOR TWISTING WHIP LASHES.

George A. Martin, Myerstown, Pa.—This is a simple little device somewhat similar to the ropemakers' winch, by which lashes of any number of strands may be quickly and neatly twisted.

IMPROVED CAR PUSHER.

Henry La Tourette, Shellsburg, Iowa.—This is an improved machine for the use of shippers and others for moving cars from side tracks; and it consists in the combination of a base bar, roller, U bar, lever, shoe, spring, two rods, and two double cranks with each other. The base bar is of wood, about eighteen inches long, to the opposite sides of the forward end of which are attached two plates, the forward ends of which project, and to and between them is pivoted a small roller. The U bar is curved edgewise, and the ends of which are pivoted to the journals of the roller. To and within the upper part of the U bar is pivoted the lever, which is curved to one side, so that it may be operated from the side of the track. To the forward end of the lever is pivoted a shoe, to fit upon the tread of the wheel. A spring is attached to the lever, the free end of which rests against the lower part of the shoe to hold its lower end forward in proper position to slip beneath the lower rear part of the wheel, when the machine is moved forward for another stroke.

IMPROVED SPARK ARRESTER.

William T. Urie, Warrensburgh, Mo.—In this spark arrester a hood, or wire net cover, is dispensed with, and free escape or exit provided for the draft. The sparks or cinders are arrested and collected in an annular space or chamber surrounding a cone forming the bottom of the two-part funnel-shaped hopper, and thence conducted away by tubes leading out through the sides of the stack.

IMPROVED CHUCK.

Henry H. Siler and Thomas A. Brooks, St. Lawrence, N. C.—This invention relates to certain improvements in chucks, centering tools, etc.; and it consists in the particular construction of a rotary adjustable face plate combined with a series of triangular slides, the sum of whose central angles is equal 360°, the said slides being arranged to move tangentially from the action of the face plate, so as to have always a common center with solid boundaries or perfectly inclosed sides, whereby is secured a variable central aperture of corresponding sides dependent for shape upon the number and dimensions of the said slides.

NEW TEXTILE INVENTION.

IMPROVED APPARATUS FOR STEAMING AND AGING PRINTED FABRICS.

William Mather, Salford, England.—This invention consists, first, in aging printed fabrics, in order to fix the colors, by the alternate application of heat and moisture; and, secondly, in an improved apparatus or arrangement of heated and other rollers in a closed steaming chamber, whereby the processes of steaming and aging printed fabrics are performed continuously. The fabric is dried and heated by passing over warm rollers. On leaving one roller it is thus prepared to absorb the steam in the chamber before it reaches the next heated roller, where the same drying and heating action takes place, and these operations are repeated as many times as may be required to fix the colors on the fabrics. The operation of the apparatus, being continuous, effects a great saving of time, and produces good results. It also economizes steam and labor.

NEW HOUSEHOLD INVENTIONS.

IMPROVED LAMP CHIMNEY.

Hiram L. Ives, Troy, N. Y., assignor to himself and T. Henry Dutcher, of same place.—This invention consists of a lamp chimney having an interior glass section, extending upward, around, and above the burner. The lower part of the chimney below the collar is scalloped and perforated to draw up the air to the flame.

IMPROVED EXTENSION FOR SEWING MACHINE TABLES.

Hannan G. Crawford, Peabody, Kan.—This consists of a central table extension and lap board for the table of the sewing machine, having hinged and folding side leaves fitted to and locked by fixed fastening pins, entering a recess and socket hole at opposite sides of the table. The sewing machine table is, by this attachment, enlarged, so as to be used with greater convenience for the different articles to be sewed, while, by turning the hinged leaves down at each side of the person holding the board upon the lap, it can be used for the same purposes as any other lap board.

IMPROVED DISH WARMER.

James H. Wright, New York city.—This invention consists in the combination of an inner case and the asbestos packing with an outer case or body and an iron heating block. In using the device, the iron block is heated, and is then placed in the cavity of the inner case, and the platter or dish to be kept warm is placed upon it.

IMPROVED PORTABLE OVEN.

Edward B. Van De Mark, New York city.—This is a portable oven which may be heated by one or more distinct fires. The smokepipe extends from the upper firepot or chamber down and around the oven, up to the point of exit. A second or upper firepot not only serves to heat the oven, but also affords a means whereby articles may be cooked on top of the oven.

IMPROVED BROOM AND BRUSH RACK.

James B. Clark, Jr., Vineland, N. J.—This is a simple and convenient rack for holding and displaying brooms, dust brushes, scrub brushes, whisk brooms, etc. Bars in which are half round or square notches are arranged in a movable frame to receive the broom handles and keep them erect.

IMPROVED IRONING TABLE.

Edgar B. Smith, Nyack, New York.—The new feature in this table consists in V-shaped brace rods, and have an eye formed in them at their angle. The eyes of the rods are passed over studs attached the one to the under side of the top, and the other to the crossbar. To the ends of the studs are pivoted buttons which, when turned across the eyes of the rods, keep said rods from being accidently jarred out of place. The rods hold the legs securely in place when adjusted for use.

IMPROVED WASHING MACHINE.

David C. Croushorn and William McBee, Panther Springs, Tenn.—This is an improved washing machine in which white and colored clothes may be washed at the same time, and also some of the clothes be exposed to a greater and some to a less degree of pounding or washing action. Intermittently rotating washtubs are connected with alternating and vertically reciprocating pounders, which are made of concentric rims that decrease in height from the outside to the inside, and so arranged that the center of the tubs will be within the outer circumference of the pounders.

IMPROVED PORTABLE WASHSTAND.

Nathan O. Bond, Fairfax Court House, Va., assignor to Henry Augustus Richardson, New York city.—This invention relates to the construction and arrangement of parts for supporting and adjusting the washbowl, facilitating siphonic action, and supporting the waste water bowl within the stand, and yet providing for its convenient displacement and removal.

Notes & Queries

C. H. W. will find a description of Sir William Thomson's compass on p. 908, SCIENTIFIC AMERICAN SUPPLEMENT.—J. E. H. will find something as to the strains on threads of gas pipes on p. 1, vol. 34.—F. D. S. is informed that it is not probable that lard oil can be purified by adding extract of nutgalls.—D. W. S. will find that the speed of circular saws is given on p. 163, vol. 34. As to speeds of pulleys, see p. 138, vol. 34.—F. B. will find directions for japanning on tin on p. 132, vol. 24.—C. C. will find directions for preparing soluble acid chromate of lime on p. 123, vol. 36.—H. P. C., Jr., will find directions for exterminating cockroaches on p. 303, vol. 35.—F. C. W. will find something on deodorizing kerosene oil on p. 203, vol. 36.—J. D. K. will find articles on Professor Barff's method of preventing iron rust on p. 232, vol. 36, and on p. 1041 SCIENTIFIC AMERICAN SUPPLEMENT.—A. B. will find a description of a waterproof cement for stone on p. 138, vol. 31.—H. H. L. will find on reference that the ink described on p. 361, vol. 34, is mentioned as an indelible ink. It will do for stamping.—E. A. D. will find a description of hydraulic cement on p. 138, vol. 31.—W. J. T. will find directions for preparing xanthogenate of potassium on p. 275, vol. 36.—J. McM. will find on p. 119, vol. 30, directions for purifying rancid butter.—A. C. W. will find a description of a steam engine indicator and its use on p. 64, vol. 30.—W. J. K. will find in No. 19 of the SCIENTIFIC AMERICAN SUPPLEMENT directions for making an electric engine.—C. H. K. will find a recipe for a good cement for china on p. 379, vol. 31.—E. J. McQ. can calculate the horse power of engines by the formula on p. 33, vol. 33.—W. D. can ascertain the power of his springs only by experiment.—J. V. B. will find on p. 250, vol. 36, something as to the time used in electric telegraphing.—C. C. M., of Innsbruck, Tyrol, will find directions for making cotton cloth uninflammable on p. 103, vol. 34.—H. C. G. will find directions for kalsomining on p. 133, vol. 34.—A. H. B. will find on p. 251, vol. 31, a recipe for cement for filling millstones.—E. W. M. will find on p. 204, vol. 28, directions for preserving natural flowers. Back numbers of the SCIENTIFIC AMERICAN can be furnished if not out of print.—A. R. W. will find the recipe for cold in the head, from the *Lancet*, on p. 351, vol. 35.—S. N. O'H. will find a recipe for furniture polish on p. 315, vol. 30. A cure for corns is described on p. 202, vol. 34.—A. J. W., E. L., C. P., J. S., F. W. C., A. C., R. J. W., N. F., M. R. S., J. N. P., W. D., and others, who ask us to recommend books on industrial and scientific subjects, should address the booksellers who advertise in our columns, all of whom are trustworthy firms, for catalogues.

(1) J. P. G. says: E. B. K. can saw firebrick with a strip of sheet iron, with teeth cut in it.

(2) D. C. S. says, in reply to D. W.'s query as to the welding of the foot of a spindle to the step or plate under it: A few years ago my 4 foot burr appeared to run heavily, the foot of the spindle got very hot, and the mill was stopped. I examined it, and found the plate of steel that was under the spindle welded fast to the point. The point of spindle was about 1¼ inches in diameter, and the plate under it was ½ inch thick and 2 inches square. I took the point out, and tried to drive the plate off with a hammer, but could not. I then cut it off, and found the weld as perfect as any other part of the steel. I refitted it and started the mill again, and it ran for several weeks, and then welded as before. This time I took the point out and trimmed the corners off the plate, dressed it up true with the balance of the point, and retempered it. I have been using it ever since, and it is as solid and good as any. There was plenty of oil in the step each time, but it was of a very inferior quality; and I now keep a good supply of good oil, and it never gets warm. It is my opinion that the welding was accomplished by the parts being thoroughly ground together under pressure.

(3) A. Y. K. asks: In using the telephone, does the battery require to be stronger or weaker than that used in ordinary telegraphy? A. The battery may be comparatively light: we believe the apparatus is also made to work without any battery, simply by induced currents.

Is there an instrument for measuring the focus of spectacle lenses? If so, what is its character? A. You can determine the focus of a lens by holding it to the light before a flat surface; its distance from the surface, when external objects are clearly defined on the same, is its focal length.

(4) L. N. L. asks: 1. Is there any method known by which frictional electricity, when generated, can be stored up or accumulated, and made serviceable in working telegraph lines? A. No; not as ordinarily worked. 2. In the report of the Michigan State Board of Agriculture for 1871, there is an allusion to Andrew Cross, an Englishman, who owned to having made crystals of quartz, carbonate of lime, lead, copper, and many other artificial minerals by electricity. Can you tell me where I can find a detailed account of his experiments? A. Many of Mr. Cross' experiments are described in Noad's "Manual of Electricity."

(5) T. H. S. says: I wish to produce the sensitive flame with common gas. I can make the harmonicon, but it will not emit a note unless I lower a tube to a certain point over the flame. Can I produce the sensitive flame responding to a certain tone without employing hydrogen? A. Coal gas will answer. You may use an ordinary Bunsen burner, having a large tube, with the airports closed tightly. Or take a glass tube about ½ inch in diameter and 4 inches long, stop one end of it with a perforated cork through which the gas delivery tube just enters. The aperture of the delivery tube should be about ⅛ inch diameter. When the flow of gas is properly adjusted, this will give you a very sensitive flame.

(6) F. I. asks: How can I make gold and silver inks? A. These are usually prepared by grinding gold or silver leaf with a little honey until the foils are converted into an impalpable powder, which is retained by the honey. The honey is then dissolved out with warm water, and the gold or silver powder mixed with a little gum water. Bronze powders mixed with gum water are often employed by artists as a substitute for the gold or silver.

(7) T. B. asks: 1. Can xanthogenate of potassium be purchased? A. It has not yet been commercially manufactured in this country. 2. What are the quantities necessary to the gallon of carbonate-charged birch beer, to prevent it from souring? A. Unless the salt were very pure it would be liable to give a somewhat disagreeable flavor to such beer. About 5 or 10 grains to the gallon would perhaps suffice. 3. Can salicylic acid be used for the purpose? A. Yes. Use from 30 to 50 grains of it to each gallon of beer.

(8) E. F. says: In picture frame polishing, I find trouble in getting the shellac dark enough in color. We cut our gum (orange) shellac and mix with imitation shellac, using about 5 gallons per day. As a coloring, I am using Vandyke brown mixed with alcohol for the dark polish. But the trouble with it is that it settles like mud at the bottom of the can in which I mix it; and when carefully poured off, it leaves the alcohol so slightly colored that it is almost useless, unless stirred up before mixing with the shellac. Is there anything that you can recommend for coloring shellac that will be clear from sediments when ready for use? A. The trouble with your Vandyke brown is probably due to the fact that you do not grind it fine enough. If this is attended to, it will not settle. Umber is sometimes used in the varnish instead of Vandyke brown.

(9) R. S. N. asks: Can you give me a formula or recipe for making an aniline ink which will answer for printing from stencil plates with? A. These inks are prepared by dissolving ordinary aniline red, violet, etc., in warm glycerin. The colors may be ground to a fine powder, and a little at a time stirred into the glycerin until the desired shade is reached; let stand for a day or so and strain through a small piece of fine silk before using. Although the aniline colors are for the most part quite expensive, their tinctorial power is so great that a very minute quantity will ordinarily suffice. These inks can therefore be made nearly as cheaply as ordinary printing ink, as only crude glycerin need be employed.

(10) A. B.—The blue or purple dyestuff known by the different names of archil, litmus, cudbear, and tournesol, is fabricated from several species of lichens by grinding them into a paste with ammonia water, and occasionally stirring until, by the action of the air, all of the orsellic acid contained in them is converted into orcine, when the mixture assumes a bright purple color. Further exposure to the air turns it blue. Lime and plaster of Paris is then added to give bulk and consistence, and the whole is dried. This forms commercial litmus. Acids decompose the blue compound with lime or ammonia, and set free the red orcine. Acid salts also redden litmus solutions. The water you used may have contained acids, or, what is more probable, the litmus contained foreign organic bodies, which by fermentation produced the results noted. This is not uncommon.

(11) J. L. says, on the welding of a spindle to its step: We also had a similar thing happen to us. The stone was a 30 inch corn burr, and was running at a high speed, when all at once the burr stopped, the belt slipped on the pulley, and we stopped the engine to examine whether there was anything in the burr or not. We soon found there was nothing unusual in the burrs, so we took them apart, took the spindle out, and found that the spindle had welded to the steel plate. We then tried to knock the plate off the spindle, but could not. We then took it to the blacksmith, who had to cut the spindle off.

(12) C. B. says: I have about 100 lbs. of a compound composed of about 2 parts lead, 2 tin, and 1 antimony. Is there any method by which I can separate them entirely, or, if not entirely, one from the other two? A. The metals may be separated, but not so as to repay you for the trouble and expense incurred in so doing.

(13) W. V. asks: 1. What chemical will prevent the decomposition of glue used in moulds for plaster of Paris castings? A. Alum water, lime, and chloride of zinc are occasionally used for this purpose. 2. Is there anything that will prevent shrinkage of the moulds? A. The shrinkage is due to the loss of water. Glycerin will prevent this; it may be mixed in with the glue, or applied to the surface of the mould. The former is the better way.

Is there any chemical that will prevent water containing certain animal substances from becoming stagnant? A. Salt, creosote, salicylic acid, and other antiseptics will retard or prevent putrefaction. The addition of a few crystals of permanganate of potassa to such water will purify it by oxidizing the organic matter which it contains.

(14) E. C. H. asks: How can I pour a solid box of Babbitt metal in a boss around a shaft, and afterwards get the shaft loose? I have tried putting paper around the journal, but fail very frequently to get the shaft loose without breaking the casting. The journal is 1¼ x 2½ inches. A. We know of no better plan than oiling the shaft and putting a piece of paper around it.

Do you use oil in tapping brass? A. Yes.

(15) J. M. says: 1. I have 5 gallons of fish oil for hardening springs which has lost its tempering property. How can I restore it? A. Add to your fish oil a piece of cyanide of potash about the size of a walnut, crushed to a fine powder, and ½ lb. tallow. 2. Can I use the same oil for hardening surgical instruments? A. Yes.

(16) A. H. B. asks: 1. How fast can I run a worm in a 12 inch worm gear with good results? A. About 200 revolutions per minute. 2. At what speed should a 4½ inch screw run to get the best results in screwing brass? A. About 150 feet per minute.

Is bone dust as good after using once, if it is not put into water? A. For polishing, yes.

(17) W. G. asks: Is there any way of polishing brass penholders, etc., better than buffing on a wheel? A. No.

(18) L. R. F. asks: What metal or combination of metals can I use, that will be harder than or as hard as cast iron, and that will not shrink in cooling? A. We know of none.

(19) J. J. H. says: I am building a small foot lathe. How can I harden the spindle that goes in the cone wheel without putting it in the fire? A. You cannot harden it without heating it.

(20) J. W. H. asks: Is there any tool made to file hand saws and set them at the same time? A. We know of no such device.

(21) A. S. T. asks: Is there a practical work on electric phenomena and the laws governing the same in regard to lightning rods? A. We are not aware of any work devoted especially to the subject of lightning rods, but the principles are to be found in almost any of the treatises on electricity. The principal points to be attended to are good conductors and earth connections; as a general thing, almost all of the rods offered for sale are reasonably good, but in the majority of cases they are put up without much regard to the earth connections. The rod should be fastened to the building directly, and not insulated.

(22) D. F. H. asks: Can an engine be made on the hydraulic principle, so that a large power can be had from a small power steam engine? A. No.

What kind of oil is used in tempering carriage springs? A. Fish oil.

Were the wires of the East River bridge put up before or after the wood work was fastened to them? A. Before.

(23) F. R. says: A friend of mine told me that I could not make a cast steel T square that would always remain true. I hold that if the steel be properly annealed, and is once true, it will always remain so, provided that it receives no rough usage. A. A cast steel square will remain true under equal conditions longer than a square made of any other metal.

(24) W. P. asks: 1. Is a plate of steel 5x10 feet, and ¼ inch thick, less or more likely to be perfect throughout than one of iron the same size ⅛ inch thicker? A. There is no practical difference. 2. Which would make the best upright tubular boiler, 30x90 inches, the heads, tubes, and firebox being iron in both cases? A. The ¼ inch thick one.

(25) J. E. H. asks: How is brass spring-tempered? A. By cold rolling or hammering.

(26) H. O. T. asks: How can I clean copper tea kettles, water tanks, etc.? A. Use salt and sand, with water.

(27) X. Y. B. asks: Can tin or copper be manufactured in tubes, the joint being seamless and smooth? A. No; but solid drawn brass tubing is made of certain sizes.

(28) A. P. T. says: I have frequently observed when using a new ¼ inch crescent coarse file upon wrought iron, particularly upon sheet iron, that the very first stroke causes its destruction. The file, as it comes from the cutler's, is evidently too hard for immediate use. I am acquainted with the process of drawing the temper in the case of ordinary tools, but cannot see how it is applicable to the case of a file. At the same time, I feel confident that there must be a remedy for the evil in question. A. A new file should not be used upon a narrow surface, as the grip of the teeth is in that case so great as to break the points of the teeth off. A file cannot be made too hard. The most economical usage of a file is to use it on brass or cast iron at first, and upon as broad surfaces as possible.

(29) C. G. L. asks: If the cast iron master wheel in a horse power is banded with a wrought iron band from ½ to 1 inch thick, shrunk on, will it strengthen or prevent the cast iron wheel from breaking when it is strained or subjected to a sudden jar during work? I claim that the cast and wrought iron are of different textures; and that when extra strain is put on the cast iron cogs or rim, it would break before the shrunk wrought iron band gets a chance to bear any strain or to assist it. A. A wrought iron band would strengthen the rim of the cast iron wheel.

(30) F. S. J. asks: 1. What is it in a locomotive that occasions a terrible roar? It is heard only occasionally, and makes everything tremble for a distance around. A. It is the steam escaping from the safety valve. 2. Will a locomotive go faster with the reversing lever, hooked up, or slower, and why? A. It depends upon the lap and travel of the slide valves. As a rule, the engine will go faster when hooked up.

(31) C. M. G. asks: What can be used as a convenient and inexpensive substitute for gas in an amateur mechanic's workshop, for hardening and tempering small drills, taps, etc., and for small jobs of soldering? Can petroleum or gasoline be utilized for that purpose? If so, how? A. Special lamps are made to burn kerosene for the purposes mentioned.

(32) K. B. asks: How can I find the correct shape of the teeth of wheels, also the length and thickness of the teeth, when pitch is given? A. The subject of drawing teeth for wheels is too extensive for these columns. Consult Willis on the "Teeth of Wheels."

How can a keg which contained dry American vermillion or other lead paint be cleansed so that it will be pure from the poison? A. Let a strong stream of cold water run into it.

(33) B. & Co. say: We have a 4 horse power caloric engine which we would like to run with oil instead of hard coal. Which would be the best method to feed and distribute the oil in the furnace? A. The burning of petroleum in a furnace is a difficult problem, at present engaging the attention of engineers.

(34) F. B. M. says: How can I drill copper? A. Keep your drill thin at the point, grind it keen, and use oil.

(35) J. E. F. says: 1. I am building a lathe for foot power. I have a large iron wheel about 6 feet in diameter, weighing about 150 lbs. Would it be any advantage to mount it on a countershaft, and use it as a balance wheel? If so, would it not be better to hang it in centers? A. It would be of no advantage. Either of the forms of treadle which you suggest will do. 2. What size of drive wheel will do? A. About 26 to 28 inches in diameter. 3. Would it not be better to have both it and the pulleys of iron? A. Yes.

(36) H. R. H. says: 1. I have a small circular saw, which I run by foot power. The large wheel is 36 inches and the pulley on the mandrel 3 inches in diameter. Are these proportions correct? A. Yes. 2. What is the best motor by which I can run it, to saw 1 inch pine wood? A. A small steam engine will answer your purpose best.

(37) W. H. R. asks: How can German steel be hardened? I have repaired some parts of machines that needed hardening, and what I supposed was steel would not harden. Upon inquiry I was informed that it was German steel. A. Your steel may be case-hardened as follows: Powder prussiate of potash very fine, heat the steel to cherry red, rub on the potash until it fuses and runs over the steel, put the latter in the fire again, reheat to cherry red, and quench in cold water.

How can I make pieces of wire 2 feet long perfectly straight? A. Straighten your wire as nearly as possible with a hammer and a level block, then beat it and roll it between two flat iron plates.

(38) G. E. Y. asks: 1. In reference to Professor Bell's telephone, what size wire and how much is wrapped on the ends of the horseshoe magnet, and is it wrapped in the same way as an electro-magnet? A. For short circuits an ordinary telegraph sounder coil will do. 2. Of what thickness is the steel plate, and how is it fastened to the sounding box? A. It should be very thin for weak currents. The system is explained in Prescott's "Electricity and the Electric Telegraph."

(39) T. M. P. says: 1. In Professor Bell's telephone, what is the thickness of the plate, and is it of a uniform thickness? A. For the transmitters, the plates should be thin to get the best effect; the instruments, however, are made of various forms. 2. Does Professor Bell use a return wire or the ground both ends, and does the instrument used for sending the sound do the receiving? A. No return wire is required.

A good receiving instrument may be made of a tubular magnet and single helix, the latter being surrounded by an external soft iron case upon which the plate may be laid loosely. 3. About what size and quantity of wire is required for electro-magnets, and what is the length of the permanent magnets? A. An ordinary sounder helix will answer for a short circuit.

(40) W. E. says: Is there anything besides water that will cut Russian isinglass, and keep it in liquid form? A. It is soluble also in warm wine spirit, in strong acetic acid, and in diluted muriatic and nitric acids.

What kind of leather should I get for a polishing belt for lathe use? A. We believe that skeepskin is usually employed for fine work. There are dealers who make a specialty of such materials.

(41) L. T. D. asks: What is the best substance for the hands for those using the horizontal bar and trapeze? A. Pulverized rosin is, we think, given the preference.

(42) G. H. S. says, in reply to a correspondent who asked if coal oil (kerosene) will make the hair grow: I can say truthfully that it will. I am now 37 years of age; and about 8 years ago my hair gradually commenced to fall out, and in one year I was almost entirely bald. I wore a wig for about 2 hours a day for 3 years, that is, whenever I had occasion to go out. I used various preparations; the hair would grow a little, and then drop out; so that I almost despaired of having it grow any more. An engineer recommended me to try kerosene oil, as a relative of his had used it with success. I first had it tried on a dog. I found it did not injure his hair in the least; I next tried it on my arms and legs (for I was afraid of it), and I found that it strengthened the hair and new hair formed after four months' use, once a week. I next tried it on my head, cautiously; and it was not a great while before new hair or fuzz began to grow; and at the present time I have a pretty good head of hair. As soon as my head begins to get any dandruff, I wash it with oil.

(43) A. B. and others who ask as to perspiration of the feet: The unpleasant odor you mention is caused primarily by the impregnation of the leather with putrescible organic exhalations, various ammonia salts, acetic acid, etc., from the excessive perspiration of the feet within, or moisture without, and from the more or less imperfect fixing of the gelatin contained in the hide by the process of tanning. Under such continued conditions, of heat, moisture, etc., the leather, if not properly cared for, will suffer a species of slow decay, hence the odor. This may be obviated in great part by a frequent change of underclothing for the feet, and by keeping the leather as dry as possible, and well oiled. An unpleasant odor from shoes is often occasioned by the use of poor blacking.

(44) W. J. B. asks: How can I polish malleable iron castings after they have been nickel-plated? A. Use a buffing wheel.

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

A. H. F. & Co.—The shells have not been received.—R. S. N.—Judging from the small sample you send, the paper is impregnated with an insoluble lead soap, probably by saturating the paper with a strong soap solution and then immersing in a solution of sugar of lead.—M. P. B.—It is a slag from some iron furnace. The small red crystals are cyano-nitride of titanium.—H. A. S.—Some of the enamels from cooking utensils contain antimony; but in the powder which you send us, which consists principally of organic matters, we found no indications of the metal.—P. A. L.—It is a granitic rock containing small crystals or iron pyrites (sulphide of iron) and chalcopyrite (sulphide of copper), also a considerable quantity of oxide and carbonate of iron.—C. L. V.—The large piece is magnesian limestone, the smaller, red-colored fragment is jasper. The piece of an arrowhead is of flint.

L. D. asks: How is Florida water made?—J. McM. asks: What is the best way to break down butter from rolls to tubs, and from tubs to rolls? What is the best method of salting and coloring butter?

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 Madstone. By W.

On a Perpetual Motion. By C. E. N.

On the Planet Vulcan. By A. F. G.

Also inquiries and answers from the following:

L. W. S.—C. A. H.—B. A. J.—E. J. W.—J. I.—W. W.—A. A. I.—M. M. H.—J. T. B.—L. D. D.—L. S. B.—C. W.—G. E. D. B.—C. W. C.—R. W., Jr.—C. R.—B. & W.—W. J. B.—S. M. L.—E. V. B.—W. R. McC.—P. W. W.—H. A. P.

HINTS TO CORRESPONDENTS.

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

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 cheap achromatic microscopes? Who sells telephones, and what do they cost? Who sells galvanic bands or belts, for medical purposes? Who sells incubators, and what do they cost? Who makes the best pony planer and the best saw table?" 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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[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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SCIENTIFIC AMERICAN

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NEW LIFE-SAVING INVENTIONS.

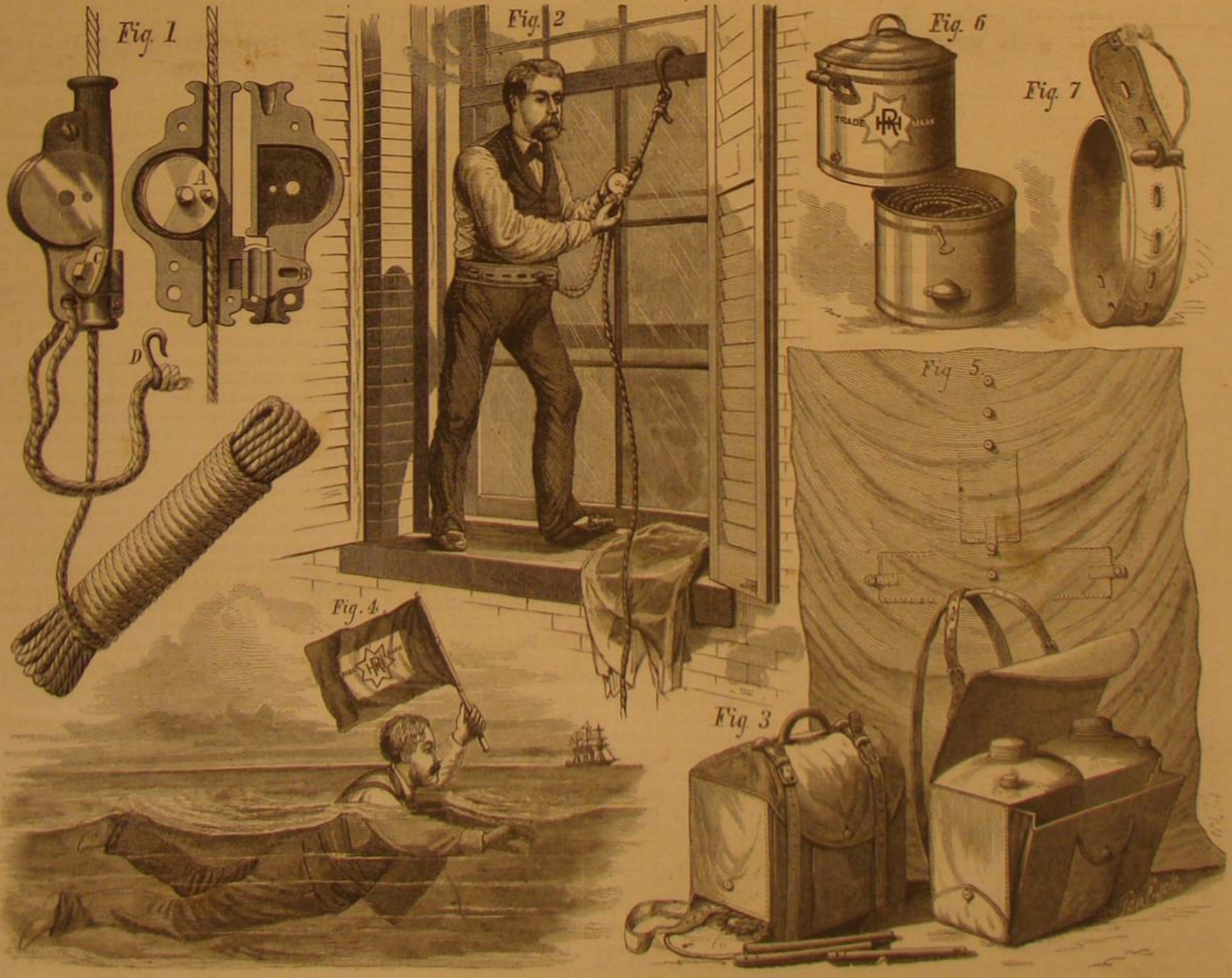
In the accompanying engravings are represented a series of devices, including means of escape from a building in case of fire, and also a life preserver for shipwrecked persons. The first mentioned invention is illustrated in Figs. 1, 2, 5, 6 and 7. It consists of a stout rope, soaked in a chemical solution which renders it fireproof, and having a strong hook at one end. On this rope slides the lowering device, which is shown in Fig. 1. This consists of a box of metal, in which is a stationary disk, A, around which the rope is carried. The two parts of the box are hinged together at B, and, when closed, compress the rope in the grooves through which it passes downward. The degree of compression is regulated by the thumbscrew, C, which brings the parts of the box more or less tightly together. Also attached to the box is a double rope, to the end of which is secured a small hook, D, for the purpose of fastening it into the belt.

In using the device, the bed clothes are placed on the window sill to prevent chafing of the rope; the large hook on the main rope is then placed over the top crossbar of the window sash. The operator then secures around his waist a strong belt, made as shown in Fig. 7; and with the staple thereon he engages the hook, D. The screw, C, having been previously adjusted to the desired rate of speed of descent, he then launches himself off. He is sustained by the belt, so that his hands are free to govern the lowering device. In this manner as rapid a descent as is desired can be made, or the motion can be checked at any instant by tightening the screw, C. The apparatus can be used for lowering women, children, invalids, or trunks, as one cool-headed person may quickly adjust the screw for each individual to be lowered, and the latter has nothing to do but allow himself to slide quietly down. On reaching the ground, he removes the hook, the rope is hauled up, the box readjusted, and the device is then ready to be used again. Or by simply attaching the rope to the safety belt, the person to be lowered can be let down by another paying out the rope hand over hand.

Fig. 6 represents a compact arrangement of water bucket and fire escape, such as might be placed in every room in a hotel. The upper portion of the vessel shown serves as a water pail, and is kept filled. The lower part serves as a receptacle for the fire escape above mentioned. Fig. 5 is a blanket with two slits for the arms and one for the face. In this, after thoroughly wetting it, a person attempting to escape through the halls of a burning building envelops himself.

Figs. 3 and 4 exhibit a device which the inventor calls a traveler's safety kit. It is a handbag, shaped like a knapsack, of fire or waterproof material, containing bottles or jars which hold a supply of wine or other stimulants, and also meat in condensed form. These are protected from breakage by a packing of best phial corks, with outer walls of cork wood. Suitable receptacles are provided for valuables; and a sectional flagstaff is added, which may be quickly put together, and to which a signal flag is attached. This staff also may be used in connection with a portable umbrella and also as a walking stick. The kit may be constructed in two portions, with bottles, etc., in each, the division being made vertically through the center. Suitable straps connect the two portions, so that, when adjusted to the person, one portion is applied to the back and the other to the breast. The apparatus is sufficiently buoyant to sustain a heavy person in the water, as shown in Fig. 4. In case of accident to a vessel at sea, the inventor states that the person provided with this kit has not only a life preserver which will keep him afloat indefinitely, but also a supply of food which will last for several days.

For further information, address the inventor, Mr. H. R. Houghton, 59 West 42d street, New York city.



HOUGHTON'S LIFE-SAVING DEVICES.

German vs. Sheffield Scissors.

"At the annual meeting of the Sheffield Scissors Manufacturers' Association, held during the past month, an animated discussion took place on the remarkable success with which the German scissors makers are competing with those of Sheffield. Mr. Hobson, the chairman, said that a warehouse had been opened in Sheffield for the express purpose of stocking and selling German scissors, and various other speakers were constrained to admit that the foreign articles were by no means badly made. As a matter of strict and most surprising fact, these German scissors are made at Solingen from Sheffield steel, and, after bearing freights in both directions, thus oust us at home. When the German scissors come here they are offered at prices 30 to 40 per cent. below the home-made goods—weavers' scissors sold by the Sheffield manufacturers at 72 cents, gold, being quoted by the importers at 54 cents free in London, or 72 cents in Sheffield. The consequence is that the Germans are doing a very large business in the steel metropolis, because almost all the manufacturers find it necessary to keep the foreign goods in stock." —*British Trade Journal.*

THE most northerly telegraph station in the world is established at Gjesvar, a Norwegian fishing station, near the North Cape, in latitude 71° 12′, north.

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NEW YORK, SATURDAY, JUNE 2, 1877.

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THE SCIENTIFIC AMERICAN SUPPLEMENT,
No. 74,
For the Week ending June 2, 1877.

THE HUMAN MACHINE AND ITS FUEL.

Dr. Joule has pointed out that not only does an animal much more nearly resemble in its functions an electromagnetic engine than it resembles a steam engine, but he also has stated that it is a much more efficient engine—"that is to say," says Professor Tait, "an animal, for the same amount of potential energy of food or fuel supplied to it, gives you a larger amount converted into work than any engine which we can construct physically." In other words, the duty—by which we mean the percentage of the energy of the fuel which it can convert into the useful or desired form—is greater in the case of animal mechanism than in that of any other engine in which fuel is employed. The work we obtain in the form of heat, constructive power, nervo-muscular action, mechanical motion, and the like: and here the analogy between the body and a machine ends, because the food in the animal is not merely a source of energy, but it enters into the development and maintenance of the body itself. It follows, therefore, that two classes of food are necessary; first, the organic, which alone is oxidizable or capable of generating potential energy, and secondly, the inorganic, which, though not oxidizable, is essential to the metamorphosis of organic matter which takes place in the animal economy. The organic constituents of food are generally divided into nitrogenous, fatty, and saccharine compounds, and the inorganic into water and saline matters.

Taking up these constituents in their order, Dr. George Wilson, in his recent admirable work, "A Handbook of Hygiene," states that the nitrogenous portions of food have for their main functions the construction and repair of tissues, besides possessing other functions of a regulative and dynamic nature not well defined. Fatty constituents play an important part in the maintenance of animal heat and in the conversion of food into tissue. The oxidation of fat in the blood generates to a great extent the energy which is rendered apparent in locomotion and manual labor. It, besides, renders the human machine elastic, and supplies lubricating material. The saccharine constituents of hydrocarbons (cellulose, starch, and sugar) are directly subservient to the maintenance of animal heat and the production of animal energy. Water in the animal economy dissolves and convcys food to different parts of the system, removes effete products, lubricates the tissues, equalizes the bodily temperature by evaporation, and regulates the chemical changes which take place in the processes of nutrition and decay. Saline matters, on the other hand, are the chief media for the transference of the organic constituents throughout the body. They are largely concerned in the consolidation of the tissues, and are supposed to convert unabsorbable colloids into highly diffusive crystalloids.

As we have already stated, the potential energy of food is the sole source of the active energy displayed in mechanical motion or work. And consequently, up to certain limits, the diet must be increased as the work increases. The question for the economist is then, first, on how much food can a man subsist and live: and second, how much more food must be added when certain work is to be performed. Dr. Edward Smith has determined that the Lancashire operatives during the cotton famine managed to live on 3,888 grains of carbon and 181 grains of nitrogen per day. This is equivalent to about 2 lbs. of baker's bread. On the other hand, a man, who could live on this amount during idleness, while at work requires (according to Dr. Letheby) 6,823 grains of carbon and 391 grains of nitrogen. This is equivalent to 2 lbs. of beef, with 1 lb. of potatoes, 1 lb. of beer, and about ¼ lb. of sugar.

Of course the quantity of the food required differs not merely with the amount of work done, but with its quality. Dr. Smith has prepared a table showing the weekly dietaries of low-fed operatives. Needlewomen, for example, in London average 124 ozs. breadstuffs, 40 ozs. potatoes, 7·3 ozs. fats, 16·3 ozs. meat, 7·0 ozs. milk, 0·5 oz. cheese, and 1·3 ozs. tea per week. This diet is richer in meat than that of the English farm laborer. The Macclesfield silk weavers are quoted at 3·2 ozs. meat per week. The Irish farm laborer gets but 4·5 ozs. meat weekly, but he has 326 ozs. breadstuffs and 135 ozs. milk. The Scotch farm worker eats over twice as much potatoes as the Irishman, despite the supposed fact that the tubers constitute the principal article of diet among the peasantry of the Emerald Isle. The table compiled by Dr. Smith includes silk weavers, shoemakers, farm laborers, and needlewomen, and the average diet per day for all is 4,881 grains of carbon and 214 grains of nitrogen. We can contrast with this, data obtained by Dr. Playfair covering the diets of English railway navvies, English and French sailors, soldiers in peace, prizefighters, hard-worked weavers, and blacksmiths. This shows that the average is 5,837 grains of carbon and 400 grains of nitrogen per individual per day. There are many suggestive comparisons to be made here. Take for example the figures relative to weavers. There is one class of these operatives who do light work on a daily average of 3,861 grains of carbon and 157 grains of nitrogen; when at hard work, this becomes 6,020 grains of carbon and 375 grains of nitrogen. As shown above, the first-mentioned quantities are no more than barely sufficient to sustain the body; and work here practically means a wearing away of the human machine. Now when the work becomes harder, 2,159 grains of carbon and 218 grains of nitrogen more are consumed; and these are the food equivalent for the extra work performed. In the case of the prizefighter in training, the daily average in point of carbonaceous matter is less than that of the low-fed operative, but the nitrogenous matter—flesh and muscle manufacturing material—the average is 690 grains, or over three times greater. The proportions of the training athlete's daily food are flesh formers 9·8 ozs., fats 3·1 ozs., starch and sugar 3·27 ozs.

It will be seen from the foregoing that it is quite possible to construct dietaries, especially suited to sustaining the animal mechanism, in accordance with the work to be accomplished. This subject we shall consider in another article.

WANTED—TORPEDO DEFENCES.

Mr. E. J. Reed, late Chief Naval Constructor of the British Navy, in a recent lecture before the Society of Arts, took occasion to express an opinion which, we think, every one who has given any thought to the method of waging future maritime wars has already more or less definitely reached. Coming from an engineer who has been so closely identified with the building of the ironclad navy of Great Britain, the views enunciated will assume greater force. They could not be more radical or more direct. Mr. Reed says, in substance, simply that, until a way of protecting vessels from the effects of torpedoes is invented, ironclad ships, notwithstanding their 24 inch armor and 100 ton guns, are anachronisms, and that their construction is waste of time and money. "Neither the suspension of chain nets, nor additional bulkhead divisions in ordinary forms of ships, will be a sufficient, nor anything like a sufficient, defence against this deadly submarine instrument of attack. The naval Whitehead torpedo delivers a most terrible blow; it moves for the space of some hundreds of yards with a speed double that of the fastest ironclads; its path is so sure and true that at that distance a second torpedo can be made to pass through the hole which the first has made; and whereas it has been assumed that, in ordinary conditions of weather and naval warfare under steam, a ship could not have more than a few feet of her depth below water attacked, the torpedo has the whole immersed bottom of the ship exposed to its assaults." Mr. Reed goes on to say that the days of war ships, more or less long and narrow, and with deep bottoms of thin iron containing the steam boilers and powder magazines, are numbered. He advises his government to reconsider its intention of beginning the building of a vessel of the Agamemnon class; and finally he concludes that modern naval necessities are "first, the construction of our large ships on principles which make them as little destructible by torpedoes as by guns, which I believe to be quite possible; and secondly, the building of all our other war ships of small and handy types." By the latter he means small vessels which can be manœuvred with sufficient rapidity to avoid torpedoes.

Mr. Reed unfortunately fails to mention the plan for protecting ships against torpedoes, the knowledge of which he implies that he possesses. It will be seen, however, that in his opinion a total reconstruction of the English navy is necessary, and that consequently the enormous sums of money which have been expended on its development are entirely thrown away. This is not cheering intelligence to the British taxpayer; and we doubt whether its purport will be acquiesced in until inventors, the world over, confess themselves vanquished by the problem of devising an efficient system of torpedo guard. So long as enormously heavy artillery is to be used, vessels must be built both capable of carrying the guns and likewise capable of resisting them. Already it is contemplated to build cannon which will dwarf the 100 ton gun; and the English iron founders, on the other hand, promise 40 inch rolled plates. If war ships must carry such loads of metal as these, it is difficult to see how they can be built light enough to dodge torpedoes. There is certainly little to be gained by building vessels possessing the latter advantage, if at the same time they are to be rendered easily vulnerable by heavy guns.

We agree with Mr. Reed in the belief that it is possible to protect large vessels against torpedoes, although we have no especial project to propose. The subject is one which we would particularly commend to the attention of inventors. It is obvious that the necessary protections can be obtained in two ways: first, by devices outside or extraneous to the vessel, and second, by modification of the construction of the ship itself. The simplest outside device is the torpedo netting constantly used by our vessels during the war. This is simply a network of chain or rope supported on booms at some distance around the ship and extending down into the water deep enough to guard the entire bottom. To prevent the access of torpedo launches, the ship may be surrounded by heavy spars also attached to the booms, and from these chain nets, as already described, may depend. These devices are obviously of little use or altogether impracticable when the vessel is in motion. To avoid stationary torpedoes anchored in channels, ships have used forked catchers protruding from the cutwater, to grasp and cause the explosion of the obstruction. Rafts pushed in front of ordinary vessels likewise serve a similar end. Under the second plan, war ships are built in watertight compartments. The Inflexible, for example, has 127 such sections. Or, as in the case of Admiral Porter's boat, the Alarm, there is a double hull with the space between divided up, while the entire hold of the ship may, through the watertight bulkheads which cross it, likewise be converted into separate sections. A torpedo, it is supposed, might injure a few compartments, while those still staunch would perhaps float the vessel. With iron ships there is not much surplus of buoyancy, however, and the racking effect of a blast might cause results much worse than the direct injury to the compartments immediately adjacent. Probably the means of defence, nearest to security, lie first in keeping the vessel constantly

under steam and under control, and second in the electric light which reveals the approach of an enemy by night. But the circumstances of weather or of locality may prevent the rapid manœuvring of the ship, and a fog may render the electric beam useless: while there is no safeguard against the unseen approach of the submarine torpedo of the Ericsson, Lay, or Whitehead type.

The conditions of the problem need no especial explanation. It is simply a question of how to render a ship's bottom invulnerable, not merely to the explosion of the torpedo itself but to that shock *plus* the energy of the ramming blow delivered by the sharp bow of a heavy torpedo boat. An invention of this kind would be immensely valuable to every naval power, and would insure fame and fortune for its originator.

TORPEDOES.

BY G. GAKUMA.

The development of submarine warfare has been so rapid of late that it is hardly possible to foretell what potent influence it may have on the war now being waged in Eastern Europe. While England, France, Italy, and in fact nearly all the European naval powers, have been building huge engines of war, of a tonnage, armor, and artillery never heard of before, the torpedo has been gradually perfected, and threatens, at least under many circumstances, to neutralize them. A torpedo may be regarded as a gun which dispenses with a gun carriage, and which, without the vast and expensive agency of a great ship, inflicts as formidable a blow as that of the heaviest artillery.

The original inventor was David Bushnell, born at Westbrook, Connecticut, 1742. He not only devised a torpedo, but also a submarine rowing boat, intended to convey it to the bottom of the vessel to be attacked. His practical experiments, however, which he was enabled to carry out with the assistance of the private purse of George Washington, did not prove successful; and the invention sank into oblivion until the commencement of the present century, when Robert Fulton, an American sojourning in France, offered a similar one to the French Government. After considerable parleying, it was rejected, and Fulton sold his secret to the British Admiralty for $75,000. The so-called Catamaran Expedition, an attempt to destroy the French line-of-battle ships and transports off Boulogne, turning out a failure, Fulton returned to the United States, and, during the war of 1812, tried in vain to blow up several of the English blockaders. The rage of the British commanders knew no bounds and the proceedings were termed "unchristian," "the invention of a fiend," etc. Cousin John Bull has a frightfully short memory at times!

In 1829, Colonel Samuel Colt commenced experiments with a submarine torpedo exploded by a galvano-electric battery; and after many disappointments, he succeeded on October 18, 1842, in destroying the brig Volta in New York harbor, in the presence of 40,000 excited spectators. So far only vessels at anchor had been attacked; but on April 13, 1843, Colt blew up a brig of 500 tons under sail on the Potomac river, he himself being the operator, and at the time at Alexandria, five miles distant from the explosion.

The first European government to adopt the invention was Austria, who laid down a perfect electric torpedo net for the defence of Venice. Russia followed suit, and during the Crimean war protected the entrance of Cronstadt as well as that of Sebastopol harbor by an improved system of ground torpedoes, which kept the English fleet at a respectful distance. The American civil war for the first time clearly demonstrated the tremendous effect of the invention, and at the same time changed its character from a purely defensive to an offensive weapon. Galled by the soon-established superiority of the United States navy, which gradually sealed up all the important Southern ports, the Confederate Government organized a special torpedo service corps; and after sinking torpedoes in every available approach, they proceeded to build small steamers constructed to carry spar torpedoes. These torpedo boats, with an easily comprehensible Biblical allusion, were called "Davids," and were in several instances used with as much pluck and perseverance as terrible effect. The United States soon imitated the David, and in 1864 the late Commander Cushing, U.S.N., succeeded in destroying the Confederate ram Albemarle, lying at anchor in the James river. Since then the electric apparatus for torpedoes and the torpedo itself have been vastly improved; and numerous new inventions have been introduced, all of which, however, may be classed under the following five heads: Ground torpedoes, spar torpedoes, Harvey (towing) torpedoes, Whitehead (fish) torpedoes, and the Lay torpedo.

GROUND TORPEDOES.

The ground torpedo is a sort of sunken mine, exploding either by contact or by electricity. If these are judiciously laid down around a harbor or anchorage, the approach of hostile ships may be rendered impracticable, provided always they are protected by shore batteries or armed ships to prevent removal. Every channel may be barred by these hidden mines; and they may be made so powerful that any ship under which they explode is sure to become hopelessly disabled. They are fastened to and held in their positions either by anchors or by stockades. The bursting charge consists of gunpowder, gun cotton, or dynamite; and the case or shell is either made of iron or wood; in Charleston harbor, old steam boilers were frequently used.

SPAR TORPEDOES.

The spar torpedo is fastened to the end of a spar from 15 to 38 feet long, carried in a boat, no matter how small, and explodes also either by electricity or contact. A most remarkable experiment was recently made at Cherbourg, France, with spar torpedoes, carried by a little vessel called the Thorneycroft, which was almost submarine. We illustrated this invention on pp. 239 and 246 of our current volume. A very small part of it was above water, but it was of sufficient strength to carry engines and two lateen sails, and it was worked by a lieutenant, two engineers, and a pilot. The French Admiral had two disabled ships in succession towed out to sea at a speed of 14 knots an hour. The Thorneycroft, however, was able to go at the rate of 19 knots an hour, a rate not attained by any vessel in the squadron. She very soon caught up with her prey, delivered her blow with a spar torpedo, which projected from her bow, and rebounded. A rent as big as a house was made in the side of the ship attacked, and she sank at once. The Thorneycroft only spun round and round for a few moments, and then returned uninjured to the squadron, from which she had started. A vessel of this kind is scarcely discernible in the water; even if she were detected, she is so small that it would be difficult to hit her; and half a dozen Thorneycrofts attacking a large vessel would be a most dangerous foe. Their expense is quite trifling compared with that of great ships of war; they can be multiplied indefinitely, and they can be carried on board other ships and be launched from them as occasion may require. The Italian Government has already carried out this idea in the construction of her formidable new ironclads Dandolo and Duilio. These vessels are fitted in their sterns with a sort of armored dry dock, harboring a small torpedo steamer. As soon as the services of the latter are required, the dry dock is filled with water and opened, and the little craft rushes out at the enemy, returning to her safe berth after her mission has been fulfilled. Admiral Porter's torpedo vessel Alarm, also recently illustrated by us, is fitted with spar torpedoes, both for bow and beam; but the torpedo generally supplied to all the cruisers of the United States is the

HARVEY (TOWING) TORPEDO.

Invented by an English officer in 1862, it was soon adopted by nearly all the other navies, and probably will be exclusively used in general actions at sea as least liable to injure a friendly vessel in the *mêlée*. The Harvey torpedo is towed upon the surface of the water by a wire rope towline from a derrick end of the yard arm over or against the enemy; and just before reaching the ship to be destroyed this towline is slackened, and the torpedo, being heavier than water, dives under it. When in this position the explosion is effected by means of a mechanical firing bolt striking down upon a pin as soon as certain levers of the torpedo come into contact with the bottom of the target. This torpedo can also be made to explode by electricity. Two different forms are used for starboard and port.

WHITEHEAD (FISH) TORPEDOES.

This invention is the secret and the property of the British Admiralty, but the following details have leaked out: These torpedoes resemble in shape a cigar, pointed at both ends, and are 18 feet long by two feet in diameter. The inside is divided in three different compartments: First, the head, which contains a charge of 350 lbs. of gun cotton and the pistol or detonator to explode it; secondly, the balance chamber, which contains a contrivance for setting it so as to remain at any depth at which it is wished to travel under the water line; and lastly, the air chamber, which contains the engines and the compressed air to drive them. The after end supports the screws—a right and a left handed—which propel the torpedo and are made of the finest steel. The air chamber is tested to the pressure of 1,200 lbs. on the square inch, although for service it is only loaded to 800 lbs. The Whitehead torpedo can be made to go at the rate of 20 knots for 1,000 yards, and at any depth that is desired from 1 foot to 30 feet. It can be set to explode either on striking an object or at any particular distance under 1,000 yards—in artillery language, either by a percussion or a time fuse. It can also be set so that, if it misses the object aimed at, it will go to the bottom and explode at half cock or come to the top on half cock so as to be recovered, as it has buoyancy enough just to float on the surface of the water when not in motion. It is fired from what is called an impulse tube, which, out of a frame fitted to a port, discharges the torpedo into the water. It can be fired above the water, but will at once go to the depth it is set for, and then go straight to the object, no matter how fast the ship from which it is discharged is going, or how fast the object aimed at may be sailing or steaming. It fact, it seems that it can do anything but speak. It is calculated to make a hole on bursting of 70 feet area, and there is no doubt that, if one of them hits a ship of any sort or description at present on the water, she must at once proceed to the bottom. It is evident that by this means a comparatively feeble ship, if only able to approach within 1,000 yards of a large one, can discharge a deadly flight of unseen projectiles at her, and at night such an attack will probably be wholly unsuspected and scarcely open to resistance, as the vessel fired against will be positively unaware of the attack until she is blown up. The newly invented electric light from the tops is a great help to the party attacked; but if three or four boats of great speed attack a vessel from different points of the compass, and if they are commanded by smart officers, nothing that she can do will save her from being hit by one or more of them. There is no doubt whatever that this torpedo is the most formidable weapon of modern naval warfare.

THE LAY TORPEDO.

Properly speaking, the invention of Mr. Lay, purchased by the United States Government, is not a torpedo, but a very ingeniously devised submarine torpedo boat fitted with a spar torpedo. This boat has the advantage of not requiring any crew on board, but in other particulars is capable of great improvements. The motive power consists of an engine driven by carbonic acid gas and a screw propeller. The boat is entirely submerged, and is steered and in all other respects controlled by means of an electric battery on shore, connected with her by a cable which is coiled up in her hold and pays out as she moves away. Her location is indicated above the surface of the water by a flag, so as to enable the operator to direct her course. The greatest defect of the Lay torpedo is want of speed. The United States Government stipulated for a speed of 9 statute miles per hour, but the maximum speed actually attained at the late trial trip, when it was steered by Lieutenant R. B. Bradford, U.S.N., showed only an average of 6·60 miles per hour, so that a ship attacked would only have to lower her boats and let them row between the approaching torpedo and the shore, and cut the cable, which would leave the torpedo at their mercy. The defence of ships against torpedo attacks of all kinds is at present very imperfectly developed, principally owing to the fact that the offensive qualities of any weapon must first be learned before effectual means of defence can be devised; and as actual warfare only can give a correct idea of the former, we are, no doubt, on the eve of very startling events, which may entirely revolutionize and change every recognized principle of naval tactics.

The great anxiety felt in England for the future safety and efficiency of the British navy, on account of torpedoes, is shown by the attempted formation of an International Torpedo Association, which Lieutenant Colonel Martin, of Boxgrove, Guildford, late commanding 4th (the King's own) Royals, is about to set on foot. He says in his programme: "When explosive bullets and chain shot were invented and actually used in war, nations unanimously agreed to discontinue their use and prohibit their manufacture; yet explosive bullets and chain shot, ft must be admitted, are harmless as compared with torpedoes. Poisoning is prohibited in war. Why not prohibit torpedoes, which are actually more subtle and deadly than poison, there being no antidote to escape from them? For instance, were I allowed to fire (from a mortar) gutta percha bags filled with strychnine and charged with a burster and time fuse to cause the bag to burst and scatter its diabolical contents over some obstinate city or fort which would not capitulate, this visitation would be far more merciful in its way towards the people of that city or fort than torpedoes would be against crews of ships, because the strychnine could be seen and avoided by flight; whereas, on the other hand, torpedoes secretly moored, or even fish torpedoes, insure complete, sudden, unexpected, and unavoidable destruction. Several clever artisans have already been killed by merely pumping compressed air into the tails of unloaded fish torpedoes. Had these torpedoes been loaded with gun cotton for service on board ship, and even if one of them exploded from careless handling during action while compressed air was being supplied to start it, or if by chance a shot or shell struck the ship at the time of starting a fish torpedo on its death track, the fearful consequences may be easily imagined. As a proof that governments appreciate the danger they incur by the use of torpedoes, I may here state that it is well known that, after the Austro-Italian war, all the picked-up torpedoes proved to be dummies. It is our bounden duty to keep pace with other countries, but every one will admit that the sooner the "International Anti-Torpedo Association has accomplished its task, the better for the cause of humanity!"

It is much to be feared that other nations will prefer to take a different view of the case, and continue to consider torpedoes a cheap and effective counterpoise to the costly and powerful English ironclads.

American Silk Manufacture.

A recent report of Mr. F. Allen, Secretary of the Silk Association of America, states that the total manufactures of silk in this country for 1876 were valued at $26,593,103. The business of last year is not considered satisfactory, although the raw silk consumed was within 150,000 lbs. of the largest amount used in any previous year. This unsatisfactory condition is ascribed to the use in the price of raw material, amounting on the average to 100 per cent; to the pressure brought to bear on our markets for goods by foreign manufacturers who had injured their markets abroad by excessive adulteration, in some cases reaching more than threefold the weight of the silk; and to the great extent of frauds by undervaluation at the Custom House. The estimate of loss to the revenue from the last named cause alone is placed at $4,000,000.

Titanic Iron from the Ural.

J. Popov has recently published analyses made by him of two titanium minerals from the Ural. The first is an ordinary titanic iron ore, containing magnesia; the other a perimorphose of the same in which the iron seems to be replaced by lime, only half a per cent of protoxide of iron remaining. The iron ore contained: Titanic oxide 56·81 per cent., sesquioxide of iron 4·02, protoxide of iron 19·65, protoxide of manganese 1·73, protoxide of magnesia 17·18; total 99·39. The perimorph contained: Titanic oxide 58·85, lime 40·83, protoxide of iron 0·58; total, 100·26.

IMPROVED FRICTION HOISTING ENGINES.

We illustrate herewith a series of improved hoisting engines, adapted for the removal of cargoes from vessels and stone from quarries, and for pile driving, and all the various uses to which such machinery is usually applied.

Fig. 1 represents a double drum and double cylinder. The engines are each of 8 horse power, and work independently of each other. The apparatus allows of work being carried on at both hatches in a vessel at once. It is also especially adapted for use in the erection of large buildings where there are two hod elevators, operated at one time, for hoisting building material. The apparatus is mounted on wheels so that it can easily be moved from place to place. The engines have plain slide valves, worked by an eccentric direct from the main shaft. There are locomotive slides and cross-head of simple construction. Both engines are supplied with steam from the same boiler, which, in common with other generators used on these machines, is made of the best charcoal hammered iron $\frac{5}{16}$ inch thick, with longitudinal seams double riveted, heads $\frac{3}{8}$ inch thick, with best fire box and flange iron in the furnace. The boiler is supplied with water by a steam pump attached to it on one side, and an injector on the other. We are informed that, by this machine, 1,980 tons of merchandise, consisting of bag sugar, linseed, jute, etc., were discharged from a vessel in 31 hours, and that 400 hogsheads of sugar were hoisted out in 3 hours' time.

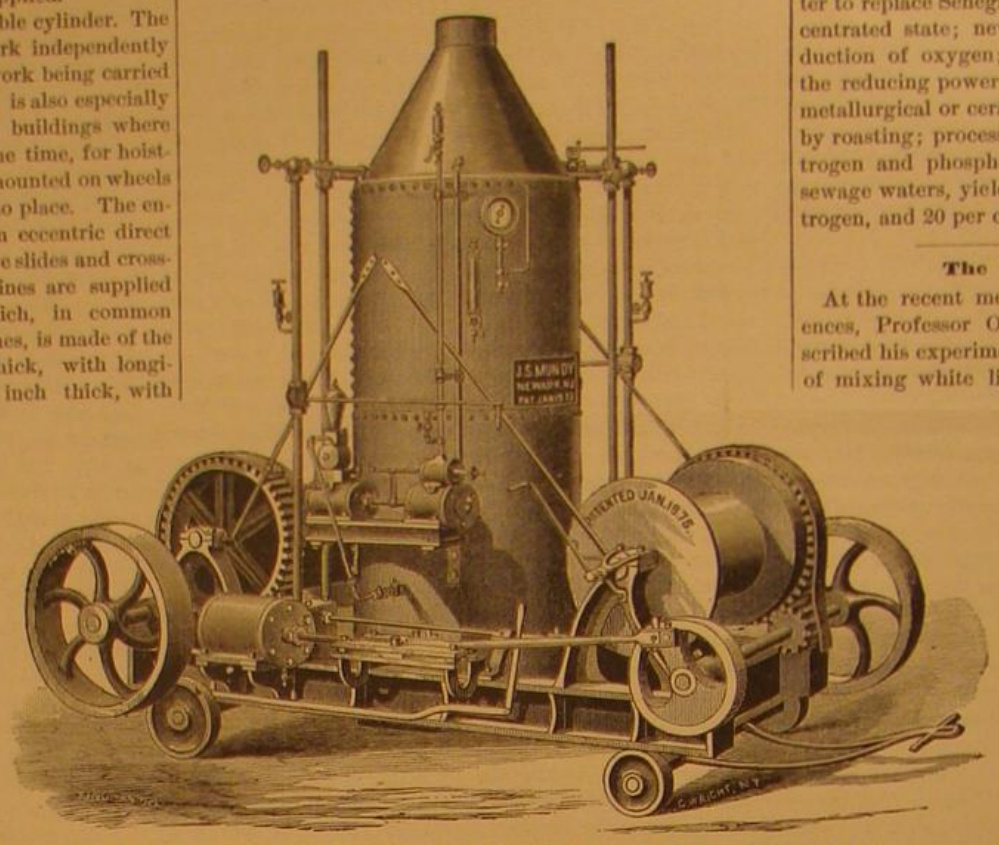


Fig. 1.—MUNDY'S DOUBLE DRUM PORTABLE HOISTER.

Fig. 2 represents an improved double cylinder and double drum pile-driving machine for dock builders' and contractors' use. Both engines are connected to the same shaft at right angles. The steam cylinders are 7x12 inches, one drum being used for running the hammer, the other for hoisting the piles. There is also a winch on the end of the lower drum shaft, for the purpose of handling the machine or timber, or for any extra work needed. This engine, it is claimed, will strike, with a 2,500 lbs. hammer, from 15 to 20 blows per minute, lifting the hammer from 12 to 20 feet high at every blow. It is also useful in working a boom derrick when the load is to be raised by one drum, and the boom raised or lowered and swung by the other. The weight is held by the improved ratchet on the end of the drum, as shown in the engraving.

These machines can be seen at work in various localities in New York and Philadelphia. The manufacturer states that one of the 40 horse power double cylinders, 10x16 inches, has raised a weight of 30 tons over 22 feet high, and lowered it successfully by the friction gearing, at the marble yards at the foot of Corlears street, East river, in this city. Fig. 3 shows a section of the friction drum, patented through the Scientific American Patent Agency, January 19, 1875. The drum is cast in one piece. The large gear is made with holes or pockets in the side to receive plugs of hard wood, that are fitted in and turned off to receive the cone flange of the drum. The spiral spring between the gear and drum forces the drum off the wood when relieved by the screw and pin at the other end. This can be used separate from the engine by the application of a belt on the pulley on the lower shaft, for hoisting in warehouses, stores, coal yards, or in any place where there can be power attached. The friction gearing serves as a brake in lowering fast or slow, at the option of the operator.

Fig. 4 represents a single machine mounted on trucks, and adapted to all kinds of light or heavy hoisting. The engine can be run as a stationary engine, by applying a governor to the steam pipe and taking power from the flywheel by a belt. At the same time it may be used for any kind of hoisting, the weight being held by a brake band, applied to the drum when the engine is in motion. The manufacturer also builds a special mining engine, with large grooved drums for using wire rope; also an improved self-propelling boom engine, for hoisting stone or marble on the walls of high buildings, a mast 100 feet high being carried on the end of the engine, for the purpose described.

For further particulars, address the patentee, J. S. Mundy, 7 Railroad avenue, Newark, N. J.

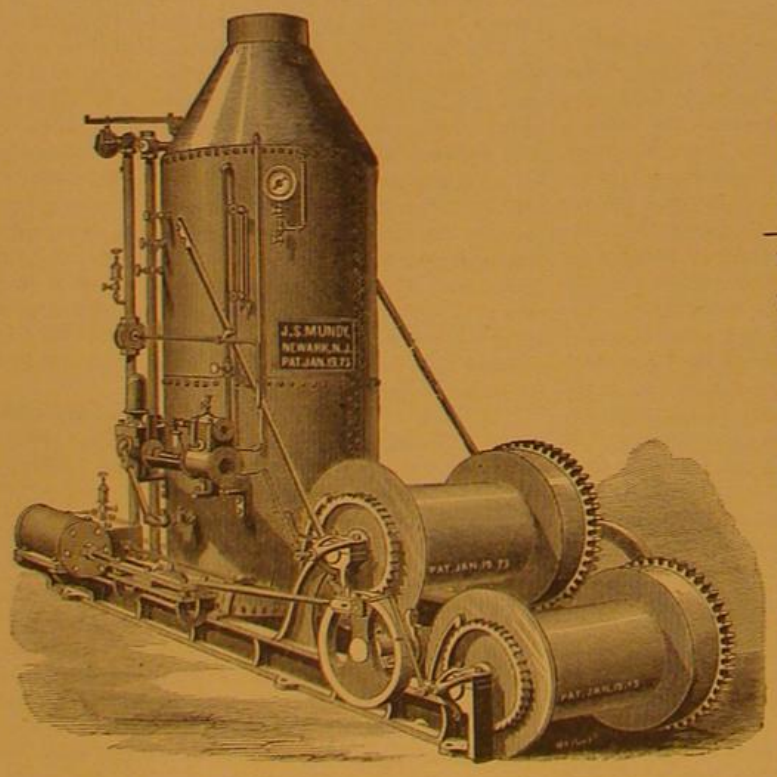


Fig. 2.—MUNDY'S DOUBLE PILE-DRIVING MACHINE.

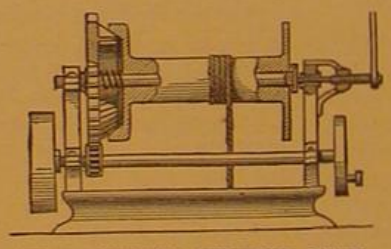


Fig. 3.—MUNDY'S FRICTION DRUM.

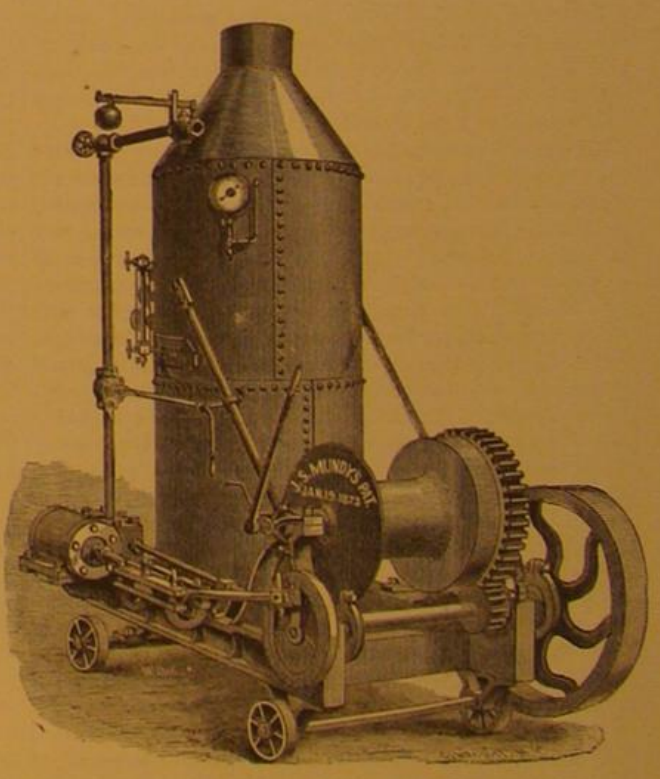


Fig. 4.—MUNDY'S PORTABLE HOISTING MACHINE.

New Ocean Steamer.

The Niagara, a new iron steamer for the Havana trade, built for J. E. Ward & Co., New York city, was lately launched from the yard of John Roach & Co., Chester, Pa. The model of this ship is said to be very fine, and she is to be engined with powerful machinery, so as to make an expected speed of thirteen knots. The following are her dimensions: Length, 294 feet; breadth of beam, 38 feet 8 inches; depth from hurricane deck, 31 feet, and from main deck, 23 feet 9 inches, with a displacement of 2,400 tons. She is furnished with one compound engine of 1,650 horse power, the cylinders being 34 and 60 inches in diameter, with 54 inches stroke, driving a four-bladed screw of Hirsch's patent, calculated to give the vessel a speed of 13 knots an hour. Her boilers, four in number, are of the cylindrical tubular pattern, 10 feet in length by 11 feet 10 inches in diameter, tested to a working pressure of 80 lbs. to the square inch. She will be brigantine rigged, and spread about 2,500 yards of canvas. The steering apparatus, and the capstan for heaving up the anchor and warping the vessel, will be operated by steam. The saloon and staterooms will be elaborately finished. The vessel is divided into five water compartments and three decks. Cost upon completion, $350,000. A sister ship to the Niagara, the Saratoga, is in course of construction at the same yard, and will be ready for launching about July 1.

Industrial Prizes.

Among various subjects, in connection with which the Industrial Society of Rouen has just offered prizes, are the following: A substance capable of replacing albumen of eggs in all its applications to printing of tissues, and considerably cheaper; new source of albumen, either in natural products containing it, or by transformation of other proteic matters; a new dark color as intense and solid as aniline black, but not weakening the cloth, and capable of being printed with any other colors without alteration at the point of contact; a method for volumetric determination of commercial glycerine; a solid blue coloring matter, applicable like indigo but cheaper; new process for fixing indigo blue by steaming; new method of fixing aniline colors; a new thickening matter to replace Senegal gum; production of ozone in the concentrated state; new application of ozone; industrial production of oxygen; rapid and exact means of determining the reducing power of a coal or any carbon; utilization, in metallurgical or ceramic arts, of iron pyrites, desulphurized by roasting; process of concentration or precipitation of nitrogen and phosphoric acid in fecal matters, urines, and sewage waters, yielding a manure of at least 5 per cent nitrogen, and 20 per cent phosphoric acid.

The Mathematics of Light.

At the recent meeting of the National Academy of Sciences, Professor O. N. Rood, of Columbia College, described his experiments in testing mathematically the effect of mixing white light with light of different colors. He used brilliantly colored disks made to revolve rapidly, and substituted in part of each disk white for color, measuring the amount of substitution and its specific effects. Thus mingled with white, the lighter shades of vermilion became purplish; of orange, more red; of yellow, more orange; of greenish yellow, unchanged; of yellowish green, more green; of green, blue; of cyanogen blue, less greenish and more bluish; of cobalt blue, more violet; of ultramarine, violet; of violet, unchanged; of purple, less red and more violet. Exactly the same results followed when violet was used instead of white to reduce the colors. Hence mixture with white has an effect similar to moving all the colors towards the violet end of the spectrum. Professor Rood regards these and other experiments of a qualitative nature, as indicating that violet is one of the primary colors. The mathematical results attained were laid before Mr. Charles S. Pierce, who subjected them to further analysis, and found that they confirmed Fechner's law, that "the sensation is proportional to the logarithm of the excitation." A diagram has been made showing the effect upon any of the spectrum colors of admixture with white; the diagram is constructed on the mathematical theory; the observed results in practice correspond.

Electro-Magnetic Plant.

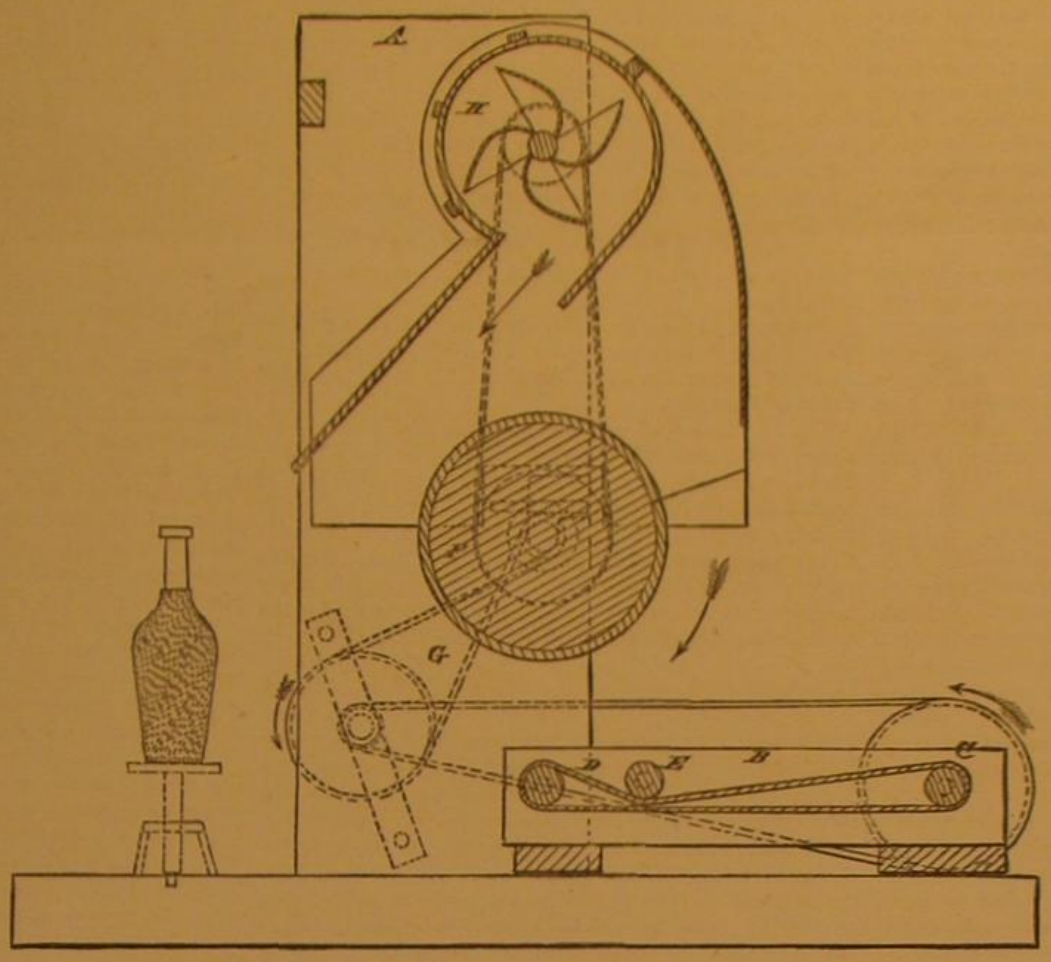
A curious plant, called the *phytologica electrica*, and possessing strong electro-magnetic qualities, has been recently discovered in Nicaragua, according to the New York *Herald*. The hand is lamed by touching it, and the magnetic influence is felt to a distance of eight feet. The magnetic needle is disturbed, and the nearer the middle of the plant is approached the stronger becomes the agitation, until finally it assumes a circular movement. The intensity of the phenomenon varies according to the time of day, and at night is scarcely perceptible. It reaches its highest point about two o'clock in the day. Stormy weather increases its activity. No insects or birds are known to approach it.

THE Rev. S. S. Whitmee, of Australia, in an extremely able and interesting lecture on "the Ethnology and Philology of Polynesia," contended that over all Polynesia there are two distinct types of people, a brown race connected with the Malays, and a negro race, with the Papuans. There is a third much mixed race, name and origin unknown.

TWO NEW UTILIZATIONS OF PAPER PULP.

We illustrate herewith two new sets of apparatus for making paper pulp into either small vessels or barrels. The first, illustrated in Fig. 1, is an improved machine for depositing paper pulp upon moulds in order to form bottles, pitchers, and other vessels of *papier maché*. A is an upright frame, to which is attached a trough, B. To the end parts of the frame, B, are pivoted two rollers, C, around which passes an endless belt, D, made of wire cloth. To the forward part of the frame, B, is pivoted a third roller, E, beneath which the carrier, D, passes, so that the distributing fingers can only come in contact with its forward part. A drum, F, has rows of spring fingers, G, of such a length that their ends will come in contact with the forward end of the carrier, D, to take particles of pulp from said carrier, and project them upon the object to be coated, in front of the machine, and slowly revolved. The particles of pulp are directed more accurately against the article to be coated by the blast from a fan blower, H. In this way bottles, pitchers, and other vessels may be quickly and evenly coated with pulp, or coatings of pulp may be deposited upon forms, from which they may be withdrawn, when dry, by slitting them. The pager pulp coatings, when dry, may be polished, varnished, and otherwise finished.

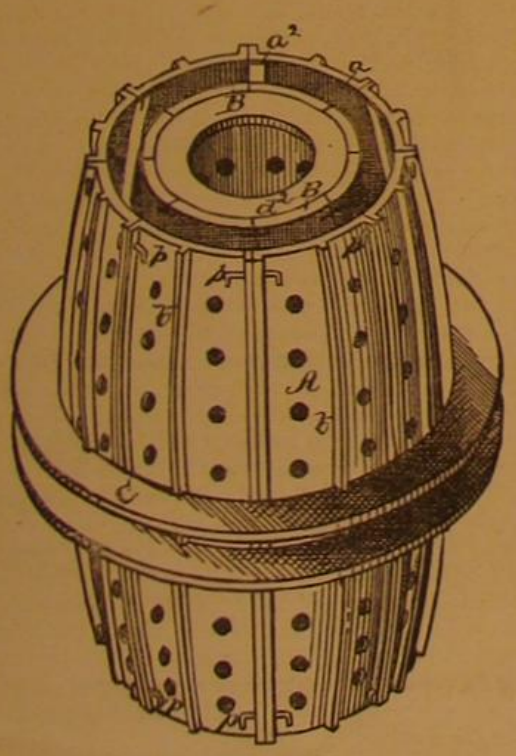
Patented through the Scientific American Patent Agency, March 13, 1877, by Mr. Isaac Jennings, of Fairfield, Conn.



JENNINGS' PAPER PULP DISTRIBUTER.—Fig. 1.

The second invention, illustrated herewith in Fig. 2, has for its object the production of a barrel or other similar article of any convenient size, and composed of ordinary straw pulp, made of straw or other suitable raw material. To this end, therefore, the invention consists of a mould or form in which to compress the pulp into proper shape.

A represents a number of staves, preferably of metal, their interior surface having the form desired for the exterior of the barrel. B B are a number of staves or sections, which, when set up inside the staves, A A, form a cone having an exterior form corresponding to that desired for the interior of the barrel. C C are rings, which are passed over the ends of the staves, A A, in the manner of hoops upon a barrel, and by their pressure preserve the external form of the mould. The stave, A, is perforated, as shown, and on its inside over the perforations is secured in



HUBBARD'S PAPER BARREL MOULD.—Fig. 2.

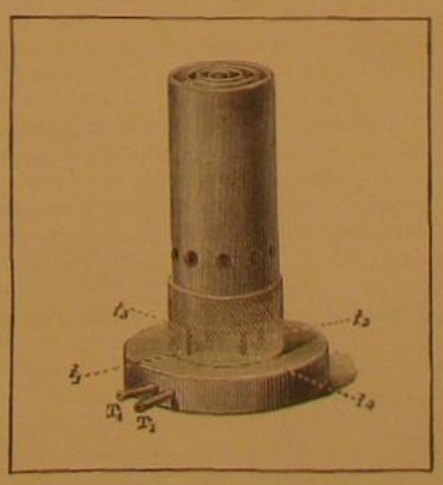
any suitable manner a wire gauze or similar device, *a*. Upon the inner edge of one side of the stave is secured a strip of thin metal forming a rabbet, a^2. This rabbet prevents the pulp from being forced out between the staves as the pressure increases, before the edges of the staves form a tight joint. Upon the back of the stave are three ribs, two of which form the edge of the stave, A, and one is a central rib, *b*. Each end of the sections, B, is formed into an offset for giving a croze or some similar formation to the ends of the barrel when pressed into shape, and said sections are perforated and covered on their exterior surface with wire gauze in the same manner as is the interior surface of the staves, A. The sections, B, are also provided with lugs, *d*, which serve to steady the sections and assist in holding them together when setting them up before pressure is brought upon the mould by serving as supports for the rings, *d*. One of the sections, B, has its edges beveled the reverse of the others, by which means it can be readily removed from the mould when the barrel is made, after which removal the other sections may be easily taken out also. The ring, C, is provided with slots or notches, *e*, which notches guide it as it is forced upon the staves, A A. These staves are also held together by wire pins, *p p*.

The complete operation of the mould or press can now be understood. The staves and sections being all set up, as above described, and the annular space between them filled with any suitable pulp, the rings, C C, are forced over the staves, A, by screw power, when the pulp will be compressed, as the rings approach each other, into the desired shape, the water contained in the pulp at the same time being forced out through the perforations in the staves and gauze. The shaped pulp, still under pressure, may now be subjected to any suitable drying process, the heat reaching it through the wire gauze and the perforations in the staves, both from the inside and outside. When the shaped barrel is considered dry enough, the rings, C C, are removed from the staves, A A. The staves thus released from pressure can readily be withdrawn, as above described, from contact with the barrel, and the barrel, as a completed article, is ready to be headed in any desired manner.

This invention was patented February 1, 1876, by Mr. Eber Hubbard, of Medina, N. Y.

THE NEW GODEFROY BURNER.

M. Godefroy's new burner, which is represented in the annexed illustration, is composed of four concentric sheet iron cylinders. The first and third are pierced with lateral holes at the base. The intervals between the cylinders communicate, some with the pipes, t^1 and t_2, joining the exterior gas tube, T, and others with the tubes, t_3, t_4, which unite with



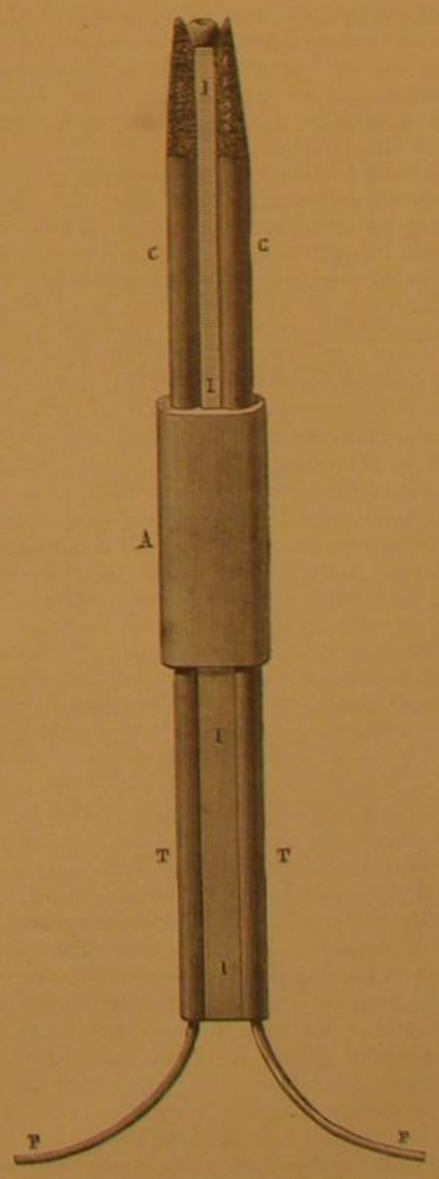
the tube, T_2. Wire gauze placed at the base of the apparatus prevents the flame from flickering, while it regulates the introduction of the air. Only two internal cylinders may be used if desired, in which case a high and regular white flame is produced.

THE ELECTRIC CANDLE.

The Jablochkoff electric candle, which we briefly described some months ago, on the occasion of its introduction to the French Academy of Sciences by its inventors, is now being used in Paris for the illumination of large stores. As the matter of lighting the streets of large cities by the electric light has of late been somewhat discussed, this invention is of timely interest, more especially as it appears to afford a new and simple means for employing that most powerful source of illumination.

The electric light, as all are aware, is now produced by means of two rods of carbon placed end to end, the extremities separated by a distance of some hundredths of an inch. Through the carbons a powerful electric current is passed, which, if the rods touch, simply heats them; but if they are separated, as above mentioned, it causes the production between the ends of the intensely luminous voltaic arc. As the rods become consumed, the arc elongates; and, finally, when the distance becomes too great, it ceases. Consequently, unless machinery is provided which compensates for this consumption by maintaining the ends of the rods always at the proper distance, the arc cannot be kept for longer than a few minutes. Electric lamps therefore are provided usually with clockwork or electro-magnetic devices for this purpose. When the source of the electricity is a battery or a continuous-current electric machine, such as the Gramme, the two rods are unequally consumed, that at the positive pole disappearing about twice as fast as the other. With other machines, whereby the current is alternately reversed, the consumption is about uniform for both.

The disadvantages attending even the most improved lamps, such as the Serrin apparatus, for example, lie in the care and attention required by the delicate mechanism, the difficulty of regulation, the casting of a shadow by the mass above the arc, the necessity of renewing the carbons at intervals of three hours, the consequent extinction of the light, and finally the high cost. It



is simply necessary to point out that M. Jablochkoff's candle aims to do away with all of these difficulties to show the importance of the invention.

The device is represented in its full dimensions in the annexed engraving, for which we are indebted to *La Nature*.

It is an asbestos ferrule, sustaining the two gas carbon rods, C, which are also held in copper tubes, T. At I is insulating material placed between the rods, and at F the conducting wires. This arrangement may of course be modified to suit differing circumstances. The insulating material is kaolin or other refractory substance which does not extend to the ends of the rods. When the current passes, the arc is produced between the extremities of the carbons; and as these become consumed, the light is gradually brought near to the refractory substance. This by the great heat is vaporized, in proportion as the rods burn away, so that protruding ends of the latter are always left, while they are always maintained at exactly the proper distance apart to which they are in the beginning adjusted. If a continuous current is used, the double consumption of the positive rod is provided for by making that carbon of double the area of section as compared with others: but the candle works better with alternating currents, in which case the carbons are of the same size. It is easy to reverse the apparatus so that the arc is produced at the lower ends of the rods. The candle may then be employed for an overhead light.

One of the principal advantages of the Perrin lamp is that it may be set in operation from a distance by merely establishing the current, the carbons having been previously prepared. M. Jablochkoff accomplishes this by placing a bit of carbon between his points. When the current passes, this becomes hot, reddens, and finally consumes. Continuity is then broken, and the arc appears. A bit of lead, or fine metallic wire, which melts easily, answers the same purpose.

The gradual fusion of the insulating material presents another advantage, namely, that it becomes conductive on attaining the liquid state, and admits of an elongation of the arc, which increases the light. This conductibility, moreover, admits of the candle being extinguished by the breaking of the circuit and then re-ignited, provided the interval is not longer than a couple of seconds. By this means, it is suggested, the candle might be employed as a means of transmitting signals by flashes, using the Morse telegraphic alphabet. This idea has already been adopted by the Russian army, and trials are soon to be made at the headquarters at Kischenew.

With the ordinary electric lamp, it is not possible to place more than one pair of carbons in the same circuit. This is owing to the necessity of regulation in apparatus where the movement of the rods is accomplished by electromagnetic machinery, which itself is dependent upon the variations of the resistance of the circuit produced by the changes of length of the voltaic arc. If the arc elongates, the resistance augments; the electromagnet weakens, and allows of the relative approach of the carbons. Consequently, if two lamps were placed in the circuit, and one arc elongated, both electromagnets would be affected, and hence both arcs would be shortened. So that the inter-relation of the two machines would constantly produce improper regulations, which would amount to no regulation at all. With the candle, however, it is immaterial how many are placed in the same circuit, provided the current has sufficient tension to pass through all. In Paris, three and four lights have been maintained from a single electric machine.

M. Jablochkoff is at work on further improvements, some of which he has perfected, and will shortly lay before the French Academy of Sciences, when we shall present them to our readers. It will be seen, however, that the invention is one calculated greatly to extend the usefulness of electric illumination.

Communications.

Our Washington Correspondence.

To the Editor of the Scientific American :

An application having been made by S. D. Locke to Secretary Schurz for an order directing the Commissioner of Patents to rehear the case of Withington *vs.* Locke, on the ground that the case was heard by the Assistant Commissioner at a time when the Commissioner of Patents was present and attending to his official duties, the Secretary has made a decision, denying the application, reviewing and reaffirming the decision of Secretary Delano in the quadruplex telegraph case, as to the right of the Secretary to interfere with the acts of the Commissioner of Patents, when honestly performed. There is no complaint made on this score; and the attorneys of both parties appeared before the Assistant Commissioner and fully argued the case, thereby tacitly admitting his competence to decide the case. No objection was made by either party until the matter was decided, when the defeated contestant made this application. After referring to the long-continued practice of the Office for the Assistant Commissioner to act on cases when the Commissioner is otherwise engaged, the Secretary says: "The duties of the Assistant Commissioner have been, and are, such as the title of his office supposes; and I am of the opinion that where parties, as in this case, submit their proofs and arguments to that officer, with a full understanding of the practice so long established, they must abide by his decision or seek their remedy in the courts."

An appeal from the Board of Examiners-in-Chief having been taken by John N. Swift, an applicant for the registration of a trade mark which had been previously registered by Winfield Peters, February 29, 1876, the Assistant Commissioner affirms the decision of the Interference Examiner and the Board of Appeals. The trade mark in question is "The John C. Ragsdale Ammoniated Dissolved Bone." The name of Ragsdale is that of a gentleman who was president of an agricultural society in Georgia, and his name was taken, by his consent, to popularize the article in that locality. Swift, having been appointed to negotiate with manufacturers for the introduction of this and other brands of fertilizers, made a contract with the firm of Snowden & Peters to furnish the article under this name, which firm afterwards dissolved, and Peters registered the trade mark in his own name. Unlike applications for patents, priority of conception of the idea has no weight in the registration of a trade mark, and Swift not only fails to show that he ever used the trade mark, but he sold the manufactured article of Snowden & Peters on their account. The rights of Snowden or of the agricultural society are not at issue in this case, and are therefore not considered. The Board of Appeals decided the case in Peters' favor, which this decision affirms on the ground that Swift had never adopted or owned the trade mark at all in the sense contemplated by the trade mark law.

Mr. T. C. Connolly, for many years a Primary Examiner, has been reduced to First Assistant Examiner—cause said to be old age.

As a result of the competitive examination for the position made vacant by the appointment of Mr. Wilber as Examiner of Interferences, Mr. H. C. Townsend has been appointed Primary Examiner.

The exploration of our Western territories will be continued during the coming summer under Lieutenant Wheeler, Professor Hayden, and Major Powell, though the field of operations is not fully determined upon. Major Powell will probably continue the geological survey of the Colorado river country, in which his party has already made extensive explorations. Professor Hayden's exploring party last year completed the survey of Colorado, and will make during the summer an exploration north of the Union Pacific Railroad. The main party under Professor Hayden will make Cheyenne their headquarters, and the different divisions will reach the principal points of their fields of operations by the Union Pacific road. The northeast division will be under Mr. G. B. Chittenden, and operate in the Sweet Water and Mud river countries. The southwest division, in charge of Mr. Henry Gunnett, will examine a section of about 10,000 square miles in area on the western slope of the main Rocky Mountain range. The northwestern division, under Mr. Bechler, will survey an equal amount north of that already referred to. This part of the country is of more rugged character than the other sections, embracing within its limits features of surpassing interest. Its topography, geology, and natural history are more remarkable than any of the other sections. The various parties are made up, and will probably have left for their field of operations ere this is published.

Secretary Evarts is represented as expressing regret at the postponement of the extra session of Congress, as it may prevent the representation of the United States at the approaching exposition at Paris. He thinks, however, that a Commission may be appointed which would in part reciprocate the French representation at the Centennial Exhibition. It is probable that a formal communication will be addressed to the French Government explaining the situation. The Secretary thinks, however, that, if Congress when they meet should act promptly in the premises, there would still be sufficient time to organize a respectable representation of our products and manufactures.

The Bureau of Statistics has published a statement showing that the exports of "oleomargarine" or "butterine," from New York, during the seven months ending March 31, amounted to 3,549,629 lbs., of the value of $481,747, of which 2,352,250 lbs. were shipped to France and 991,329 to Great Britain. This probably accounts for a discovery that the English people have lately made that a large quantity of very nice-looking butter, said to have been imported from the island of Jersey, had never been made in Jersey at all; and they were puzzling their brains to find out where it had come from—having very strong suspicions that it was not really butter but oleomargarine.

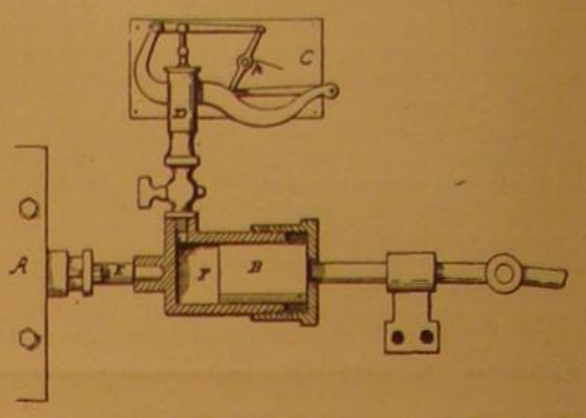
Our Board of Health has condemned a thousand barrels of an article sold in this market by a Chicago firm for vinegar, which, when tested by the chemist, was found not to be vinegar, but a compound containing $54\frac{54}{100}$ grains per gallon of anhydrous sulphuric acid combined with lime to form sulphate of lime (equivalent to $117\frac{36}{100}$ grains of gypsum per gallon) and 5 grains free sulphuric acid per gallon. This stuff is probably shipped all over the country, because it can be made so much cheaper than pure vinegar; and the people should therefore be warned to notice whether they are buying vinegar or diluted sulphuric acid.

Washington, D. C. OCCASIONAL.

A Practical Method of Determining the Friction of Slide Valves.

To the Editor of the Scientific American :

There has recently been considerable discussion of late concerning the friction of slide valves, from which it appears that there is a wide difference of opinion among mechanical engineers on this subject. I propose to show a method by which the friction of a slide valve may be measured; and for that purpose I have designed the instrument shown in the engraving. It is intended for taking diagrams which will indicate the frictional resistance of a steam engine valve at every part of its stroke. In the engraving, E is a valve stem of a steam engine, which works a valve within the steam chest, A. Attached to the end of this valve stem is a cylinder, F, which is provided with a nicely fitting piston, B. The stem of this piston, B, is joined to the eccentric rod of the engine. A common steam engine indicator, D, is connected with the upper part of the cylinder, F. If the cylinder chamber is filled with water, and the piston, B, is



driven forward by the eccentric (the water in the chamber being confined and inelastic), the motion of the piston will be communicated to the valve stem, and all the parts will move forward together as if they were rigidly connected. The cylinder, F, has an external nut by which the valve is drawn back in the opposite direction, and which prevents the piston, B, from being withdrawn from the cylinder. The thrust of the eccentric on the piston, B, will produce a pressure in the cylinder which will cause the pencil, *p*, of the indicator to rise and fall as the pressure increases or diminishes. The card, C, on which the diagram is drawn, is placed flat and stationary (instead of being mounted on a cylinder), while the indicator is carried back and forth with the valve. When the pencil, *p*, is brought in contact with the card, and the valve is moving forward, a diagram will be drawn, with a length equal to the stroke of the valve, which will indicate the pressure at every part of the stroke. The mean resistance of valve and power absorbed in foot lbs. can be determined by the usual method of working out steam diagrams.

If we wish to know the percentage of power of the engine which is absorbed in moving the valve, let a diagram be taken from the cylinder of the engine, and during the same stroke let a valve diagram be taken; then the foot lbs. of work developed by the engine may be compared with that absorbed by the valve. It may be said that the upward movement of the indicator piston would reduce the travel of the valve; but if the piston, B, is made sufficiently large, this reduction would not be of practical importance.

Indianapolis, Ind. JOHN C. DEAN.

The Origin of Petroleum.

To the Editor of the Scientific American:

On page 294 of your current volume, I notice an article on a "New Theory of the Origin of Petroleum." The idea may be new in print; but I heard it advanced during the winter of 1865–66 by a Mr. Smith, then a resident of Enterprise, Pa. He said: "By volcanic action, the earth's crust was broken, leaving crevices through which the ever-present water poured, which, coming into contact with the heated matter near the center of our globe, formed a gas which, in seeking outlets through the earth's crust, became more or less pent up, and necessarily would condense, forming our petroleum." He did not, as our friend in Russia has done, tell the nature of the matter with which the water comes in contact, but gave the idea generally. I think he wrote on this subject either to a Titusville (Pa.) or an Erie (Pa.) paper; but as to that, I am not certain. I remember, however, that he had a number of pretty sharp arguments with oil men on this theory. Mr. Smith went further, accounting for the gas that escaped the condenser by saying that "it passes into the air, forming into globe-like shapes, which in passing upward gather around them a moisture which of course confines them until, by gradually gathering this moisture (thereby gathering weight), they settle little by little until they mingle with the clouds, which generate electricity, or at least contains it, and are exploded by a spark, causing the flash and explosion—thunder and lightning." The latter part of his theory may be a little "airy;" but we must in some way dispose of this gas, and why not in this way as well as any other?

I think this will prove that we as a people are not so far behind the old world as such "credits" make us appear.

Buffalo, N. Y. L. E. PORTER.

Poisonous Enameled Ware.

Much consternation has lately been caused by the announcement in certain Boston papers that the enamels on the so-called marbleized and granite ware, which have for the past year or more found ready and extensive sale in our markets, have been found to contain lead and arsenic. The ware is quite handsome, of a mottled gray and white color, resembling somewhat certain varieties of marble in appearance. The vessels (principally culinary utensils) are in general enameled both inside and out. It will be seen from the letter given below that the statements as to the objectionable character of these enamels are not wholly without foundation in fact. The manufacture of the "marbleized" ware were awarded a medal in the Centennial Exhibition last year; and in the report of the judges, we find the state-

ment that the marbleized ware "differs from all other enamels in that it contains no poisonous or injurious substances whatever," and that "it is unaffected by excessive heat, or acids of any description."

We have received the following from Professor S. D. Hayes, the State Assayer of Massachusetts:

To the Editor of the Scientific American:

It will be replying to many inquiries about enameled ware if you will kindly give this note a place in your columns. I have recently analyzed various specimens obtained in the open market, from dealers, kitchens, agents, and directly from the makers of these wares, and I have seen them manufactured. The wares to which I refer now are known respectively as "marbleized" and "granite" iron wares, resembling each other so much in their mottled gray color that they are not easily distinguishable by persons unfamiliar with them.

The marbleized ware, as hitherto manufactured, contains considerable lead in a soluble form, with a little arsenic, and it should not be used in cooking or drinking vessels, although there is no objection to it for other purposes. Oxide of lead adds to the elasticity and fusibility of the enamel, so that there is a temptation to use it on the part of the workmen in the factories. But serviceable enamel ware can be produced without it, and I have analyzed pieces made within a few days, by the manufacturers of the marbleized ware, that are free from deleterious ingredients.

Some of the pieces of granite ware analyzed contained a small proportion of antimony (about one per cent), which is not a dangerous element in the enamel; and as there is nothing else present that is injurious, it is safe for use in the kitchen or elsewhere. The other pieces of granite ware contained no soluble metals whatever, excepting iron, and they are entirely harmless in composition.

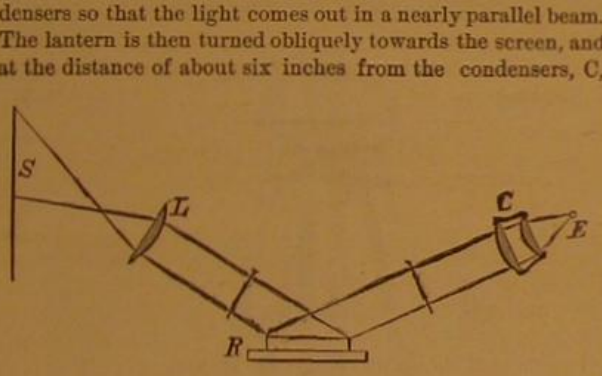
Boston, Mass. S. DANA HAYES,
State Assayer and Chemist.

PROJECTION OF INTERFERENCE COLORS FROM SOAP FILMS.

BY HENRY MORTON, PH D.

Among all the phenomena of light, none are of such fundamental interest as those of interference; for none have a closer relation to the first principles of our theory as to the nature of light, or are so constantly coming up in all parts of the subject in connection with the most beautiful developments of color, as for example in the diffraction spectrum and in chromatic polarization. Yet until recently no means has been at command for exhibiting directly by projection this phenomenon in its characteristic beauty. Now, however, in the simple arrangement which I am about to describe, we have all that could be asked in this connection.

The arrangement is as follows: We place the electric light, E, in the lantern and remove the front element of the condensers so that the light comes out in a nearly parallel beam. The lantern is then turned obliquely towards the screen, and at the distance of about six inches from the condensers, C,



is set the soap film ring, R, with the soap film on its face. In such a position as to receive the light reflected from this film, is placed a plano-convex lens of about 12 inches focus, and about 4 inches diameter, which is adjusted back and forth by trial until the best effect is obtained on the screen. This effect is to begin with a gradually changing field of the most brilliant color, with occasional irregularities, but essentially passing through the tints of the spectrum to a deep violet blue.

When this point is reached, the ring, R, is to be rotated in its own plane a half revolution, so as to bring the lower part of the soap film to the top. The result of this is the flowing down over the film of various thicknesses of solution from the accumulation of its lower edge, now suddenly brought to the top. These varying thicknesses produce the most brilliant colors, and, by reason of this and the graceful cloud-like forms which are assumed, develop a spectacle with which I know of nothing comparable, unless it be one of the most gorgeous sunsets I have ever seen. Purple, crimson, gold, blue, and green, exquisitely blended and of intense brightness, are some of the tints.

The idea of making the ring rotate, so as to secure this effect from the flowing of the soap solution, originated with my friend, Professor George F. Barker, of the University of Pennsylvania, and rings of a very satisfactory character, involving several little matters of detail, are manufactured by Messrs. George Wale & Co., of Hoboken, N.J. The solution for the soap film is best made as follows: *a*. Take olive oil soap (white Castile soap), cut it into shavings with a plane, and dry thoroughly. Dissolve these shavings in alcohol until the alcohol is saturated. The solution should show a specific gravity of 0·880.

b. Mix glycerin with water until it shows 17·1 Baume. To make the final solution: To 6·102 cubic inches of solution *b*, add 1·52 cubic inches of solution *a*, and boil until the alcohol is all expelled. This is obtained when the boiling point rises above 212° Fah. Cool, and turn into a graduated flask, and add water until the volume is again 6·102 cubic inches. Filter, if necessary, to remove oleate of lime.

Some of this solution being poured into a small plate or shallow dish larger than the soap film ring, bring the latter, face downwards, upon its surface, until the edge is just immersed, and then, keeping the face horizontal, raise gently and turn into an upright position. Should there be drafts in the room, an ordinary glass shade may be placed over the soap film ring, without interfering with the experiment, and the film will then be more persistent and safe.

ASTRONOMICAL NOTES.

OBSERVATORY OF VASSAR COLLEGE.

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

Positions of Planets for June, 1877.

Mercury.

Mercury rises on June 1 at 4h. 19m. A.M., and sets at 6h. 29m. P.M. On the 30th, Mercury rises at 3h. 17m. A.M., and sets at 6 P.M.

The best time for seeing the planet is on the morning of the 20th, when it is furthest from the sun and rises an hour before it.

Venus.

On June 1, Venus rises at 4h. 57m. A.M., and sets at 7h. 57m. P.M. On the 30th, Venus rises at 5h. 41m. A.M., and sets at 8h. 35m. P.M.

Venus is small, but bright; and after the middle of the month it can be seen for nearly an hour after sunset, following almost exactly the path of the sun.

Mars.

On June 1, Mars rises a little after midnight and sets at 10h. 25m. in the morning. On June 30, Mars rises at 11 P.M., and sets at 9h. 38m. the next morning. Mars is in southern declination among the small stars of *Capricornus* and *Aquarius*, but is moving toward the north, coming into better position and increasing in apparent size.

Jupiter.

Jupiter is brilliant now in the southern sky, and will be in its best position about the middle of June. On the 1st, Jupiter rises at 8h. 50m. P.M., and sets at 5h. 51m. the next morning. On the 30th, Jupiter rises at 6h. 41m. P.M., and sets at 3h. 41m. A.M. the next day. Jupiter souths at midnight on the 20th at an altitude of 25° 10′ in this latitude.

The various changes of Jupiter's four moons can be seen with a small telescope, and many of the most interesting occur in June. On the 12th, Jupiter will be seen with only three moons until after 9 P.M., when the 1st moon will reappear from behind the planet. On the 19th, the 1st satellite will disappear between 8 P.M. and 9 P.M., by passing behind the planet; and between 10 P.M. and 11 P.M. the largest will disappear by coming in front of the planet. On June 26, Jupiter will be seen when it rises, with all four moons; but a little after 10 P.M. the first will disappear by the planet passing between us and the moon and hiding its light; this satellite will reappear in 2h. and 24m.; and for a little over an hour the four moons are still seen. But the 3d or largest is very near the planet, and a little after 2 A.M. comes in front of and is lost in the light of Jupiter. The small stars around Jupiter are those of the constellation *Sagittarius*.

Saturn.

Saturn rises on June 1 at 1h. 5m. A.M., and sets at 0h. 23m. P.M. On the 30th, Saturn rises at 11h. 10m. P.M., and sets at 10h. 29m. A.M. of the next day.

Mars and Saturn rise at nearly the same time on the 30th, but Saturn is 5° further north.

Uranus.

On the 1st, Uranus rises at 9h. 57m. A.M., and sets at 11h. 49m. P.M. On the 30th, Uranus rises at 8h. 9m. A.M., and sets at 9h. 57m. P.M. Uranus is still among the stars of *Leo*.

Sun Spots.

The report is from April 17 to May 16 inclusive. In the photograph of April 17, there appears on the western limb the group of large spots mentioned in the last report; but from this date to April 21 clouds prevented observations, and during that time the group disappeared. On April 21, a pair of small spots was seen far advanced on the eastern limb. On April 23, this pair was followed by a pair of very small ones. During the passage across the disk, there was a continual change in the number and arrangement of the spots in these two groups. Before April 30, both had disappeared. In the picture of this date, a small group was seen on the eastern limb; but after May 5 it could not be found. When last seen, it was near the center of its course, but very faint. The observation of May 5 showed a small spot, followed by a very faint one. On May 4, these spots had not been seen, and were first visible on the western limb. On May 8, a large spot was seen coming on. From May 8 to May 12, no observation could be made. On May 12, two large spots were seen near the center; one of these was seen before May 8, the other had burst out between May 8 and May 12. The one first seen on May 8 disappeared between May 13 and May 14 at about the center of its course; the other is still visible (May 16), and is at present preceded by a small spot not seen on May 15.

GRANT'S IMPROVED HORSE HAY FORK.

We illustrate herewith a new and ingenious apparatus for unloading hay and like material by means of horse power. The advantages claimed are simplicity and strength, and the adaptability of the device to unloading barley or any like substance, either long or short, ordinarily difficult to handle by appliances of this kind. Fig. 1 is an exterior view, and

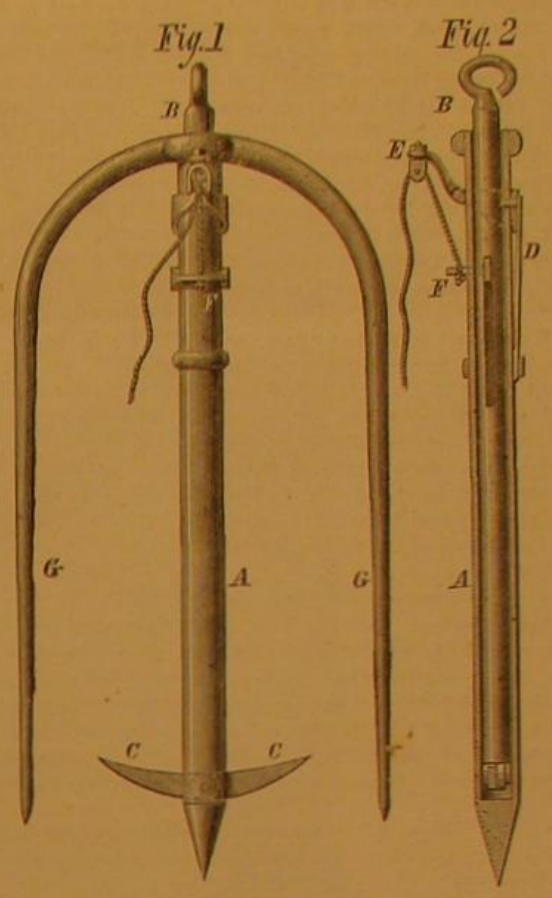


Fig. 2 exhibits a section of the central tubular tine, A. Into this tine fits a tubular plunger, B, which is provided at its upper end with a hook, and is plugged at its lower extremity, where are affixed ears to which the barbs, C, are pivoted. The spring, D, is clamped to the tine by a band and screw, and has a catch pin which passes through the disengaging lever, E, and the side of the tine, and enters a hole in the plunger, B. The lever, E, encircles the tine, and rests under the spring, and is held in place by the catch pin. The end of this lever is bent upward, and is provided with a small pulley. At F, is a key, which passes through a mortise in the tine and through a slot in the plunger, thus serving to limit the motion of the latter. The end of the key is bent over the front of the tine, and is formed into an eye, to which the disengaging cord, which passes upward over the pulley, is attached. At G are lateral tines, which are detachably secured to the central tine, so that, when a light fork is desired, the latter may be used alone.

In using the apparatus, the plunger, B, is drawn upward until caught by the catch pin. In this position, the barbs, C, are retracted. The fork is then lowered into the hay or grain until well buried. The lever cord is then pulled, when the catch pin is withdrawn from the plunger and the latter descends, throwing out the barbs. These as they extend press and pack the material up into the crotchets of the tines. In this position, the plunger is again caught by the catch pin; and as the bottom of said plunger rests on the barbs, the weight thereon is taken off their pivots and brought to bear on the key, F. The load is then lifted. When it is to be discharged, the lever is again moved, the catch pin withdrawn, and the weight causes the fork to descend, the plunger remaining stationary. This causes the retraction of the barbs and consequent release of the hay. The invention received an award and commendatory report at the Centennial Exposition.

Patented through the Scientific American Patent Agency, April 3, 1877. For further information relative to sale of territory, etc., address Peter Grant, Clinton, Ontario, Canada.

A Large Passenger Steamer.

The new steamboat, the Massachusetts, of the New York and Providence line, was built by Mr. Steers, of Greenpoint, N. Y. Her dimensions are as follows: Length, 325 feet; beam, 46 feet; beam, over all, 76 feet; depth of hold, 16 feet 4 inches. The frames are of white oak and locust and cedar, the floor timbers of white oak, and the top timbers of locust and cedar. The deck is of white pine. The launching weight of the Massachusetts, without the machinery or joiner work, was 1,000 tons. The engine is of the vertical beam type, with all the recent improvements. There is a 90-inch cylinder with a stroke of 14 feet. The wheels measure 39 feet 7 inches in diameter. There are two smoke pipes. The boat will be steered by steam. The interior arrangements are very handsome.

THE dreaded *hemileia vastatrix*, which has hitherto been confined to coffee plantations of Ceylon and Southern India, has at last made its appearance in Sumatra, and in all probability will find its way before long to the neighboring islands where coffee is grown.

A WONDERFUL WATCH.

In the accompanying engravings we present the remarkable watch which that able scientist, Mr. Mark Twain, says "knows considerably more than the average voter," and "comes nearer to being a human being than any piece of mechanism I ever saw before." Mr. Twain probably did not have in his mind the modern reaper, which picks up grain, makes it up in bundles, cords it, and ties a knot in the cord, or the Jacquard loom, which weaves portraits, or the talking machine, or the perfecting Hoe and Walter printing presses, all of which are very much more human-like in their performances than this watch, when he ventured the above opinion; so that we cannot fully indorse his thoughtful remark, but it is none the less true that the timepiece is an exceedingly ingenious specimen of horological skill.

We are not going to explain the machinery, because we want to print something else in this issue, and our readers might not enjoy reading about nothing but this watch, as would be the case if we described it in detail. Therefore we give several beautiful engravings of the works, and a general description of what they accomplish.

Fig. 1.

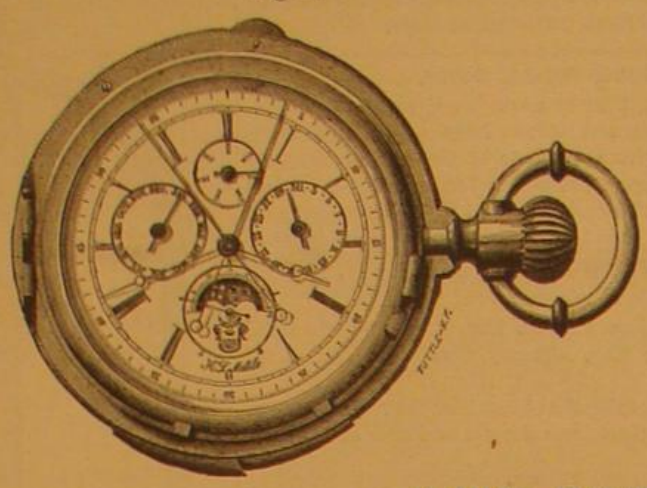
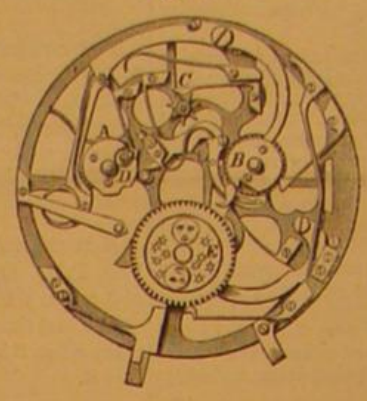


Fig. 2.



MATILE'S WATCH.

In Fig. 1 is given a view of the face of the timepiece, showing four small dials. There is of course, first, the usual dial for noting the time. Beside the two hands necessary for the latter purpose, are two long hands which point to a graduated scale which, divided in 60 parts and subdivided to fifths of a part, surrounds the circumference of the dial. These two hands normally both point to twelve. Suppose we are timing two horses starting

Fig. 3.

at different times. The instant the first horse is off, we press a stop on the side; then hand No. 1 starts marking seconds. When the second horse starts, we press the stop again, and hand No. 2 begins its movement in the same direction. At any desired moment the stop is pressed a third time, and

Fig. 4.

both hands are instantly arrested. Finally a fourth pressure on the stop sends the two hands back to twelve. Just under the XII mark is a small dial which shows the day of the week; another dial on the right exhibits the day of the month, another on the left the name of the month, the fourth below has a hand which beats fifths of seconds, and also an open face through which a golden moon on a blue enameled sky can be seen. This moon follows exactly the phases of our satellite; so that the time of new or full moon is instantly seen. The moon besides has a stop of her own, so that she can be set a day or more ahead in adjusting the watch, and another stop serves to regulate the month and day dials. The watch, besides, is a repeater; and on pressing still another stop, it sounds first the hour, then a certain number of times to indicate the quarter, half, or three quarters past, and then the requisite number of separate strokes to tell the minutes elapsed since the quarter. Leap year and February 29 are fully provided for. There is a little wheel, D, Fig. 2, which makes one quarter revolution per year. In four years it completes its turn, and the hand on the February mark of the month dial stays there for one day longer.

Fig. 2 represents the works just beneath the dial plate. A is the wheel for the month hand, B that for the date hand, C that for the week day hand, and E is the moon wheel. Underneath this mechanism, the machinery looks as represented in Fig. 3. The principal portion of the works that operate the repeater device is here. On turning the watch over and opening the back, intricate mechanism is shown, as in Fig. 4, which exhibits the annular bells, the hammers, and the double winding apparatus.

M. H. L. Matile, of Locle, Switzerland, made this remarkable timepiece, and exhibited it at the Centennial. The mechanism is so perfectly and accurately executed that it requires comparatively little power to be exercised by the main train to accomplish all this work, and this without interfering with the notation of exact time. It should be mentioned that a first-class rating and certificate from the observatory of Neufchatel accompanies the watch, setting forth its surprisingly accurate running qualities. We are indebted to Messrs. Mathey, of 119 Fulton street, this city, for our information.

Where to Buy Sportsmen's Tackle, etc.

Mr. W. Holberton, dealer in sportsmen's goods, of 102 Nassau street, this city, has issued a neat little illustrated pamphlet, giving full descriptions of all the novel and ingenious inventions which increase the comforts and lessen the hard work incident to camping out. Particulars are also given relative to the best guns and fishing tackle, and of the numberless appliances which go to make a sportsman's outfit complete. What with portable stoves, portable tents, portable boats, and portable beds, life in the woods need now involve few of the hardships which go to alloy its pleasures; while if the modern hunter grows in destructiveness with the multitudinous devices, invented for his benefit and here illustrated, certainly more piscicultural societies and more game law makers will find renewed fields for their endeavors. We cannot particularize as to the best things noted in Mr. Holberton's catalogue, although there is one "fly book" which will especially commend itself to anglers, and is, we think, one of the best arranged books we have ever seen. A full description is given of the new glass ball trap for pigeon shooters, which is an excellent apparatus, which we —and Mr. Bergh we are sure will cordially join us—can commend to the notice of amateur shots. Persons dealing with Mr. Holberton have the satisfaction of knowing that his advice as to flies, etc., can be relied upon, as he is a practical sportsman himself. The price of the pamphlet is 10 cents.

PROFESSOR R. H. THURSTON'S AUTOGRAPHIC TESTING MACHINE.

We illustrate herewith the latest and most complete form of Professor Thurston's machine for testing the strength, elasticity, ductility, shock-resisting power or resilience, and the homogeneousness of metal. The material is tested by twisting, by which is obtained a great range of distortion, and the most favorable treatment for revealing all the characteristics of the test piece. The latter is placed between two independent jaws, one of which is rotated by means of an arm in the simpler styles, and in the one here illustrated by a worm, L, and gear, M. The force thus applied is transmitted through the test piece to the other jaw, from which depends a weighted arm or pendulum, B. The resistance offered by this pendulum to the force tending to deflect it from the perpendicular, causes that force to react upon the test piece and produce distortion and fracture. The angular position assumed by the pendulum is a measure of that force. A pencil is secured to the pendulum and is moved when the latter is thrust forward in a direction perpendicular to the plane of rotation, by its contact with a guide curve, F, fastened to the frame of the machine. A cylinder, G, is secured to that jaw which is moved by the gear wheel. The cylinder and the pencil have precisely the relative movements of the two ends of the test piece, so that the length of the curve, automatically described by the pencil upon a paper wrapped about the cylinder, becomes a measure of the degree of distortion or of the ductility, and its height measures the resistance offered by the material. The material thus tells its own story, these elements recording themselves simultaneously and continuously from the initial point to the point of final rupture. The diagrams made by the machine show to the eye at a glance the nature of the material tested, and are very characteristic. The strength of the material is measured on the diagram with a pocket rule or a pair of dividers. Any bright boy can make the tests and interpret the diagrams.

These machines offer facilities for a study of the physical properties of the materials of construction, and of the manner in which molecular changes are induced by the various processes of manufacture and of use. They are in constant use for the tests and researches carried on in the Mechanical Laboratory of the Stevens Institute of Technology, and have been supplied to the United States Navy Yard at Washington, to the Russian and Japanese Governments, and to some of our leading railroads, iron manufacturers, and scientific institutions. The apparatus is especially valuable in testing such metals as cast iron, as it measures extensions which other machines cannot detect to the hundred millionth of an inch. It has been used with success in testing car wheel irons, showing their relative value with accuracy. The purchaser of the machine is supplied with tables by which he obtains accurately the percentages of elongation, and with instructions giving the methods of deducing the strength, elasticity, homogeneousness, and other qualities.

The machine illustrated was designed and made entirely by the students of the class of 1876 of the Stevens Institute of Technology, and was exhibited by them at the Centennial Exhibition. It received the award of the judges. The earlier forms received the gold medal, the highest award at the Exhibition of the American Institute, 1874 and 1875, and the medal of the Cincinnati Exhibition of 1875. The machine is manufactured in the workshop of the Mechanical Laboratory of the Stevens Institute of Technology, Hoboken, N. J., and by Messrs. William H. Bailey & Co., of Salford, near Manchester, England.

The Speaking Telephone in New York.

Professor A. Graham Bell recently exhibited his telephone at Chickering Hall, in this city. Wire communication was established with New Brunswick, N. J., a distance of 32 miles. The lecturer in his first discourse explained the laws of sound, and afterwards the members of the audience were afforded opportunities to converse with Mr. Watson at the other end of the line. Small instruments were used, and the sound produced was not generally audible throughout the hall.

Fall of a Court House.

A new court house, nearly completed in Rockford, Ill., recently fell down, killing ten men and wounding fourteen. The dome was 119 feet from the ground, and was supported by iron columns, which in turn rested on a brick wall. The latter was not constructed of sufficient strength to hold up the superincumbent weight. It accordingly gave way, and was followed by the entire dome and roof, leaving little more than the four walls of the edifice standing.

THE FOUNTAINS AT ARANJUEZ.

About thirty miles to the south of Madrid, the capital of Spain, lies a princely domain surrounding a magnificent country mansion. This is Aranjuez, the summer residence of the King. It was designed and constructed under the directions of Philip the Second, and is reached by a well constructed road connecting it with the capital, as well as by the Madrid and Alicante railway. The palace of Aranjuez contains many noble works of art; but the chief attraction to natives as well as visitors is the park, with its ornamental gardens and fountains. Our engraving represents the Triton fountain, which stands in a shady and secluded spot. The arrangement of the water jets and of the bronze and marble sculpture is exceedingly artistic and effective. Broad double avenues of elms traverse the park, leading to the center; and the walks are lined with box and laurel hedges. The purple buds of the cactus and aloe stand out against the green of the rare shrubs; and the air is filled with the fragrance of the orange blossom.

THE TRITON FOUNTAIN IN THE PARK AT ARANJUEZ.

CALIFORNIAN SEA LIONS.

Of the family of *phocidæ* or seals, the *otariæ*, comprising the so-called sea lions and sea bears, are especially interesting. Like most members of the seal family, they are easily tamed, and are affectionate and docile; they can be taught to sit up, to bow, to kiss the hand, and to perform many tricks. Many of our readers have probably seen the southern sea lions (*otaria jubata*) in the Zoölogical Gardens in London, and also the northern or California sea lions (*otaria Stelleri*) in the Thiergarten at Hamburgh, Germany. The sea lions in Central Park, and at the Aquarium in this city, are of the latter species; and the intelligence and affection for their keepers which they manifest, and their efforts to raise themselves out of the tanks of water in which they are kept, in order to reach their master, are very amusing. Our illustration shows the specimens in the Hamburgh collection above mentioned, the animals being quite young. The males of this genus are about 5 feet long when fully grown, and the females about 4 feet. They yield fur of a golden brown color. Their ears are small, pointed, and pendent, and their eyes are large, full, and expressive. The jaws display, when open, formidable teeth. Their snouts are furnished with long drooping, silver-white bristles. They are found along the coasts on the Northern Pacific Ocean, from Behring's Straits to California and to Japan, and are hunted for their fur, as well as for their flesh, which is a favorite article of diet in the Aleutian Islands. Our readers will at once notice the comparative smallness of the heads and length of the necks, the latter being elongated at will. The prominence of the shoulder blades gives them a hump-backed appearance. They are much more agile than would be supposed from their size and weight, and they move lightly and gracefully through the water. Their bodies are very flexible, and they can scratch their heads, as dogs do, with their hind paws. Their bellowing can be heard at a great distance, and the males are fond of exhibiting their vocal powers; the sound is disagreeable, resembling the cry of a child in distress, although, of course, it is much louder.

In a recent lecture on heat, delivered at the Royal Institution, Professor Tyndall described an invention of Mr. Siemens to detect the oxidation of telegraph cables. It indicates the heat that the oxidation occasions, and thus shows to what extent the rust is forming. It is chiefly of service with cables coiled in tanks.

CALIFORNIA SEA LIONS IN THE HAMBURGH ZOOLOGICAL GARDENS.

The Destruction of the Young Locusts.

The Commissioners selected by Congress to investigate and report on the best means of destroying and preventing the ravages of the locusts have issued their first "Bulletin," under the auspices of the Interior Department. With gentlemen of such ability as compose this Commission, our agriculturists may have reasonable hopes that a remedy may be found for relieving them of the obnoxious and destructive enemy of their crops. The present number has exclusive reference to the destruction of the young insects which will so largely, the Commissioners state, occupy the attention of our Western farmers for the next two months. It is to be followed by a second number, on the natural history and habits of the species. The report says:

"The only feasible way of now destroying these is to plow them deeply under where that is possible. The plowing will be effectual according as the soil is porous or tenacious, and according as the surface is afterward compressed by harrowing and rolling. All other things being equal, a plowing of 4 to 6 inches will prove more effectual, if the ground be subsequently harrowed and rolled, than deeper plowing with no subsequent comminution and compression. We advise the farmers in the locust region to supply themselves with early ripening seed corn, and to prepare to grow more leguminous and tuberous crops than is the custom. But as the principal struggle during the next two months will be with the young insects, we devote this bulletin more particularly to the best means of overcoming them. Heavy rolling, where the surface of the soil is sufficiently firm and even, destroys a large number of these newly hatched young, but is most advantageously employed when they are most sluggish and inclined to huddle together, as during the first eight or ten days after hatching, and in the mornings and evenings subsequently. They then drive almost as readily as sheep, and may be burned in large quantities by being driven into windrows or piles of burning hay or straw. They may also be killed with kerosene, and by means of flattened beating implements, wooden shovels being extensively used for this purpose in Europe. But to protect the crops and do battle to these young locust armies, especially where, as was the case in much of the ravaged country in 1875, there is little or no hay or straw to burn, the best method is ditching. A ditch 2 feet wide and 2 feet deep, with perpendicular sides, offers an effectual barrier to the young insects. They tumble into it and accumulate, and die at the bottom in large quantities. In a few days the stench becomes great, and necessitates the covering up of the mass. In order to keep the main ditch open, therefore, it is best to dig pits or deeper side ditches at short intervals, into which the 'hoppers will accumulate and may be buried. Made around a field about hatching time, few 'hoppers will get into that field till they acquire wings, and by that time the principal danger is over, and the insects are fast disappearing. If any should hatch within the inclosure, they are easily driven into the ditches dug in different parts of the field. The direction of the apprehended approach of the insects being known from their hatching locality, ditching one or two sides next to such locality is generally sufficient, and when farmers join they can construct a long ditch which will protect many farms. We have not a doubt but that with proper and systematic ditching, early in the season, when the insects first hatch, nearly everything can be saved. Where water can be let into the ditches so as to cover the bottom, they may be made shallower, and still be effective. A ditch 3 feet wide, unless correspondingly deep, will be more apt to permit the escape of the insects when once in than a narrower one. In hopping, the more perpendicular the direction the insects must take, the shorter will be the distance reached. Of course, the wider the ditch, if it be correspondingly deep, the more effectual will it prove. In exceptional cases, when the locusts are nearly full grown and the wind is high, so as to assist them, even the two feet ditch loses much of its value.

"Next to ditching, the use of nets or seines, or converging strips of calico, or any other material, made after the plan of a quail net, has proved most satisfactory. By digging a pit, or boring a post auger hole 3 or 4 feet deep, and then staking the two wings so that they converge toward it, large numbers of the locusts may be driven into the pit after the dew is off the ground. By changing the position of this trap, much good can be done when the insects are yet small and huddled in schools. But all modes of bagging, netting, crushing with the spade or other flat implements, and burning, which can be employed to good advantage when the insects first begin to hatch, become comparatively useless when they begin to travel in concert over wide stretches of land. The same may be said of all the mechanical contrivances to facilitate the destruction of the insects; they are useful if used in concert in a given neighborhood soon after the young hatch, but subsequently do not compare to ditching. There are a number of contrivances that have been more or less successfully used, but we cannot treat of all of them in detail. We shall, rather, at this time, content ourselves with descriptions of a few, which will illustrate the principles to be kept in view. Those used in Minnesota, so far as we can learn, are applications of one principle, namely, an open-mouthed bag, dragged by hand or horse power. We have seen a very large one that would take from eight to twelve bushels of pupæ per day; but this was after the insects had been pretty effectually fought by burning and otherwise. It was very effective. Its owner proposes to place his whole dependence on it next year. It had one addition over others that we think valuable. It ran back 10 feet or more to a bag, and near the rear end two or three square feet of cloth had been cut out and replaced by wire gauze. This gave a chance for the air to draw through, and as the locusts worked toward the rear end they made toward the light shining through the wire. This machine was rigged on cart wheels, and the only expense was in getting three long poles from the woods, and in purchasing about forty yards of cotton muslin.

"Major J. G. Thompson, of Garden City, Minn., has used with satisfaction a net made as follows:

"'Two pieces of common batten about 16 feet long were used as framework for the mouth of the net, one for the bottom and one for the top. From the end of the bottom piece a wooden shoe of the same material ran back about 6 feet to steady the trap and serve as a runner. To the rear end of this shoe a similar piece was fastened by a hinge, and ran forward and was fastened to the top piece of the frame, so that the mouth of the trap would open and shut like a jaw. To hold the mouth open, two short upright posts were fastened to the top piece by a hinge, and rested upright upon the bedpiece. The net itself was made of cotton cloth for the bottom, and the top was made of mosquito netting. The mouth of the net extended 16 feet from one side of the trap to the other, and the net ran back about 6 feet to a point with a hole at the end to let out the insects collected. A boy ten years old can draw one end of this net, and by the use of it Major Thompson saved one piece of wheat.'

"Similar machines have been drawn by horses hitched to each side of the trap, being 12 to 16 feet apart. The horses serve the purpose of driving the locusts inward toward the mouth of the net. There have been many forms of these machines, but all on the same general principle. In Colorado, also, machines have been used to good advantage, most of them having for their object the burning of the young insects. Mr. J. Hetzel, of Longmont, uses a burner drawn by horses. It is 12 feet long, 2 to 2½ feet wide, and made of iron, set on runners 4 inches high. An open grate on the top of the runners is filled with pitch pine wood, and a sheet covers the grate to keep the heat down. The grate is generally made with a network of heavy wire, such as telegraph wire. Two men and a team will burn 10 to 12 acres a day, and kill two thirds of the insects, but it requires a hot fire. Mr. C. C. Horner gives in the *Colorado Farmer* the following more detailed description of a machine which works on the same principle:

"'It consists of three runners made of 2x4 scantling 3 feet in length, to be placed 6 feet apart, making the machine 12 feet wide, runners to be bound together by two flat straps or bars of iron (the base being 12 feet long). Across the top, bars of iron hold the runners firmly together and form a frame across which wire can be worked, to make a grate to hold fire. The upper part of the runners should be hollowed out so that the grate may glide along within 2 inches of the ground. A sheet iron arch should be set over this grate to drive the heat downward. This machine is very light, and can be worked with one horse. Pitchwood is best adapted to burning, and can be chopped the right length and size and left in piles where most convenient when needed. This machine is intended to be used when the little 'hoppers just make their appearance along the edge of the grain, going over the ground once or twice each day, or as often as necessary to keep them killed off. The scorching does not kill the grain, but makes it a few days later. This is certainly the cheapest manner of getting rid of this pest, as well as the most effectual.'

"Mr. Rufus Clark, of Denver, according to the same paper, uses a piece of oilcloth 9 to 12 feet long and 6 feet wide. One side and each end are secured to light wooden strips by common carpet tacks, and the corners strengthened by braces. The oilcloth is smeared with coal tar, purchased at the Denver gas works at $7.50 per barrel, and the trap is dragged over the ground by two men, a cord about 10 feet long being fastened to the front corners for that purpose. The entire expense of the 'trap' is about $3.50; and as it is light and easily handled, it will be found serviceable on small as well as large farms. Zinc, instead of oilcloth, has also been used for the same purpose. When the insects are famishing, it is useless to try and protect plants by any application whatever, though spraying them with a mixture of kerosene and warm water is the best protection we have tried, and will measurably answer when the insects are not too numerous or ravenous.

"The best means of protecting fruit and shade trees deserve separate consideration. Where the trunks are smooth and perpendicular they may be protected by whitewashing. The lime crumbles under the feet of the insects as they attempt to climb, and prevents their getting up. By their persistent efforts, however, they gradually wear off the lime and reach a higher point each day, so that the whitewashing must be often repeated. Trees with short, rough trunks, or which lean, are not very well protected in this way. A strip of smooth, bright tin answers even better for the same purpose. A strip 3 or 4 inches wide brought around and tacked to a smooth tree will protect it, while on rougher trees a piece of old rope may first be tacked around the tree and the tin tacked to it, so as to leave a portion both above and below. Passages between the tin and rope or the rope and tree can then be blocked by filling the upper area between tin and tree with earth. The tin must be high enough from the ground to prevent the 'hoppers from jumping from the latter beyond it; and the trunk below the tin, where the insects collect, should be covered with some greasy or poisonous substances to prevent girdling. This is more especially necessary with small trees, and kerosene or whitewash having Paris green mixed with it will answer as such preventives. One of the cheapest and simplest modes is to encircle the tree with cotton batting, in which the insects will entangle their feet, and thus be more or less obstructed. Strips of paper covered with tar, stiff paper tied on so as to slope roof fashion, strips of glazed wall paper, and thick coatings of soft soap, have been used with varying success; but no es-toppel equals the bright tin. The others require constant watching and renewal, and in all cases coming under our observation some insects would get into the trees, so as to require the daily shaking of these morning and evening. This will sometimes have to be done, when the bulk of the insects have become fledged, even where tin is used, for a certain proportion of the insects will then fly into the trees. They do most damage during the night, and care should be had that the trees be unloaded of their voracious freight just before dark. Most cultivated plants may be measurably protected from the ravages of these young by good cultivation and a constant stirring of the soil. The young have an antipathy to a loose and friable surface, which incommodes them and hinders their progress, and they will often leave such a surface for one more hard and firm. Finally, though insisting on ditching and the digging of pits, as, all things considered, the best and most reliable insurance against the ravages of the young locusts, we would urge our farmers to rely not on these means alone, but to employ all the other means recommended, according as convenience and opportunity suggest. Another method of destroying the young has been proposed and to a certain extent adopted. It promises, if carried out effectually, to be of much advantage. It is to protect the prairie grass from fires until spring, and, after the bulk of the eggs are hatched, to simultaneously burn over the entire neighborhood, township, or county, or as far as the combination may extend. This requires concerted action and considerable watchfulness, but if carried out rigidly will destroy a very large number of insects, and has the advantage of being inexpensive. It is inapplicable on the cultivated grounds, but applies to the areas where the other measures are least effective.

"One of the most effectual means of destroying the young locusts, and one which is too often overlooked because its effects are not so directly apparent, is the preservation and multiplication of the native birds. Without undertaking at this time to specify the species which should be especially protected, and about which there is yet some difference of opinion, we feel warranted in stating that until the useless species in this respect are distinguished from those that are beneficial, it is best to protect all insect-eating birds; and if the laws of the State are insufficient for this purpose, let communities, townships, and counties use all their lawful powers therefor. Chickens, turkeys, and hogs devour locusts in immense quantities, and thrive during years of locust invasion or whenever these insects abound. Prairie chickens and quails devour them with avidity, and even hunt for their eggs; swallows and blackbirds pursue them unrelentingly; the little snow birds devour great quantities of eggs when these are brought to the surface by the freezing and thawing of the ground, and the same may be said of almost all birds inhabiting the western country in winter. The good offices of birds were everywhere noticed in 1875. Professor F. H. Snow, of Lawrence, Kan., found the young locusts in the gizzards of the red-headed woodpecker (*melanerpes erythrocephalus*), yellow-billed cuckoo (*coccyzus Americanus*), cat bird (*mimus Carolinensis*), red-eyed vireo (*vireo olivaceus*), great-crested fly-catcher (*myiarchus crinitus*), and crow blackbird (*quiscalus versicolor*), species that had not been noticed to feed on them before. The shrike or butcher bird impales them on to thorns and other pointed substances; and a number of other birds, as well as reptiles, such as toads, frogs, and snakes, feed upon them. We therefore strongly recommend the raising of as large a number as possible of hogs and poultry, both as a means of utilizing and of destroying the young locusts."

The States of Missouri, Kansas, and Minnesota have passed laws granting bounties for capturing and destroying, or otherwise preventing the increase and ravages of the grasshopper.

The Effect of Tobacco on the Human System.

In the fourth annual report of the Michigan State Board of Health, Dr. Scott relates something new in the influence of tobacco on the human system, as follows:

"There has come under my notice for several years, but more particularly during the last two years, a kind of rheumatic condition of the walls of the chest. The patient complains of a dull heavy pain in the chest walls. The disease in a large majority of cases is confined to the left side. The pain is circumscribed and limited to a space of not more than two inches in diameter, just below and a little to the left of the left nipple. At times the pain is very severe, and always constant day and night, when the patient is awake. I have investigated the disease to some extent, and find it to be more common among tobacco users, especially those who use the weed to excess. Patients suffering from this complaint invariably come to their physician with the belief that they have heart trouble. I have not found signs of organic lesion in any of the cases that I have examined, but there does exist in some of them what might be called 'irritable heart.' I am convinced that the greater number of these cases are the result of intemperance either in the use of tobacco or other stimulants, for the reason that, when the patient abstains from the use of them for a short time, his pain ceases and his condition improves. In one case, where the patient abstained from the use of tobacco for thirteen months, the pain entirely ceased; but at the end of this period the gentleman recommenced the use of tobacco, and after three weeks' use the old pain returned with all its severity. I am certain that quite a number in this vicinity are receiving treatment for heart disease, when, if they would reform in tobacco using, they would speedily recover."

NEW YORK ACADEMY OF SCIENCES.

The chemical section of the Academy of Sciences held their regular monthly meeting at 64 Madison avenue, Monday evening, May 14, 1877, Dr. J. S. Newberry, President, in the chair.

Mr. Henry Newton, E.M., exhibited some plates illustrating the paleontology of the Black Hills. The President spoke of the failure on the part of Congress to appropriate sufficient funds to pay the cost of their publication, thus throwing much of the expense of this very useful and practical survey upon Mr. Newton and his colleagues. Mr. Newton will soon return to the Black Hills to finish the survey begun by him and Mr. W. P. Jenney last season.

Mr. C. Chamberlain exhibited a specimen of the new mineral—astrophyllite—from El Pasoz county, Colorado. This mineral contains 13 ingredients, including titanium, tantalum, copper, etc. It is micaceous, but the laminæ are not flexible; it is of a yellowish color, and in powder looks like Mosaic gold. Also specimens of analcite with apophyllite, from Lake Superior.

The first paper of the evening was entitled

THE RELATION BETWEEN MALARIA AND VEGETATION,

as shown in the vicinity of New York, by General Egbert L. Viele. The speaker began by stating that in his plan of Central Park, which he made twenty years ago, he made a botanical garden one of the features of the Park. It was thrown out then, but now it is proposed to do what he then proposed. He next spoke of the drainage of the city, and exhibited a map showing the ancient watercourses. Many of these streams, he said, were supplied from perpetual springs, which will continue to flow until the end of time, yet no provision has been made to carry off the water of these springs; the city is absolutely without drainage. He had hoped that a botanical garden in the Park would develop certain plants that have the power of neutralizing the injurious effects arising from want of drainage. At that time 70,000 species of flowers and trees were growing in the Park, most of them being kept browsed down to 6 inches or a foot. The relation between plants and animals was next referred to; and much credit given to the researches of Tyndall, Huxley, Darwin, Pasteur, Bastian, and Haeckel. The opposite views of these investigators had promoted research and had been of great benefit, but much still remains unknown. The microscopist knows how close is the resemblance of plants to animals in the lower forms of life, how they seem to pass from one to the other. In higher forms of life, the refuse of one is the food of the other, so that they mutually sustain each other. An equilibrium of the two is a necessity for a wholesome state of the atmosphere. The tendency of civilization and the gravitation of people together into large cities is upsetting the equilibrium of natural forces. There is not enough vegetable life here to consume the refuse of the animal life. What are these surplus elements? They are everything that is offensive to any of the senses, whether in air, earth or water, indoors or out of doors, by day or by night. One of the results of this surplus of animal refuse is malaria. It has been established that there are present everywhere certain destructive principles which may at times and under favorable circumstances develop into malaria. We owe this word *mal aria* to the Romans, and it meant with them "bad air," which is recognized the world over as the cause of disease. The Greeks called it *miasma*, and built temples to Æsculapius to void off its evils. We wonder at their idolatry and ignorance, but our own ignorance is almost as great in regard to its true character. Malaria implies bad air; miasm, infection floating in the air. Under what circumstances does air become an agent in propagating such diseases as plague, cholera, yellow fever, and smallpox, which have destroyed millions, and are still at their deadly work? The speaker then spoke of the usual classification of diseases for statistical purposes, under "malarial," "zymotic," etc., in which malarial embraces all those which distinguish one country from another, one year from another, and which have at times decimated cities and countries. He stated that three fifths of all the deaths in the world result from miasmatic diseases. These have gone on from age to age almost unchecked and unrestrained, the average death rate increasing. He then spoke of the plague, cholera, smallpox, yellow fever, and their ravages in historical times; and said that an erroneous impression prevailed that malarial diseases are restricted to intermittent fever, chills, and fever and ague, which prevail wherever drainage is defective or the soil has been disturbed. People think that these fevers are never fatal, and come to think of malaria as something we can endure and become accustomed to. There were 30,000 deaths in this city last year, more than half of which were due to malarial diseases. He next referred to the three chief theories held by physicians in regard to malarial diseases; first, the gaseous theory, that they are due to certain gases; secondly, the vegetable theory, that they are due to germs; thirdly, the specific poison theory. Malaria has a history, a geology, a botany, a chemistry, a topography, a geography; yet all these have failed to explain it. It is hoped that the new science of biology will do more for it. Many of these diseases attack a person but once, and are contagious; a certain time elapses between exposure and the development of the disease. They generally run a certain length of time. These are called acute specific diseases. Could any gas do this? We know none with such power. The theory of specific poison only substitutes a general term and explains nothing, but only removes the question a step further. The vegetable theory is most worthy of study by biologists. The speaker exhibited a drawing of the *penicillium glaucus* magnified, also of a drop of blood from a patient that died within 48 hours with smallpox; the latter viewed under a microscope was as lively as a pond full of fish. The similarity of the two forms was quite remarkable.

Nearly the entire food of plants is derived from the air. It must be the refuse of the animal world, things which are hurtful to animal life. We all know that the country, where vegetable life predominates, is more healthy than the town. Tyndall has shown the presence of minute organisms in the air, and how they can be developed into larger forms. This island was, in its primitive state, a most beautiful place, and now how changed! Nature is for ever dethroned, the rivers are encroached upon and polluted, watercourses are cut off; the supersaturated soil gives off these germs of disease which make it as bad as the Roman Campagna. Central Park has become a mass of shrubbery through which no winds can blow, and is dotted with pools of stagnant water. Let this be remedied, and let botanists plant there those trees which are capable of consuming most of these poisons, and let our citizens aid to destroy the poison by the same means. The speaker concluded by pointing out on maps that, where fevers most abound, there have formerly been watercourses, and showed that the Roman fever was likewise brought about by the destruction of drainage systems and watercourses.

A somewhat spirited discussion followed, in which Dr. Newberry remarked that the *globulus* and the other species of *eucalyptus* known to us at present, are not sufficiently hardy to endure our climate, but expressed a hope that the mountainous portions of Tasmania might yet give us a more hardy species, or that those known may be gradually acclimatized to our latitude by beginning to cultivate them further south.

Mr. Alfred R. Conkling then read a very interesting paper on the

GEOLOGY OF LAKE TAHOE AND VICINITY,

illustrated by a large blackboard map. The region about this lake seems to be an exceedingly interesting one. On the east side, near Carson City, are several hot springs with water at temperatures of 111° Fah. to 120°. The formation is quarternary. There are several gold mines on the east side of the lake, in quartz and granite, and several shafts have been sunk. In some of these mines copper minerals are also found. At the northern end of the lake is a peak called Mount Rose, 1,082 feet high. There are two other outcrops of igneous rocks on the east summit, one of which is called Shakespeare's Cliff, from the grouping of lichens on one side, which resemble that famous dramatist. The other is called Cave Rock. The lake itself is 21 miles long, and 12 broad at the widest part. Its depth near the south end is 900 feet, and increases to 1,645 near the north end. The temperature of the water is 54° Fah. It lies 6,000 feet above the level of the sea. On the west side are mineral springs whose waters contain carbonic acid and sulpheretted hydrogen gases, and have a temperature of 46° Fah. They are bottled and sent to Carson City. On the same side are some ridges and peaks. Evidences of ancient glacials are abundant. One of these old glaciers was equal to the Mer de Glace. The paths of several others are marked by morains. In the neighborhood are some small lakes, the basins of which may have been dug out by glaciers. At the southwestern side is a bed of graphite. Echo Lake, near by, is so called because there is no echo there. North of the lake is a hot spring, the water of which has a temperature of 132° Fah.

Dr. Newberry made a few remarks on this interesting phenomenon of a deep cold lake on the top of a mountain, and the probability of its being the result of glacial action.

Fly Paper.

Powdered black pepper is mixed with syrup to a thick paste, which is spread by means of a broad brush upon coarse blotting paper. Common brown syrup will answer, but syrup made from sugar is preferable, as it dries quicker. For use, a piece of this paper is laid upon a plate and dampened with water. The paper may also be made directly at the mill by adding sugar to the pulp, and afterwards ¼ to ½ of powdered black pepper, and rapidly working it into a porous absorbent paper.

INTERNATIONAL POSTAL ORDER SYSTEM.

Since the system of interchange of our postal orders with those of foreign countries, persons abroad can remit small amounts to this country safely and without any trouble. It is a great convenience to the public to be able thus to transmit money, and to publishers it proves especially convenient.

In a letter before us, from Leeds, England, the writer states: "There appears some difficulty in getting your papers at reasonable prices in this country. We are at the mercy of news agents, who seem to charge what they like. I would suggest the advisability of your inserting the subscription price by post, as a means of increasing the circulation of the paper to a considerable extent, for it is increasing every day in the estimation of engineers and others." Now, had it occurred to our correspondent that he could readily have deposited his pounds or shillings with the postmaster at Leeds, to be transmitted to us, he would probably have done so, in place of scolding the news dealers; and likely there are many other intelligent foreigners who would like to have the SCIENTIFIC AMERICAN, but who do not know how to remit for it. So, in accordance with the suggestion of our correspondent, we annex a list of prices, in the currency of different countries, for the SCIENTIFIC AMERICAN, for the SCIENTIFIC AMERICAN SUPPLEMENT, and for both papers, as the subscriber may desire:

POST-OFFICE MONEY ORDERS FROM THE FOLLOWING COUNTRIES AT PRICES ANNEXED, WHICH COVERS POSTAGE.

The prices here given are for one year's subscription, including the postage.	SCIENTIFIC AMERICAN.	SCIENTIFIC AMERICAN SUPPLEMENT	SCIENTIFIC AMERICAN and SUPPLEMENT together.
Austria	S. Florins 9	13	20
Belgium	Francs 20	30	46
Denmark	Kroner 15	23	35
France	Francs 20	30	46
German Empire	R. M. 16	25	37
Great Britain	Shillings 16	24	36
Holland	H. F. 9	14	21
Italy	Francs 20	30	46
Norway	Kroner 15	23	35
Russia	Roubles 5	8	11
Sweden	Kroner 15	23	35
Switzerland	Francs 20	30	46

Deposit either of the above amounts in any of the important post offices in Great Britain or Ireland, or in any country on the continent of Europe, making the order payable to MUNN & Co., New York city, and send us the receipt, with the name of the sender, and the address to which the paper is to be mailed.

NEW BOOKS AND PUBLICATIONS.

HOW TO TEACH ACCORDING TO TEMPERAMENT AND MENTAL DEVELOPMENT; or Phrenology in the School Room and the Family. By Nelson Sizar. Illustrated. Price $1.50. New York; S. R. Wells & Co., 737 Broadway.

Although physiologists generally believe that phrenology has not yet settled itself into a fixed science, its disciples invariably use its theories as mathematical axioms and undisputed facts. The many instances in which its teachings are nullified, by the fine skull development of many idiots and criminals, have done little to shake the faith of believers in the suggestions of Gall and Spurzheim; and as is usual in such cases, those celebrated craniologists would have been surprised to find their ideas (founded with apparent justification on the comparison of many heads) resolved into arguments as to the direction of the studies of youth. The volume before us attempts to do this; and it is illustrated by engravings of various types of heads, from which many people might deduce a theory that a man's errors and vices are due not to his immoral nature or his neglect of self-control, but to the shape of his head.

HOW TO RAISE FRUITS: a Handbook of Fruit Culture. By Thomas Gregg. Illustrated. Price $1.00. New York city: S. R. Wells & Co., 737 Broadway.

This little book is a thoroughly excellent and practical treatise; and it has our special commendation, not only on account of its valuable instruction to fruit growers, but for its conviacing demonstration of the value of fruit, to the farmer as a source of a revenue, and to the consumer as an article of diet.

A HISTORY AND HANDBOOK OF PHOTOGRAPHY. Translated from the French of Gaston Tissandier. Edited by J. Thomson, F.R.G.S. New York city: Scovill Manufacturing Company, 419 to 421 Broome street.

M. Tissandier is the editor of our excellent contemporary *La Nature*, and one of the best French writers on popular scientific topics. In the present volume he has combined a history and a useful manual of the photographic art, the latter of which is excellently adapted for the purposes of the amateur. For general perusal, the work can be especially commended, as it gives in pleasant, readable style, a capital account not only of photography but of many of the new processes, for the mechanical reproduction of pictures, dependent on photographic manipulation. The subjects of photo-micrography and astronomical photography are fully discussed. The illustrations are numerous and remarkably good; and an appendix is added, giving many valuable practical recipes.

Inventions Patented in England by Americans.

From April 24 to April 30, 1877, inclusive.

CARRYING WEIGHTS.—J. E. Barlow, Sing Sing, N. Y.
CHEMICAL TELEGRAPH.—C. A. Randall *et al.*, New York city.
CONCENTRATING SULPHURIC ACID.—F. W. Kalbfleisch, Brooklyn, N. Y.
EMERY WHEEL.—I. P. Brown, Jr., Newark, N. J.
FEED WATER HEATER.—G. Steel, New York city.
HYDRAULIC LIFT, ETC.—H. R. Plimpton, Boston, Mass.
JOURNAL BOX AND BEARING.—W. B. Bishop, New York city.
LIFE BOAT.—G. Bates, Massachusetts.
MILLING MACHINERY, ETC.—T. D. Jones, Syracuse, N. Y.
PROPELLING VESSELS, ETC.—J. H. Carpenter, New York city.
RECORDING THERMOMETER, ETC.—R. K. Boyle, New York city.
REDUCING ORES, ETC.—C. M. Dupuy, Philadelphia, Pa.
REFRIGERATOR CAR.—J. M. Ayer, Chicago, Ill.
SHIP'S BERTH, ETC.—J. C. Thompson (of Brooklyn, N. Y.), 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 MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED COMBINED COTTON CHOPPER AND SCRAPER.

Empson C. L. Bridges, Brick Church, Tenn.—In this machine the frame to which the hoes or choppers are attached is vibrated by suitable gear connection with the transporting wheels, and the said vibrating frame can be raised and lowered by a crank shaft, and adjusted forward or back by a like adjustment of the sliding frame to which it is attached. The scraper, which goes in advance of the chopping mechanism, may be adjusted laterally by a treadle mechanism.

IMPROVED CAR COUPLING.

Edward B. Middleton, Charleston, S. C.—This coupling is composed of a hook fixed on a rod which slides vertically in suitable bearings in the drawhead. When two cars meet, the hook engages with a catch block, which is also fixed on a vertically sliding rod in the opposite drawhead. The upper ends of the said rods project above the drawheads and are provided with enlarged heads which are so constructed that they tend to hold the hook and catch block in proper position, lengthwise with the drawhead.

IMPROVED DOUBLE ACTING ANTI-FREEZING FORCE PUMP.

Henry M. Wyeth, Richmond, Ind.—This invention is intended chiefly to provide a submerged double acting porcelain lined pump, which shall be of a simpler construction and less expensive manufacture than those heretofore made. It is an improvement upon that form of pump in which two inlet valves are employed in connection with a single outlet valve arranged in a side pipe which opens into both ends of the cylinder. The invention consists mainly in casting the pump and the side pipe in a single piece, which secures the desideratum of cheapness, and with the greater portion of the said pipe offset or removed from the periphery of the cylinder so as to leave a space between, which permits the successful lining of the pump with porcelain.

IMPROVED COMBINED CENTER AND CARRIER FOR LATHES.

Charles A. Niebell, Scranton, Pa., assignor to himself and P. Franz, of same place.—This device is so constructed as to enable the workman to get the correct center of a shaft without its being necessary to remove the work from the lathe more than once. It may be adjusted to correspond with a long or a short center. It also may be used for gas pipe centers, on shafts for cutting off the riser, for facing pipes, and as a chuck upon any kind of a lathe.

IMPROVED NUT LOCK.

Joseph C. Wright, Philadelphia, Pa.—The object of this invention is to construct a nut in such manner that it may be rigidly held on its bolt, when set in position, by inserting a packing of soft metal or other material capable of expansion, into a recess cut, punched, or swaged in the face of the nut in such manner that the packing may have a direct bearing on the thread of the bolt.

IMPROVED HOSE COUPLING.

William B. Kilbourne, Auburn, Me.—This hose coupling may be readily united. It is not liable to clog so as to prevent it from being quickly put together, and the threads cannot be crossed. The lugs of one part are placed in the recesses in the other part, and the parts of the coupling guided by the lugs are brought squarely together. A sleeve is then moved forward and screwed on the threads of the recessed part by means of a spanner placed on the lugs.

IMPROVED PUMPING APPARATUS.

Waldemar F. Plockross, Fagundus, Pa.—This relates to apparatus used in pumping oil or water from deep wells. It consists of a suitably braced right angled lever, which swings on a pivot between stationary posts, and is connected at the end of its horizontal arm with the pump rod, and at the lower end of its vertical arm, by means of rods, with any convenient motive power.

IMPROVED CORNSTALK PRESS.

Edgar P. Davis, James E. Davis, and John Fisk, Crete, Neb.—This is an improved machine for pressing cornstalks, weeds, hay, brush, etc., into small bundles for fuel. It presses the material compactly, holds it securely until bound, and is so made that one person can be sawing the bundles into lengths while another is passing the bands around them.

IMPROVED PUMP.

Michael Cook, West Le Roy Mich.—The object of this invention is to provide an improved means for giving motion to the piston; also for counterbalancing the same, and for readily removing the lower valve of the pump without removing the pump from the well. An advantage gained by the peculiar construction of this pump is, that the displacement of water by the enlarged piston rod reduces the weight of the water resting on the piston.

IMPROVED STEERING PROPELLER.

Clemens Uller and Jasper N. Bennett, Columbus, O.—The object here is to provide, as an auxiliary device for vessels already built, or to be built, an improved propelling and steering apparatus, by which the vessel may be propelled to the right or left, forward or backward, without stopping the engine. The invention consists of a vertical revolving shaft, with horizontal paddles that are submerged in the water and turned alternately into horizontal position by a cam of a sleeve around shaft, said sleeve being adjusted by a steering lever, in connection with a disk and ratchet device.

IMPROVED FOLDING BOAT.

John H. Bates, Nanticoke, Pa.—This consists in the arrangement in a boat of a folding bottom, folding ribs, and flexible sides, and a removable rail, seat, and oar lock. A covering of canvas, or other flexible waterproof material, is attached to the boat bottom by means of nails, and is secured to the rails at the top of the boat by straps which are engaged by buttons that project from the rails and from the posts at the bow and stern. The boat thus constructed is light and strong, and is capable of being quickly taken apart or put together, and when taken apart it may be folded together and packed in small compass.

IMPROVED STEAM ROAD WAGON.

George W. Wade, Clam Lake, Mich.—The track wheels are made large and with wide flanges upon the inner sides of their rims, to serve as tracks for the small driving wheels to run upon, so that the machine may lay its own track as it advances. A power is applied to the axle, the driving wheels roll forward upon the flanges of the track wheels, and are all the time rolling up a slight inclined plane. Should the track wheels, or either of them, strike an obstruction, they will stop, while the driving wheels will roll up a steeper inclined plane until the center of gravity has passed the point of resistance, when the track wheels will gently tilt over the obstruction, and the wagon will pass on without jar.

IMPROVED COMBINED NOZZLE AND SPRINKLER.

Neil Malmquist, Brooklyn, N. Y., assignor to himself and John Loyd, New York city.—This invention consists in a sprinkler provided with a short tube in its face directly opposite its screw socket, and having its outer end covered with a perforated cap, with a tube in its side, having the outer end closed. A small marble is placed within to adapt the device for throwing water in a solid stream or a shower.

NEW AGRICULTURAL INVENTIONS.

IMPROVED PLOW.

James F. Wilson and Richard I. Wilson, Calhoun, Ga.—The wings of this plow are so constructed that they may be raised out of, and lowered into, working position separately or both together, as may be desired. They also may be adjusted to prevent small plants from being covered or injured by having soil thrown upon them.

IMPROVED CORN PLANTER.

Robert Fox, Deerfield, Iowa.—This relates to improvements in corn planters; and it consists in an arrangement of plows on an adjustable shaft, by turning which the plows are raised or lowered.

IMPROVED PLOW.

Charles Atkinson, Monterey, Ill.—This is an improved plow for opening trenches and subsoiling. It is so constructed as to clear itself in opening trenches, and may be readily adjusted to work at any desired depth in the ground.

IMPROVED DITCHING MACHINE.

James R. Slaton and John M. Wadlington, Morgansfield, Ky.—This is an improved machine for opening ditches of any desired depth and width. It may also be used with advantage for grading roads, and for various other purposes where soil is to be moved. The scraper may be raised or lowered by the advance of the machine, according as a lever is operated. Devices are provided to lock the scraper in place and hold it down to its work in operating upon hard soil. There is an upper carrier designed for use in opening deep ditches to prevent the soil, and especially clods and lumps, from sliding or rolling back. As the soil reaches the upper end of the carrier it passes into an inclined spout, by which it is conducted to the side of the ditch. The spout may be inclined in either direction to deposit the soil upon either side of the ditch, as may be desired.

IMPROVED CHURN DASHER.

John L. Maxwell, Bentonville, Ark.—By suitable construction, as the dasher is raised, the tendency is to form a vacuum beneath it. This opens the valve and draws air into the cavity of the handle and the cavity of the dasher. As the dasher is forced downward the valve is closed, and the air is forced into and through the milk. This introduction of air, and the peculiar form of the dasher, throws the milk into violent agitation and brings the butter quickly.

IMPROVED DITCHER.

Wilbur R. Peet, Viola, Iowa.—With the bottom cutter is connected a rest, supported on any suitable bar, so as to allow the furrow slice to begin to turn only at some distance from the knives, and thus prevent any strain that might arise from tearing the slice. A turning board is arranged, cut and fitting diagonally across the face of the rest, and rising on a gradual lateral slant to and above the bars, so that when the furrow slice rises above the bars it will be thrown over and reversed from its natural position, and not merely turned on end. The turning board is provided with water channels to allow the moisture to drip back into the furrow.

IMPROVED SWINGING GATE.

William A. Ohaver, Monmouth, Ill.—To the shorter end section of the gate is attached a balancing block, which facilitates the swinging of the gate into open or closed position, but which does not entirely balance the longer section, so that the latter is slightly heavier than the block and shorter section, for bearing, by its outer and lower end, either on a notched block when closed, or on the ground when opened, for being retained in either position without propping or holding.

IMPROVED PLOW.

William Clore, Rising Sun, Ind.—This invention consists in so constructing and connecting the share, land side, and colter of a plow, that a close and firm joint will be formed, and the parts always maintained in exactly their true relation to each other.

IMPROVED PLOW.

John M. Looker, Abilene, Kan.—This plow may be readily adjusted for the different kinds of plowing, and to take and leave land. The invention consists in a plow provided with an arrow-head point having its landside wing projecting beyond the line of the landside of said plow; and in the share formed solid with the arrow-head point, made nearly flat, and having the outer part of its forward edge curved forward.

IMPROVED FARM GATE.

Orlando F. Fuller, Lamont, Mich.—This is an improved farm gate that may be conveniently adjusted at suitable distance above the ground, to clear the snow in winter, and admit the passage of smaller animals. It is also self-closing by its own weight as soon as released.

IMPROVED HOP DRYER.

Charles A. Sands, Burlington, Kan.—This invention consists of a hop drying apparatus, consisting of a centrally pivoted box that takes the place of the drying floor. The box has a top and bottom of wire gauze, and hinged end doors that connect with openings in the walls of the upper and lower stories, for charging and discharging the hops to and from the dryer. The end doors of the drying box are provided with transverse rubber cushions or strips for closing the space between the walls and the box when said doors are in a horizontal position, and thereby compelling the heat to pass through the drying box.

IMPROVED HAY RAKER AND LOADER.

John S. Hewitt, Wheatland, Mo.—This is a machine that may be attached to the side of a wagon, which will gather the hay from the ground and deliver it to the hay rack carried by the wagon. As the wagon is drawn forward the machine is set in operation by the rotation of a wheel. The forward motion of the machine gathers the hay on the teeth of the rake. An endless apron elevates the hay and delivers it to another apron, which carries it laterally to the rack of the wagon.

IMPROVED SELF-RAKE FOR HARVESTERS.

Isaac N. Cherry and Robert N. Cherry, Jersey city, N. J.—The object here is to provide a rake for harvesters that will deliver the gavels at the rear of the machine in compact form for binding. The reciprocating motion of the ratchet bars, the teeth of which move the grain along the platform, is continuous, and when a sufficient quantity of grain is carried into the fingers of the delivering apparatus, they first close down on the gavel and then are drawn backward. When the gavel is drawn from the platform the fingers fold down and allow it to pass, but afterward spring up and prevent the escape of loose grain. The entire mechanism is exceedingly ingenious.

NEW HOUSEHOLD INVENTIONS.

IMPROVED NIGHT LAMP.

Harry W. Huntington, Williamsburgh, N. Y.—This lamp is provided with a very small wick tube, and is intended for burning through the night; and by the arrangement of the wick tube the flame is located at a distance above the oil, so that the oil is not heated and gas is not generated, and, consequently, danger is avoided. By the use of a chimney of suitable length smoking is avoided without using many of the devices common to larger and more complicated burners.

IMPROVED SPITTOON.

Pierre Célestin Ste. Marie, Montreal, Canada.—This spittoon is composed of two parts, so constructed and fitted together that when the spittoon is overturned its contents are received by the upper part thereof, thereby preventing soiling of the floor or carpet. The spittoon is supported upon casters, whose stems or pivots are fitted in sockets formed in ornamented bases or enlargements of the base rim of the spittoon.

IMPROVED COMBINED DESK, WASHSTAND, AND BLACKING CASE.

Alexander O. Kirkwood, Yonkers, N. Y.—This consists in the combination, in a single piece of furniture, of a desk having a convenient receptacle for books and papers, a washstand having a convenient reservoir for water, a stationary bowl, an adjustable mirror, and a closet for towels, etc., and also a towel rack and a blacking case, which contains a folding rest for the foot and a place for the blacking and brush.

IMPROVED SPRING BED BOTTOM.

John H. Palmer, Warren, Pa.—This spring bed bottom is so constructed that the springs may be conveniently adjusted according to the weight they may have to support, that the rails may be braced against the pull of the springs, and that the springs may be kept in proper position when under pressure. In it, plates are provided with single or double notched flanges, and made in two parts, with their adjacent ends inclined to cause them to meet at an angle, in combination with the frame and springs of a bed bottom and couplings, formed of two short rods, are rigidly connected by an arm, in combination with the springs.

IMPROVED STOVE MAT.

Christian A. Reimers and John C. Branch, Davenport, Iowa.—The wooden body of the mat is covered with a zinc sheet which is spun over its circular edge. In order to form a raised rim on the zinc a bead is spun, or otherwise formed, on its upper side, near the edge of the mat, and a rod or stout wire is laid in the groove (on the under side of the zinc) to prevent the bead being indented or flattened by blows or pressure.

IMPROVED VEGETABLE SLICER.

Joseph H. Alfred, Rosbach, Iowa.—This consists of a frame containing a pivoted and grated support on which to place articles to be cut, and in a series of knives arranged tangentially to a circle described from the pivot on which they swing, and which pass between the bars of the support. The whole is supported by a frame, to which are attached receptacles for the articles to be cut, and for the slices cut by the apparatus.

IMPROVED KNIFE AND FORK CLEANER.

Albert E. Van Horn, Sebewaing, Mich.—This consists of an inclined scouring table with side rims, having a till or receptacle at the lower end for the scouring powder. A leather strap is stretched on a fork-shaped support for facilitating the cleaning of the forks.

IMPROVED DOOR CHECK.

James B. Everest, Yonkers, N. Y.—This consists in a spring of peculiar shape made from a single piece of spring wire; the object being to provide an inexpensive and simple device that may be readily placed under doors of every description for holding them in any desired position.

IMPROVED TABLE EASEL.

Christine Fisher, Salisbury, N. C.—This easel is adapted to the use of architects, civil engineers, and others, and is so constructed that it may be adjusted to have a level top, or to give its top any desired inclination, and to enable paper of any desired length to be used, holding the part being worked upon smoothly and firmly.

IMPROVED BUTTER AND FRUIT JAR.

Charles A. Sands, Burlington, Kan.—This improvement consists of a butter and fruit jar having a bevelled lid seated by an interposed rubber gasket on the tapering top edge of the jar, and being secured by a rubber band lapping over the lid and the recessed edge. The bottom edge of the jar has also a circumferential recess with a rubber band extending into the recessed part and lapping over the bottom edge, to produce, in connection with the top band, protecting cushions.

IMPROVED ARM REST.

Philo R. Wago, Rockport, Mo.—This is a novel device to be attached to a desk or table for supporting the arm while writing; and it can be adjusted to the required height to suit books of different thickness. In working on large sheets of paper or maps covering the whole desk, it is used to widen the desk, thus making it convenient to write on the extreme lower edge of the sheet. It also can be used with equal advantage in any position which the writer may assume.

NEW MISCELLANEOUS INVENTIONS.

IMPROVED AWL.

George P. Harley, Allendale, S. C.—By this invention leather may be stitched together with rapidity and facility. It has a recess and hook back of the point, and tapering side channels running from the recess to the point.

IMPROVED CARD HOLDER.

Henry J. Herbert, London, England, and Edward R. Wilbur, New York city.—This is an improved device for holding business cards, adapted to be hung upon a wall, and so constructed as to display a card. The chief feature of the invention is a hinged card receptacle, and a case therefor. The rear side of the receptacle is provided with a weight or spring, to draw it closed when released, after having been opened.

IMPROVED WHIP.

George P. Overin, New York city.—The core is formed of one or more strings of gut, and is stiffened and filled out by rattan sections. Hitherto, the rattan sections have not been used with the enameled surface, as the pith only has been employed; but, by this method, the natural strength and elasticity of the outer or enameled surface are retained and utilized.

IMPROVED COPY BOOK.

John W. Manning, Cambria, N. Y.—This consists in an arrangement of movable copies, and in an improved method of fastening the same in the book, which facilitates the operation, so that the copy books may be readily made. The copy slips are of the same length as two of the pages of the book, and are folded in the center and placed on the threads and wire. The copy is moved down the page, so as to cover each line as it is written, so that the scholar imitates the copy and cannot follow the line he has previously written.

IMPROVED FILTER RACK.

Byron Fenner, Westfield, N. Y.—This consists of a filter rack made of a spirally coiled wire, attached by top hook and jointed center link with lower hook to the top and bottom of funnel.

IMPROVED FRUIT DRYER.

Samuel Myers, Adamsborough, Ind.—This consists in novel means employed to pass a current of dry heated air over fruit until it is completely dried, without allowing the air to stand, or that which has been moistened by contact with fruit on lower shelves to come afterward in contact with that on the upper shelves.

IMPROVED HARNESS SADDLETREE.

James McCormick, Glidden, Iowa.—This invention consists in a saddletree made in two parts having lugs formed upon their upper ends, halved to each other, and provided with teeth to mesh into teeth formed upon the under side of the base of the water hook. The lugs are perforated to receive the screw by which the said parts are firmly locked together. Upon the rear end of the screw is formed a loop to receive the back strap, and which also serves as a handle for screwing the said screw in and out. The tree may thus be adjusted to fit the horse's back.

IMPROVED MANUFACTURE OF SPECTACLE TEMPLES AND JOINTS.

Dormer C. Winans, New Haven, Conn.—According to the method heretofore practised, the temples and joint pieces of spectacles have been constructed from separate pieces of metal, and soldered together. The object of the patentee is to cheapen and improve the construction of temples and joint pieces by forming them solid together, or in one piece. For details, see patent.

IMPROVED TALKING AND CRYING DOLL.

William A. Harwood, Brooklyn, N. Y.—The object of this invention is to provide a sound-producing attachment to be applied to the bodies of dolls, which may be blown by the mouth to imitate vocal sounds.

IMPROVED ICE BOX ATTACHMENT FOR COOLING ALE, ETC.

James J. Moloney and Isaac S. Schuyler, Brooklyn, N. Y.—This is an ice box provided with a cooling chamber below the ice chamber, and at one side of the latter with keg compartments. A track with movable hoisting apparatus is arranged above. There is a detachable extension of the tracks upon the outside of the ice box to receive a truck and cask, and a combination of crank shaft and rope for moving the trucks upon the tracks.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion. If the Notice exceeds four lines, One Dollar and a Half per line will be charged.

Notes & Queries

J. B. will find directions for making an æolian harp on p. 315, vol. 33.—J. M. McG., Jr., should read Paddlefast's articles in the SCIENTIFIC AMERICAN SUPPLEMENT.—S. B. W. should read our article on p. 33, vol. 33, on the horse power of an engine.—C. S. S. can calculate the proportions of gear wheels by following the directions on p. 107, vol. 34.—C. D. L. will find on p. 26, vol. 33, an excellent recipe for paint for outdoor work.—C. A. S. should vulcanize his iron castings. See p. 315, vol. 33. This also answers S. T. B.—A. S. C. will find directions for fastening leather or rubber to metal on p. 101, vol. 34.—H. W. S. will find directions for making printers' rollers on p. 283, vol. 31.—C. S. M. will find directions for raising mushrooms on p. 129, vol. 34.—R. B. L. will find on p. 360, vol. 34, directions for renovating clothing.—A. T. N. is informed that the galvanic action set up by putting zinc into an iron boiler is supposed to prevent the formation of scale.—J. W. G. & Co. will find tables of the specific gravity of water in Box's "Practical Treatise on Heat."—B. B. will find something on the passage of water through pipes on p. 48, vol. 29.—I. P. I. will find directions for making wood incombustible on p. 103, vol. 34.—J. J. will find a good recipe for liquid blacking on p. 73, vol. 26.

(1) A. B. R. and many others: The Spitz dog is very closely related to the white or arctic wolf, and has much of the same habit and temperament. Dr. Hammond thinks that the Spitz is a cross between the Pomeranian hound and the arctic fox, and that it is probable that the saliva of the animal is nearly always poisonous in our climate, and particularly so when the dog is at all irritated or excited. It is safe to say that the Spitz dog has never been completely domesticated, no matter how many years have been spent in his education. Nature has fitted him with a very warm and thick coat of fur, which allows him to be acclimated only in the arctic regions, whence he has evidently been brought, an unwilling captive. In appearance, the dog, at maturity, generally averages 26 inches from the tip of his sharply pointed snout to his tail, which is quite bushy, and in general curls up over his back. He stands about 12 or 15 inches high. His head much resembles the fox in shape; the ears are small, and the entire body is thickly covered with beautifully white, stiff hair, that stands more or less straight out from the body. This hair is very long—in some cases as much as three inches—especially around the head, throat, and flanks, and gives the dog the appearance of having a much larger body than is really the case.

(2) C. S. V. says: A friend argues that a cow can at will hold up her milk, that she can purposely hold it to go dry. Can this be true? A. The secretion of milk by the cow is wholly involuntary. But it is within her power to prevent the flow of milk from the udder under ordinary circumstances. It is best that the animal be relieved of her milk whenever the udder becomes fully distended.

(3) E. T. V. asks: What is the law as to the examination of druggists' clerks in New York city? A. All pharmacists must present satisfactory credentials or certificates of competency and qualifications to the Board of Pharmacy, when, on payment of a fee of two dollars, and enrolling their names and places of business upon the register, they are entitled to a certificate from the Board. In order to register, the person must be a graduate in pharmacy, a licentiate in pharmacy, or a graduate having a diploma from some legally constituted medical college or society. Graduates, in the meaning of the law, are those persons who have had at least four years' experience in stores where prescriptions of medical practitioners have been compounded, and who have a diploma from any college of pharmacy within the United States, or from some authorized foreign institution or Examining Board. Licentiates are those who have had at least four years' experience in stores, etc., and who shall have passed an examination before the Examining Board or Board of Pharmacy. Applicants for examination must pay a fee of five dollars to the Board, and pass examination before receiving a certificate. Persons failing to comply with the law are subject to a heavy fine.

(4) H. W. S. says: We use wood baskets for throwing charcoal on forge fires, and they are thus exposed to the fire, and are charred and burned. What cheap preparation can we use as a coating to protect them? A. Use a strong solution of tungstate of soda in hot water, or one of waterglass. The tungstate costs about 25 cents per lb. The fireproof asbestos paint is, we believe, a waterglass mixture of the asbestos powder. See our advertising columns.

(5) T. McC. asks: 1. Is it possible to mix benzine and water? A. No. 2. Is it possible to mix linseed oil and water? A. No; but the oil may be saponified by heating with an alkali, and the soap so formed dissolved in water. 3. Is there anything that will dissolve glue without heat or water? A. Try strong acetic acid. 4. Is there anything that, if put on rosin, will destroy it? A roof that is newly tinned has streaks of rosin on the joints, and I want to get it off without damaging the paint. A. We do not know of anything of the kind. Rosin is quite soluble in turpentine, benzine, naphtha, etc. 5. What is the quickest dryer for distemper color? A. See answer to C. D. R., p. 300, vol. 36.

(6) C. H. W. asks: What is there about concentrated lye to cause an explosion? A short time since a lady near Crawfordsville, Ind., was making soap and was using concentrated lye; she had put a box of lye in a kettle, and when she thought it was boiled out, she took it in her hands, and it exploded (there being a small quantity left in the can), injuring her hand very much. She has since taken lockjaw from the injury. A. We are at a loss to explain this strange occurrence. You evidently have not given us all the facts in the matter. You should have stated what kind of a box contained the lye, and what else was in the boiler at the time. Ordinarily there is nothing in potash or soda lye that can directly cause an explosion such as you describe.

(7) C., in speaking of an article published in our issue of March 24 on "Light and the Distances of the Stars," says: I question a problem that finds the distance of stars by the light which comes from them at a rate of 185,000 miles per second without knowing how long the light has been traveling. A. We reply by saying there are no such problems, the distances of but very few of the stars have been or ever can be measured; these are measured by accurately observing their position with regard to other stars; and then, six months after, when the earth has made one half of a revolution around the sun, or, in other words, has moved 185,000,000 of miles to the right or left of its former position, observations are again taken. And if there is no apparent change in the position, then we have no means of determining their distance; but if there should be a slight change of position, the same as there is when a person moves his head while looking at objects at different distances from him, then, knowing the distance we have moved and the amount of displacement produced, we may compute the relative distances of the objects. With those which have no apparent displacement, their distance is only a matter of reasoning: Take a group of stars like the *Pleiades;* if they are not at a very great distance from us, then they are quite near to each other; and as they have no motion to prevent, they would be drawn together by their mutual attraction. Therefore we reason that they are immense distances away from us and from each other, and the apparently small motions which they have are velocities which we have no conception of. But whether it takes light thirty years or thirty thousand to reach us makes very little difference, as the distance of either is incomprehensible. Some persons have asserted that the immensity of space must be filled with stars, or else the outside ones would be attracted toward the center, and thus fall together. But this is not so, for a group of stars may have an orbital motion in which the centripetal and centrifugal forces are balanced, in which case it requires no outside attraction to keep them in position.

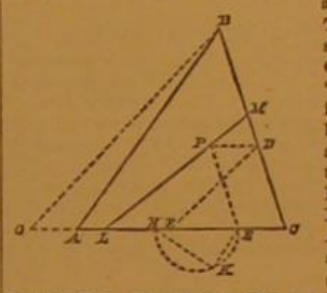
(8) S. B. G. asks: Why is it stated in textbooks that a degree is longer at the pole than at the equator of the earth? A. It is because the length of the degree on the earth is not measured from its center, any more than a degree on an ellipse is measured from its center of gravity. It is measured from the center of a circle of which the curve between the points measured is a part; therefore a degree at the equator is measured on a circle of shorter radius than at the pole. The length of the degree being proportional to the radius of the circle on which it is measured, it will be longest at the pole.

(9) T. H. L. asks: 1. Why is it that some people, who seem to be quite strong in other respects, find it so difficult to climb hills, while others, whose physical development seems to be no better, walk up them without any apparent difficulty? A. The only assignable cause is an existing difference in the physical powers—strength of muscle and lung capacity—in comparison with the total weight. The difference between many people in this respect is often a radical one. 2. What is the best means that may be used to overcome the difficulty? A. Physical culture in general is the only thing to be observed. Work in the open air and partake in moderation of nutritive food.

(10) J. O. M. asks: How is the copper plating deposited on iron? A. It is usually applied by dipping the chemically cleaned iron in a hot bath of solution of sulphate of copper.

(11) D. C. H. says: Some months ago there appeared in a journal of *materia medica* an article describing a new kind of pottery which was said to stand wonderful fire tests. Can such an article be used in restoring sulphuric acid after the oil refiners have used it? A. There is no ware of this kind that we know of that would prove of much service for your purpose. See p. 268 (No. 17), vol. 1, of SCIENTIFIC AMERICAN SUPPLEMENT.

(12) W. E. B. says, in reply to W. H. B.'s query as to bisecting a triangle by a line passing through a given point: The following solution is from Gillespie's "Land Surveying." Let A B C be the given triangle, and P be the given point. From P draw P D parallel to A C and P E parallel to B C. Bisect A C in F, and join F D. From B draw B G parallel to F D, and bisect G C in H. On H E describe a semicircle. On it set off E K = E C. Join K H and set off H L = K H. Then L M, drawn from L through P, will be the required line bisecting the triangle.



(13) A. C. says, in reply to C. A. C., in regard to circumferential velocity of disk to cut cold iron: We find the best speed to be that which gives a circumferential velocity of about 24,000 feet per minute, using a steel disk 42 inches in diameter, and from ¼ inch to $\frac{1}{16}$ inch in thickness.

(14) W. A. M. asks: What is boro-silicate of soda? A. It is a glass or enamel made with borax (biborate of soda), soda and silicic acid (sand).

(15) E. W. asks: How can I make a cement or wax, suitable for sealing glass bottles containing a liquid? A. Fused paraffin is often employed for the purpose, also sealing wax. Sealing wax may be made according to the following recipes: Fine red, No. 1: Shellac (bleached), 4 ozs., cautiously melted in a bright copper pan over a clean charcoal fire. When fused add 1¼ ozs. Venice turpentine, and 3 ozs. vermilion. No. 2: Shellac 3 lbs., Venice turpentine 19 ozs., finest cinnabar 2 lbs.; mix, and fuse as before. No. 3.—Same as last, but use half the amount of vermilion. Common red: Resin 4 lbs., shellac 2 lbs., Venice turpentine and red lead, each, 1½ lbs. Bottle wax, No. 1.—Black resin 6¾ lbs., beeswax 2 ozs., finely powdered ivory black 1 lb. No. 2.—As last, but substitute Venetian red or red lead for ivory black. Fine black, No. 1.—Shellac 60 parts; very fine ivory black in impalpable powder, 30 parts, Venice turpentine 2 parts. No. 2: Resin 6 parts, shellac and Venice turpentine, each 2 parts. Soft red: Beeswax 8 parts, olive oil 5 parts, Venice turpentine 15 parts, and red lead to color. Green: As last, but substitute powdered verdigris for red lead. The addition of a little camphor makes the wax burn better. The bottles should be dry, and, if possible, warm.

(16) J. S. B. and others, who ask about postage stamp mucilage: The government mucilage, used for postage stamps and envelopes, is said to be made as follows: Gum dextrin 2 parts, acetic acid 1 part, water 5 parts. Dissolve in a hot water bath, and add 1 part alcohol.

(17) H. G. says: I am running a horizontal engine of 4 inch cylinder and 6 inch stroke, with an upright tubular boiler, the outside measure of which is 30 inches by 6 feet; and I experience considerable difficulty in keeping up steam, and am in doubt as to whether the trouble lies in the engine, which is a pretty old one and loses steam somewhat, or whether the boiler is too small. What is the nominal horse power of the engine and of the boiler? A. You might settle the question definitely by measuring the water evaporated by the boiler, and using a brake at the same time to determine the power exerted by the engine. Any guess we could give from the data sent would be of very little value.

(18) R. G. G. asks: Will you please inform me how a compass is carried on an ironclad vessel, so that the iron will not have any effect on it? A. It is either put up so high as to be out of the influence of the iron, or the effect is counteracted by magnets.

(19) J. H. M. says: 1. I have a 1½ horse power steam engine, and an upright boiler 22 inches high and 16 inches in diameter. The boiler has twenty 1¾ inch tubes. Cylinder is 3x4 inches, pipe from boiler to cylinder is ¾, and exhaust pipe 1 inch. Engine when started frequently throws water up the exhaust pipe; and when at work it will often throw up a stream of water, which, unless shut off, puts out the fire. Sometimes it will run all day without throwing water. What are the cause and the remedy? A. You do not send sufficient particulars to enable us to form a decided opinion. From your statement, it seems probable that the circulation in the boiler is not very good, and that the water level is not maintained constant. If this is a correct view of the case, you may derive some advantage by introducing a dry pipe, such as is used on locomotives. 2. The pump on the engine also troubles me occasionally, unless I loosen the cap of the first supply valve and let in a little air to start the suction, it will not pump. With a little air, it works all right, but causes a leak of water. A. It may be that the connections are too small for the speed at which it is run.

(20) B. S. asks: What are the advantages of cars running on trucks with 4 or 6 wheels *vis à vis* to the cars of two axles, with 4 wheels only? A. Every one does not think that trucks are an advantage, as you doubtless know; but their advocates consider that larger cars can be used, that will run more steadily, and go around sharper curves. You will find a good discussion of the subject in the "Catechism of the Locomotive."

(21) W. D. D. says: I have a tank which holds 800 barrels of water, and one 3 inch pipe from bottom of tank 300 feet long, to fill a street sprinkling wagon tank. The water does not half fill the 3 inch pipe. What is the cause? A. It is quite likely that the pipe has high points in which the air collects, and thus reduces the effective area.

(22) G. W. B. asks: If a gallon bucket be placed 20 feet under water, the top of the bucket being closed and a ½ inch pipe placed in the top and reaching up through the water through which the air may pass out, the bottom of the bucket being open, how long will it take for the bucket to fill with water? How long will it take for each distance under water for a ¾ inch pipe? A. The difference of time in the several cases would vary as the square roots of the depths. There would be no appreciable difference with the two pipes.

(23) T. H. says: In your reply to W. L.'s query as to why a gun barrel scatters the shot, you said: Generally it is due to the fact that the barrel is not true or is foul, or to the shape of the breech. I have got a rifle and it is an easy matter to hit a nail head in a fence 20 feet off with a bullet: but I cannot hit a cap book cover with 20 shot, as they scatter from 4 to 5 feet from the mark? A. You are confounding two distinct articles.

(24) E. H. says: A. claims that, when a steam fire engine goes to work from a cistern she is pumping water, and, when the same engine goes to a plug and receives all the water she wants, that she is only discharging what she receives in her pumps or wells. B. claims that a steam fire engine is pumping water, no matter how or by what means she gets it. A. There seems to be some confusion of terms in these questions, but we answer according to our understanding of them, that the pump when at the well both draws and forces water, while at the hydrant it only forces.

Why are the front wheels of a wagon so much smaller than the hind ones? A. Principally to enable it to turn readily.

(25) L. F. C. asks: Why does the light coming to us from fixed stars appear to twinkle? A. Because of the sudden changes in the refractive powers of different strata of the atmosphere, which are not sensible in the case of stars that have perceptible disks.

(26) J. H. S. says: 1. I have an engine of 16 inches bore and 36 inches stroke. I am driving the same at 75 revolutions, with steam 10 lbs. to the inch, cut-off at half stroke. The engine is doing all that it is safe to drive with it, by shaft 8 inches in diameter. Belt is so large that it will hold the engine still at any part of the stroke. I wish to drive two engines, each as powerful as the one I now have; and I propose to add one of the same size on the other end of the shaft. The experts here say that I must make the shaft as large again as it is, and the belt also. I say that both belt and shaft are as large as is required, as they have beaten the full power of the one engine. A. It is possible that you are right; but you cannot know without making an experiment. At most, however, the size of the shaft will not have to be greatly increased. 2. How long is the expanding steam useful after being cut off? Condensation has nothing to do with this; I take the ground that there is useful effect in steam until it is down to the pressure of the atmosphere, assuming in this case that there is no condensation. My opponents say that if the engine takes 10 lbs. of steam to turn it over the center, that the expansion is of no use after the pressure has fallen below 10 lbs. I say that there is useful effect in steam as long as it is above the atmosphere, and so long will it give out useful effect on the piston. A. You have the right idea, but somewhat too extended. If there is any back pressure, that is the limit of the expansion. 3. Is there any advantage in the engine valves like Corliss' over ordinary valves? Take the common slide valve with a cut-off on the back of the main valve, the top valve to be worked by the governor so as to cut off the steam at any part of the stroke. Is this advantageous, and which is the best of the two systems? A. The valve that closes most quickly, and is the most nearly balanced, will give the best results, other things being equal.

(27) H. T. says: I see in your SUPPLEMENT an article on compressed air, stating that there is at least 50 per cent lost. How does this loss occur? If I force 10 cubic feet air into 1 cubic foot space, would it exert a force of 150 lbs. to the square inch, and would it not give back all the power that it cost to compress it, less the friction for packing, etc.? A. The statement to which you refer gives the reason. The air, instead of being allowed to expand and give back the power required to compress it, is supposed to be admitted for the whole of the stroke.

(28) J. H. G. says: 1. I am building an engine 4¼ x 4½ inches, and wish to put it into a boat, with fine lines, 30 feet long, of 7 feet beam and 30 inches draught. Please give me the probable speed obtainable, the engine using steam at 100 lbs. pressure for ¾ of the stroke and making 500 revolutions per minute? A. Probable speed from 9 to 10 miles an hour. 2. What should be the heating surface of boiler and diameter and pitch of the screw? A. Heating surface of boiler, 150 square feet. Propeller, as large as can be submerged, of 3 feet pitch.

(29) M. T. S. says: I am making a machine of cast iron for cutting fruits and vegetables. What paint or varnish should I put on it to keep it from rusting? A. Paints or varnishes will not answer for this purpose. It is best to have the iron nickel or silver plated. See p. 232, vol. 36. "Prevention of Rust on Iron."

(30) G. C. Q. asks: 1. What volume of water in the state of vapor can be absorbed by a given volume of sulphuric acid before the acid becomes completely saturated? A. Strong oil of vitriol will absorb more than twice its volume of water vapor; but as the dilution proceeds, the absorbing power of the acid decreases proportionately. 2. What is the most simple method by which the acid can be rid of the water it has absorbed, so that it is ready to absorb again? A. The only way is by evaporation with the aid of heat in glass, porcelain, or platinum vessels.

(31) G. E. asks: How can I mix paint that will do for painting steam pipes or the parts of an engine which are heated by steam? If I use water color it rubs off; if oil, it turns dark from the heat? A. If you do not wish to use a dark color, mix your paint to a lighter shade than it is permanently to be, and let the heat deepen to the color till it sets.

(32) J. V. B. says, in reply to D. D., who asks what is the cheapest and best preparation for the preservation of shingles: Use 3 lbs. of green vitriol in water to the 1,000 shingles. This preserves the shingles and renders them to a great extent fireproof. Shingles made from wood of evergreen trees are best.

(33) R. B. R. asks: Is there any instrument in which, as in a reservoir, electricity could be stored up, so as to be used occasionally as need might require to produce motion? If I should employ a windmill to generate electricity by a Gramme machine, could I store up the electricity until it acquired a certain and sufficient tension, and then draw from it as I choose, without the necessity of using plates, porous cells, carbons, etc., and without danger? A. No. A battery composed of Leyden jars may be charged with statical electricity, but the quantity of electricity that can be so stored is limited, and it is difficult to retain the charge for any length of time. Low tension electricity, such as is used on telegraph lines, cannot be stored.

(34) J. F. D. says: Some time ago I made a voltaic pile, which I cannot get to work. I put circular blanks, 4 inches in diameter, thus: Copper, zinc, fabric, copper, zinc, fabric, etc., punched holes in center of them, and piled them up around a stick. Please tell me what is necessary to make it work? A. Remove the stick and moisten the pieces of cloth. The shape of the disks does not in any way influence the strength of current. Make the cloth the same size as the disks with which it is in contact. It will require several hundred of the couples to produce a sensible spark.

(35) A. B. asks: How can get I rid of lice in poultry? A. Make the roosts perfectly clean with hot soap and water, and afterwards apply spirits of turpentine or kerosene oil. Also strew some sprigs and branches over the floor of the coop. The building should be kept clean.

(36) S. R. S. says: Having read that an engine has been disabled by putting a bar of soap in the tank, I wish to know what the action of the soap in the boiler was? Did it cause foaming? A. Yes.

How can I take grease spots out of fine felt cloth without injuring the cloth? A. Moisten the spotted parts thoroughly with pure benzole, and immediately cover them on both sides of the cloth with dry pipeclay or tripoli powder. Then place under a weight for some time, and the spots will disappear.

(37) H. E. L. asks: Is there anything that will remove Indian ink stains from drawing paper? A. There is nothing that we know of, except a good steel eraser or sanded rubber. Indian ink contains finely divided carbon, which is unaffected by any ordinary solvent.

(38) J. A. H. asks: What size of wire and how much in length shall I use for magnets for the electro-magnetic engine described in SCIENTIFIC AMERICAN SUPPLEMENT No. 19, to give the most power with a single Calland cell? If I use 2 cells, how shall I connect them? What is the rule for estimating the resistance of batteries and of magnets and other wire connections, in order to proportion one to the other? Mr. Sawyer says, in describing the engine above referred to: "No. 34 wire is the best size for magnets;" you say, in answer to a subsequent inquiry on the same subject, "use No. 18 wire." Can you explain this? A. With a given battery the greatest magnetic effect is obtained when the resistances of the battery and magnetizing helix are equal. The average resistance of a medium size Calland cell in good condition is about 1·5 ohms, consequently the resistance of the helix should be the same according to the above statement, and this is equivalent to about 350 feet of No. 18 or 90 feet of No. 23 pure copper wire. With a Grove cell, large wire and fewer convolutions would be best.

(39) H., L., & Co. ask: Does the putting of concentrated lye in boilers, to soften the scale, injure the iron? A. The lye will have little effect on the iron, but may cause the water to foam.

(40) C. R. asks: How can the lambskin aprons used by freemasons be cleaned? I used benzine; it frees them of dirt, but makes them look dingy and yellow. A. Have you tried soap and water? It is not probable that the benzine would leave a stain on the wool if used in excess. Bisulphide of carbon is among the best solvents for oil and grease, and will perhaps give better results than the benzine. Try also wood naphtha. If too little of the solvent is used, it will only carry the stain from the surface further into the material. It should be observed that all of these oil solvents tend to destroy the pliability of the leather and necessitate its re-priming or oiling after drying.

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

D. M. B.—It is a coarse sand formed by the disintegration of granite. If you look at it with a strong magnifying glass, or low power microscope, you will find it composed of films of mica, orthoclase, and quartz crystals. It contains some iron oxide and pyrites.—N. B. B.—They appear to be all carbonate of lime crystals—calcite. The varieties of calcite are very numerous and diverse in their diaphaneity, crystalline structure, and color, the variation being due to the different modes of origin and impurities.—W. R. L.—It is graphite or plumbago, mixed with clay.—E. D. R.—We have not been able to classify the shells, as they were very much broken and imperfect.—M. M. B.—It is a hematitic iron ore, containing crystals of iron pyrites. See p. 7, vol. 36. It is of little value.—A., Bros.—It is graphite, an allotropic form of carbon, sometimes called plumbago and black lead. It is found associated with sphene, tabular spar in granular limestones, with pyroxene, spinel, chrondrolite, hornblende, scapolite, syenite, and gneiss, and in some iron ores. It is used for lead pencils, in black-lead crucibles, and as a substitute for oil in lubricating machinery; and it constitutes what is known as stove blacking. It is found in many parts of the United States, and is mined at Ticonderoga and Fishkill, N. Y., at Brandon, Vt., and in North Carolina. Its market price is from 3 to 6½ cents per lb.

COMMUNICATIONS RECEIVED.

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

On Flying Machines. By D. J. C.
On Fire Escapes. By J. M. C.
On Interference Colors. By H. M.
On Compressed Air. By F. G. W.
On a Snake-Eating Frog. By C. F. S.
On a Needed Invention. By J. E. E.
On Microscopy. By P. T.
On the Flight of Birds. By J. H. H.
On Cutting Gears. By M. J. S.

HINTS TO CORRESPONDENTS.

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

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 sells hydraulic rams, and where can circulars descriptive of them be obtained? Who makes steel wire, suitable for spiral springs, to be wound cold? Who sells sal soda and soda ash? Who buys bones, and what are they worth? Who sells machines for setting pins in rubber cloth, for making metallic hair brushes?" 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

April 24, 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.

Air, cooling, etc., M. J. Kelly (r) ... 7,643
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Bottle stopper, C. Sedgwick ... 189,906
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Brick kiln, E. R. McDougal ... 190,069
Broom heads, making, D. Squier ... 190,066
Butter worker, D. A. Frick ... 190,024
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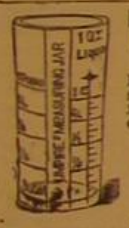

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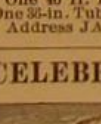

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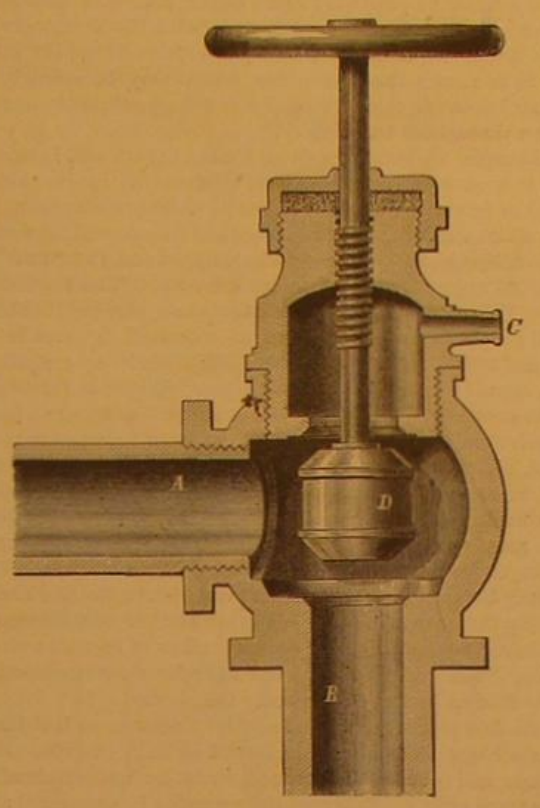
The Speaking Telephone in New York.

Professor A. Graham Bell has recently completed a series of three lectures, in which he introduced his speaking telephone to New York audiences. There can be no question but that the instrument is a most wonderful invention. Without the aid of any battery, using only the current induced in the circuit by its permanent magnet, the telephone on the occasion of the last lecture transmitted musical sounds and speech from Yonkers to New York, a distance of 26 miles. With the battery attached, melodies and chords played on a small organ at Yonkers were distinguishable throughout the large hall where the lecture took place. It is a most bewildering sensation to hear a song faintly emitted first from a box on the stage, then from another suspended overhead, and finally from a third across the room, as the operator switches the current from one telephone to another.

Professor Bell prefaced the exhibition of his instrument with a brief account of the principles on which it is based, and gave an interesting statement of the investigations leading to its invention.

WIGGINS' IMPROVED RELIEF AND SAFETY STOP VALVE.

The improved stop valve illustrated herewith is designed to prevent the accidents due to the careless closing of the feed pipe while the pump is in motion. It is so constructed as always to leave an open discharge. In the annexed engraving, A is the opening leading to the pump. B is the conduit to the boiler, and C opens into the atmosphere. There are two valve seats, one on each side of the opening, A. D is a double valve which may be adjusted to rest upon the lower seat, and so close the passage to the boiler, or upon the upper seat, and so shut off the discharge. It can never close both openings at once; so that there is always a free discharge for the water. In the shell above the upper seat, there is a chamber through which the water passes to



the discharge opening. The stem is screw-threaded, so that the valve may be easily adjusted to either seat. It will be seen that, should the discharge of water into the boiler be stopped while the pump is at work, the water will escape through the passage, C; and there will be no danger of bursting the pipes or breaking the pump.

This valve is used exclusively on the Atlas farm engine, made at the Atlas Works, 700 North Second street, St. Louis, Mo.

Patented through the Scientific American Patent Agency, March 20, 1877. For further information, address the inventor, Mr. Charles P. Wiggins, 1940 O'Fallon street, St. Louis, Mo.

THE SOUTH STREET BRIDGE, PHILADELPHIA, PA.

The large and handsome engraving on this page is a perspective view of the South Street Bridge, Philadelphia, Pa. We select the engraving from the pages of *Engineering*, which journal published the following description, from the pen of Mr. W. Barnet Le Van, a well known engineer of Philadelphia.

The bridge commences at the intersection of Chippewa and South streets upon the eastern side, to the high ground of the Almshouse property beyond the Junction and West Chester Railroads on the west side of the river, connecting with Spruce street. The entire length of the structure is 1,934 feet 7 inches, consisting of two fixed spans 195 feet 8 inches each, and a draw 198 feet 2 inches in length, supported by a pier at each end of the draw and one in the center to receive the pivot. Each end pier is formed by two columns of cast iron 8 feet in diameter, cast in sections 10 feet in length, 1¼ inches thick, with inside flanges 2¾ inches wide by 1¼ inches thick at top and bottom of each section. The flanges are pierced with holes 5 inches apart, from center to center, to receive 1¼ inch bolts. The bottom flange is omitted in the section forming the bottom of the column, when in position, for greater facility in penetrating the soil.

[*Continued on page* 354.]

SOUTH STREET BRIDGE, PHILADELPHIA, PA.

Scientific American.

ESTABLISHED 1845.

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New subscriptions will be entered from the time the order is received; but the back numbers of either the SCIENTIFIC AMERICAN or the SCIENTIFIC AMERICAN SUPPLEMENT will be sent from January when desired. In this case, the subscription will date from the commencement of the volume, and the latter will be complete for preservation or binding.

VOL. XXXVI., No. 23. [NEW SERIES.] *Thirty-second Year.*

NEW YORK, SATURDAY, JUNE 9, 1877.

Contents.

(Illustrated articles are marked with an asterisk.)

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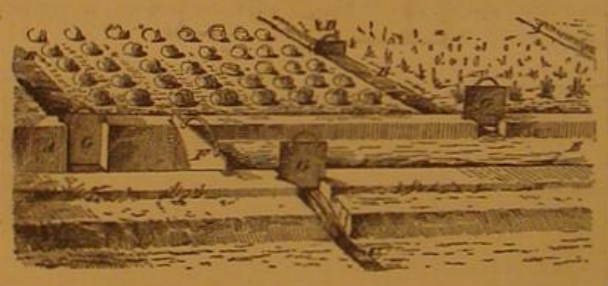
THE SCIENTIFIC AMERICAN SUPPLEMENT,
No. 75,
For the Week ending June 9, 1877.

SEWAGE IRRIGATION ON A SMALL SCALE.

It is now generally conceded that the application of sewage to purposes of irrigation is the only process which fully meets all the requirements attaching to the disposal of that material. It is the only one which, while it purifies the sewage, efficiently realizes the highest profits, and may be carried on without creating any nuisance or detriment to the health of the neighboring inhabitants. This is the opinion expressed by Dr. Wilson in his recent admirable work on "Hygiene," and it is fully corroborated by the very extensive review of the whole subject of the disposal of sewage which is embodied in that model official document, the Report of the State Board of Health of Massachusetts for 1876. The conditions under which the sewage of a village may thus be turned to agricultural profit, and at the same time the pollution of streams be prevented and a public source of disease removed, are by no means complicated; while the advantages which actual experiment has shown to be secured are so great as to render the matter one which may be strongly commended to the careful attention of village authorities and farmers throughout the country.

The simpler the details of the work, the better; and in this view it is recommended that for villages the application should be by surface carriers, in lieu of underground piping. Land which has been worked in ridge and furrow will require leveling, that is, the soil should be stripped and the ground be broken up, so as to bury the surface even. The English Rivers' Pollution Committee state that main carriers should be laid in nearly level lines, so as to command the area below; and secondary carriers, from half a chain to a chain apart, should contour the entire surface. The main carriers may be covered in, having valves or sluice boards, of an inexpensive and simple kind, to retain or let out sewage as required. These carriers should be of brick or earthenware pipes, in size proportioned to the volume of sewage to be distributed. Conduits below 18 inches in diameter may be made most cheaply of earthenware pipes; brickwork may be cheaper for conduits of larger cross sections. Small carriers may be formed of small agricultural tiles, but jointed and laid only three parts in the soil, so that one tile or more can be removed temporarily at any point to allow of surface overflowing. All ordinary conduits may be open trenches, readily formed by hand labor or by the plow.

In the first place, the land must be prepared so that the beds shall have a slope varying from 1 in 50 to 1 in 150. If not loose and porous, the ground must be underdrained. The sewage must be delivered (by pumping if necessary) at the highest point on the irrigated area, whence it is distributed by gravitation. The annexed diagram exhibits the



arrangement usually adopted where only the main carrier is of brickwork or pipe and the branching carriers mere trenches. A is the main conduit, dammed at various points by gates, as shown at F. By opening the gates, G, any trench, B, C, etc., may be made to distribute the sewage over any part of the field; and the flow is limited by placing the dam, D, at any desired point. The sewage flows uniformly over the surface of the land, each plot being irrigated for a few hours at a time, and once in every three to twelve days, as is necessary: grass, for instance, may be treated much oftener than vegetables.

The amount of land necessary depends somewhat upon the character of the soil and the climate. The English Rivers' Pollution Committee prefer one acre for the sewage of every 150 people. The Earl of Warwick, however, who has one of the most successful sewage farms in England, has one acre of land for every 50 people. In England, Scotland, and France, no difficulty has been found in irrigating through the winter. In our northern climate, where the ground often freezes to considerable depth, the results, it might be expected, would not be so uniformly successful; but judging from experiments made at Berlin, where the soil sometimes freezes to a depth of three feet, there is reason to believe that irrigation is well accomplished the year round.

The effluent water from sewage farms is often so pure as not to reveal any evidence of contamination to the chemist; and it has been freely used for drinking purposes without bad effects. The following data relative to the utilization of the sewage of the Augusta (Maine) State Asylum will serve to show how the system may be put in practice on a small scale, and the results it secures. In this case, the sewage passes by gravitation into large tanks where it is mixed with a quantity of absorbents (straw, leaves, muck, etc.). The solid parts are from time to time carted on to the land, and the liquid passes off, often quite clear and sparkling, to be used on the land for irrigation. A portion flows over a few acres, from which three crops of fine hay were cut in 1875. Another part is used for hose irrigation of the vegetable garden, care being taken not to sprinkle the leaves. A third part is carried to different sections of the farm and distributed from a vehicle which acts on the principle of an ordinary street watering cart, though different in principle. Seven thousand gallons of sewage are disposed of in this way daily, and the results are as follows: What was formerly a nuisance has become inoffensive. The hay crop on the land irrigated by gravitation had increased sixfold, and increase is also noted in other crops. The system pays for itself through the greater value of the crops raised (labor, however, being that of patients, costs nothing); and irrigation was efficiently carried on during the coldest weather. In such cases as the above, and generally in all where the sewage of a comparatively small number of people is to be disposed of, the subsoil method of irrigation may likewise be advantageously used. By this system the sewage is carried to a safe distance from the houses in tight pipes, and is then distributed in open jointed pipes about one foot below the surface of the ground. Subsoil drains are placed at a depth of four feet to carry off the purified liquids. Colonel G. E. Waring some time ago described in the *Atlantic Monthly* his application of this system to the removal and utilization of a country house as follows: "The house drainage is discharged into a tightly connected and thoroughly ventilated tank. Its outlet pipe, starting from a point one foot below the surface of the water, and about two feet below the capstone, passes out near the surface of the ground, and is continued by a cemented vitrified pipe to a point about 25 feet further away. Here it connects with a system of open jointed drain tiles, consisting of one main 50 feet long and eight lateral drains, six feet (the writer has since stated that half this distance is better) apart, and each about 20 feet long. These drains underlie a part of the lawn and are only about 10 inches below the surface." The slope from one extreme of the system to the other is only 15 inches. The pipes require cleaning about once a year.

PREVALENT MANIAS.

The blue glass mania has had its day. The bar rooms are removing their signs of "cocktails in blue glass," and the cerulean goblets, wherein those seductive and presumably sun-strengthened beverages were dispensed, may be purchased for small sums from the cheap china vendors on our sidewalks. We notice a diminution in the sheets of blue glass hung in windows of private dwellings, "signs," some one calls them, "to inform the public of the gullibility of the inmates;" and in fact the only evidence at hand which exhibits any vitality of the now rapidly collapsing blue glass mania is the production of a cheap variety of note paper, called the "Pleasonton," because the pasteboard box in which it is contained has a blue glass lid. The General can doubtless explain the efficacy of the glass in this connection. Blue glass, therefore, has had its run, its inventor has earned his notoriety, and also the thanks of the glass dealers, who have reaped a fine pecuniary harvest.

Two new manias are at hand, to wit, the celery cure and metallo-therapy. "Celery is the greatest food in the world for the nerves," says one of our contemporaries: and the information is traveling the length and breadth of the land. It is fashionable nowadays to call every ailment that flesh is heir to a nervous disease; and where our ancestors would have resorted to such homely remedies as a hot drink and simple cathartics, the present practice demands chloral, and bromides, and quinine, and strychnine, and phosphates, and rare chemicals without number. Of course celery is pleasanter to take than most drugs; and now that it is brought forward as a new nervine, plenty of people will use it. As it can do no harm, and, indeed, may actually work good by checking the too prevalent consumption of "nervous specifics," the mania is rather a benefit than otherwise, and should be encouraged. Wild celery or smallage is known to possess some narcotic effect, and is reputed as unhealthy. As regards the medicinal properties of cultivated celery, there are no utilizations of them in the United States Pharmacopœia; but as celery (*apium graveolens*) belongs to the same family as the parsley (*apium petroselinum*), it is probable that it would yield apiin and apiol, as such substances are obtained from the latter. Apiol acts as a tonic, similar in its effects upon the system to quinia.

The other mania, metallo-therapy, to which we have already briefly alluded, is perfectly harmless, and at present is confined to France. *Les Mondes*, of recent date, reports another "astonishing cure"—a child four years old this time, almost dead with meningitis. The metallo-therapy inventor enveloped the infant—there is no Children's Protective Society in France—in plates of iron and copper from head to foot. Half of the body was covered with one metal, half with the other, in order "that both metals might have an equal chance of doing good." In eight hours, the child revived; in six days, it was out of danger; in a month, it was well. Manufacturers of iron and copper plate may now consult with blue glass makers as to how to advertise this.

SAFETY VALVE TESTS.

In September, 1875, a Special Committee of the United States Board of Supervising Inspectors of Steam Vessels made a series of experiments to determine the proper proportions for safety valves and to test the relative merits of such valves as were furnished by manufacturers. Their report has just been published by the Government; and as it contains considerable information that will not be generally accessible, we propose to furnish a synopsis to our readers that shall embody the most important points determined by the Committee. As nearly all the prominent safety valves in the market were submitted to test, this report is useful in showing what is still required to produce the ideal safety valve. It is scarcely necessary to say that a perfect safety

valve is one which will rise as soon as the pressure at which it is set is attained, will prevent the pressure increasing if the boiler is forced to its utmost extent, and will close promptly as soon as the pressure commences to fall. It may well be doubted, in the light of experience, whether it is possible to design a valve possessing all the above features; but they can be closely approximated, as will appear.

The boiler which was used for making the experiments was cylindrical, with internal furnaces, of the modern marine form, and was capable of evaporating about 1,900 lbs. of water an hour on an average, at a pressure of 20 lbs. by gauge. Before experimenting with the competing valves, the committee made a number of experiments with common safety valves of different sizes, the valves being carefully constructed, with knife-edge points of support for the lever and valve stem, as shown in Fig. 1. These experiments fully confirm the opinion, held by many experienced engineers, that the common safety valve, when made of sufficient size, is about as effective in relieving a boiler and closing promptly as the best special forms that have been devised. It is a matter of regret that the Committee's experiments did not include a test of what is sometimes called the "positive safety valve," in which the weight is suspended directly from the valve stem and acts without the aid of levers or springs, the valve being spherical and thus exposing a greatly increased area when opened, as these features are very meritorious, at least in a theoretical point of view. The experiments with these ordinary safety valves enabled the Committee to give rules for general practice which agree well with those determined by other experimenters. The Committee recommend the following rules for determining the evaporation in lbs. per hour of stationary and marine boilers: 112×square feet of grate surface, for natural draught; 168×square feet of grate surface, for forced draught.

It was found, when experimenting with the common safety valves, that the lift decreased as the pressure at which the valve was set was increased; and by observing the areas of openings, the Committee derive the following rule for calculating the area of opening, in square inches, required to discharge a given weight of steam per hour: Multiply the number of lbs. of water evaporated per hour by 0·0011, if the valve is set to blow off at 10 lbs.; by 0·0010, if at 20 lbs.; by 0·0009, for 30 lbs.; by 0·0008, for 40 lbs.; by 0·0007, for 50 lbs.; by 0·0006, for 60 lbs.; by 0·0005, for 70 lbs.; by 0·0004, for 80 lbs.; by 0·0003, for 90 lbs.; by 0·0002, for 100 lbs.

By observing the lifts of the ordinary valves when discharging at different pressures, the Committee obtain the following rule for calculating the area of valve that will give the required area of opening for any particular case: Multiply the number of lbs. of water evaporated per hour by 0·005; the product will be the area of the valve in square inches. This rule gives a smaller area than the similar formula proposed by the late Professor Rankine, in which the multiplier is 0·006. It is to be remembered that the valves used by the Committee were constructed especially for the experiments, and may have acted more effectively than the average; so that the multiplier given by Professor Rankine will probably be safer for general use. It may be added that rules of this form are the only safe ones for general use, the ordinary formulas giving very discrepant results, as shown by the following example in the report: The area of safety valve required for the boiler on which the experiments were made, at a pressure of 70 lbs., would be: For the rule of U. S. Board of Supervisors, 37 square inches; for that of the English Board of Trade, 11·8; for that of the French Government, 6·75; for that given by Molesworth, 18·88; for the 1st rule given by Professor Thurston, 8·3; for the 2d, 29; for that given by Rankine, 12; for that proposed by Committee, 10. Attention has been directed to the discrepancies of these rules on several occasions; and in spite of the distinguished authority on which they rest, it is reasonable to hope that all but the last two will speedily find the oblivion they so justly deserve.

The Committee observe that, when very large valves of the common form is used, their action is not satisfactory, as at high pressure the lift is scarcely noticeable, the pressure being relieved by a kind of tilting of the valve; and they fix the limit at valves having an area of 10 square inches, recommending that two or more valves be used, when a greater area than 10 inches is required.

TESTS OF COMPETING VALVES.

Valves of special form were sent by 27 makers, and tested

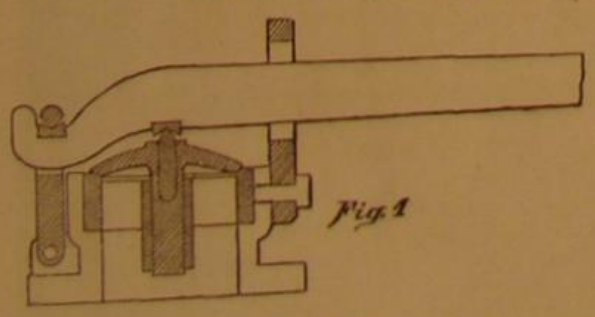


Fig. 1

by the Committee. The general object of all of these valves was to give an increased lift as soon as the valve was opened. The valves are divided by the Committee into 6 classes, according to their construction:

1. Reactionary safety valves, in which the escape of the steam is opposed by a lip or stricture with the idea that the reaction will force the valve further from its seat. One form of this class is shown in Fig. 2.

2. Disk safety valves, in which a disk is secured to the valve having a greater area than the valve, so as to force the

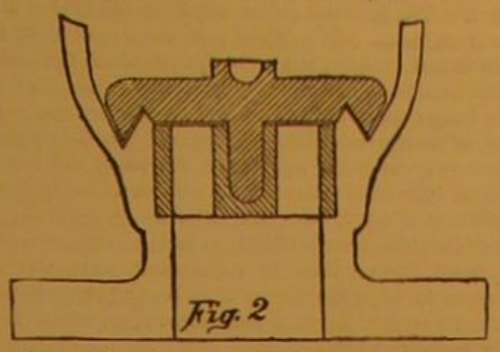


Fig. 2

valve further from its seat, when it opens. Fig. 3 is an example of this class.

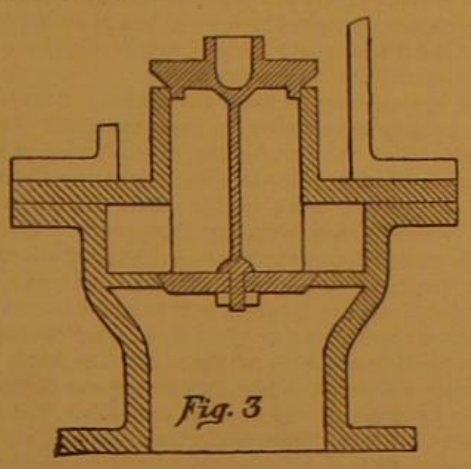


Fig. 3

3. Annular safety valves, with two seats upon an annular opening (as shown in Fig. 4), with a view of obtaining a greater area of opening for a given lift.

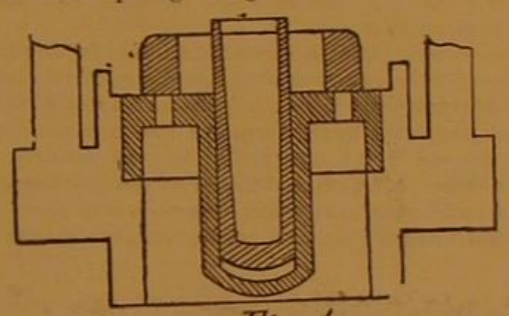


Fig. 4

4. Double seated safety valves, of the same general form as the double puppet valve, the upper and lower parts being of different areas, so that they move easily and expose large areas of opening. The practical difficulties of construction, however, will probably prevent the adoption of this plan. The Committee report that they "can say nothing favorable of any of this construction that were tested."

5. Combination safety valves, which are assisted in their operation by small auxiliary valves or a combination of levers. One of this class is shown in Fig. 5, the valve being held down by a spring balance attached to the lever, and being assisted to rise, when opened, by the action of the rod and bell-crank lever, the other end of the spring balance being attached to the long arm of the latter.

6. Piston safety valves (see Fig. 6 for an example of this class), in which a piston connected with the valve assists it to rise. A uniform method of test was adopted for all these valves. Each was attached, in turn, to the boiler, was set to blow off at 30 lbs., and was allowed to operate for 10 minutes, with a strong fire in the boiler, was then set to 70 lbs. pressure, and the experiment was repeated. The following table gives a summary of the results obtained with 12 of the competing valves, and 2 of the common valves constructed by order of the Committee. The table in the report contains results of the list of 22 valves, but the data were only complete in the case of 12, as the area of opening was not observed for the others, or they were tested at different pressures. The different valves are distinguished by numbers in the table given below. Several of the valves tested gave such unsatisfactory results that they were not included in the Committee's table.

It will be observed that some of the special forms of valves, with considerably larger areas of openings than the common valves, allowed the pressure to increase as much or

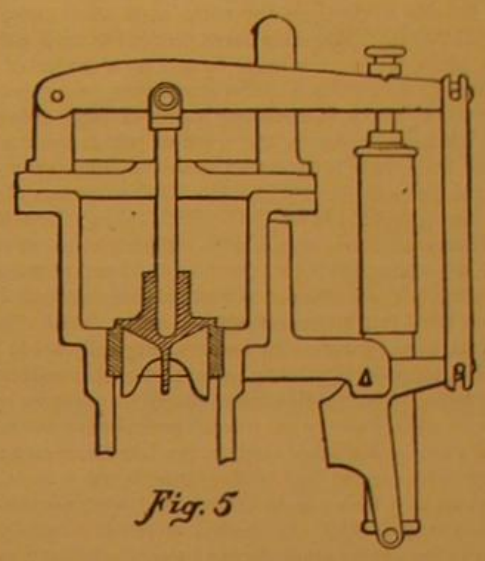


Fig. 5

more. This is probably due to the fact that the very form by which the greater lift was obtained made it more difficult for the steam to escape, and thus rendered a larger opening necessary to discharge the same quantity of steam. In

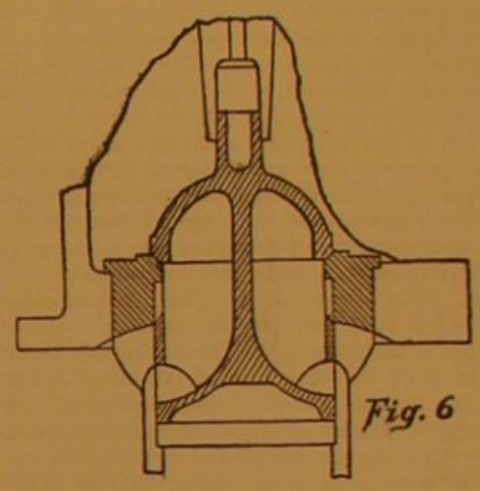


Fig. 6

the case of several experiments with the same valve, where the table shows considerable differences in the results, these were generally due to lack of adjustment, so that the best results represent the action of the valve when properly adjusted. This remark applies both to the common and special forms of valves. There is one peculiarity, quite an important one, which the table does not show, but is noted in the records given in the case of each experiment.

With the common valves, when the valve opened, the pressure gradually increased to the maximum, when the boiler was forced, and, when the pressure was allowed to fall, it closed at the points indicated. With nearly all the other valves, however, after the valve opened, the pressure fell below the opening point, the valve sometimes closing several times, and the pressure falling below the opening point several times, in the course of a 10 minutes' trial, and sometimes the pressure fell at once and the valve blew off at a less pressure than that at which it was set, during the whole trial. It is evident that this is not a desirable feature in a safety valve, if safety can be secured without this loss; and the records of the trial seem fully to confirm the opinion previously stated that the common valve, represented in Fig. 1, is not excelled in any important particular by its competitors—at least for stationary purposes. For use upon locomotives, and steamers in rough water, some of the special forms may be advantageously employed, and the Committee especially recommend three, constructed on the reactionary principle, viz: Ashcroft's, Crosby's, and Richardson's (Nos. 1, 2, and 6 in the preceding table). It is believed that these recommendations are justified by experience. The Committee state that there are objectionable features in the other forms of valves presented to their consideration, which may possibly be removed, and think the instruments should be further perfected before their adoption for steamer use can be recommended.

No. of valve.	Area of valve in sq. in.	Class of valve.	SET TO OPEN AT 30 LBS. No. of trials.	Greatest and least excess of pressure.	Greatest and least area of opening.	Greatest and least closing pressure.	SET TO OPEN AT 70 LBS. No. of trials.	Greatest and least excess of pressure.	Greatest and least area of opening.	Greatest and least closing pressure.
					sq. in.				sq. in.	
1	5	Reactionary.	..	....	....	.....	2	0	1·231	65½, 67½
2	5	"	5	5½, 2½	1·257	26½, 29	5	4, 3	·729, ·628	64, 68½
3	5	"	2	7, 6½	1·580	27½, 28	1	9½	·92	67½
4	5	"	2	6, 0	2·934	20½, 26	2	0	1·427	55½, 56
5	5	"	1	16	·457	30	1	4	·284	61
6	5	"	5	7, ½	·869, 1·455	27½, 29½	3	3½, 1½	·691	66½, 68
7	7	Combination.	2	2, 0	1·11	17, 26	4	4, 1	·574	60, 67½
8	5	"	3	1½, ½	1·171	27½, 29	4	½, 0	1·171	64½, 70
9	5	Disk.	2	0	1·82	27	2	½	1·18	67½, 68½
10	5	"	2	4½, 1½	1·11	26½, 29	5	0	·555	65, 69½
11	6	Annular.	1	0	1·42	27	3	0	·84	59½, 69½
12	5	Piston.	3	1½, ½	1·231	25½, 28½	5	4, 3	1·231	60½, 66
13	5	Committee's valves.	2	7½, 4½	·929	28	1	5½	·633	68
14	10		..	.....	....	.....	1	2	·725	68½

[*Continued from first page.*]

This end is not beveled, as is generally done, but left square, so as to retain the full value of the thickness of the column for a bearing surface on the rock, each section weighing about 14,600 lbs., averaging seven sections to each column.

The pivot, or center pier, is formed by a cluster of nine columns, a 6 foot column in the center supporting the pivot of the draw, and a surrounding circle of eight columns 4 feet in diameter, carrying the track on which the draw revolves. This circle is 36 feet in diameter from out to out, while the pier columns are placed with their centers directly under the main chords of the bridge, making them 36 feet apart from center to center, and at right angles to the center line of the bridge, giving an opening of 77 feet on each side line of the bridge, giving an opening of 77 feet on each side in the clear. The section of 6 foot columns average 10,800 lbs., and the 4 foot columns 6,800 lbs. each. These columns were cast from government cannon, originally made from cold blast charcoal pig, being an exceptionable material for this purpose. The columns were placed in position by the use of compressed air, by the plenum pneumatic process. In sinking these pneumatic cylinders, the late Mr. Murphy, the engineer who erected the bridge, introduced a more economical air lock than was heretofore used, which enabled the workmen to pass from the normal atmosphere outside the column to the denser atmosphere of the interior, and to prevent the escape of the compressed air while so doing. He also adopted, for the first time, brackets in sections, and extending clear round the whole inner circumference of the bottom of the column, and secured to its side by four 1¼ inch tap bolts, and to the rock by four bolts 18 inches long, with fox wedges at the lower end, and thread and nut on top, thereby adding much to the stability of the work. This was necessary on account of the small amount of holding ground for the cylinders, overlying the bed rock.

The bed of the Schuylkill, at the site of the bridge, is a micaceous gneissic rock, undulating in surface, with overlying strata of sand and tough, compact mud, intermingled with gravel and small boulders. Lying directly on the rock, considerable quantities of driftwood were found, its appearance evincing great age and a long occupation of its present position. The average depth of this bottom material is about 30 feet at the western pier columns, diminishing to only 5 feet at the eastern pier. At the draw the thickness is about 18 feet. The draw span of this bridge is 198 feet 2 inches long from end to end of chords, and 23 feet wide between centers of trusses, with two outside footways of 6 feet 8 inches in the clear, making the total width from out to out 39 feet 4 inches, equal to the outside diameter of the pivot cluster of columns supporting the span at its center, leaving two water ways of 77 feet each, as required by the specification. The decrease in the width of the bridge at this point from 55 feet (the width of permanent span) to 39 feet 4 inches is unfortunate, but to have maintained the width of 55 feet would have made not only a wider span, but also a much longer draw span (necessary because of the requirements of navigation) adding enormously to the weight, already very great (being now nearly 400 tons), and involving increased dimensions throughout, and as a consequence increased cost of pivot, curb, and supporting columns. The truss of the draw span is similar in design to the two permanent spans, but modified in section and position of members so as to meet the duties of a bridge supported on a pivot at its center, and as a permanent span, which it practically becomes when closed.

The pivot on which Mr. Murphy originally proposed to rest the draw span was one of his own design, and consisted of two smooth lubricated surfaces 6 feet in diameter, made of gun metal with spiral grooves, being arranged so as to equally spread the lubricating material. From the large area of the working surfaces the distributed load would have been only about 200 lbs. to the square inch. This was a feasible plan, and perhaps the most economical way of solving the problem. But this was changed to a pivot center of two sets of small conical rollers running on steel plates, which is now working satisfactorily. The entire draw is carried directly by the stone filling of the central 6 foot cylinder; an arrangement of radial arms with wheels under the circular curb (which is 32 feet in diameter) which prevents any undue tipping of the span when open or during the opening or closing of the span. The width of the approaches is 55 feet, consisting of carriage way 35 feet wide, and two footways 10 feet wide on each side. The eastern approach is 518 feet 10 inches in length, consisting of 363 feet 6 inches of broken range ashlar retaining wall of sandstone, and 114 feet 6 inches, being three conoidal or flue arches of original design, composed of brick with stone rings and a granite abutment of 40 feet 10 inches, with pilasters and Doric capitals.

The western approach is 826 feet 6 inches in length, consisting of 87 feet 4 inches of regular range ashlar retaining wall of granite, and three trussed spans 244 feet 9 inches in length, supported by eight wrought iron columns over the Junction and West Chester Railroads, to an abutment of 62 feet 4 inches in length, and thence by nine brick arches 43 feet 6 inches span, from center to center, with stone rings, 391 feet 3 inches long, with granite piers, to a granite abutment of 40 feet 10 inches, same character as eastern abutment.

The contract price for the bridge was $770,000, but the ice breakers or fenders for the center pivot pier of the draw span formed an extra contract, for which Mr. Murphy received $65,000 additional.

Improved Whaling Gun.

During last year, Captain Eben Pierce, the well known manufacturer of bomb-lances, and Selmar Eggers, after much planning and experimenting, perfected an invention which is destined to prove vastly beneficial to our community in swelling the revenue accruing from the whale fishery. This is a breech-loading whaling gun, varying from the ordinary weapon as much as a modern sixteen-shooting rifle does from the flint-lock shot gun of our ancestors.

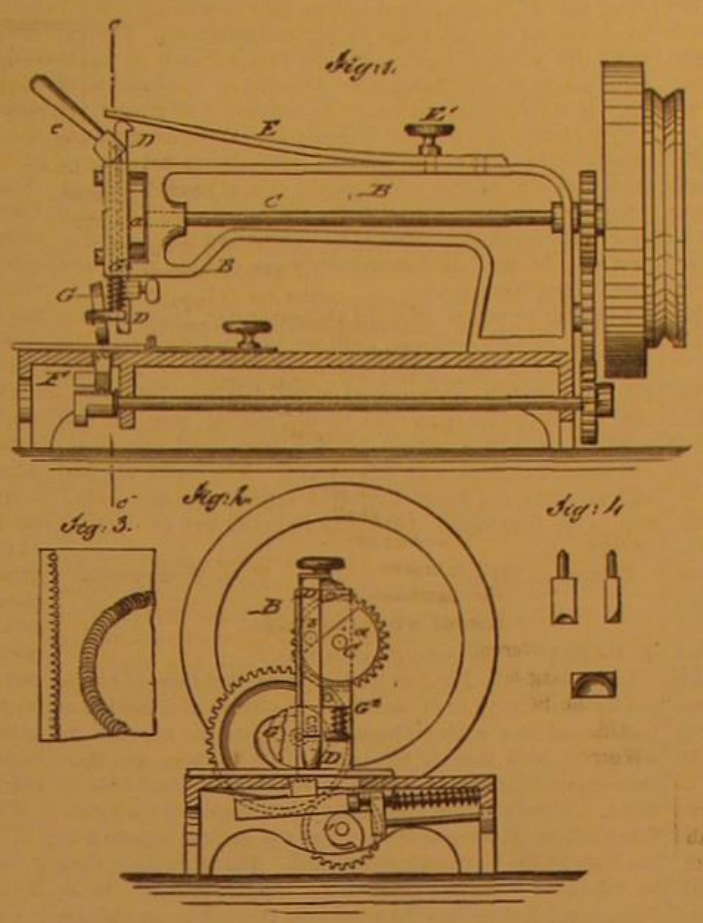
The weight of the gun is 18 lbs., or nearly the same as the old style, while it is much better balanced and proportioned, reducing the comparative weight of the barrel that renders it so difficult to steady and aim the ordinary guns. The length and base of the barrel is the same, admitting the use of the usual size bombs. The great superiority of this weapon lies in the manner of loading. The old guns were loaded with loose powder, and were more dangerous to handle when charged; the powder would also become dampened with flying spray when in a boat that was going through the water at a lively rate, and it has often occurred that, when the pursuers had arrived within easy range of their prey, they would find the charge moistened and the weapon consequently useless. Mr. Eggert's gun is so constructed that, by touching a spring in the butt, a chamber in which the barrel terminates is opened; in this a cartridge with a seven-eighths inch copper shell is inserted, charged with 2½ drachms of powder, or about half the quantity required to load the ordinary guns. The chamber is then closed upon pulling the trigger, the hammer strikes a sharp blow upon a cap in the end of the cartridge, and the piece is discharged. The whole operation of loading, fixing, and reloading can be accomplished in two minutes' time. It will be seen at once that the gun is much surer and safer, as these cartridges can be kept in the pocket until needed; and no water can lessen their power after they are placed in the chamber. With the breech-loader a lance can be sent with destructive effect over 750 feet when fired at slight elevation. The weapon is constructed of gun metal, and thus is almost impervious to wet, another weakness to which the old style gun was susceptible.—*New Bedford Mercury.*

INTERIOR VIEW OF SOUTH STREET BRIDGE PHILADELPHIA PA

IMPROVED MACHINE FOR STAMPING LEATHER GOODS.

In the accompaning engraving is illustrated a novel machine for stamping ornamental designs on the leather work of hide tree saddles and of carriages. It may also be used for producing the embossed leather employed for furniture covering, bookbinding, etc. The upper revolving shaft, C, in the side elevation, Fig. 1, works the stamp rod, D, which moves in a guide in the arm, B, and is acted upon by a band spring, E. Said spring may be adjusted by the clamp screw, E'. The shaft, C raises the stamp rod by means of a cam, *a*, which engages with a friction roller, *b*, on the rod, as shown in Fig. 2; on being released from the cam, the rod is brought down forcibly by the spring. Fig. 4 shows the various shaped stamping bits, which are clamped into the lower portion of the stamp rod, D. The leather is fed by a vibrating feed mechanism, F, and retained by a presser wheel, G, which is attached to an arm on a presser rod, G^1, which is pushed down by a coiled spring, and raised or lowered by the lever, *e*. Fig. 3 represents a piece of leather, as marked by the machine, the uniformity of the impressions being secured by the regular movement of the feeding device. The mechanism is operated by the belt wheel and gearing on the right in the usual manner.

Patented through the Scientific American Patent Agency, April 3, 1877, by Mr. Lewis H. Urner, Nevada, Mo.



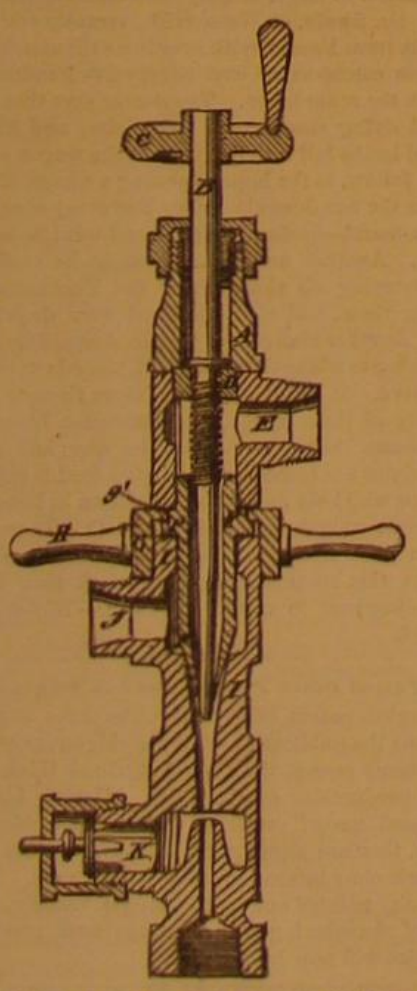
URNER'S LEATHER-STAMPING MACHINE.

Sleep.

Sleep, Dr. W. A. Hammond says, may be defined as general repose. Almost all the organs rest during sleep. The heart, popularly supposed to be in perpetual motion, is at rest 6 hours out of the 24, the respiratory organs 8, and the other organs more or less. The brain alone is constantly employed during wakefulness, and for it sleep was formed and made needful to its preservation. It is true that sleep does not give the brain a total recess from labor; imagination and memory are often vividly active during sleep, and unconscious cerebration likewise takes place, but enough rest is obtained for the renovation of the brain, and that which has been torn down during wakefulness is to a certain extent rebuilt. Sleep is a most wonderful power—often stronger than the will, as in the case of the sleeping soldier—and more mighty than pain, as when sick persons and tortured prisoners sleep in the midst of their suffering. No torture, it is said, has been found equal to the prevention of sleep. The amount of sleep needed differs according to the constitution and habits. Big brains and persons who perform much brain labor need a large amount of sleep. Children need more sleep than grown people because construction is more active than decay in their brains.

A NEW INJECTOR FOR STEAM BOILERS.

We illustrate herewith an improved water injector for steam boilers, which is claimed to be so constructed as not to require any internal packing, as to prevent locking or bursting and side leakage, and as to work equally well at any pressure of steam. It may be detached, examined, and again attached in a few minutes *without interfering* with the working of the boiler.



A is the outer part of the injector, through a stuffing box in the outer end of which passes the spindle, B. The spindle has a hand wheel, C, and a screw thread formed upon its middle part, which fits into a female screw, D, in the part, A, at the outer side of the steam inlet, E. The forward part of the spindle, B, passes into the nozzle, F, the base of which is screwed into the inner end of the part, A. Around the base of the nozzle, F, is formed a flange, *f*, which abuts against the end of the part, A, and is rabbeted upon its outer side to form a ring groove to receive an inwardly projecting flange, *g*, formed upon the outer part of the inner surface of the ring or wheel, G. The wheel, G, is provided with handles, H, for convenience in turning it, and has a screw thread *formed* upon the inner surface of its inner part, to receive the screw thread formed upon the outer end of the part, I, with which, near its outer end, is connected the water inlet, J. With the part, I, near its inner end, is connected the overflow, K. With this construction, by turning the ring or hand wheel, G, the water supply can be regulated according as the steam pressure in the boiler may require. This device was patented through the Scientific American Patent Agency, March 20, 1877, by Mr. James Westley, of Manchester, England.

Soiree of the Louisville Microscopical Society.

A large audience assembled in the Hall of the Louisville Library to attend the annual soirée of the Louisville Microscopical Society. Arranged on tables were *nineteen* instruments representing the most famous makers of this country and Europe, from a small old fashioned Bascule to a large and magnificent Ross. The objects selected for exhibition were selected from the various departments of Nature.

Professor Brach, with a Zentmayer "Grand American," with the paraboloid, exhibited a series of beautiful picked diatoms. On a second instrument he showed the effect of polarized light on crystals and various animal and vegetable tissues. Mr. W. R. Belknap exhibited fine specimens of gorgonia and spicules of sponge. Dr. Clapp showed various animal parasites, *trichinæ spiralis*, tape worms, etc. Dr. Holland showed the various ferments in different stages of development. Dr. Jenkins, with the micro-spectroscope, showed the spectra of blood and various colored liquids. Dr. Keohler exhibited a number of handsome slides of fossil woods. Mr. A. L. McDonald, with a beautiful binocular, gave both eyes a chance to see crystals of arsenious acid cinnabar, and *polycystinæ*. Dr. J. B. Marvin had under an instrument a frog so arranged as to show the circulation of the blood. He also showed beautifully injected specimens of animal livers, kidneys, tongues, etc. Professor C. Leo Mees showed, with a magnificent Ross instrument, Moeller's phototype plate, *Deutzia gracilis*, etc. Mr. I. Pettus exhibited the lower forms of vegetable life, diatoms and *protococcus*, also *rotifer vulgaris*, who seemed especially voracious on this occasion, and vinegar eels. Professor Lawrence Smith illustrated the formation and growth of crystals under polarized light. He also showed a series of micro-photographs, under his peculiar inverted microscope. Dr. Sloan, with a handsome Grunow instrument, showed blood of various animals, magnified 2,000 diameters. Mr. Pack Thomas exhibited tracheal vessels of silkworms, tongue of fly, eye of beetle, etc. Mr. David Lane, with the oxyhydrogen microscope, projected a number of objects on a screen, the circulation of blood in a frog's foot, many common insects, and plants, *drosera rotundifolia*, etc., were shown.

The exhibition was a decided success, and the society will give another soirée in the first week in June.

A Good Portable Printing Press.

A small portable printing press is a convenient and useful article in almost any business house. It will serve to print letter heads, envelope advertisements, cards, and small circulars, notices, etc., and thus will save printers' bills. It is a capital present for boys, as it induces them to acquire the rudiments of an important trade, which in after life may be turned to practical account. An excellent little machine of this description is known as the Excelsior Press, and is made by Messrs. W. A. Kelsey & Co., of Meriden, Conn. The advertisement of this firm will be found in our advertising columns.

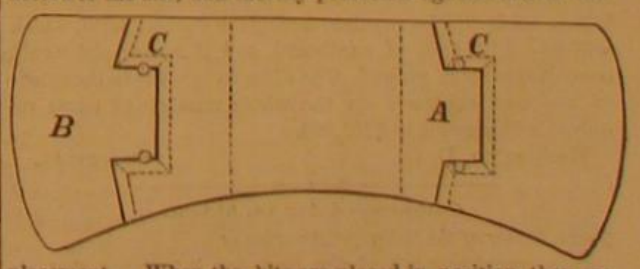
Composition for Covering Boilers and Steam Piping.

The process has been employed for some time with great success for preventing the loss of heat from steam pipes, domes of generators, cylinders of steam engines, etc. It consists in covering the same with a mixture of sawdust (no matter from what wood) and ordinary flour paste in a very liquid state. The sawdust being added to make a thick paste, and applied according to the following directions, will form a compact mass, the adherence of which is very great when applied on clean surfaces of wrought or cast iron; but on copper pipes it is more difficult to apply the first coat: in which case it is necessary to wash the copper pipe to be covered with a clay wash made with potter's clay until it forms a thin coating, after which the sawdust and paste will adhere firmly. It is very simple to apply; any ordinary mason with a small trowel is all that is necessary. Lay on five successive coats one fifth of an inch thick, each layer making, when finished, one inch thick. Let the pipes or other objects to be covered be kept warm by the aid of a little steam, and let one coat be perfectly dry before applying a second. Should the pipes be outside, exposed to the open air, give them three or four coats of coal tar to make them waterproof, but if inside a building it is not necessary. It is well to pass the sawdust through a riddle, to cleanse it from the coarse fragments of wood which are always to be found among sawdust. There is no contraction in drying the composition, therefore no leakage. Steam pipes so covered, the correspondent believes, lose less heat than when covered by any other patented process sold for that purpose. It is much less expensive, and much more efficient. The sawdust is to be found in most factories, scarcely of any value. With 1 cwt. of flour (about $3.75 worth), he says he can cover as much surface as formerly with $200 worth of the composition he was then using, which cost him at the rate of 75 cents or $1 per cwt. Its lightness renders it still more valuable for such purposes. There is very little expansion or contraction in the pipes, being well protected; therefore no leaky joints.—*Textile Manufacturer.*

A NEW AXE.

Mr. John O. Rollins, of Truckee, Cal., has patented through the Scientific American Patent Agency an improved axe, having detachable bits that may be readily interchanged and securely attached, so as to admit the use of one axe with thick or thin bits, for different purposes, and the replacing of dull bits by sharp ones.

The body, A, may be made of cast iron if desired, which admits of cheaper manufacture. The ends of the body are provided with tapering grooves, or with beveled edges, to which the corresponding beveled bits are fitted, both methods being shown in the illustration. The middle part of the axe body is centrally recessed back of or extended beyond the slightly inclined side parts, the bits being in the same manner made with a central extension or recess, so as to be connected to the axe, and thereby protected against lateral displacement. When the bits are placed in position, they are locked against displacement in the longitudinal direction of the axe by rivets, C, of soft metal, that are driven in tightly to retain the bits securely on the axe. The rivets may be easily removed by a steel punch for the purpose of replacing dull or broken bits, or inserting bits of different size for different work, as required.



Spurious Flowers of Sulphur.

Mr. Hanks recently exhibited to the San Francisco Microscopical Society specimens of the spurious and the genuine flowers of sulphur for comparison. The real article is obtained by subliming sulphur; and except that there is with it usually a little sulphurous acid, the product is almost chemically pure. But a great deal of what is sold as the sublimate now turns out, under the microscope, to be merely crude brimstone, ground to a powder. Instead of "flowers" it should be called flour of sulphur. The spurious article contains many impurities.

Communications.

Our Washington Correspondence.

To the Editor of the Scientific American:

Since my last, there have been several changes in the examining corps of the Patent Office. Dr. Jayne has been removed from the class of "metal working" to that of "agricultural products," to fill the position made vacant by the reduction of Mr. Connolly to first assistant, and Dr. Jayne's old place is filled by Mr. Church, who was formerly law clerk. Mr. Tasker, who had charge of the class of "woodworking," has resigned, and Mr. Bartlett has taken his position. This left the classes of "navigation" and "firearms" without a head; and Dr. Antisell, who many years since had charge of the class of "chemistry," but resigned during the war, has been appointed to fill this place. It is said that Dr. Antisell, in addition to the class of firearms, is to examine patent medicines, which is considered by some as rather a curious combination; but others are of opinion that the two classes will go very well together, as many of the medicines are thought to be as dangerous as the firearms, and as a parallel instance to this cite the sub-classes in charge of Dr. Wilkinson, who not only has "surgical instruments" to kill people with, but "coffins" to bury them.

In continuation of the system of surveys carried on by the government, the Wheeler expedition is about to take the field for 1877. It will be divided into three sections, one of which, to be known as the Colorado section, will rendezvous at Fort Lyon, Colorado, on the Arkansas river; a second one, the Utah section, at Ogden, Utah; and a third at Carson City, Nevada, to be called the California section. There will be six regularly organized parties prosecuting systematic surveys, the work of each one of which will finally appear in a complete atlas sheet. An additional base-measuring and triangulation party will operate in connection with the Utah section, and another special party will survey certain points in the Sierras, south of Lake Tahoe, a most interesting section in a topographical view. A distinct party will continue the survey of the Washoe mining district, while a special observer will prosecute underground inquiries relating to the disposition of bodies of ore; temperature at different levels; presence or absence of water and its temperature; the treatment of ores; and the ventilation of mines.

The official returns to the Bureau of Statistics show that, during the last month, the exports of fresh beef from the United States were 8,416,829 lbs., of a value of $821,431, and that 169,043 lbs. of mutton, valued at $17,648, were exported from New York alone. During the four months ending March 31, 1877, over 2,000,000 lbs. fresh beef and 339,002 lbs. of mutton produced in Canada were exported from Portland to England. That we may not lose this addition to our exports, nor be deprived of our own supply of this food, the State Department has addressed a communication to our consular officers in Europe calling for all the information that can be obtained in reference to the foot and mouth disease and rinderpest, and whether these diseases are likely to be communicated by the importation of dried and salted hides.

An official notification has been received by the State Department from the Chinese Government, that it has opened to American trade four more ports, namely, Tchang, Wuhu, Wenchow, and Pakhoi.

The same department has received information that the emigration from Hamburg, Bremen, and Stettin, during 1876, was 50,577, all of which, except about 5,000, sailed for this country. This, however, is a falling off from last year of about 6,000, which is attributed to the hard times.

The bids for supplying postal cards for the next four years have just been opened. There were twenty bidders, and the bids ranged from 69 $\frac{55}{100}$ cents to 1.15\frac{1}{2}$ for single tinted cards, and from 73 $\frac{45}{100}$ cents to $1.25 per thousand for double tints—the lowest bidder on either class being the American Phototype Company of your city. The price paid the present contractors is 1.39\frac{1}{2}$ per thousand, and their bid for the next four years was 75 cents. It is estimated that over one billion cards will be required during the ensuing term, which will take 3,125 tons of cardboard, and if spread out would cover 250 acres of ground. The difference between the prices on the two contracts on the whole number of cards required will amount to $701,900.

Washington, D. C. OCCASIONAL.

Compressed Air vs. Steam.

To the Editor of the Scientific American:

In a recent number of the *Iron Age*, it is stated that air compressors, now at work in some of our Western mines, yield ninety per cent of the compressing power. In other words, a one hundred horse power steam engine compresses sufficient air to run a ninety horse power air engine. If this is so, it would seem that a system of locomotives might be worked quite as cheaply with compressed air as with steam; for the reason that a stationary engine has at least from ten to twenty per cent the advantage of a locomotive in the consumption of fuel, owing to the great radiation to which a locomotive is exposed. The air locomotive has also another important economic advantage in its less costly and more durable air tank, as compared with a locomotive boiler.

A plain cylinder of boiler plate with hemispherical ends is a very simple affair, requiring no staying, and containing about three times the capacity of a locomotive boiler of equal weight and strength. A single charge of compressed air in such a tank, at a pressure of 250 to 300 lbs. to a square inch, would probably run a car load of passengers several miles on a level line. To present the case in a practical way, let the Greenwich Street Elevated Railway Company, for instance, locate a one hundred horse power air compressor and an ample reservoir at a central position between the termini of their line. The reservoir may consist of a number of cylindrical tanks with hemispherical ends, 4 feet in diameter and 40 to 50 feet long, made of the best boiler plate, so as to be perfectly safe and tight at a pressure of 300 lbs. to the square inch. Let the tanks be so placed that every part of their external surface may be easily got at for an occasional coat of paint to prevent corrosion. The expense for current repairs and for fuel for such an apparatus would be very light, it would seem, as compared with that of their present system of locomotive boilers. If the length of their line or other exigency should require the locomotive tanks to be charged at other than the central point, a three inch pipe may be laid from the central reservoir to any other point of the line desired for that purpose. The valve gear of the locomotives should be so arranged that the cylinders may be used as compressors when making stops and when going down grade.

I can see no reason why the air locomotive, in connection with the elevated railway, shall not eventually give us the most desirable and perfect system of city transit possible. No other system embraces so many excellent features as this, especially for passenger transit, namely, pure air and sunlight and a fine outlook, freedom from mud and snow, and non-interference with other travel. The reader will find an interesting and finely illustrated article upon air locomotion in the SCIENTIFIC AMERICAN SUPPLEMENT of January 1, 1876.

Worcester, Mass. F. G. WOODWARD.

The Flight of Birds.

To the Editor of the Scientific American:

In regard to the flight of birds, I think that there is no necessity to resort to such theories as the figure of 8 motion to understand how a bird flies when it beats the air with its wings. I think that the formation of the feathers, and their imbrication in the wing, ought at once explain that kind of flight. When the bird makes the down stroke, the wing offers a solid resistance to the air, and the motion imparted to the body of the bird must be upward. The wing must then be raised to come into position for another stroke. In so doing, each feather lets the wind pass through in an oblique manner, which causes them to act as sails on a windmill or on a ship, thereby propelling the bird forward. The bird instinctively knows how to direct these strokes, as it wishes to ascend, descend, or move straight forward. The effect of the down stroke can be seen when a large bird such as a turkey buzzard begins to fly in a place where there is not room for rapid headway. Each down stroke is more violent than the up one, and the body is jerked up each time.

A flying machine might be made so that the wings would have a sufficient resistance to the air to keep it up, and the propelling part could be arranged independently. But there is another mode of flight that has puzzled the minds of men. It is a remarkable thing that man has seen beyond the Milky Way, and is now studying the constituents of the sun, yet he cannot understand the sailing of birds. I have seen many attempts, but they all fall short of the mark. I have seen buzzards with outstretched wings rise in a spiral course, when it was so calm that a leaf on a tree was not moved. I have seen the frigate bird wheel in graceful curves upward when the sea was as smooth as a mirror. I have seen the buzzard sail nearly in the eye of a strong wind without any other motion being perceptible than a little balancing. I have looked down hundreds of feet on them as they sailed beneath me, and never could detect any motion of the wings. The theory of inclined planes will not explain it. I have also noticed large butterflies float about in a most heaven-like enjoyment, in some cozy opening among trees, on a fine summer evening, when there was not a breath of air, without once moving their wings, as if they were some disembodied spirits that had neither attraction or gravitation, but only will. I have seen a motion very similar to the sailing of birds in fishes. I saw a number of porpoises sailing immediately in front of the prow of the steamer. They were packed quite close together, and moved exactly as fast as the steamer. As it was necessary that they should breathe occasionally, they were continually rolling over each other to come to the surface. Sometimes half the fish would be out of the water, yet the uniform motion was kept up, and no one on board could detect any motions of fins or body to warrant such speed. There are other modes of flight such as by bats and insects, the dragon fly as an instance; but the sailing of birds is a most interesting study for philosophers, and it will be safe to say that man will never be able to put it in practice. But the knowledge may come in play in explaining some things yet in embryo.

Hagerstown, Md. JOHN H. HEYSER.

Reclamation of the Sahara.

To the Editor of the Scientific American:

Your article, in the SCIENTIFIC AMERICAN of May 12, entitled "Lands below the Ocean Level," presents a statistical discussion of present and future results of converting the great Sahara Desert into an inland sea, by connecting it with the ocean. The conclusion that the expiration of 100 years would be sufficient to convert the great desert of sand into a desert of salt is doubtless correct, on the supposition of a communication having a water discharge equal 525 times that of the German Rhine. But the construction of such a channel is practically impossible. A channel conveying, say, ten times the volume of the Rhine might, however, be possible; and from it entirely different results would probably ensue. The quantity of water delivered by such a channel would cover $\frac{1}{525}$ of the area of the desert, or about 76,000 square miles. Almost immediately upon the admission of water to the arid plain climatic changes would ensue, reducing the temperature and the rate of evaporation. As the formation of the new sea progressed, its surface and shores would become the recipients of the gentle shower and the driving storm. These causes would continue to operate with increasing force as the sea augmented in size. If we suppose evaporation to be reduced one fourth by the new conditions, and that another fourth is returned by rainfall, it will follow that a body of water would ultimately result, having an area of 152,000 square miles—that is, the area will have been doubled from these two causes—an area one half larger than that of the Caspian Sea. The presence of such an enormous body of water in the Great Desert would, we may well conceive, establish a tributary river system of its own and maintain an independent meteorological area of vast extent. Taking 15 feet as the annual evaporation (since we have supposed it to be diminished one fourth), and allowing 2 feet rainfall yearly as sufficient to insure productiveness of the surrounding desert, we shall have an area 7$\frac{1}{2}$ times that of this new sea, or 1,160,000 square miles of reclaimed territory, to say nothing of the incidental benefits accruing to Morocco, Algeria, and Tripoli, and possibly to Egypt and Nubia also.

As to the stability of the new condition of things, no present fear need be entertained. For, since 525 times the flow of the Rhine would require 100 years in which to fill the great Sahara with a deposit of salt, the proposed 10-Rhine channel would occupy 5,250 years in accomplishing the same end. Indeed, it is doubtful if a much longer period would accomplish it. For it must not be forgotten that a sea *fauna* and *flora* would be developed, capable of converting a very large amount of salt into organic compounds, thereby eliminating it. Moreover, the consumption by humanity and the surrounding animal life would effect a not insignificant postponement of the supposed final result.

Platte City, Mo. R. T. ELLIFRIT.

A Fire Escape Invention Wanted.

To the Editor of the Scientific American:

Cannot some ingenious Yankee invent a wire bed bottom, that will form a spring bottom when on the bed, and which can, when necessary, be unfolded to form a ladder of any required length, say for one, two, three, or four stories of a house? It would be of little use unless it was so simple as to require no skill to operate it; and it should have one end attached to the bedstead, so that the occupant could throw off the bed clothes, throw the wire ladder out of the window, and go to the ground.

Beaver Falls, Pa. J. E. EMERSON.

Sheep Farming in California.

It is estimated that from one half to two thirds of the sheep in the State have perished from starvation. The loss of cattle is not so large, as they were taken to the mountains in time. Dr. Swain, of Watsonville, recently started for the mountains from Fresno, with over three thousand sheep, and the lifeless carcasses of over twenty-five hundred of them now mark the route taken. The doctor says that unclaimed dead and dying sheep cover the plains, and hundreds of sheep and lambs fall into line behind the wagon of the traveler, and follow, in the hope of getting a morsel of hay. One man from the San Joaquin Valley lost every sheep he had—eleven thousand—during a storm, and went home a penniless man. Another, an Italian, thought he could save the cost of ferrying his sheep across the Tuolumne River by swimming them, and eight hundred were drowned in the attempt. Another man east of Visalia, despairing of ever getting his sheep to where there was feed, turned twelve thousand out to starve. If he undertook to drive them to the mountains many of them must die of starvation before reaching there, because there is no feed on the way; and then, when the mountains are reached, all the good feed is already taken up by men who hold possession, shot gun in hand, and who are desperate enough to fight to the death. There will probably be a good many cases of bloodshed and death in the mountains this summer, and many stock men will mysteriously disappear to return no more.—*Watsonville (Cal.) Transcript.*

Patent Office Publications in England.

The English patent office authorities have determined to discontinue the publication of the abridgments of specifications, in many senses, the *English Mechanic* thinks, the most valuable productions of the office. Having introduced a "cheap and nasty" style of printing specifications and drawings, they are anxious to save a few more pounds to add to their clear income of $500,000 per year. To remedy the difficulty pointed out by the judges, namely, the impossibility of deciphering the drawings now produced, full sized copies will now be supplied.

Laying Water Pipes.

When water pipes are laid at an inclination either above or below the horizon, a correction will have to be made in estimating the supply, by adding or deducting $\frac{1}{10}$ of an inch to or from the initial pressure for every foot of fall or rise in the length of the pipe.—*Molesworth.*

PRACTICAL MECHANISM.

BY JOSHUA ROSE.

NEW SERIES—No. XXVII.

PATTERN MAKING.—GEAR WHEELS.

We now approach a class of work in which the fullest amount of care and attention on the part of the pattern maker, for the attainment of accuracy, is exceedingly desirable. Patterns for wheel work, clumsily constructed, may be positively worthless, or may at least give rise to great loss of time in the fitting shop, in correcting the defects in the castings taken from them. It is not our purpose to enter into the various methods of arriving at the proper form or curvature that is to be given to the teeth, as that is a subject quite extensive and a study in itself. What more particularly concerns us is the general construction of the patterns from designs furnished.

Gear wheels are of two kinds, spur and bevel, the former for transmitting motion when the shafts are parallel, and the latter to be used when the shafts are inclined to each other. When the teeth of a bevel wheel are inclined at an angle of 45° with the axis, that wheel is called a miter. Skew bevels are wheels suitable for shafts that are inclined to each other and are not in the same plane. Pinion is a distinctive term, applied to the smaller of a pair of gear wheels when there is a great disparity between them; or it may mean generally a small gear wheel.

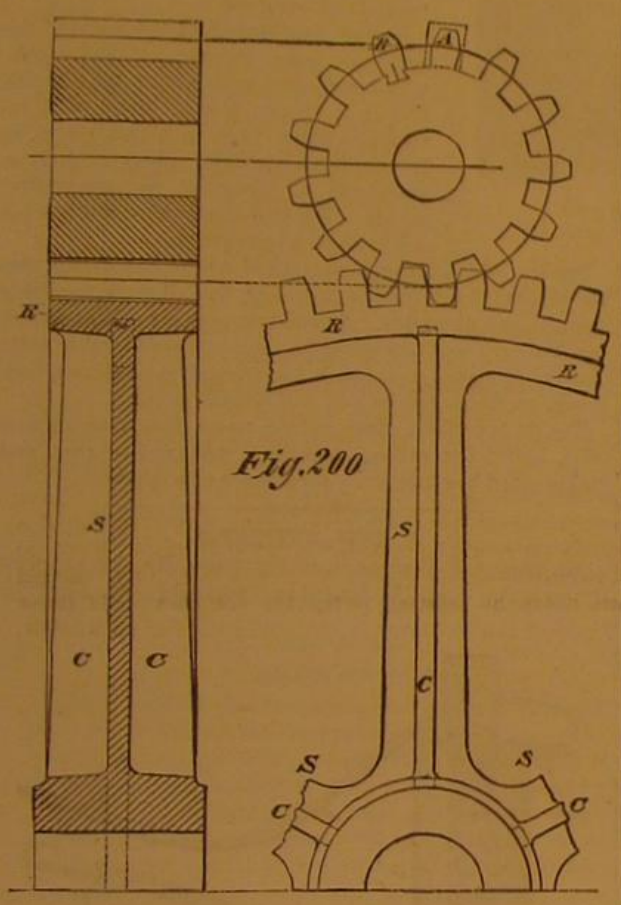


Fig.200

Fig. 200 is a plan and section of the pattern of a spur wheel and pinion, such as is usually supplied to workmen. The plan exhibits the form of the teeth and pitch, with the size and number of arms. The sectional view shows the breadth of face, depth of hub, and ribs on the arms. In the construction of gear wheel and pinion patterns, the particular method to be adopted, as also the material to be used, will depend upon size and the service expected to be got out of the patterns. Mahogany, dry and straight grained, is an excellent material for wheel patterns; but for large work it is too costly. In some cases the teeth are worked in mahogany, and fixed to a pine body; in the majority of cases, however, pine is the only material used. The pinion may be carved out of one piece, or it may have the teeth attached to a hub; and if the latter, then the teeth may be held by dovetails, or they may be simply glued or nailed. If the pinion is so deep in proportion to its diameter as to be strong enough, and not more than 5 or 6 inches diameter over all, it may be cut from the solid; in this case, the grain of the wood must lie in the direction of the teeth. For turning the piece, we must use a chuck or face plate smaller than the pinion is at the bottom of the spaces, so as to be able to trace circles on both sides by the motion of the lathe; if such a face plate is not at our disposal, we may bore a hole in the piece to be turned, and fit to it an arbor of hard wood. Having turned the pattern, trace upon it very fine circles to indicate the pitch line, the line for the roots of the teeth, and (if required) circles for the centers used in tracing certain peculiar forms of teeth. All these circles are to be traced on both sides of the pattern, and draft is to be allowed by making the circle for the roots of the teeth a little smaller on one side than on the other, and also by turning the piece slightly taper. The pinion is now to be pitched out, on one side, very accurately; this is sometimes a matter of no small difficulty, for, having passed round with the compasses a few times, the points are liable to slide into previous impressions, giving rise to error. For this reason the pattern maker does not allow the points of his compasses to fall where he intends the center of the teeth to be, until he has obtained the correct division, which is known by the compass point, after having made the tour of the circle, falling exactly into the starting point. He now proceeds to lay down the centers of the teeth, and to delineate their size and form; then, by squaring across the face, the points of the teeth are transferred to the other side; the teeth are then outlined on that side and the intervening spaces cut away exactly to the lines.

For a large-sized pinion, the usual method is to build up a hub or body with quadrants breaking joint at each course or layer; the body is then turned, and the circumference pitched off to the required number of teeth. Blocks of hard or soft wood, planed nearly to the size of the teeth and hollowed on the side that goes next the body, are to be glued on and set to the lines made on the surface of the body when it was pitched off (see tooth marked A, Fig. 200). When the glue has properly set, the whole is replaced in the lathe, and turned off, the same as for a solid pinion; the lining-in will also be a repetition of the process above explained. Another method is to fix the teeth on dovetails, as at B, Fig. 200; but as this is very seldom adopted for spur pinions, it will be more in place to describe it when dealing with bevel gear.

We now proceed to the construction of the wheel, which in our illustration has six spokes or arms, marked S; the rim, R, must of course be built up in segments; and when we have reached to the height of the top of the flat arms, we should turn the inside to the finished size, and cut in the arms, as shown in Fig. 200, the rest of the building can then be proceeded with. To avoid here useless repetition as to the details observed in building or in preparing the arms, the reader is referred to the SCIENTIFIC AMERICAN of January 20, 1877. Having turned the body of the wheel both inside and out, we proceed to attach, on each side of the arms, a hub, so as to form the whole hub as in Fig. 200; the ribs, C, are then fitted, and lastly we complete the body by filleting the corners. For the teeth there is but one method that is usually adopted, and that is to form them in a box as follows: Plane a piece of hard wood, as in Fig. 201, some five or six

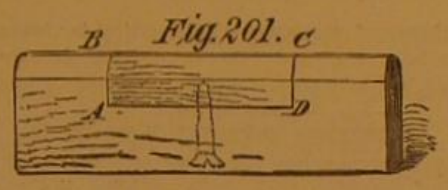


Fig.201.

inches longer than the teeth, and about three inches wider; the thickness is not to be less than that of the tooth at its thickest part. The ends of this piece must also be planed; from the edge, B C, gauge the line, A D, the required depth of tooth. Lay off, about in the center of the piece, the distance, B C, equal to breadth of face of the wheel, and make two saw cuts, B A and C D. Let this piece be now let into a piece of planed board, Fig. 202, which is an inch or so longer than the radius of the wheel at the tops of the teeth. This piece is to fit tightly into the mortise, which is made equally on each side of a center line on the board. Take now in a trammel the radius of the wheel at the top of the teeth, and mark off, from the outer edge of the hard wood box, the distance, E F, on the center line of the board. The point, F, represents the center of the wheel. Take the radius of the wheel at the pitch line, and also at the roots and points of the teeth; and with these distances describe the arcs, E G, H I, J K, and such other arcs as may be necessary, on which to take the centers for describing the correct form of the tooth. Complete the delineation of three teeth, or at least the center one, which will be upon the hard wood box; reverse now this box, and draw the outline of the tooth upon the other end of it; remove the piece from the mortise, and plane off to the shape of the tooth as drawn; remove the portion, B A D C, and the box is ready for shaping teeth in. Such teeth during the process are held by the screw shown.

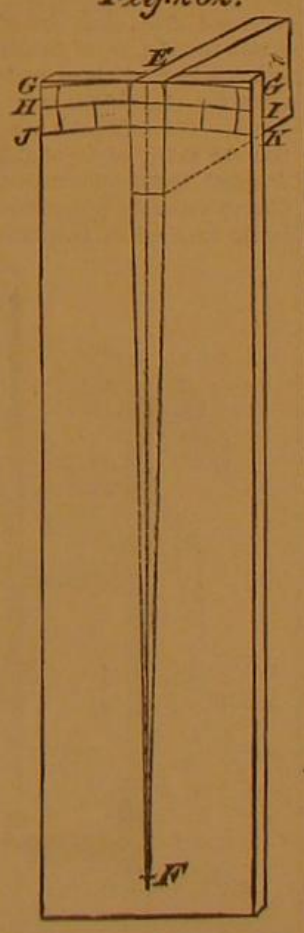


Fig.202.

Select for the teeth lumber very straight in the grain, and rip off a number of strips about two or two and a half feet long, of a width and thickness, when planed, slightly fuller than the required teeth, and hollow one edge to fit the curvature of the rim of the wheel. Saw the strips into pieces a trifle longer than the teeth, and plane the ends so that, when finished, the length of the pieces is exactly equal to the breadth of the rim; this latter process is most rapidly performed by placing some eight or ten side by side in a frame, and, if necessary, tightening them by a wedge and nipping in the vise (see Fig. 203). The frame must be equal in width to the length it is required to make the pieces, and care must be taken not to diminish this width, as is sometimes done. In planing a number of teeth, it perhaps is as well to blacklead the frame where it is apt to be planed; this will at least

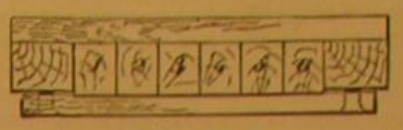
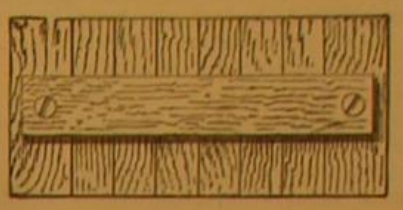


Fig.203.



show when damage has been done. The blocks are now severally shaped to the proper contour in the box, Fig. 201, particular attention being paid not to shave away the box in shaping the teeth; for this reason it is well to have an extra plane, very finely set, to finish with. The rim of the wheel having been divided according to the number of teeth required, and lines squared across its face, at *a*, Fig. 204, the finished teeth are glued on exactly to the lines. Only a few spots of glue should be applied, so that little or none may exude and hide the line that we pose the teeth by; when the glue has perfectly set, the teeth should be additionally secured by nails. If the above processes are followed up with proper care, the teeth will all be found evenly set around the wheel; nevertheless, it is only right to verify their position with a pair of callipers while the glue is yet soft.

Fig.204.

Very large wheels, or even those of moderate size when difficulties of transportation are anticipated, are made by bolting together a number of sections. A section usually consists of an arm and two equal portions of the rim, one on each side of it, so as to have a joint midway between each pair of arms. However, this may be one thing that must be observed, namely, to have the joints always in the center of spaces; therefore it is sometimes necessary to employ unequal segments or sections, in which case the pattern is made to the longer segment; and when these are cast, the flange is moved to suit the shorter one, and the superfluous teeth are stopped off in the sand. This saves cutting the pattern, which remains good for other wheels when required. The extremities of the arms, which are to be screwed to the hub, are provided with flanges for this purpose, the hub being flattened to accommodate them. A great deal of nicety is required in constructing wheels on this principle, as the spaces between the teeth at the joints must be neither wider nor narrower than at other parts.

Killed by Lightning.

Recently, during a severe lightning and thunder storm, at Newberne, N. C., three young persons, Isaac Richardson, aged 20, Eliza Collins, 20, and Laura Williams, 19, were struck by a heavy discharge of electricity, and instantly killed. Richardson was escorting the two girls, arm in arm, from church to their homes; and as they neared Queen street, a gentleman, who was but a few feet behind, saw them fall as the flash struck them. The coroner found the lifeless bodies lying side by side, with arms still locked. At the time of the accident they were walking under a steel-handled umbrella, which was found lying upon the ground near the bodies (the cover partially burned), and which, undoubtedly, was what attracted the electric discharge.

Strange Electric Phenomena.

The city was interested, last evening, by the appearance on C street of a strange phenomenon. At first it had the appearance of sparks of fire coming up through the pools of water beside the street. These sparks seemed to explode on reaching the surface, in many instances producing reports loud enough to be heard across the street, and being accompanied by a little cloud of smoke, and emitting a decidedly sulphurous smell. It was noticed that the phenomena occurred only on one side, under the telegraph wires. The sparks seemed to be caused by drops of water falling from the wires of the telegraph, which exploded when striking the pools of water. This solution was seemingly confirmed by the fact that when the wires became dry the phenomena ceased. It still remains to be explained, however, why, under the circumstances, such results should follow the falling of the water drops from the wires.—*Virginia City Enterprise.*

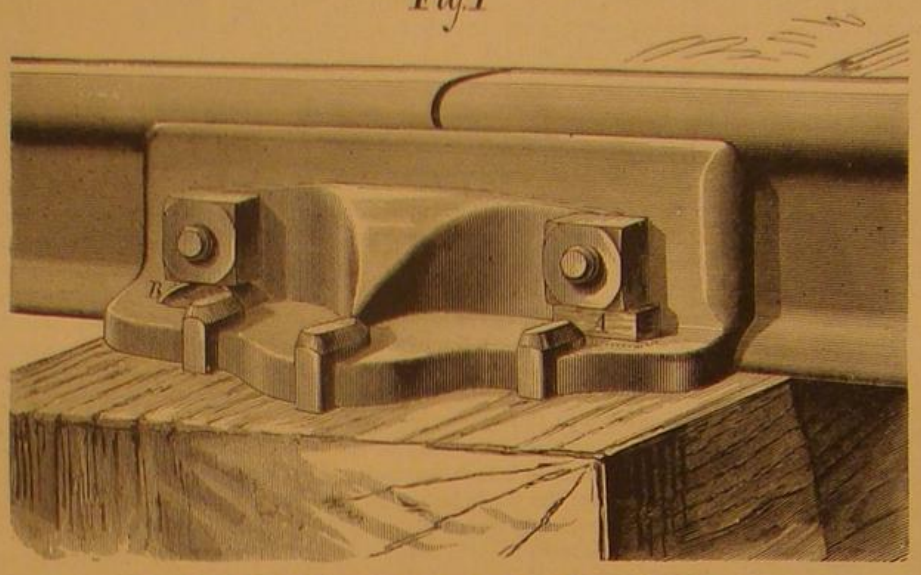
IMPROVED RAILROAD JOINT AND NUT LOCK.

We illustrate herewith a novel railroad joint and nut lock. The object of the device is to support the ends of the rail, keeping them from spreading or turning over, and at the same time furnishing abundant material opposite the joint to compensate for separation of the rails. As the appliance is made to fit closely, two bolts are done away with. The inventor states that the joint would be safe without any bolts on the same section of rail. The nut lock provided is cheap and simple, and may be either a wooden or iron key, or a spring, placed as described further on.

The shape of the device is clearly shown in Fig. 1. As the sectional view, Fig. 2, indicates, it is especially well adapted to the old pear-head rail, a form which has gone almost entirely out of use from the fact of its being too low to admit of fish plates and bolts, as commonly employed. The inventor considers that there is no better shaped rail than this, both for durability and strength; and he claims that, in connection with the joint here described, the pear-head rail will be as smooth to ride over as any of the fished rails. The engraving shows that the pear-head rail, being nearly an inch lower than the ordinary T rail, the leverage will be much less. The inventor further adds that a mile and a half of track, provided with his joint, has been laid, and that the riding thereon is exceptionally smooth. It is not deemed necessary to minutely describe the form of the invention, as it is plainly apparent from the engravings. It is moulded and matched to the rail. It requires no spikes in the flange of the rail, which, with the ordinary fish joint, are very necessary to keep the rail from creeping. In this way the full strength of the flange is retained. The nuts are locked by driving under them a wooden or iron key, as shown at A, Fig. 1, the same fitting down into a channel in the brace, or by adapting a steel bent spring, as shown at B. This device is applicable to ordinary fish joints by having a small projection rolled on the outside plate to hold wooden plugs or keys.

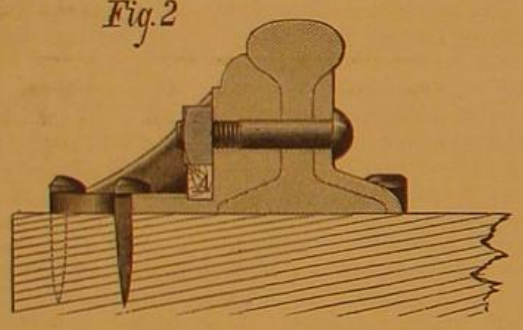
Patents for both brace and nut lock pending through the Scientific American Patent Agency. For further particulars, address the inventor, Mr. T. J. Nicholl, chief engineer, Gilman, Clinton, and Springfield Railroad, Springfield, Ill.

Fig. 1



NICHOLL'S RAILROAD JOINT AND NUT LOCK.

Fig. 2

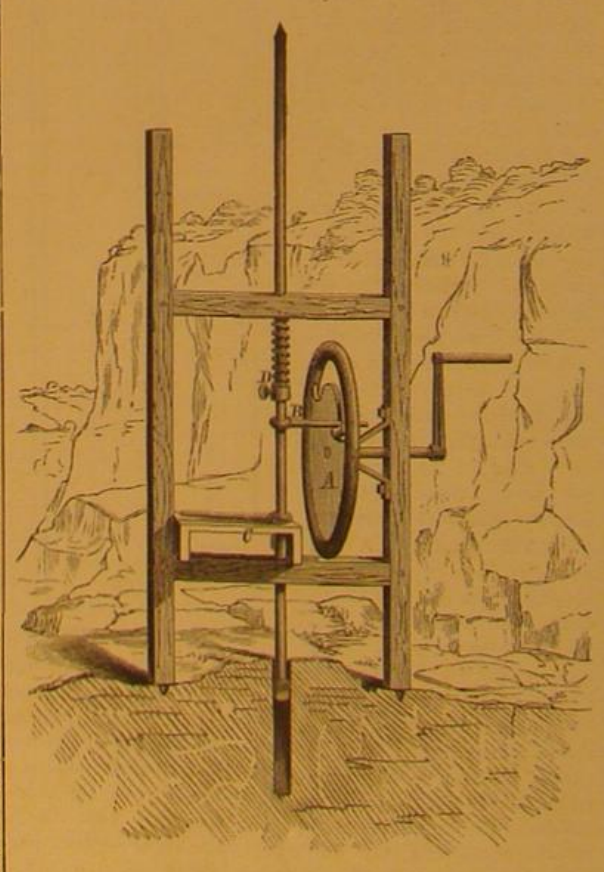


The Telephone.

New facts are discovered in the practical use of Professor Bell's speaking telephone much faster than theories can be framed to meet them. At present he uses only permanent magnets in operating the instrument; there is no battery used at all to give the current, it being obtained solely from ordinary and not very large horseshoe magnets wrapped with fine wire near each of the poles. Strangely enough, the magnets work equally well, no matter which pole of either magnet faces the other in the circuit. Instead of the usual arrangement of poles, + —, + —, these may be placed — +, + —, and yet serve the purpose of the telephone completely. Great electrical resistance, such as that caused by the interposition of 16 persons holding each others' hands as part of the circuit, interferes little with transmission. As the resistance is in such a case nearly twenty times that of the Atlantic cable, there seems to be reason for the hope that the sound of the human voice may be readily transmitted between Europe and America. The Bell telephone is strangely oblivious to some kinds of defective conduction and sensitive to others. Thus wet weather, which interferes with ordinary telegraphy, has no perceptible effect on the telephone; but imperfect joints uniting the lengths of wire are a grave impediment to the working of the new instrument. Three curious sounds are heard in the telephone when used with the ordinary wires between cities; these sounds are fainter than those which the instrument specially transmits, and make a sort of undertone of sound. The most distinct of the three is the ticking of Morse signals and the like. These can sometimes be distinguished as the signals of separate letters and words, but in general they are confusing by their number. They are produced by the vibrations of the telegraph poles from all the other wires that may be fastened to the poles that carry the telephone wire. There is a low crackling sound which is believed to be produced by the rubbing of imperfect or rusty joints of the telegraph wire. There is also a faint, continuous, bubbling sound, for which no satisfactory explanation has yet been offered. The Mechanics' Institute of San Francisco sent a gentleman to Professor Bell to induce the latter to apply the telephone in mines, so as to give prompt and complete communication throughout the mine and with the surface. The ordinary telegraph does not at present work well in the majority of mines, for various reasons. But to that, and many similar applications for the use of the telephone, though backed by most liberal offers, Professor Bell has invariably replied that he has not yet finished his experiments nor ascertained all the conditions necessary to the faithful service of the instrument. Nevertheless, he has one in constant use, connecting the workshop of some makers of electrical instruments with his own laboratory, and "chin-music" travels over the intervening half mile of wire without difficulty or mistake.

MERSHON'S IMPROVED ROCK DRILL.

In the accompanying engraving is represented a novel method of operating rock drills, enabling the same to be driven more rapidly and with greater facility than is possible with the usual sledge hammers. It also saves the labor of the man ordinarily required to hold the drill upright. The mechanism consists in a strong frame, through boxes in the cross beams of which the drill slides. One end of a short shaft is journaled into the frame, and the other in brackets. Upon the inner end of the shaft is a disk, A, in which there is an arc-shaped slot. In the slot is journaled a roller, which is concave in the direction of its length. B is an arm that projects from a ring which encircles the drill, and passes through the slot in disk, A. The brackets that support the inner end of the shaft are of such size as to come wholly within the slot, so as to allow of the rotary motion of the arm. A block, C, is secured to the lower cross timber to receive the ring of the arm, B, at the lower portion of its stroke. The drill point is enlarged and made V-shaped, so that the sharp edges of the V trim the sides of the hole. A spiral spring surrounds the drill bar, and is suspended directly under the upper crosspiece. This spring is compressed by the fixed collar, D on the bar when the latter is raised.



The disk shaft is turned by an ordinary crank, or it may be connected with any convenient motor. The mode of operation is as follows: As the disk is rotated, the arm, B, is carried upwards by the roller; and as the arm clamps the drill rod on being raised, it carries the latter with it, compressing the spring, and at the same time turning the rod through a part of a revolution. When the roller comes directly over the shaft, the arm is released, and the drill rod and arm fall together. As the ring of the arm strikes the block, C, the drill rod is entirely released, and is thus allowed to make a full blow upon the rock, the effect of which is increased by the expansion of the spring. Each time that the drill is raised, it is automatically turned, so that its cutting edge is constantly being shifted to new points in the rock.

Patented May 1, 1877, through the Scientific American Patent Agency. For further particulars, address the inventor, Mr. A. J. Mershon, Warsaw, Ind.

California Timber.

The sugar pine of California occupies the same place that white pine or cork pine does here, and is about equal to it as finishing lumber. It is used almost exclusively for sash, doors, and inside blinds. For all uses where a soft, white, straight grain is required, there is no wood on the slope equal to it. The heart is durable for shingles, crossties, and the like. Shingles made from heart sugar pine are free from some of the objections attaching to those made from redwood.

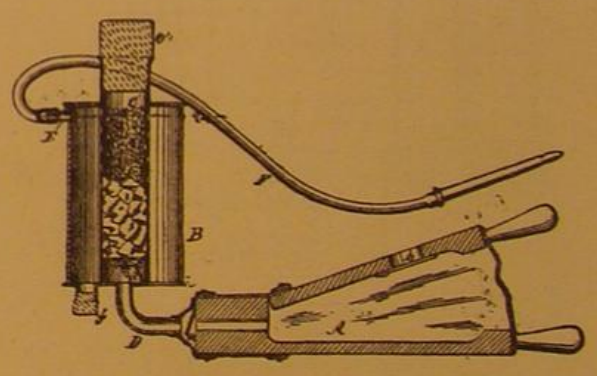
Yellow pine is used in the place of the sugar for some purposes; it has a soft, white and even grain, but works harder and is a firmer wood. Much of it resembles sugar pine so closely as to be barely distinguishable. Some of it is as handsome as many of the ornamental woods. For building lumber and fencing it is preferred to sugar pine.

Spruce, which is sometimes called red fir, is a strong timber adapted for joists and scantling, and all work requiring strength and durability. It stands exposure to the earth and weather very well and resembles Puget Sound lumber quite closely; it makes good plank for sidewalks, platforms, ship plank, car floors and frames, and similar work.

The fir is a white, close-grained wood, free from pitch or odor, useful for ceiling, scantling, and wainscoting, and makes good box lumber.—*Northwestern Lumberman.*

A NEW FUMIGATOR.

Mr. George T. Blanchard, of Plymouth, Me., has patented through the Scientific American Patent Agency, April 24,



1877, the improved fumigator herewith illustrated, which is mainly designed for use in killing lice and ticks on sheep and other animals, and also in destroying insects that infest shrubs and plants.

A is a bellows of ordinary construction, having the valves *a b*. B is a chamber containing a central perforated tube, C, in the bottom of which is placed a perforated grate, *c*, which is supported by the curved strips, *d*. A pipe, D, connects the lower end of the tube, C, and the bellows, A. The upper end of the tube, C, extends above the top of the chamber, B, and is stopped by a cork, *e*. An aperture is made in the bottom of the chamber, B, which is closed by a cork, *f*. A nipple, E, projects from the side of the chamber, B, for receiving the flexible tube, F, which terminates in the nozzle.

The manner of using the fumigator is as follows: A burning coal is placed on the grate, *c*, and the tube, C, is wholly or partly filled with fumigating material, such as tobacco or sulphur, and is stopped by the cork, *e*. The bellows is worked, and the smoke issues through the perforations of the tube, C, into the chamber, B, where it is cooled, and whence it passes, through the flexible tube and the nozzle, to attack the insects.

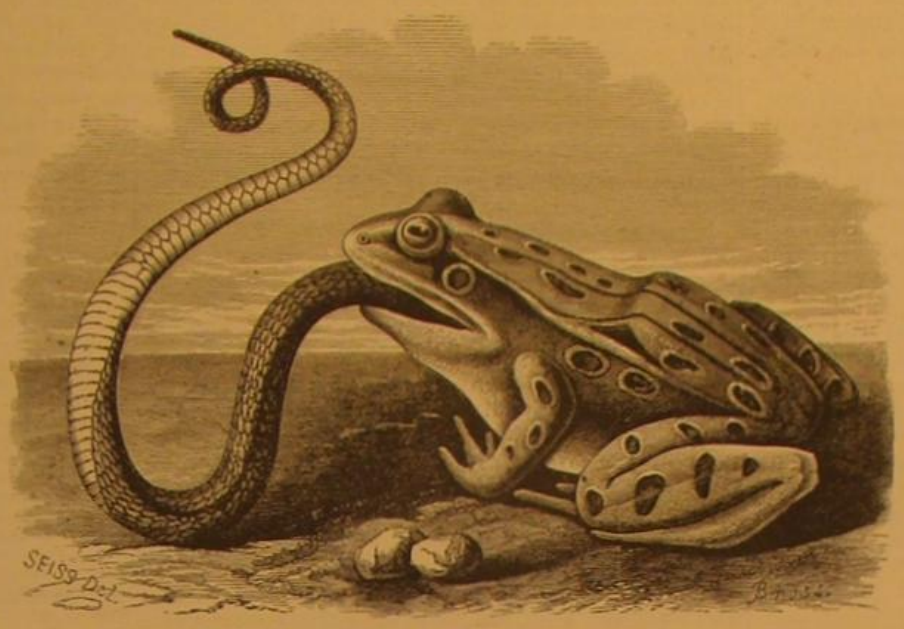
Ashes and dust that accumulate in the chamber, B, may be blown out through the aperture in the bottom by removing the cork, *f*, and working the bellows.

Foresite.

A new silicious mineral, found at San Cero, in Italy, has received the name of foresite in honor of the mineralogist, Rafael Fores. It occurs in granite, along with tourmaline, felspar, stilbite, and desmin, and crystallizes like the latter. Its composition is as follows: Silica, 49·96 per cent; alumina, 27·40; lime, 5·47; magnesia, 0·40; potash, 0·77; soda, 1·38; water, 15·07.

A SNAKE-EATING FROG.

Mr. C. F. Seiss, of Philadelphia, Pa., writes as follows: "It is a well known fact that many serpents subsist almost entirely upon frogs, but I never knew of frogs attempting to devour their common enemy, the snake, until I myself witnessed it. Last autumn I had in my vivarium a female shad frog (*rana halecina*, Kalm), a young bullfrog (*rana Catesbiana*, Shaw), and also two male marsh frogs (*rana palustris*, Le Conte). One morning I introduced to them a De Kay's brown snake (*Storeria Dekayi*, Holbrook). The bull and marsh frogs were much terrified at the appearance of the snake, and leaped wildly about, hiding at last under stones in corners as far removed from the snake as possible. Not so, however, with *halecina*. She did not, if I may use slang, 'scare worth a cent,' but looked upon the sudden appearance of the snake as a matter of course. The snake, happy at being released from the small dark box in which it had been confined, began moving about quite briskly. It at length crawled too near *halecina*, who with her tongue instantaneously seized it by the head, and began swallowing it with rapid gulps, until six inches of the snake had disappeared in her now distended abdomen. At this moment the snake had the appearance of an immense tongue, which the was frog slashing about most energetically. Not wishing to lose the snake, it being the most valuable of the two reptiles, I endeavored to force the frog to part with the snake, by tapping her smartly with my lead pencil. This had not, however, the desired effect, but I was forced to grasp the frog in one hand, and the snake in the other, and thus draw the snake from its unpleasant situation. The snake acted as if partially blind or bewildered after its removal, but otherwise seemed none the worse for its five minute trip around the frog's stomach. *Halecina* made two more attempts to swallow her fellow prisoner the snake; both times she was caught in the act and frustrated, and it is without doubt, she would at length have succeeded, had I not adopted precautionary measures. The above-mentioned snake was twelve inches in length, and the frog, from nose to vent, two and a half inches. Previously, this same frog had swallowed a live brown Triton (*desmognathus fusca*, Rafinesque), over three inches long. I will presume the frog mused thus: 'I will be compassionate toward you, poor Triton, and end your sorrowful longing for liberty'—and swallowed him!"



THE SNAKE-EATING FROG.

A BEAUTIFUL FERN.

The *Gleichenia dicarpa*, which we illustrate herewith, is an exquisite fern of the natural order *polypodaceæ*. It is, we believe, a native of New Zealand; and it is a highly ornamental addition to the shrubbery and the fern house. It is of a rich, dark green color, the spores being brownish yellow. It grows well and flourishes in a peaty or loamy soil. It can be easily propagated by divisions of the roots.

Botanists recognize as many as eight sub-orders of ferns, the *polypodaceæ* being known as the true ferns. This class includes the great majority of those with which we are familiar in the wild state or under cultivation. As many as 3,000 different species of ferns have been enumerated. In the earlier geological ages, ferns formed an important part of the vegetation, as may be seen by studying the coal formations; and they are found in our days in all parts of the world. One peculiarity of the genus is that many species flourish best when secluded from the air; and for this reason the Wardian case was designed especially for their cultivation, and has become one of the most popular and beautiful of household ornaments.

GLEICHENIA DICARPA.

Purification and Uses of Petroleum.

M. Masson, druggist, of Lyons, France, has succeeded in removing the disagreeable odor of petroleum by the following process: Into a vessel containing 225 lbs. of petroleum are separately introduced, by means of a long funnel, 2 ozs. each of sulphuric and nitric acid, and 1·1 lbs. of stronger alcohol are carefully poured upon the surface of the petroleum. The alcohol gradually sinks to the bottom, and when coming into contact with the acids heat is developed and some effervescence takes place, but not in proportion to the quantity of the liquids. Ethereal products of a very agreeable odor are formed, and the substances thus treated acquire an analogous odor, at the same time becoming yellowish in color. The operation lasts about an hour, after which the liquids are thoroughly agitated for some minutes with water, and after resting for eight or ten hours the purified petroleum is drawn off. The lower stratum, which is a mixture of the acids, water, and alcohol, may be used for deodorizing the heavy oils of petroleum, by agitating them well for twenty minutes, and, after twelve hours' washing the oil twice with milk of lime, to remove the free acids. It will then have the same, but a weaker odor, as the light petroleum first treated, and answers well for lubricating purposes.

Petroleum thus purified may be used in pharmacy for many purposes. All the tinctures for external use may be prepared with it, like the tincture of arnica, alkanet and camphor; it may be used for dissolving ether and chloroform, like alcohol, and, combined with fats or glycerin, promises to be of great utility in the treatment of skin diseases, etc. The alcohol used in pharmacy might be replaced by this purified petroleum.—*Répertoire de Pharmacie.*

Woodpeckers.

N. O. says, regarding a statement that woodpeckers never make incisions in the bark of trees for the purpose of sucking the sap, that woodpeckers proper, as well as a species called sapsuckers, tap beech, cherry, wild cherry, sugar maple, and almost all smooth-barked trees. They bore holes ¼ or ⅜ inch apart, horizontally, round the tree or its limbs; these holes are an inch deep sometimes, as many as 50 having been seen in a row.

A Disastrous Launching.

A disaster which resulted in the killing of six men and the wounding of several others occurred during the launch of the iron steamship Saratoga, at Mr. John Roach's shipyard, in Chester, Pa. The men were engaged in knocking the blocks from under the keel of the vessel, and failed to hear the warning to come out, when the ship began to move. Before they could escape, they were caught among the timbers and terribly mangled as the vessel passed over them. Mr. Roach has launched some forty ships, and hitherto without accident.

A Museum for Working Men.

Mr. Ruskin has opened near Sheffield, England, a museum for working men. It is the first school established under the St. George's Company for the working men and laborers of England, to whom the *Fors Clavigera* is inscribed; and as soon as he had selected the site Mr. Ruskin called some of the Sheffield men together and explained to them the reasons of his choice. He was well pleased with the workmen, spoke to them in the most familiar and friendly strain, and remarked that he had come to learn and not to teach. Having found they appreciated the boon he was about to confer upon them, he has sent to the museum many rare and interesting objects. On his paying a second visit to Sheffield, several working men who had embraced the doctrine of Robert Owen were anxious to obtain an interview with him, especially as he was reputed to be of an exceedingly amiable and affable disposition, and to hear his opinion as to the feasibility of establishing a co-operative village, consisting of houses, works, dining and lecture hall, library, etc., and surrounded with plenty of fresh air and pure water. Out of the funds of St. George's Company he has now purchased at Abbeydale, Sheffield, a beautiful estate of thirteen acres, at a cost of altogether $11,000, and has expressed his willingness to accept his co-operative friends as tenants until the annual interest they may contribute shall have cleared off the capital; that the estate is to be known as Equality Country, that twelve families have united in the undertaking, and that all their earnings will be thrown into a common stock, are matters of surprise to those who have taken a leading part in the movement. At most two families will live on the estate until it is known that the scheme is a success, the object of its promoters being simply to carry on the boot and shoe making trade on co-operating principles, in antagonism to the modern system of producing, by means of machinery, cheap and nasty goods; and if in this they succeed, they may gradually increase the number of their dwellings and form the whole into a co-operative village. The garden produce will be simply to meet their own requirements; but in whatever direction they may extend their present programme, Mr. Ruskin has not been asked to furnish them with the requisite means to carry out the movement.

Professor Bell's Talking Telephone.

A correspondent asks: "Do you think that the telephone will take the place of the telegraph now in use?" As this question is one which a great many are now asking, we would say that we do not. It may perhaps supersede the Morse system to some extent for private lines and the like, and, possibly, may be utilized somewhat in forwarding press reports; but for regular commercial telegraphing, it does not appear to us to possess, as it now stands, any advantages. In the first place, messages would require to be taken down in short hand by the receiving operator, and afterward copied in long hand; and we all know the liability to error, not to speak of the great delay of such a system. Then, again, while "Auld Lang Syne," "Home Sweet Home," or anything with which we are perfectly familiar, could be very easily recognized, it is questionable if regular messages could be "telegraphed" without serious errors occurring. It is very much like talking through the little toy "lovers' telegraph," or an ordinary speaking tube. If great care is taken to speak slowly and distinctly, and you have an idea of what is coming, you can generally make out enough to understand what a person is talking about. But it seems to us that nobody would care to trust important messages, sometimes involving life and death, or thousands of dollars, to being sent in this manner. We chronicled, issue before last, a ludicrous mistake made in just this way. A reporter telegraphed over the police wires to the editor of a Brooklyn paper that he was at the lunatic asylum, where he had gone on business, and could not get back in time for the afternoon edition. The sergeant told a policeman to step around to the newspaper office and inform the editor that Koselowski (the reporter) was at the lunatic asylum. The policeman misunderstood the message, and reported to the editor that Cardinal McCloskey was insane, and had been removed to the lunatic asylum. It is not too much to expect that just such mistakes would constantly occur were the telephone in use for commercial telegraphy. For the above reasons we do not think that telegraphers need have any fears about the telephone usurping, to any great extent, the place of the system handed down to them by Professor Morse.—*The Operator.*

On Dyeing with Aloes.

To prepare the coloring matter of aloes we introduce gradually 10 parts of this resin in 60 parts of nitric acid heated in a water bath. When the disengagement of gas is slackened, we evaporate the yellow solution at first in the sand bath, then in a water bath, and we redissolve the residue in water, which precipitates the

major part of the matter; we wash it to carry off all the nitric acid, then we dry it. The yellow, bitter matter thus obtained is entirely soluble in water, alcohol, and ether; its yield is from 66 per cent of the aloes employed. Aloes dye wool without a mordant, in shades which go up to a deep brown. We obtain mode shades very varied with mixtures of orchil and aloes; we grind up, for example, 20 parts of orchil with 1 of aloes, and we dissolve them in soda. We obtain the same varied shades by the employment of aniline colors. A mixture of aloes and soda ash dissolves in water with a beautiful purple color, which gives in dyeing fast bluish grays, analogous to those which are obtained with fustic on an indigo blue ground. We dissolve 1½ parts of aloes in water, and we add 2 parts of soda ash; after 12 or 24 hours we dye. If before dyeing we neutralize the bath, and add to it afterwards chalk, we obtain green olive shades. —*M. Victor Preston, in Muster Zeitung.*

NEW YORK ACADEMY OF SCIENCES.

A regular monthly meeting of the section on "Geology and Mineralogy" was held at the School of Mines, on Monday evening, May 21, 1877, Dr. J. S. Newberry, President, in the chair. Dr. Martin offered a series of resolutions in regard to the scientific use of the public parks, praying that they may be guarded from encroachment and misuse, that they be made schools for taste and scientific instruction, and that they be stocked with plants and animals of scientific and economic value.

Dr. Newberry exhibited a photograph of the restoration of a mammoth from Siberia. It is 26 feet long, 16 feet high, and represents an animal eight times as large as an elephant. The president also showed a new fossil from the Catskills, which seems to connect our red sandstones with the old red sandstone made famous by Hugh Miller; also a plaster cast of the new crustacean found in the upper silurian and named *eosarcus*.

The first paper of the evening, by Mr. B. B. Chamberlin, was on

SOME CHOICE MINERALS AT THE CENTENNIAL,

and was illustrated by a large number of beautifully executed water-color drawings. Among the minerals referred to were the native copper and silver of Lake Superior. Drawings were shown of calcite crystals of a delicate wine color, also of stalactites and stalagmites from the lead mines of Iowa. Arizona sent a meteor weighing 1,400 lbs., and Mexico another. Among the beautiful things there were emeralds, rubies, and crystals of corundum from North Carolina. Mr. Chamberlin also spoke of the amazon stone from Pike's Peak, Col., and exhibited beautiful drawings of this green mineral, some specimens of which have sold for $150. He described the diamond exhibit from South Africa as exceedingly interesting, embracing both white and colored stones. In the collection sent by the School of Mines, St. Petersburgh, was a topaz 5 inches in diameter, also emerald in rock, crocoite, and other beautiful and rare minerals. In other portions of the Russian exhibit, the magnificent display of polished stones and gems, lapis lazuli, malachite, labradorite, rhodonite, etc., made a splendid display.

THE EVOLUTION OF THE NORTH AMERICAN CONTINENT

was the subject of a paper by Dr. J. S. Newberry. The speaker said that the oldest rocks we know are themselves formed from sediment deposited by the disintegration of still older rocks of which we have no trace, and which may have likewise been the sediment from a still earlier continent. Of this older continent, we know not where it was or what it was; we only know that it was large enough to form a continent from its own ruins. Its history has been obliterated. Beginning with the old metamorphic rocks, known as the Laurentian and Huronian, which extend from Labrador to the Lakes of the Woods and as far north as the Arctic Ocean, we have the oldest known form of the American continent. Since that time it has been changing form by the formation of newer rocks. Owing to the cooling and contracting of the earth, there is a continual tendency to raise the high lands higher and depress the valleys lower: while at the same time other influences are at work, grinding off the elevations and filling up the depressions. In many places we dig or bore down to the old metamorphic shales and slates, surrounded by newer rocks. There are islands of these old slates in Texas, and the Black Hills were found by Messrs. Jenney and Newton to be an island of these old rocks very much disturbed, with the slates turned up on edge. They contain characteristic shells which connect them with the Potsdam of New York. The Pacific coast is a rock-bound shore that seems totally invulnerable; but the big rollers come in and pound away at the rocks perpetually, until the rocks are undermined and fall. Finally the rocks are pulverized and carried off to be deposited in the far distant sea. This sea has taken possession at different times of different parts of the continent. Wherever there was a depression, there has been a deposit of the remains of sea fish, spines, teeth, etc., on the bed of the sea. When the sea became shallow, another series of deposits, shells, etc., was made. Thus each period left a record of the physical conditions and the kind of life that existed in the sea at that time.

By the aid of the magic lantern, Mr. Russell threw upon the screen a series of pictures showing the shape of the continent in the Silurian, Devonian, carboniferous, tertiary, and and other ages; also pictures of the crustaceans, fish, reptiles, birds, and mammals that existed at each of these periods, together with ingeniously restored imaginary landscapes. This series ended with the introduction of man, the crowning glory of all. The lecture was well received and attentively listened to throughout.

What Liquor is Doing.

R. F. Mushet writes to the English press that Liquordom is killing trade, and, after mentioning the amounts spent annually, he remarks: "Now I say to manufacturers that it is all very well to reduce wages, and to economize their processes of manufacture, but unless they unite manfully, and put down the liquor fiend, he will crush them all. Besides the nine hundred and forty millions actually paid in the past seven years, the effect of swallowing the Satanic solution itself has lost and cost the nation at least an equal sum. If the days' works lost through drink in the last seven years were reckoned up, the amount of wages thus sacrificed would appear incredible. If manufacturers were to unite, as one body, and refuse to employ any man or woman who frequented drink shops, and would set the example by themselves abstaining, prosperity would soon return; for a sober England could compete successfully against all other nations."

We are most forcibly reminded of the truth of all this by an item in the *Labor Tribune* of Pittsburgh, which gives an account of the number of drinking shops in Allegheny City; the editor proceeds to use the stirring words: "When will men rise above this serfdom to a soul-enslaving appetite? Reform is impossible while saloons abound. Good wages cannot be long preserved where men encourage such vices. The working classes will be compelled sooner or later to acknowledge that abstinence must be practised before there can be any permanent amelioration in their condition."—*Coal Trade Journal.*

Paper Calender Rolls.

Paper calender rolls are almost as hard as iron, but are used in preference to iron because, while they will preserve their roundness, truth, and smoothness, they possess a certain amount of elasticity, and are therefore less liable to damage from the strain due to any foreign substance passing through them. The method of fixing the paper to the rolls is as follows: Disks of thin common brown paper, of a diameter large enough to turn up to the required diameter of roll and with a hole in the center of each large enough for them to pass freely over the roller shaft, are first cut out; then a number of similar disks, with the central hole made about four or six inches larger, are made. In putting these disks upon roll shaft, four having the smaller holes are put on, and then one with the large hole, the object being to insure that the paper shall press together at and towards the outer diameter of the roll, and not bind so tightly towards the center; thus the outer part of the roll is sure to be the most compact, and therefore the most durable.

To avoid bending the roll shaft by reason of any unevenness in the thickness of one side of the sheet of paper from which the disks are cut, every other disk is turned halfway around when placed upon the shaft. When the shaft is filled with tthese disks, it is placed under a very powerful hydraulic press, giving a pressure of about 200 tons, which compresses the disks solid together without the aid of glue or other adhesive substance. The disks are allowed to stand until they are compressed sufficiently to give room for additional disks, which are added in the same manner as before, the whole being again compressed. This process is continued until the intended length of the roller is filled with compound paper, when the latter is fastened as follows: Upon each end of the roll shaft a recess is turned, and a flange, made in two halves, is bored, smaller than the recess referred to by the amount allowed for shrinkage. The outer diameter of the flange is then turned, larger than the recess cut in the iron disks or flanges forming the end of the roll by the amount allowed for shrinkage; which flange is made slightly smaller in diameter than the intended size of the paper roll. The two half flanges are put in place upon the recess in the shaft, and the end flange or disk is shrunk on over the diameter of the two half flanges, thus firmly locking the whole to the shaft through the medium of the recesses on the shaft. This locking device is placed on one end of the roll before the paper disks are placed in position; then, after the disks are compressed and while the roll is in the hydraulic press, the flanges or disks at the other end are shrunk on. This plan is the one generally adopted in this country, that employed in England being considered deficient in that it gives the paper opportunity to expand ⅛ inch in the locking process. The rolls are then turned up in the lathe with a front tool for iron, the speed being but little greater than that employed to turn iron of equal diameter. The finishing is done by an emery wheel, the same as for an iron roll.

Dyeing Straw.

The season approaches when dyers have to take in hand articles of straw, and especially hats. As a rule, straw goods should be well steeped, and then treated with alum, orchil, and extract of indigo, and yellowed with turmeric. The shades most in demand are black, brown, and gray. Black (for 25 hats): Logwood, 4 lbs. 6 ozs.; bruised galls, 17½ ozs.; turmeric or fustic, 4½ ozs. Boil for two hours, and then steep in a beck of black liquor (crude acetate of iron) at 4° or 5° B., and rinse in several waters, dry, and rub with a brush of dog's grass, to bring up the polish.

Gray.—This shade can be obtained only on very white straws. Steep in a bath of soda crystals to which a little lime water has been added, to causticise the alkali. The purpose of this washing is to remove all traces of sulphur from the straw. For 25 hats, take: Alum, 4 lbs. 6 ozs.; tartaric acid, 3½ ozs. Add ammoniacal cochineal and extract of indigo, according to the shade desired. By making the one or the other of these wares predominate, we obtain a reflection more bluish or reddish. A little sulphuric acid is added to the beck, to neutralize the alkalinity of the ammoniacal cochineal. The hats are boiled in the dye for about an hour, and rinsed in water slightly acidified.

Maroon (25 hats): Ground sanders, 1 lb. 10 ozs.; turmeric, ground, 2 lbs. 3 ozs.; bruised galls, 7 ozs.; rasped logwood, 24½ ozs. Boil in a kettle so roomy that the hats may not be bruised. Rinse. Steep over night in black liquor at 3° B., and rinse in several waters. To produce a deeper black, return to the first beck, which is strengthened by an addition of sanders and logwood. Polish as for black.

Havana.—This shade, being a degradation of maroon, may be obtained by the same process, reducing the proportions by one half or one third, and omitting steeping in black liquor. The hats may be soaked for a night before dyeing in 4 lbs. 6 ozs. or 6 lbs. 9 ozs. of alum.—*Moniteur de Teinture.*

NEW BOOKS AND PUBLICATIONS.

FIRES: their Causes, Prevention, and Extinction, combining also a guide to Insurance Agents. By F. C. Moore. Published for the Continental Insurance Company of New York city.

Although this work is primarily a manual of instruction for insurance agents, and is especially intended for the employees of the above-named corporation, it embodies much that is new and valuable on the subject of fire prevention. There is of course no one class in the community who have a more direct interest in lessening the number of fires than the fire underwriters, and consequently it is to them we may look for thoroughly practical suggestions, based on the best experience and not combined with doubtful speculations. As a means of information of what is dangerous, as likely to cause fires in workshops, factories, and buildings of all kinds, how much the rate of insurance risks are enhanced by the presence of such perilous material, how to prevent fires, how to deal with them, and lastly, as a full exponent of the rights and duties of both insurer and insured, we can cordially commend this book. It contains much that we do not think has ever been published elsewhere, and it is written clearly and well.

STEAM INJECTORS: their Theory and Use. From the French of M. Leon Pochet. Price 50 cents. New York city: D. Van Nostrand, 23 Murray and 27 Warren streets.

As the injector is now coming into use for other purposes than the feeding of boilers, there is a large demand for literature concerning its theory and action; and this M Pochet has done much to supply. The mathematics of the subject are exhausted in his little treatise.

ENGLISH SCIENCE LECTURES.—Messrs. Macmillan & Co., of Astor Place, New York city, are now issuing series of the lectures addressed to popular audiences which are delivered in London, Manchester, and other cities in England. We have now before us one on "the Earth's Chemistry," by J. Norman Lockyer, one on "Technical Chemistry," by Professor Roscoe, and one on "the Succession of Life on the Earth," by Professor W. C. Williamson. The names of the lecturers guarantee the accuracy and value of the information contained in the discourses; and we are glad to find that the language employed in them is singularly clear and precise, and in every way adapted to the purposes of popular instruction.

Inventions Patented in England by Americans.

From May 2 to May 7, 1877, inclusive.

CARRIAGE LIGHT.—A. H. Phillippi, Reading, Pa.
FRINGING MACHINE.—J. B. Lincoln, Providence, R. I.
LIQUORING SUGAR.—O. H. Krause, Jersey City, N. J.
PEN, ERASER, ETC.—S. C. Thompson, New York city.
PHOTO-RELIEF PLATE.—W. H. Mumler, Boston, Mass.
PLATE PRINTING PRESS.—R. Neale, Brooklyn, N. Y.
REED ORGAN.—L. K. Fuller, Brattleboro', Vt.
SHEET METAL CAN.—L. V. Sone, New York city.
VARNISH, ETC.—G Wolff, Philadelphia, Pa.
VENTILATOR.—T. W. Bracher, New York city.

DECISIONS OF THE COURTS.

United States Circuit Court—District of Minnesota.

PATENT SEAT.—DAVID C. PRICE VS. JAMES E. KELLEY.

[In equity.—Before Nelson, J.—Decided February, 1877.]

The patents granted to David C. Price for improvements in portable show and circus seats are not infringed by the use of chair seats placed upon every alternate board of the ordinary circus seats.

OPINION OF THE COURT.

Nelson, J.:

The complainant obtained two patents, Nos. 125,329 and 134,486, dated respectively April 2 and December 31, 1872, as the original inventor of an "improvement in show and portable show seats." He also secured patent No. 163,537, to be issued to himself as the assignee of the original inventor, Wm. H. Shuey, and dated May 18, 1875, "for an improvement in circus seats." He brings suit against James E. Kelley, because of an infringement of his patents.

The complainant declares his invention, No. 125,329, has for its object "to provide an improved arrangement of seats for use in circus and other shows, the same being constructed with a view to the comfort of the spectator, while possessing the necessary qualities of security when erected, and compactness when packed for transportation." He claims as new an "improvement consisting of notched support, straps or bars, and boards and chairs, constructed and arranged as shown in a diagram;" also chairs provided with slots or recesses through which boards can pass, and "the seats be shoved along to the required position;" also "the combination, with the supports and boards, of the binding bars or straps and stakes to secure the supports."

The diagram of this invention shows the ordinary stringers used in circus and outdoor portable seats, elevated and adjusted on an inclined plane, the stringers being notched for the support of boards and elevated at the back by means of trestles. Every alternate board has a chair seat upon it, and the board immediately in front is used as a foot rest. The boards upon which are the chairs or seats, as well as the foot rests, are secured in place at each end by a zigzag-shaped strap passing from the top of each stringer over the boards to the bottom and terminating in an eye, through which a stake is driven into the ground.

In No. 134,486, every alternate board is suspended at each end from the under side of the stringer by a band of metal running the length, or nearly so, of each one, and by forming the shape of a clevis, upon which the ends of the board rest, secures it in position like a hanging shelf, and is called a foot rest. The complainant claims as new "the series of foot boards or rests, in combination with the supports (stringers) and braces" (trestles).

In No. 163,537, the invention is claimed as a "show seat consisting of the frame, the back formed of a single piece of bent wood, pivoted to the side of the frame, and jointed braces, the back being constructed to fold around and closely embrace the seat frame in order that the upper surfaces may be flush."

The defendant alleges want of novelty, denies that the patents are for original inventions, and denies that he has infringed either of the inventions and patented improvements.

It is admitted that there is no novelty in using stringers and trestles to form portable show seats, nor in making every alternate board on the stringers a foot rest; but the combination of all these in connection with a chair seat and folding-back, and straps to secure the ends of the seat boards in position, is urged by the complainant's counsel as new and patentable, and the infringement of this combination is charged.

An examination of the manufacture of the defendant shows that it has nothing in common with that of the complainant, except the notched stringers and the trestles, and the metal straps used to secure the seat boards, the space between the strap and the stringer at the notches being sufficiently open to allow the ends of each board to pass easily through.

The chair seat proper has nothing in common except a cushion. The Price or Shuey patent has an open back in the shape of a yoke, pivoted to

the side of the seat, and with braces attached and jointed to permit its being folded about the seat. The Kelley seat is composed of two leaves upholstered and connected at one edge by a hinge joint, so as to hold the back when open and allow it to be folded upon the top of the seat. The hinged edges are rabbeted so that the back when open bears against the seat proper, and prevents the seat board from splitting. Price suspends every alternate board in the ordinary circus seat by a stirrup of metal fixed below the stringers for a foot rest. He is thus enabled to bring his seat boards nearer together, and accommodate more spectators with no inconvenience. The knees and feet of the person when seated, being below the seat boards, do not interfere with those seated in front.

Kelley uses notched stringers and raises his seat boards so that they have the appearance of a high bench, upon which he puts his chair seats, and then uses for a foot rest every alternate board on the top of the stringers, as in the old and ordinary circus seats. When the seat board is raised, the board in front used as a foot rest falls below the back of the seat immediately in front of it, and the persons seated do not interfere with those in front. The security and comfort of the spectators are attained by each, and the mechanism permits the seats to be packed in a small compass for transportation, and rapidly and easily adjusted, but the arrangement in each is different. The only device used by Kelley not found in the old and ordinary circus seat is the upholstered chair seat and back, and the metal strap or clamp fastened to the stringers which holds the seat board in position. Price describes *this strap* in his patents and claims it as new. The testimony of the mechanics and architects is, however, that *this* mode of securing boards or underlying axles by a clamp or clevis in a firm and fixed position is a common and ordinary device, and "is on general principle of holding stairs or steps in their place and securing windlasses," etc.

The complainant, therefore, cannot maintain his suit on account of the use of this device, and as defendant constructs substantially the ordinary circus seat, which is old and common, and upon every alternate board of which, when elevated, he puts a chair seat which is not an infringement, his bill of complaint must fall.

It is unnecessary then to examine the other issues raised by the pleadings. Decree will be entered dismissing the bill of complaint.

Davis O'Brien Wilson, for complainant
Palmer & Bell, for defendant.

United States Circuit Court—Eastern District of Pennsylvania.

PATENT TOBACCO STAMP.—LORILLARD & CO. VS. MCDOWELL & CO.

[In equity.—Before McKennan, C. J.—Decided February 24, 1877.]

Charles Seidler's reissued patent of October 24, 1876, construed to embrace the impressment of a hard or metallic label upon either the inner or outer face of a plug of tobacco.

An inventor is supposed to describe in his patent the best mode of practising his invention, but is not necessarily limited to the precise construction shown, so as to exclude a method differing from it only in a single detail, but producing the same result.

A reissued patent is not void simply because it contains an expanded claim. The inadvertence on the part of the inventor in not making such claim in his original patent is conclusively determined by the Commissioner of Patents in granting the reissue.

McKennan, Cir. J.:

This is a motion for an interlocutory injunction, to restrain infringement of the patent set up in the complainant's bill. An original patent was granted to Charles Seidler on the 12th of January, 1875, which was surrendered and reissued to him October 24, 1876. The invention is thus described:

I have discovered and successfully developed in practice a means of marking and distinguishing tobacco in plugs. I prepare labels, or distinguishing pieces of separate material, and impress them into the body of the plugs, one label into each plug, preferably putting the label under the outside wrapper, and giving it a character by raised letters or analogous devices, which is recognizable through the flexible covering. The material of which these labels are composed is preferably sheet iron tinned, cut into a circular form, and having points or prongs bent backward from their edges, and with raised or sunken letters or marks upon their upper face, to indicate the quality, origin, or trademark. Before the plug of tobacco is subjected to its final pressure, one of these labels is placed upon it in proper position, and, by powerful pressure, the prongs of the label are sunk into the tobacco, so that its face is about flush with the outer surface of the plug, and adheres firmly to it. An outer leaf of properly dampened tobacco is then wrapped around the plug, which is subjected to a powerful pressure, and the label is seen beneath this wrapper, and is rendered thereby difficult of removal.

The invention is therefore claimed under five heads, the first and third of which are:

1. A plug of tobacco having a hard label pressed into one of its faces, as specified.

3. A plug of tobacco having letters or other decorative and distinguishing marks produced on a hard metallic surface, and pressed as specified.

These claims the respondents are alleged to have infringed, and construed as I think they must be construed, to indicate the impressment of a hard or metallic label upon either the inner or outer face of a plug of tobacco, the fact of infringement is clearly made out, both by the affidavits read in support of the motion, and by an inspection of the tobacco manufactured and sold by the respondents.

This construction of the patent has been very earnestly contested, upon the ground that the specification describes only the mode of applying the label to the plug underneath the outer covering, and that the words "as specified," limit the scope of the claims to that particular mode, but the patentee must be understood as merely describing what he regards as the best mode of practising his invention, as the law requires him to do, and not as excluding a method different from it only in a single detail, which produces the same result, and is distinctly within its object. He claims to have discovered a new method of identifying tobacco, which consists in the attachment of a hard label to each plug by pressing it into the points or prongs which project *from* the under surface of the label, and thus the fundamental object of his invention is fully effectuated. When *this* is done the outside wrapper is applied; but the label is thus placed underneath the wrapper, not as auxiliary in any way to the specific office of the label, but avowedly only to render it more difficult of removal.

It is obvious then that to dispense with this additional safeguard, and to apply the label outside of the wrapper, does not differentiate the devices, nor does it vary the method of attaching them to the plug in any essential degree.

Of the objections to the validity of the patent but little need be said at this stage of the case.

The first of these is to the novelty of the invention, or rather that it is a double use of an old device. But it is not shown to have been used for any purpose analogous to that contemplated by the patentee, or even remotely suggestive of such use.

It was the result of considerable thought, and of careful and repeated experiments, and supplied a perfect means of distinguishing the quality and origin of plug tobacco, which had not before been *furnished* to either the manufacturer or consumer. Nor does the denial of its patentability seem to me to have any firmer foothold.

Simple as it is, it nevertheless involved reflection and experiment to bring it to practical maturity, and its evident utility, indicated by its prompt displacement of other identifying devices, and its very extensive use, even by the respondents, strongly attests its patentable merit.

The remaining objection, that the reissue is void, as not being for the same invention described in the original patent, is clearly untenable. The drawings in both are the same, and the specifications of both are substantially the same. They both describe, as the invention, a hard or metallic label applied to a plug of tobacco before it is subjected to its final pressure, with characters impressed upon it indicating its quality, origin, or trademark; while in the original patent the claim is limited to tobacco, to which the label is applied underneath *the wrapper*. To remedy this restriction, inadvertently imposed, as the Commissioner of Patents has conclusively found, the reissue was properly granted with an expanded claim, to secure to the patentee the full benefit of the invention described, but not claimed in the original.

The motion for a preliminary injunction must, therefore, be allowed.

George Harding, for plaintiff.
Leonard Meyers, for defendant.

Supreme Court of the United States.

CLOTH MARKER FOR SEWING MACHINE.—HENRY W. FULLER AND ISAAC W. BARNUM APPELLANTS, VS. ENOCH S. YENTZER AND WALTER SCATES.

[Appeal from the Circuit Court of the United States for the Northern District of Illinois.]

A patent will not be sustained if the claim is for a result, a principle, an idea, or any other mere abstraction.

Where a new combination of old elements, producing new and useful results, is patented, it is the established rule that the invention, if any, within the meaning of the patent act, consists in the means or apparatus by which the result is obtained, and not merely in the mode of operation independent of the mechanical devices employed.

Where the claim immediately follows the description of the invention, it may be construed in connection with the explanations given in the description, and if the claim contains words referring back to the specification it cannot properly be construed in any other way.

It being understood that a result is not patentable, claims which read "forming one, two, or more creases in cloth, by means of, etc.," and "marking a line on the surface of cloth or other material sewed in a sewing machine, by means of, etc.," construed to be for the described apparatus for producing the results named.

Where the invention is embodied in a machine, the question of infringement is best determined by a comparison of the machine or apparatus constructed or used by the respondent with the mechanism described in the specification of complainants' patent.

Combinations consisting of old elements are not the same when none of the devices employed in one can be substituted for those in the other, so as to render the apparatus operative to effect the described result without reconstruction and invention.

A patent may be granted for a new combination of old elements or ingredients if it produces a new and useful result; but in such case the invention consists merely in the new combination, and the patent therefor is not infringed by a substantially different combination, even though it includes the exact same elements or ingredients.

The rights of a patentee for a mere combination of old ingredients are not infringed unless it appears that the alleged infringer made, used, or sold the entire combination.

The substitution of a known equivalent for one of the ingredients of a patented invention is not a good defence for an infringer; but if the ingredient was a new one, or performed a substantially different function, or was not known at the date of the patent as a proper substitute for the one omitted, there is no infringement.

Decree confirmed, dismissing the complaint.

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 DRAFT REGULATOR.

Thomas Baker, Albany, N. Y.—The object of this invention is to enable the fireman to control his fire, so that the heat, after the fire is fully burning, may be prevented from passing off with the products of combustion to so great an extent as it otherwise would. The invention consists in the combination of the open-bottomed case, the damper, bar, and chain, the weight and chain, the pulleys and shaft, and the chain, guard, and point with each other and with the flue of a furnace. By pulling upon the chain the damper can be raised to any desired extent, and can be secured in place, when adjusted, by passing a link of the said chain over a pin attached to the forward end of the guard. By counting the links of the chain drawn from the forward end of the guard, the fireman can adjust the damper in any desired position without leaving the front of the furnace. A steam gage is attached to the front of the boiler, so that the fireman can always see what the steam pressure is, and can regulate the damper as required.

IMPROVED DEVICE FOR CONVERTING MOTION.

Edwin Long and Louis E. Lyon, Iowa City, Iowa.—This invention relates to an improved device for converting a reciprocating into a rotary motion, and is more particularly applicable to treadles for driving light running machinery in which a number of revolutions for the flywheel are desired for each movement of the treadle. The improvement consists in a snatch block loosely connected with a reciprocating lever or bar, and having a hole or throat through the same through which one side of a band passes; which band is stretched about a driving and a tension pulley, and which snatch block has such shape of opening on throat as to seize the band when moved in one direction and to release the band, when moved in the other, back to its former position preparatory to taking a new hold.

IMPROVED ANCHOR.

Fisher A. Buck, Eastport, Me.—This invention is a novel modification of the mushroom anchor, in which the arms that branch out radially therefrom are curved upward at the ends, and provided with an inclined and tapering fluke, of circular shape, that is riveted or otherwise securely fastened to the ends of the arms. The circular fluke may be made of suitable width, so as to impart to the anchor a greater holding surface and power of resistance. The main advantage of the circular fluke consists in the fact that it will prevent the fouling of the anchor.

NEW MISCELLANEOUS INVENTIONS.

IMPROVED AEROSTAT.

William S. Hull, Jackson, Miss.—This aerostat is designed to be used either in miniature form as a toy (being driven by a torsional rubber spring in this case) or upon a larger scale with steam, or other suitable motive power, as a flying machine. The improvement consists in the construction and arrangement of two propellers at opposite ends of a tubular frame containing the driving mechanism, the said propellers being arranged to rotate in opposite directions, and constructed each of a series of right-angled *triangular* blades or fans, having one side at right angles to the rotating shaft and their larger acute angles deflected away from the shaft and supported upon independent projecting arms or bars.

IMPROVED ORE WASHER.

Dexter A. Hendrick, Calumet, Mich.—This invention relates to an improved "vanning" process mineral dresser, which process proceeds upon the principle of separating the rich ore from the lighter earthy matter by reason of their different specific gravities when the pulverized material is agitated with water; the rich ore gravitating to the bottom, while the lighter earthy matter is thrown off at the top. The machine consists in a receiving pan which by a tilting motion imparts to its contents a rotary motion without revolving upon its own axis, which pan is provided with means for regulating its degree of inclination or tilt, and is supported upon or stepped in a jigger lever which is alternately lifted and allowed to drop by means of a cam or wiper wheel, so as to further agitate the contents of the pan: a revolving rake being employed in connection with the pan, which rake is always upon the high side of said pan.

IMPROVED TEETHING NIPPLE.

Charles E. Rogers, La Crosse, Wis.—This invention relates to means by which the teething of children may be facilitated, and consists in an instrumentality of peculiar form, the same being provided with a handle to adapt it to be manipulated by the child, and a nipple of such shape and length that the gums may be brought to bear upon it, while it cannot be forced too far into the mouth or throat so as to do harm.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED DEVICE FOR SETTING, JOINTING, AND GAGING SAW TEETH.

Levi H. Bigelow, Fremont Centre, Mich.—In order that saws may perform their function properly their teeth occasionally require to be set, to give them a uniform inclination or angle, also to be jointed, to make them uniform in length; and when clearers are used, they require to be cut down or made shorter than the fleam or cutting teeth, between which they are located. The object of this invention is to provide a cheap, simply constructed, but efficient device, for use in performing these operations.

IMPROVED BOX SCRAPER.

John P. Tierney, Sacramento, Cal.—The knife box is made hopper-shaped. The knife or cutter fits against the inner surface of the box, so that its edge may project through the slot in the bottom; said knife is easily adjustable. A roller is added which prevents the instrument from being clogged with shavings.

IMPROVED WHEEL TIRE.

Isaac N. Pyle, Decatur, Ind.—This construction is such that the outer tire may hug the inner tire snugly when shrunk upon it, and may draw said inner tire more firmly down upon the fellies, making the entire wheel firm and strong.

IMPROVED SASH HOLDER.

Luther Jones and James Stroud, New York city.—This consists in the arrangement of two rollers at right angles to each other, in a suitable frame for attachment to the upper corners of the window sashes of cars to relieve them of friction caused by the swelling of the sash or casings when damp, or by the warping of the sash or window frame.

IMPROVED METHOD OF ATTACHING HANDLES TO CROSSCUT SAWS.

Charles A. Sands, Burlington, Kan.—This invention consists of a saw with a detachable spring guard, that serves to stiffen the back of the same, and also to cover the teeth of the same after use. It consists, further, of adjustable handles applied to face plates clamped to the saw ends.

IMPROVED METAL WAGON BODY.

Simon *Peter Graham*, London, Ontario, Canada.—The body of the carriage is made of sheet metal, and constructed with a flange around the bottom, which rests upon the wooden sill, and is secured to it by screw bolts. The top of the body is also flanged and attached to a wooden piece which forms the support for the seat proper. The sides and back of the body are united by a lap seam or joint which performs the function of a brace. The body is cheaper and stronger than those heretofore constructed.

IMPROVED WAGON END GATE.

Stephen D. Davis, Malvern, Iowa.—This end gate forms a box-like extension of the wagon body, and is so attached to it that it may be adjusted vertically as well as horizontally. It may be readily detached from the wagon body, and is so constructed as to support the ends of the sides of the latter.

IMPROVED LATCH FOR DOORS, ETC.

Augustus C. Woolman, Bellefontaine, O.—This latch has the form of a quarter section of a sphere, and is pivoted in a socket attached to the gate. It also has a handle which hangs vertical, so that the latch maintains a horizontal position, except when the gate is being opened or closed. A beveled catch plate is attached to the post, so that when the gate is closed the catch will strike the same and be turned on its pivot till it passes the catch, when it at once resumes the horizontal position and engages with the catch.

IMPROVED SKYLIGHT.

Joseph Henry, Chicago, Ill.—This invention is an improvement upon that for which the same party received letters patent dated March 27, 1877. It relates to constructing in one piece the head of the bar or rafter, upon which the glass rests, and in supporting the head by means of flat bolts provided with shoulders for that purpose. The invention also relates to a double gutter joint for use between the rafters, the same being constructed with a bent flange that is inserted between the panes or plates of glass.

IMPROVED MACHINE FOR GRINDING SHAVINGS.

Isaac Tompkins and Abram G. Tompkins, Brooklyn, N. Y.—This invention consists of an interior grinding cylinder that revolves within an inclosing cylinder, having a cutting surface and exit perforations, the inclosing cylinder forming a space around the inner cylinder that diminishes gradually in width. The small pieces into which the shavings are cut pass through the perforations of the outer cutting cylinder to an exterior casing, from which they are conducted to a suitable receptacle.

IMPROVED OSCILLATING CUTTER HEAD FOR FINISHING SPOKES.

Joseph R. Locke, Amesbury, Mass.—This machine is so constructed that the cutter heads may be oscillated to bring their cutters into proper position for finishing spokes.

IMPROVED BOARD LATH.

Andrew A. Smith, Boulder, Col.—The object is to furnish a lath so constructed that it will not be necessary to break joints in putting it on, which will strengthen the building, and will require less studding and less labor to put it on than ordinary laths. The invention consists in a board lath formed by slotting boards of the proper thickness with sets of slots, alternating or breaking joints with each other.

IMPROVED PLATFORM WAGON.

Ebenezer H. Booth, West Colesville, N. Y.—This improvement in the construction of platform wagons enables the draft to be applied directly to the axle, so that the wagon box can be set level. Its holds the body or box against swaying, and may be used either with or without a reach.

IMPROVED SAWING MACHINE.

George J. Kautz, Emporium, Pa.—This is an improved sawing machine, designed for use in a sawmill for cutting off slabs, edgings, and other lumber into lengths for wood, laths, pickets, etc. It is so constructed as to feed the lumber forward to the saw, and feed the saw forward to the lumber automatically. It may be adjusted to cut off the lumber in longer or shorter lengths, as required.

IMPROVED SETTING, JOINTING, AND GAUGING THE TEETH OF SAWS.

Levi H. Bigelow, Fremont Center, Mich.—By this device the cutting or flew teeth of a saw can be set at a uniform angle and jointed to make them of uniform length, and the clearers or clearer teeth can be gauged to a uniform length (but less than that of the cutting teeth, between which they are located). The device is extremely cheap, simple in construction, compact in form, and apparently adapted to operate efficiently.

IMPROVED METHOD OF MAKING WOODEN BOXES.

William Huey, Cambridge, Md.—This invention relates to certain improvements in the construction of wooden boxes, which improvements are designed more particularly for that class of wooden boxes which are stiff and rigid in shape, such as are employed for holding hats, caps, boots, shoes, thread, cotton, cigars, and all fancy articles, but which improvements are applicable to and designed to be also used in the construction of fruit baskets, crates, etc. The improvement consists in the manner of forming the bend or joint at the corners, whereby a single piece of board is made to form the several sides of the box without the trouble of measuring and fitting, and without the use of nails, screws, or dovetails for this purpose. The manner of forming the joint is to cut, by means of revolving cutter heads, preferably transverse channels across the board, and then after steaming the board to bend the same around. A peculiar form of channel which permits the successful bending of the board without breaking constitutes the main feature of novelty, which channel has straight angular sides that form a miter when the board is bent, with a curved groove at the bottom of the angular groove which affords bending room to prevent cracking.

IMPROVED STOP HINGE FOR CARRIAGE DOORS.

Charles W. Butler, New York city.—This is an improved hinge for carriage doors, trunks, etc., which stops the doors, covers, and other objects when the latter have been opened to about right angles. The invention consists in two bars hinged to each other at their inner ends, and at their outer ends hinged to the outer edges of the slotted plates or wings of a hinge.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion. If the Notice exceeds four lines, One Dollar and a Half per line will be charged.

Notes & Queries

It has been our custom for thirty years past to devote a considerable space to the answering of questions by correspondents; so useful have these labors proved that the SCIENTIFIC AMERICAN office has become the factotum, or headquarters, to which everybody sends, who wants special information upon any particular subject. So large is the number of our correspondents, so wide the range of their inquiries, so desirous are we to meet their wants and supply correct information, that we are obliged to employ the constant assistance of a considerable staff of experienced writers, who have the requisite knowledge or access to the latest and best sources of information. For example, questions relating to steam engines, boilers, boats, locomotives, railways, etc., are considered and answered by a professional engineer of distinguished ability and extensive practical experience. Inquiries relating to electricity are answered by one of the most able and prominent practical electricians in this country. Astronomical queries by a practical astronomer. Chemical inquiries by one of our most eminent and experienced professors of chemistry; and so on through all the various departments. In this way we are enabled to answer the thousands of questions and furnish the large mass of information which these correspondence columns present. The large number of questions sent—they pour in upon us from all parts of the world—renders it impossible for us to publish all. The editor selects from the mass those that he thinks most likely to be of general interest to the readers of the SCIENTIFIC AMERICAN. These, with the replies, are printed; the remainder go into the waste basket. Many of the rejected questions are of a primitive or personal nature, which should be answered by mail; in fact, hundreds of correspondents desire a special reply by post, but very few of them are thoughtful enough to inclose so much as a postage stamp. We could in many cases send a brief reply by mail if the writer were to inclose a small fee, a dollar or more, according to the nature or importance of the case. When we cannot furnish the information, the money is promptly returned to the sender.

N. A. R. will find directions for browning gun barrels on p. 11, vol. 32. This also answers G. D. M., who can clean brass shells by the process described on p. 102, vol. 25.—M. L. is informed that a recipe for root beer is given on p. 138, vol. 31.—A. D. B. is informed that there is no simple rule for the proportions of a screw propeller. He should read the subject up in the special treatises devoted to it.—O. B. S. does not give sufficient data as to his boiler.—L. T. F. and many others will find rules for calculating the horse power of engines on p. 33, vol. 33.—H. will find directions for whitening ivory on p. 10, vol. 32.—M. W. will find directions for making hard plaster of Paris on p. 43, vol. 34.—T. J. McN. should read our article on lightning rods on p. 144, vol. 31.—H. W. S. will find directions for making printers' rollers on p. 283, vol. 31.—M. A. A. will find something on cancelling postage stamps on pp. 83, 135, 266, vol. 36.—M. F. F. will find directions for removing freckles on p. 347, vol. 32.—E. R. C. will find directions for mounting chromos on p. 154, vol. 27.—E. J. L. will find a description of a galvanic battery suitable for medical purposes on p. 196, vol. 27.—W. H. C., J. J. Q., C. A. S., J. D. H., I. P., W. S., I. K. B., W. L., G. N. T., N. T., and others, who ask us to recommend books on industrial and scientific subjects, should address the booksellers who advertise in our columns, all of whom are trustworthy firms, for catalogues.

(1) G. A. asks: 1. How thick must a tube of cast steel be to hold 1,000 lbs. pressure per square inch? A. These questions are too indefinite. The thickness of the tube will depend upon its size. 2. Through ¼ inch hole, how many gallons water would be forced out per minute with a pressure of 1,000 lbs. per square inch? A. The discharge through the orifice will depend upon its shape and location.

(2) A. J. C. asks: How can I make a pattern by which to cast a cam wheel having upon its outer edge three equal eccentrics? Motion is given by two levers, one above and the other below, the levers having upon each one a roller which presses upon the outer face of the wheel, thus giving three strokes of the levers for each revolution of the wheel. A. Make the outline of the cam such that all lines drawn through the center will be equal.

(3) B. I. L. asks: How many lenses, and of what sizes and foci, are required to make a camera obscura for copying pictures? A. It requires but one, and it is not material about its size and focus. One 2 inches in diameter and of 18 inches focus will answer very well.

(4) J. B. H. asks: 1. On. p. 186, vol. 36, in reply to J. N. A., you say that a horse power to 1·5 lbs. coal is among the best results. Will you state what class of boiler will accomplish this result? A. The figure represents exceptional results with marine engines having very efficient boilers, and giving a horse power with the consumption of 14 or 15 lbs. of steam an hour. 2. I suppose that the heat given up by the condensation of any given amount of steam would, if all used, evaporate an equal amount of water into steam. Is this true? And, if true in theory, about how much result in evaporation can be gotten from the condensation of a given quantity of steam? A. You will find this matter discussed in nearly any modern treatise on the steam engine.

(5) H. H. F. asks: Is the use of alum in bread and cakes, at the rate of a teaspoonful to a loaf of moderate size, injurious? A. Yes. The presence of alum in bread, in any proportion, is very objectionable.

(6) E. L. W. asks: 1. Can you inform me how metal stencil plates are prepared? A. Stencil plates are usually made of hard brass. The letters and characters, if small, are usually stamped out with suitable dies; but when large, the work has to be done by hand cutting. 2. Are they treated with hydrochloric acid? A. Not that we know of.

(7) J. D. E. asks: What are the curves and positions of the lenses of the Huyghenian eyepiece? A. There are two plano-convex lenses with their plane sides towards the eye. Their aperture is ⅙ their focal length. The field lens is of 2 or 3 times longer focus than the eye lens. Their distance apart is one half of the sum of their focal lengths: that is, if the focus of one is 1 inch, of the other 2 inches, the distance apart is 1½ inches. A diaphragm a little smaller than the aperture of the eye lens is placed between the lenses at the focus of the eye lens. For a medium power, the focus of one may be 1 inch, of the other ½ inch, etc.

(8) W. J. G. asks: How many lenses and of what sizes and foci are required for a photographic camera to take pictures 4 x 6 inches? A. It requires an achromatic combination of flint and crown glass. The diameter is not material, say 1 inch, with a focal length of about 8 inches. The smaller the lens, the sharper the picture.

(9) F. W. G. says: In a very severe thunderstorm last summer, a large brick house here was struck by lightning. An "American District" telegraph wire was connected with one of their boxes in the house. Parties at the house claim that the wire brought the lightning to the house. I say that the house would have been struck anyway, and that the wire was a protection. Who is right? A. It is most probable that the wire had nothing to do with the matter. A discharge which would damage the house would, in all probability, have fused the wire.

(10) P. M. S. asks: Can you give me some information about rosin oil? A. When rosin is distilled, it yields about 74 per cent of liquid distillates. The first portions are mobile, yellow, and strong smelling, and are known as essence of resin (colophonone). Later in the distillation the viscid fluorescent rosin oil (or pinolin) passes over. This body is used in paints, for the manufacture of printer's ink, in making soap, and as a cheap lubricant.

(11) W. E. B. says, in answer to G. S. W., who asked if there is any rule for dividing a circle into 3, 4, or more equal parts by parallel lines: He will not probably find any general rule for this purpose; but I find by calculation that the chord of an arc of 149° 16′ 30″ cuts off a segment whose area is about $\frac{1}{2500}$ in excess of one third the area of the circle, and the chord of an arc of 132° 21′ cuts off a segment whose area is about $\frac{1}{2500}$ in excess of one fourth the area of the circle. These values are probably sufficiently accurate for all practical problems.

(12) A. E. F.—A good recipe for silver writing fluid is the following: Mix 1 oz. finest block tin in shavings with 2 ozs. mercury till they become perfectly amalgamated. Then shake up in a stoppered bottle with enough gum water to give proper consistence. The writing, when dry, will have the appearance of silver.

(13) H. S. asks: How is manganese obtained from the ore? A. Metallic manganese may be obtained from pyrolusite—the peroxide of manganese—by smelting at the highest heat of the blast furnace. It is, when free from carbon and silicon, a soft, easily tarnishable metal, resembling iron somewhat in appearance; and it has a specific gravity of about 7·2. It sells in small quantities for about $1 per lb. Manganese has six oxides, of which the dioxide is the most important. This occurs in Nature (in a nearly pure form) in the mineral pyrolusite, which, broken into lumps or powder, is commercially known as black oxide of manganese or simply manganese, the latter name being incorrect. The black oxide is worth from $10 to $20 a ton in New York. See p. 226, vol. 35.

(14) L. G. asks: 1. What is the greatest force, as expressed in horse power, which has as yet been obtained by means of electricity, and please tell me what is the name of the inventor? A. Professor Page, as long ago as 1850, constructed electro-magnetic engines of between 4 and 5 horse power. 2. As this power is very feeble, could I, by means of several engines working separately and giving the maximum power each is capable of, and working together on the same driving beam, obtain as great a power as desired, costing less and with less weight than from a steam engine of same force? A. No system of magnetic engines has yet been found as economical as the steam engine.

(15) J. E. S.—Your relay for submarine telegraphy might be used on lines of moderate length; but for very long lines the mirror instrument is the best.

(16) F. S. says: 1. I wish to construct a telephone. Can I be prevented from making and using the instrument by patent or other cause? A. You can make one for experiment, but could be prevented from using it after its successful working. 2. What number and length of wire should be used in the coils? A. Altogether about 190 feet of No. 24 copper wire will answer for short circuits. 3. How and of what material should the sounding plate be made? A. It can be made of thin iron. A very good description of the apparatus is to be found in Prescott's "Electricity and the Electric Telegraph." 4. Do you think a good mechanic could construct one that would work well from these directions? A. Yes

(17) J. F. says: For gumming envelopes I use mucilage composed of 2 ozs. dextrin, 1 oz. acetic acid, 1 oz. alcohol, 5 ozs. water. I am not satisfied with it. The adhesiveness is not sufficient. It is more adhesive without the alcohol. A. A strong aqueous solution of reasonably pure dextrin (British gum) forms a most adhesive and cheap mucilage. Alcohol, or rather diluted wine spirit, is usually employed as the solvent where the mucilage is to be used for gumming envelopes, postage stamps, etc., in order to facilitate the drying, and acetic acid is added to increase the mobility of the fluid. The strong aqueous solution is more adhesive than that prepared with alcohol, for the reason that it contains a greater proportion of the gum. To prepare this, add an excess of powdered dextrin to boiling water, stir for a moment or two, allow to cool and settle, and strain the liquid through a fine cloth. The addition of a little powdered sugar increases the glossiness of the dried gum, without interfering greatly with its adhesiveness. The sugar should be dissolved in the water before the dextrin is added.

(18) F. B. says: On p. 187, vol. 36, C. V. W. says that $\frac{\frac{1}{6}\text{ chord}^2 + \text{height}^2}{2 \text{ heights}}$ = radius of the circle. Can this be true? I have tried it several times with a graduated beam compass, but cannot make it so. A. The rule is correct. Probably, you have made some mistake in applying it.

(19) J. H. F. says: I bought a small engine, nominally of 4½ horse power. The dimensions are as follows: Steam chest 4 x 5 inches, cylinder 8½ x 4½ inches, stroke 7 inches, upright boiler is about 6 feet high, with water space 4 feet 5 inches, and 2 feet in diameter. I have made several attempts to run a corn mill, and have tried 12, 16, and 18 inch burrs; it will pull them if they are fed sparingly, but if fed in the ordinary manner they stop the engine. If running fast, pulling the mill, the piston rod or the rod running from eccentric to slide valve bends and quivers from top to bottom. This rod has no knuckle joint, but is made thin in one place to give it the right motion. I notice that running at good speed with 60 lbs. of steam a man can stop it by simply bearing his weight against the pulley. Please tell me what power the dimensions indicate, and give me your opinion in regard to the unsatisfactory manner in which it works. A. From your account the engine does not seem to be very well constructed. We advise you to test it with a friction brake, and see how much power it can exert steadily, and how much steam is required.

(20) F. L. says: 1. How should I treat a leak in a flue of an upright boiler? When I let the water out, by the blow-off cock, I can hear the air escape out of the flue. When I have a fire under the boiler the flue does not leak at all; but as soon as the fire is out the leak begins again. A. Such a leak can doubtless be made tight by caulking, if a slight expansion is sufficient to stop it. 2. What is the best way to refit a pair of safety valve seats, the valves on which do not set very closely, and stick somewhat, after being opened by a high head of steam? A. You can grind them in with oil and brickdust or emery. 3. To have two safety valves on the boiler, is it proper to have both valves set at the same weight, or should one be a little heavier than the other, say one for 60 lbs. and the other for 70 lbs.? A. If each is large enough to relieve the boiler, they might be set as you suggest. 4. What is the cause of knocking in steam pipes? A. It is caused by water in the pipe, or condensation and sudden changes of temperature. 5. Would it not be a good plan to have hand holes in the outside shell of the boiler at the level of the crown sheet, so as to be able to clean the crown and flues with a hose? A. This arrangement is sometimes adopted.

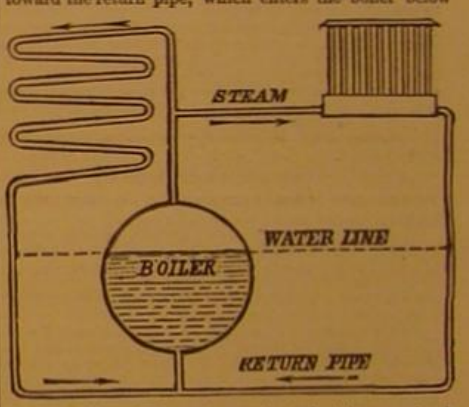
Will the rubber waterproof garments that ladies wear on damp days do to make a balloon? A. It might be made to answer very well if there was a demand for it. 2. How is this rubber material made? A. If you wish to experiment, it would be better to obtain samples from manufacturers than to attempt to make it.

(21) J. K. W. asks: What is the trouble with a double acting pump, which, in pumping from the cistern with the long suction pipe, if run very slowly (about 20 revolutions per minute) will work; but when the speed is increased to 100 revolutions, it seems to drop the water and the speed increases to 500 or 600 revolutions per minute, and it does not pump. A. The trouble is probably caused by the collection of air in the pipe. If so, it can be remedied by the use of a cock or valve.

How can I burn naphtha in a boiler furnace? A. We believe that there are special devices in the market for this purpose. Insert a notice in our Business and Personal column.

(22) J. E. asks: Can you inform me of any varnish for insulating No. 36 copper wire. I have used shellac dissolved in alcohol, but it would not answer. A. You cannot hope to thoroughly insulate helices of such fine wire by merely varnishing it. The wire must be covered with silk, cotton, or some other similar insulator. On cotton or silk covered wire, a strong solution of shellac gives very good results, and is very commonly employed. Fused paraffin wax is sometimes used, and is one of the best of insulators.

(23) C. G. L. says: You advise the use of a trap to return the water of condensation from the radiators to the steam-heating boilers. A trap of any kind is worse than useless, if the apparatus is for heating only, and all the radiators are above the water line of the boiler. It is only necessary that the pipes be of suitable size, and that all pipes and radiators shall incline toward the return pipe, which enters the boiler below



the water line. The water must stand at the same level in the boiler and return pipes, returning as fast as the steam condensed. I have known a boiler to be run for several months without the addition of any water: and in well constructed apparatus, the loss would be but a few gallons per month. The cracking and thumping often complained of is probably caused by water remaining in the pipes. This can frequently be remedied by raising any depressions in the pipe, where the water is trapped, or by taking the water from such depressions to the return pipe by a drip.

(24) J. N. says: 1. I wish to make a boiler which when finished will be exactly 30 inches high by 14 inches diameter. I intend making it of ¼ inch wrought iron, and the boiler heads of ½ inch cast iron. Will the cast iron heads stand enough pressure to run a small engine, size 3 x 1½ inches, to do light work? A. We advise you to make the heads of wrought iron. 2. How much steam can I carry? A. You can carry about 30 lbs. per square inch.

What is the best way to clean the rust off iron and polish it afterward? A. If the work is very rusty, you can use oil and brickdust or emery, and finish with a file.

(25) J. P. G. says: 1. I would like to know the difference between phosphorus and amorphous phosphorus? A. Red or amorphous phosphorus is only a modified form—an allotropic condition—of the ordinary vitreous variety. Their chemical nature is identical, though they differ greatly in their physical properties. This difference is believed to be due to an alteration in the molecular grouping. This property is known as allotropism, a word which means simply "different states." The phenomenon of allotropism is not confined to phosphorus alone, but is more or less a property of all the elements. Carbon in one condition gives us the brilliant, transparent, and nearly incombustible, diamond; in another, the black, opaque, easily inflammable charcoal or coke; while in another we have the metal-like graphite. The red phosphorus is usually obtained by heating vitreous phosphorus for some time to, or nearly to, its point of vaporization in an atmosphere of carbonic acid or hydrogen. It is more passive or inert than white phosphorus; it is heavier, of a brick-red color, and is not phosphorescent. It does not oxidize at ordinary temperatures, and requires a much greater degree of heat for its fusion than the waxy or vitreous variety, into which it may be directly converted by heating to 500° Fah. 2. Which is used on the common matches? A. Both active and passive phosphorus are used in the preparation of matches; but the latter, although more costly, is coming into more general use in parlor or safety matches and the like, in which it is mixed with chlorate of potash to cause it to ignite readily by fric

tion. When once ignited, it burns as readily as the vitreous variety.

(26) W. P. C. asks: Can you tell me of any substance soluble in water, for which sulphuric acid (diluted) has a stronger affinity than for iron, lead, tin, and zinc? A. Your questions are rather indefinite. All of the alkalies—soda, potassa, ammonia, etc.—also some of the alkaline earths, as lime, baryta or strontia, are more or less soluble in water and have stronger affinities for sulphuric acid than iron. 2. Also any substances soluble in water for which sulphuric acid has less affinity than for copper? A. If we understand you, most of the metallic sulphates are soluble in water, and are not decomposed by strong oil of vitriol. If you mean metallic bodies, there are none that we know of that dissolve in water without decomposing it and combining with one of its elements to form bases. Platinum, silver, gold, lead, mercury, etc., are not attacked by sulphuric acid in the cold, the former not even by the hot acid. 3. Can you tell me where I can find a table showing the relative affinities of the principal metals, acids, and alkalies? A. You will find such tables in most good works on chemistry.

(27) M. E. says: You once published a recipe for milk paint which contains considerable lime. I have used it on my walls and find it very satisfactory, but knowing nothing of the effect that lime has on different coloring, I have been unable to obtain the colors I wished. Will you tell me how to produce a light buff and a brown? A. Use oxide of iron or yellow ocher mixed with a little umber for the brown. A mixture of Spanish brown with a little chrome yellow gives a good yellow. Use Vandyke brown for a strong tone.

(28) W. H. R. asks: How can I make and use a quick bleaching liquor, for bleaching cotton goods which have become yellow from long service? A. Make a strong solution of chloride of lime (hypochlorite of lime—bleaching powder) in water, allow to settle, and draw off the clear liquid. Rinse the goods in clean water containing about 5 per cent of sulphuric acid, and then pass them slowly through the bleaching solution. They should then be well rinsed in water containing a little carbonate of soda. If the cloth is much colored it may be necessary to allow it to remain for a short time in the bath. This is the usual method of bleaching in laundries.

(29) H. M. S. says: I shook some pieces of litmus in a bottle partly filled with water, until the latter became of a deep blue color. Corking it up tight, I placed it on a shelf with other chemicals, among which were several acids. About a fortnight afterwards I observed that it had turned to a yellowish brown color, quite transparent compared to what it was before. Upon uncorking it and exposing to the air, it turned gradually to a deep red or carmine on top, and this extended upon shaking until the whole liquid was so; and it became opaque again, though of a different color. Can you explain this? A. Litmus is very often adulterated with lime, plaster, Prussian blue, etc. The action you noted may have been due to these other adulterants, or to some acid impurity contained in the water used for making the solution.

(30) F. S. & S. ask: What is the best cement for filling white metal signs with? A. Try the following: Melt together in a clean iron pot 2 parts each of best asphaltum and gutta percha; stir well together, and then add 1 part of gum shellac in fine powder. It may be used hot, and mixed with smalt, vermillion, or other pigment, if desired.

(31) B. P. asks: Please give a recipe for making paste to stick bills which are exposed to the weather? A. Take flour 25 lbs., alum in powder ½ lb., boiling water sufficient quantity. Paste will not very long resist the action of wet weather, but may be made to do so by giving the bill, after sticking with it, a wash of soap water, sugar of lead solution, or a solution of crude lac in naphtha.

(32) F. S. C. asks: What will restore faded black walnut doors? They have been covered with shellac, but the color of the wood is gone. A. It will be necessary to first remove the shellac. Much of it may be removed with a little ammonia water and alcohol; but it is best to scrape off the last portions, and sandpaper the wood. If the wood is genuine walnut, a little oil will then bring out the color, and it may be finished with a good coat of copal varnish. If the doors are of imitation walnut, make a solution of 2½ ozs. Vandyke brown in a boiling solution of 1½ ozs. washing soda in 1 quart water, and add to it about ¼ oz. of powdered bichromate of potassa. Stir well together, and when cool strain through a cloth for use. This will give you an excellent imitation of dark walnut; and when dry, it takes a good coat of varnish.

(33) A. F. H. asks: How can I make a new white coating stick effectually on an old ceiling? A. It is necessary to take all the old white coat off complete, to thoroughly wet the brown coat left on, and then finish with a new white coat.

(34) W. A. H. says: I wear a small compass attached to my watch chain; and in casually looking at it I noticed that it deviated about 90° from north. I also noticed that, when I stood alongside of our safe, the compass pointed directly to the safe. I walked to the stove, and my compass again swerved; but instead of pointing directly to the stove, it pointed diametrically from it. The safe and stove are not near enough to each other to exert any combined influence. The only difference between the situations is that one lump of iron was hot and the other cold. Please give your explanation of this remarkable effect of caloric over the magnetic needle. A. The data given are not explicit enough to enable us to give a satisfactory explanation; but it will probably be found that the pole of the needle which points towards the safe varies as the former is near the top or bottom of the latter; possibly, also, the same will be the case as regards the stove. The safe or stove, or both, may have become slightly magnetic from the inductive action of the earth.

(35) W. S. says, as to the welding of the point of a spindle to the plate on which it rested, while running: We had a parallel case in our mill some years ago. The burrs were 4 feet diameter, spindle was 10 feet long, 4 inches diameter, of cast iron, with a taper steel point inserted in the spindle. The point was about 1½ inches in diameter, flat; it ran on a steel plate, above which was a collar, about 1 inch thick, fastened securely in the oil pot, which was square and always full of oil. The motion was observed to be getting slower, and something was unusual about the running of the burrs. The engine was stopped to examine, and it was found that the end of the steel point was perfectly welded to the plate and collar in which it worked. Before it could be got out, it had to be heated to a red heat in a blacksmith's fire and driven out by punching a hole through the steel plate. The tapering end, however, was loose, and allowed the spindle to revolve when the point stopped. The pot was full of oil in which the point was running. Had we not seen this, we could hardly have credited it. If the supply of oil were insufficient, and the heating had been caused by want of it, the wonder would not be so great; but when the oil was in the pot to a depth of 2 inches, it is difficult to account for the phenomenon.

(36) I. B. C. asks: 1. In making a core for an electromagnet is soft iron the best? A. Yes. 2. Which makes the best armature, soft iron or steel? A. soft iron.

(37) J. M. H. and several others write as follows: Your answer to query of W. D. S. in regard to carrying the bar of iron is incorrect. The true answer being 2 feet 3 inches instead of 3 feet, as published in No. 8, p. 299, vol. 36. I presume the error was due to an oversight. A. As our correspondent correctly surmises, the answer was due to an oversight, or perhaps something of the same character, as Mr. Richard Grant White calls "heterophemy," since the conditions to which our answer applies are those in which a weight is shifted on the bar for proper distribution, the bar being supported at the ends, and its own weight disregarded. The numerous corrections that have been sent to us show the interest with which this column is regarded; and as our only desire is to furnish correct and useful information, we are always grateful to our readers for calling attention to any corrections that may be necessary.

(38) F. G. W. asks: In making a small engine, cylinder 1½ inches in diameter and of 3 inches stroke, would gas stop cocks be sufficient as cut-offs, or must I have a slide valve? A. If the cocks were nicely fitted, they might answer very well.

(39) M. O. S. asks: Do you consider a rotary engine as powerful with the same amount of steam as a cylinder engine? If not, what is the difference? A. We understand you to ask whether the rotary engine will give out as much power with the consumption of a definite amount of steam as a reciprocating engine. In special cases it may; but on the average, we think not.

(40) S. B. W. asks: What does a first-class land engineer get a year? When do you think that the time will come when they will stop putting on so much cheap help to run engines, and have every engineer examined? A. In large establishments, such as public buildings and hotels, where the engineer has considerable machinery, pipe connections, etc., to look after, the compensation is proportionately large. We imagine that, including all classes of establishments, the pay of the engineer varies from $30 to $300 a month, perhaps, in exceptional cases, being higher. Laws regulating the appointment of engineers may be good in theory; in their practical application, however, they are not always successful.

(41) S. & K. say: 1. We are pumping oil from one tank into another. S. says his pump is sucking the oil from the tank. K. claims that the oil comes to the pump by the atmospheric pressure upon the oil in the tank. Is there any such thing as suction in the true meaning of the word? A. What is called suction is due to atmospheric pressure. See p. 352, vol. 31. 2. Can you pump as well out of a tank which stands on a level with the pump as you would out of a tank standing some distance higher? A. When the tank stands above the level of the pump, the pressure forcing the oil into the pump is increased by the weight of the column of oil.

(42) F. W. asks: 1. Will a boiler 4 feet long, 1 foot in diameter, with five 2 inch flues through it, put in an arch horizontally, make steam sufficient to run an engine, 2½ x 5 inches, at 300 revolutions per minute? A. The boiler will scarcely be large enough. 2. What power will such an engine give with steam at 75 lbs. to the square inch? A. See p. 33, vol. 33.

(43) H. J. D. says: I inclose a specimen of scale from my boiler. I have used potatoes, petroleum, tannate of soda, and sal soda. The sal soda seems to do as much good as anything. Is there any danger to the iron from sal soda in large quantities? A. With frequent blowing, you can use considerable amounts of soda safely. 2. Do you consider such scale, in places nearly ¼ inch thick, dangerous? A. Scale should not be allowed to collect to the thickness mentioned. 3. Could I keep the boiler clear by using soft water, say 4 or 5 months in the year? A. If you can use soft water occasionally, it will be likely to loosen the scale. From an inspection of the sample, we think you can prevent the greater part from entering the boiler by using a feed-water heater with sediment collector.

(44) J. N. P. says: I fitted up two barometer tubes. One stands about ¾ of an inch higher than the other. Would boiling the mercury before filling up the tube drive all the air out? A friend says it would not, but that I must boil it in the tube after filling. Can I do that successfully without bursting or warping the tube? A. It is desirable, to insure a good vacuum, to boil the mercury in the tube, and in a vacuum. If you have no experience in such matters, it will be much better for you to have the tubes filled by a philosophical instrument maker.

(45) T. J. M. asks: In floating down a river, will a flat-bottomed boat go at the same speed as the current if no power is used to push it or increase its motion? A. Yes.

(46) A. S. T. says: We have laid a pipe underground from a spring, and have brought it above the surface in one place for the purpose of tapping. Will the water continue to be discharged in an unbroken stream, that is, over the crook? A. Air may collect at the highest point, and should be removed by opening a valve or cock.

(47) P. W. asks: If a weight be suspended by a wire in water, one inch below the surface, weighs 1,000 lbs., would it weigh the same if lowered in the water half a mile deeper? Of course the weight of the suspending wire is to be deducted. A. The weight of a body immersed in water is reduced by the weight of the water which it displaces. As water is slightly compressible, the body will weigh a little less at a considerable depth than near the surface.

(48) E. W. P. says: We have an artesian well which does not overflow. The water is elevated by steam pump, the suction pipe of which passes down inside of the well tubing, leaving a small space between the two pipes. If the well tubing was attached to the pump and made airtight, leaving out the inner suction pipe, would the pump work? Would it not be on the same principle as trying to draw water from a barrel without an air vent? A. Exactly.

(49) S. D. Y. asks: If I make a model of a boat to a scale of 1 inch to the foot, will its buoyancy be 1,728 times less than that of the boat? A. Yes, if you mean by buoyancy the volume of water displaced, and if you use in the model materials of the same specific gravity as those that are in the boat.

(50) H. M. says: I am about making a water velocipede, but do not know of what size and weight the wheel should be. How deep should the wheel be in the water? The length of platform is 3½ feet, length of floats 8 feet, width of platform 2 feet 8 inches, height of seat 1 foot 4 inches, floats are to be 10 inches in diameter, platform 3 inches above the floats, with cork fenders on each side of platform to save it from upsetting, and make it safer. How long should the crank or treadle and the posts on stands for the wheel be? A. As we have had no practical experience with these devices, we are not sure that we can aid you much. Your proportions seem to be judiciously chosen. The crank, treadle, etc., may be arranged with the same dimensions as in ordinary velocipedes, suited to the proportions of the rider. If any of our readers have experimented with these water velocipedes, we would be glad to know the results.

(51) A. B. says: I am building a steamboat, the diameter of my paddle wheel is 8 feet, and is 6 feet 8 inches across. I use an 8 to 10 horse power engine. Boat draws from 8 to 12 inches water. How many buckets should I have, so as to have the least amount of slippage? A. Make it so as to have 3 or 4 buckets in the water, with ordinary draft.

(52) E. O. M. asks: 1. Which is the best way to learn the exact amount of priming when a boiler is tested? If the method is expensive, and requires the skill of an expert, what is a tolerably good way which is inexpensive and adapted to the capacity of an ordinary boiler tender? A. Some form of calorimeter should be employed; and we know of none that can be used successfully by an inexperienced person. 2. What is the peculiarity about a boiler which inclines it to entrain sediment without also entraining water? This peculiarity is claimed for some boilers. A. You should inquire of the patentees. 3. Robert Wilson in his work on steam boilers under the heading of "Incrustation," says that the light carbonates, when entrained, are liable to blow off the cylinder cover, break the piston, or stop the engine. Did you ever hear of such damage, and what are the particulars? A. If any of our readers can furnish information on this subject we would be glad to hear from them. No such occurrence has ever been brought to our notice. 4. Is it possible for any boiler to entrain all the scale-forming impurities of salt water? A. We think not. 5. What can be done to relieve the cylinder of the engine from its trials when so much solid matter is thrown into it? A. Use large relief valves.

(53) C. H. H. asks: How are electric bells constructed so that they may be made to ring for five or ten minutes? A. Attach one end of the line circuit to a spring against which the armature rests when it is not attracted; also, connect the armature to one end of the magnet coil. The other end of the coil is to be connected to the battery, and the circuit completed; this will cause an attraction of the armature; and after traveling together for a very short distance, the latter leaves the spring and breaks circuit. The armature, being now no longer attracted, returns to its normal position and completes the circuit again, when another attraction results and the vibration is continued as long as desired.

(54) B. N. G. says: 1. I want to build a boiler for an engine 2 x 2 inches, to run a boat 15 feet long with a screw 18 inches in diameter, of 3 feet pitch. I intend to build the boiler by placing the heads on the end of the shell, bolted on with several of the tubes with nuts on the ends. Do I need shoulders on the inside of tubes? How large should the shell be? A. No. 2. How large an oscillating engine should I want to run a boat 15 feet long, of 4 feet beam, and how large a boiler would it take? A. You can make the engine 2 x 3. Make the boiler 20 to 22 inches in diameter, and 3 feet high. 3. Should an oscillating engine be larger than a slide valve engine, of the same power? A. An oscillating engine, if properly constructed, will not take any more than the other, under the same conditions. 4. Shall I need a license to run my boat on the Merrimac? A. According to the United States law a license is required. Whether the law is strictly enforced in your locality, we do not know.

(55) H. M. C. asks: If the sides of a triangle, A B = a, A C = b, B C = c, are known quantities, how can I find the area A B C of the triangle, in terms of a, b, and c? Perpendicular, A D, is supposed to be unknown. A. The following is the formula, the demonstration of which may be found in any good treatise on plane trigonometry: $S = \frac{a+b+c}{2}$. Then

$$\text{Area} = \sqrt{S \times (S-a) \times (S-b) \times (S-c)}.$$

(56) G. J. R. says: I have been thinking of building a small steamer: I do not think the water will average over two feet deep. I have an engine of 2 inch bore with a 3 inch stroke. Please tell me its capacity? Will this engine do to drive a boat 26 feet long and about 5 feet wide, to carry 8 or 10 persons? A. The engine is, we think, too small for such a boat as you propose.

(57) E. C. W. asks: 1. Which is the better, cypress or cedar, for light boat building? A. Cedar is generally considered preferable. 2. How ought boats to be treated, after finishing, to protect from the water and weather? A. The joints can be made tight with putty or white lead, and the boat should be well painted.

(58) M. F. says: I am the owner of a tract of land in the Carson valley, that lies some 25 feet above the level of the Carson river. It is very productive, but I am at a loss to know how to get much of it under cultivation, as it must have irrigation, and ditching would cost me more than I am able to expend. Can I force water upon the land from the river by means of a force pump, say, through a 3 inch pipe? If so, what size or power of pump should I have? How much fall of water should I have back of the pump, and would it do to set the pump in an excavation in order to give it a fall? A. If you can use a windmill, your plan of artificial irrigation may be successful; and by addressing a manufacturer, you can obtain particulars as to machinery required.

(59) C. C. C. asks: How can I line sheet iron tanks with Portland cement? A. We do not think you can succeed in causing the cement to adhere permanently to the sheet iron unless the lining is given a great thickness. The cement could be moulded into thin bricks and built in with cement mortar. Portland cement can be obtained of any dealer in building materials.

(60) Mr. J. H. Tjörswaag, of Flekkefjord, Norway, says: As an example of how fast the appearance of a landscape can change even under higher latitudes, I can mention that last year in the early days of June the snow covered the ground at Masi, in the northernmost part of Norway under 70° north latitude, and in the middle of July the potatoes were all in full bloom. It is but fair to add that the sun does not go below the horizon from the 15th of May till the 27th of July at the above-mentioned place.

A couple of years ago I built a new barn with barnyard all of wood. Partly for the sake of appearance, but chiefly to make the barnyard more easy to clean, I gave the walls and ceiling two coats of oil paint. Now as long as mild or warm weather prevails, it is all well enough; but as soon as cold weather sets in, the evaporation from the animals (only four or five cows) settles under the ceiling, collects in drops, and (when heavy enough) falls on the floor, on to the animals, or runs down the walls, making everything wet and dirty. Can I ventilate the room (25x14x7½ feet) in an efficient manner, and at the same time retain sufficient warmth for the animals, and how? The temperature here during winter varies from 18° to 45° Fah. A. The space is rather small for that number of cows, and a little ventilation would benefit them. A small opening at the floor upon one side and at the ceiling upon the other would answer the purpose. The size of these openings might be graduated by sliding shutters.

(61) E. R. asks: 1. If I have an air-compressing pump which will hold ½ cubic foot of common air, how many times must I force the piston up and down until I have respectively pressures of 15, 30, 50, 75, 100, and 125 lbs. per inch over the atmospheric pressure in an air tank of the same dimensions as the pump? A. It will make considerable difference whether you cool the air as it is compressed, or not. You will find formulas by which you can make the necessary calculations, in question (26) on p. 235, vol. 35. 2. If the valve that connects the pump with the tank be 2 inches in diameter, will it take a greater force to move the piston down when the communication between the tank and pump is open, and does the compressed air in the tank press with a greater force on the valve than if the valve were only 1 inch in diameter? A. By using the larger valve, the friction of the air will be reduced.

(62) F. G. T. asks: 1. What size of boiler will it take for a small engine ¾ by 1¼ inches? A. You can make a boiler 3 inches in diameter, and 5 inches high. 2. Would it do to make it out of tin? If so, what pressure would it stand? A. It can be constructed of tin for a pressure not exceeding 10 lbs. per square inch. 3. Could I keep up steam with burners and coal oil? If so, how should they be placed, under the boiler or in a flue? A. The lamp should have a burner that would answer without a chimney, or by having a central flue in the boiler, that would take the place of a chimney. 4. What tools would it require to make a small engine out of ready made castings? A. The tools required to fit up the engine will be a vise, some files, taps and dies, hammers, chisels, and wrenches.

(63) R. K. asks: Will you please tell me what is the difference of heat in the sun's rays on a perpendicular round stick 4 inches thick by 2 feet high, and one of the same size placed to incline 6 inches to the south? A. We presume you refer to the different areas exposed at right angles to the direction of the rays, in the two cases. You can easily plot or calculate this for any assumed direction of the rays.

(64) F. W. S. says: I wish to build a vase which shall hold about forty gallons of water, to be placed where I can have pipes running about five feet below the vase. Will it be possible to construct it in such a manner that, by the use of pipes, the water of its own weight may be made to form a fountain from one to two feet high? A. You can arrange it on the principle of Hero's fountain, which is illustrated in many elementary treatises on natural philosophy.

(65) J. B. says: 1. We have to use salt water in a boiler. Is it injurious? A. Salt water forms scale in a boiler, which is injurious. 2. How is a condenser made? A. A condenser is a vessel in which the steam is condensed either by contact with or by being exposed to the cooling influence of water. 3. What is the hottest water which a common force pump will throw in a boiler? A. Pumps made for hot water will act when the temperature is quite high. With others, the temperature of the water should not ordinarily exceed 100°. 4. Is salt water more injurious to a boiler than sulphurous or lime water? A. There are some spring waters that are more injurious to boilers than salt water from the ocean.

(66) W. G. says: I have a steam pump of the following dimensions: 22 inch steam cylinder, 10 inch plunger, 4 feet stroke, 9 inch suction pipe, and 9 inch discharge pipe. The discharge pipe runs 250 feet north on a rise of 40°. It makes a quarter turn, and runs 94 feet east, horizontally, and then another quarter turn and runs 200 feet north on a rise of 40° to the point of delivery. The pump works as smoothly and with as little jar as possible; but there is a heavy jar in the discharge pipe which moves the whole column when the pump runs over 18 strokes per minute. When it runs less than 18 strokes, there is no jar. Will you please tell me the cause and the remedy? A. According to data sent, the vertical height of column of water is nearly 320 feet. The jar is probably due to the stopping and starting at the end of each stroke, and might be reduced by the use of a larger air vessel.

(67) J. V., of Canterbury, England, says: I have a traction engine, with one cylinder 8 inches in diameter and 12 inches stroke, which I work at 100 lbs. pressure. What difference will there be in the power if I put on an 8x16 inches cylinder, all other things being equal? What difference will there be in the power of a 9x12 inches and a 9¼x16 inches engines, all other things being equal, at 100 lbs. pressure? A. Calling the power of the 8x12 inches 1, that of the 8x16 will be 1·33, that of the 9x12 will be 1·27, that of the 9¼x16 will be 1·78.

(68) J. H. E. says: The following is taken from a book high in authority on mechanical subjects, speaking of an ordinary steam engine: "If, on the introduction of steam to the cylinder, it has a pressure of say 4 atmospheres, it follows that it will act upon the piston with all this force to cause it to descend; since, however, the lower part of the cylinder is at this time in communication with the external atmosphere, there is a resistance = 1 atmosphere opposed to its movement, therefore the actual effective pressure on top of piston = 3 atmospheres." I wish to inquire if the pressure (4 atmospheres) is that which is indicated by the steam gauge, and what becomes of the pressure of the air in the boiler after the air is worked out? I know that an engine will run with less than 15 lbs. pressure by the gauge. A. In the statement quoted by you the reference is apparently to absolute pressure, or pressure above a vacuum. The steam gauge, being pressed internally by the steam and externally by the air, indicates the difference of these pressures, or the pressure above the atmosphere.

(69) W. S. says: 1. Given the boiler or reservoir of a fire extinguisher, tested to 150 per square inch, 24 inches long, of 9 inches diameter, and about ¼ inch thick, laid horizontally and fired with charcoal, required the size of engine it will run, and the best working pressure? A. The reservoir could be made to answer as a boiler; but it would not be advisable to carry a pressure of more than 60 or 75 lbs. 2. I wish to cast the cylinder of brass. If I take a piece of iron, turn it off smooth, and polish it, could I use it for the core to cast the cylinder around, and could I drive the iron out? A. You will not be able to make a very good cylinder in the manner you propose. There is no difficulty in making a sand core quite as smooth as the one that you suggest.

(70) I. C. C. asks: How can I make a good filter, capable of filtering three or four pails of water a day? I have made my box 14x14 inches at top, and 14x 2 at bottom, with a height of 3 feet; and I filled it with alternate layers of charcoal, coarse gravel, and sand. For a week or 10 days it will work well, and then the amount filtered lessens. A. It would probably answer your purpose to use sand only, spread out over a large horizontal surface, and when choked by the accumulated sediment, to remove about one inch in depth of the sand and renew it. After a more extended interval the whole might be renewed.

(71) T. P. B. asks: What is fire? A. Fire is, commonly speaking, gaseous matter in a state of intense heat, due ordinarily to combustion, or a direct and energetic combination with atmospheric oxygen. Scientifically it might be described as matter under the influence of intense atomic or inter-molecular vibration. Consult some good work on chemistry or chemical philosophy.

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

C. W. R.—It contains carbonate of lime and alumina.—Miner, New Mexico.—It consists of red oxide of iron and clay.—G. F.—They are all crystals of quartz (pure silicic acid). They are quite common, and of little value.—M. A.—It does not contain silver, but antimony and lead. —M. A. A.—The sand you send consists principally of quartz crystals and iron, and manganese garnets.

M. H. H. says: 1. An acquaintance claims that, in a sugar cane mill, one of the crushing surfaces should be the surface of a small cylinder, for as it presents a smaller surface to the cane, it will do the same work easier. Is it so? 2. What are the advantages and disadvantages of horizontal and perpendicular rollers? —T. W. D. asks: Which steamboat, running in fresh water, is the fastest, and what is her speed?

COMMUNICATIONS RECEIVED.

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

On Saving Life in Case of Fire. By J. S.
On Nickel Plating. By D. G.
On High Interest. By J. H. S.
On Reclaiming the Desert of Sahara. By R. T. E.
On a Tidal Motor. By A S.
On the Trisection and Multisection of Angles. By W. T.
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On Labor-Saving Machinery. By T. R. V.

Also inquiries and answers from the following:

F. M. B.—C. G. L.—D. B.—G. W. K.—M. A.—W. D. —J. W. L.—J. E. H.—M. J. C.—S. H.

HINTS TO CORRESPONDENTS.

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

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 sells lampblack by wholesale, and what is its price? Who sells apparatus for the production of sulphate of potash? Whose is the best metallic piston packing? Who makes cotton and wool carding machinery? Whose is the best gas meter? Where can the best fireworks be obtained?" 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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[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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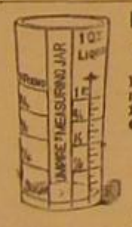

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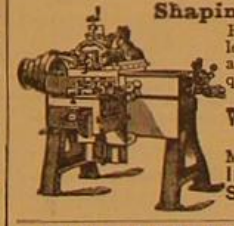

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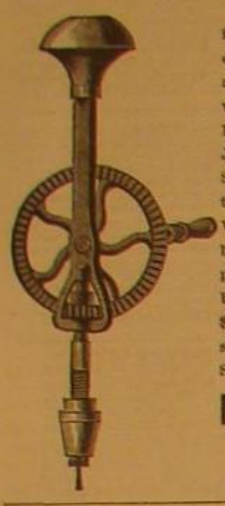

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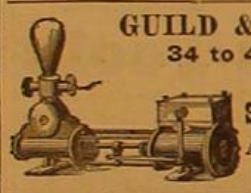

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