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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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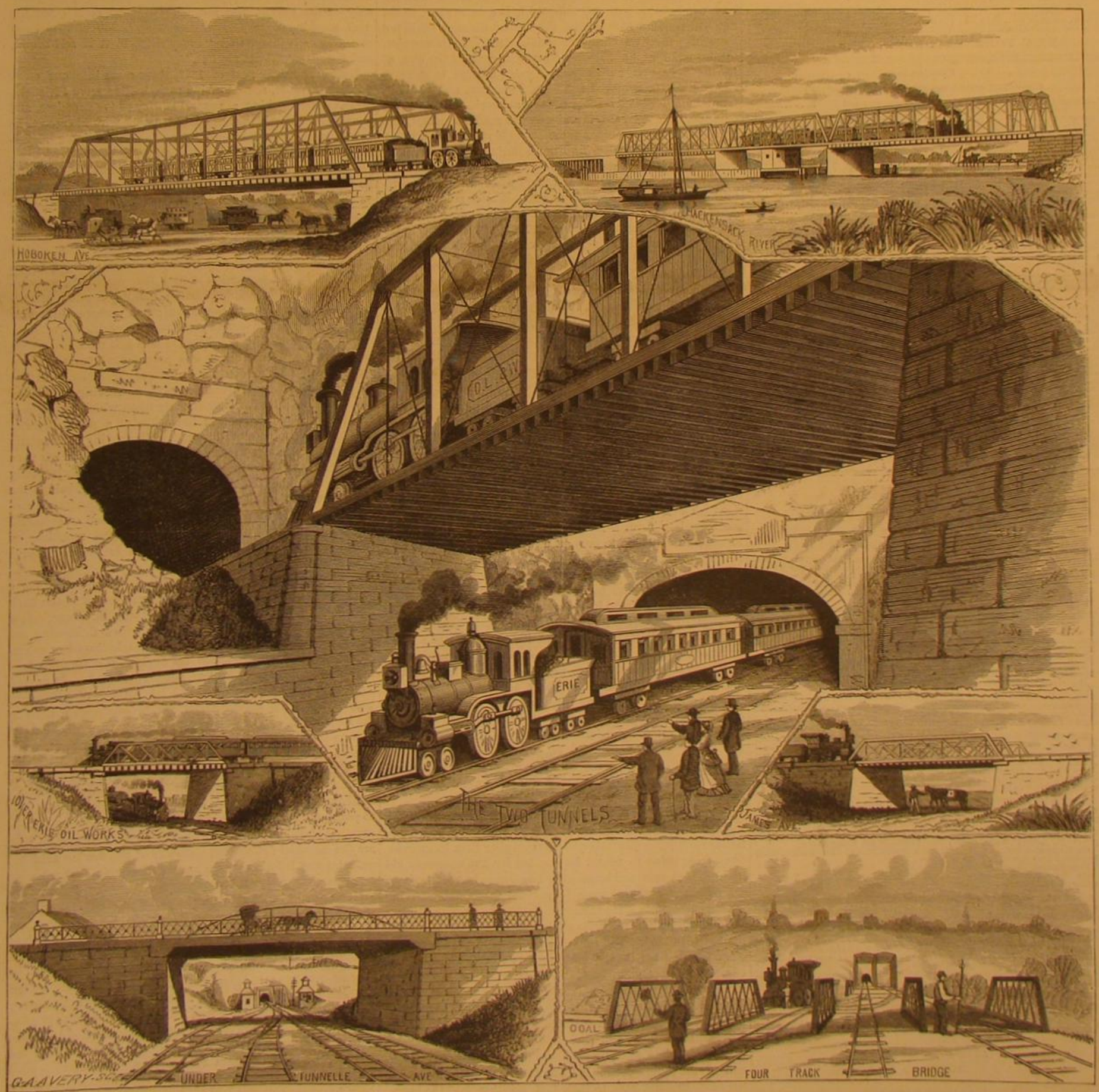

THE ENGINEERING WORKS OF THE DELAWARE, LACKAWANNA, AND WESTERN RAILROAD, HOBOKEN, N. J.

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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.

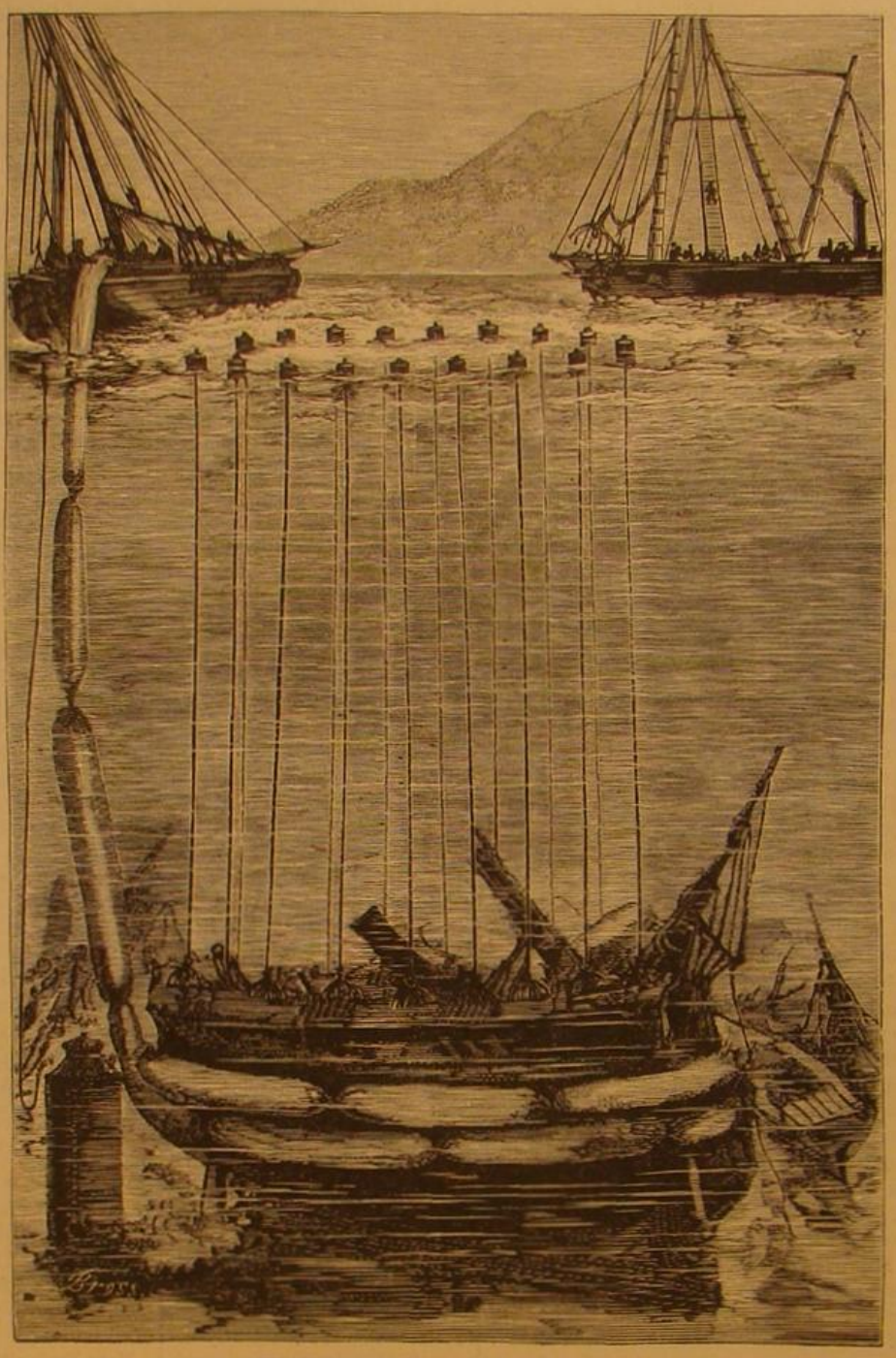
Bone Meal for Grapes.

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.

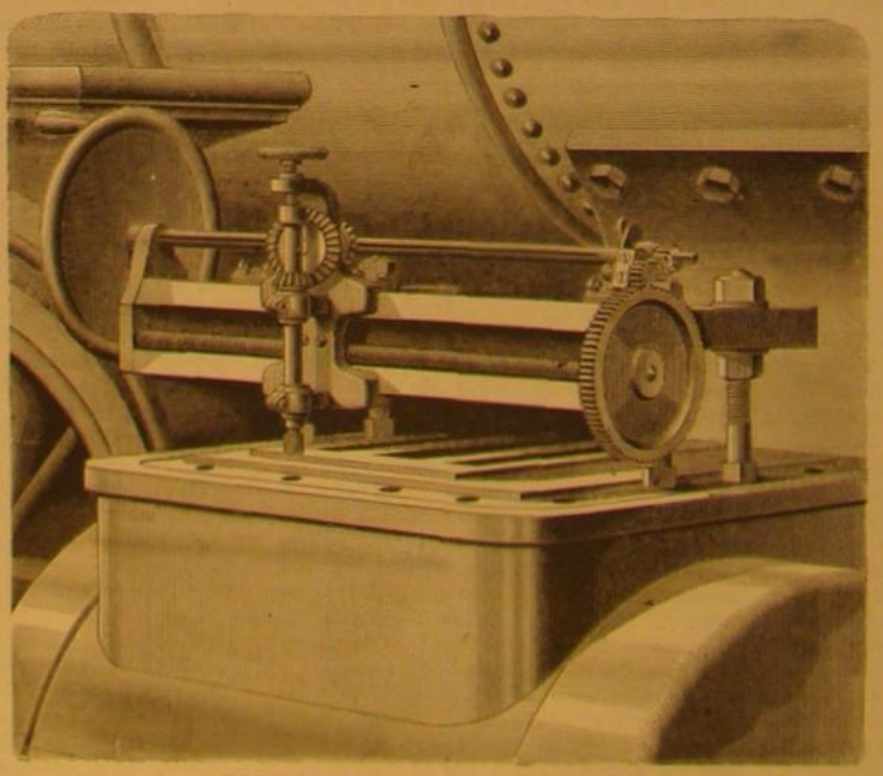
In the spectroscope the new metal gives: 1. In the indigo-blue, two sets of characteristic lines. 2. In the bright green, two other sets of simpler lines, also characteristic. 3. Some blue, violet, and green secondary lines; in all twenty-three lines. These characteristic lines exactly coincide with 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."

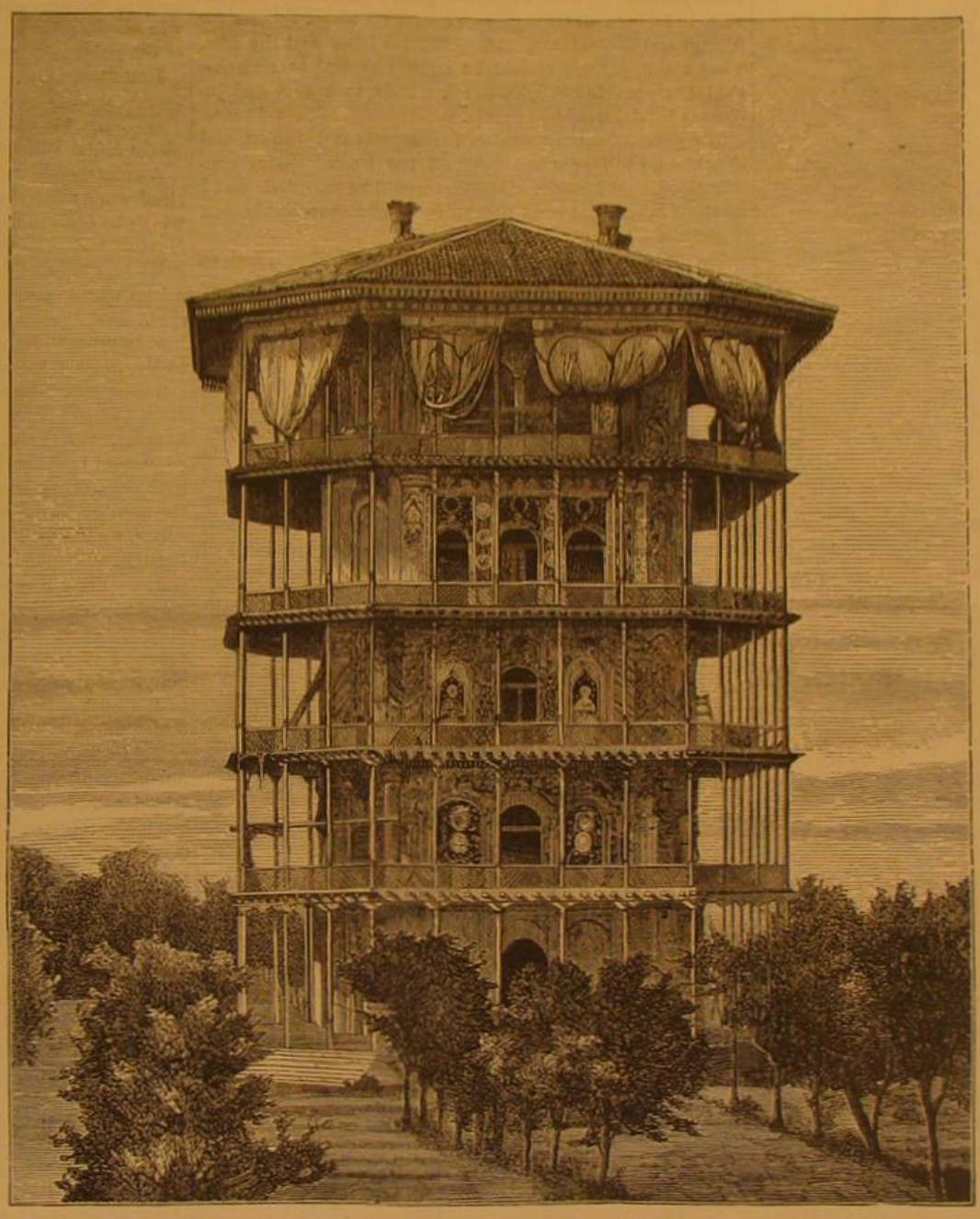
Powder Paper.

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.

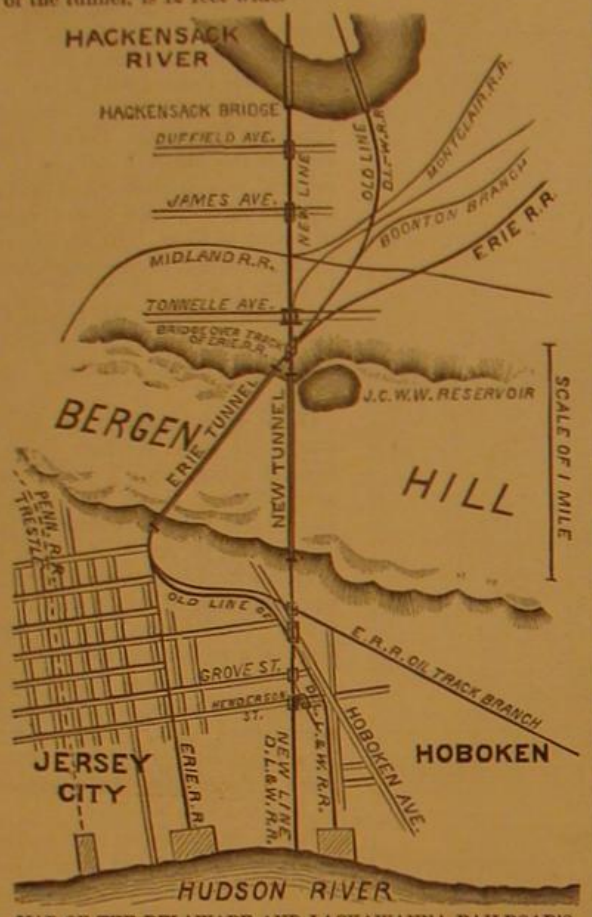
The rise in price of breadstuffs caused by the declaration of war by Russia against Turkey may lead unprincipled men to imitate the adulteration of flour practised in some foreign countries. An easy method of detecting such adulteration, according to Jegel, is to mix the flour with chloroform. The chloroform 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.

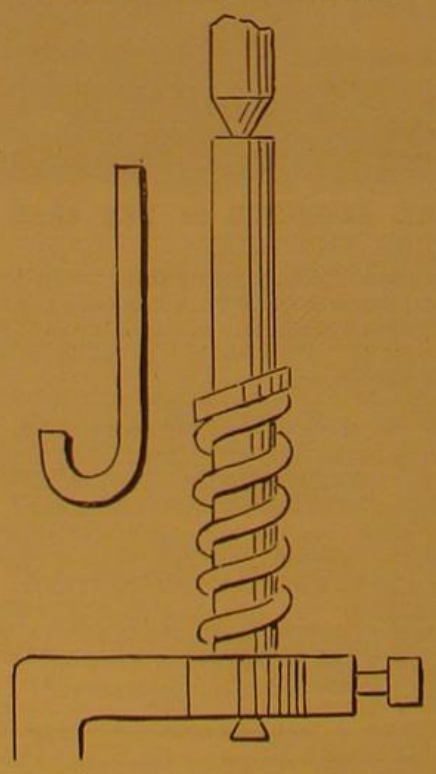
JOSEPH E. HOLMES.

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.

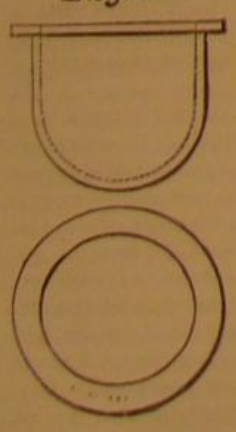
BY JOSHUA ROSE.

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.

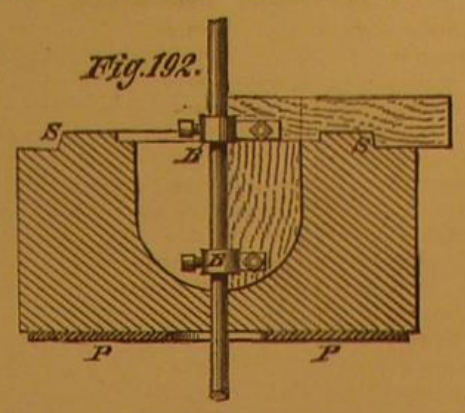
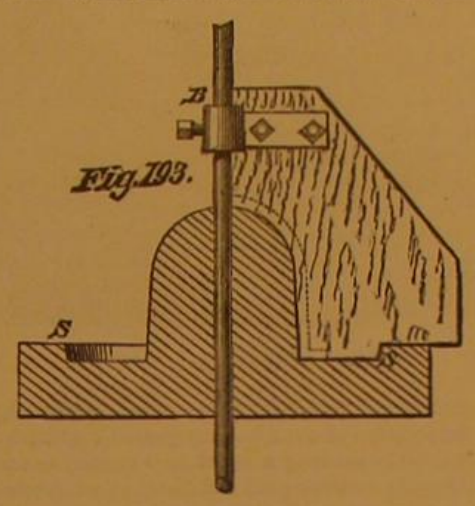


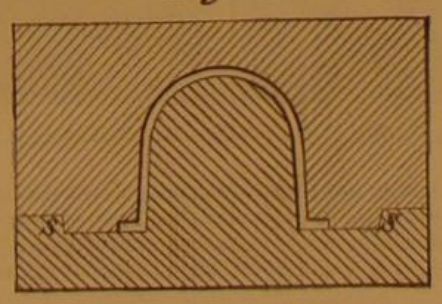
Fig. 193.



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.

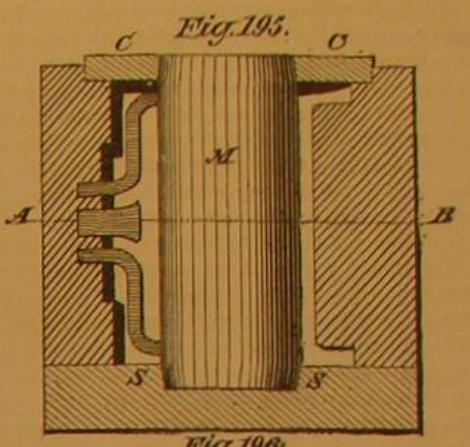
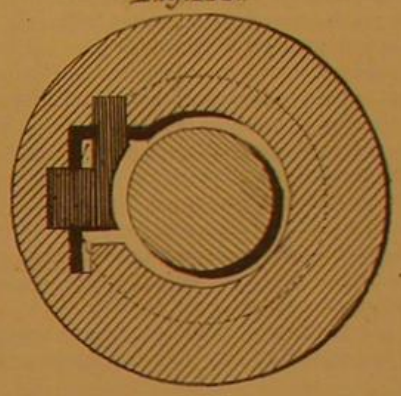


Fig. 196.



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.

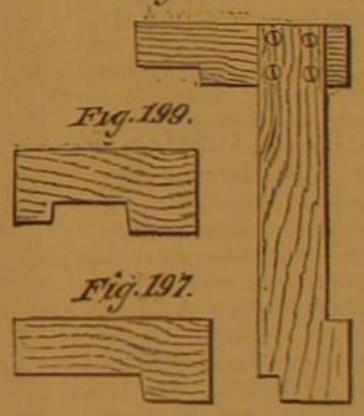


Fig. 199.

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,

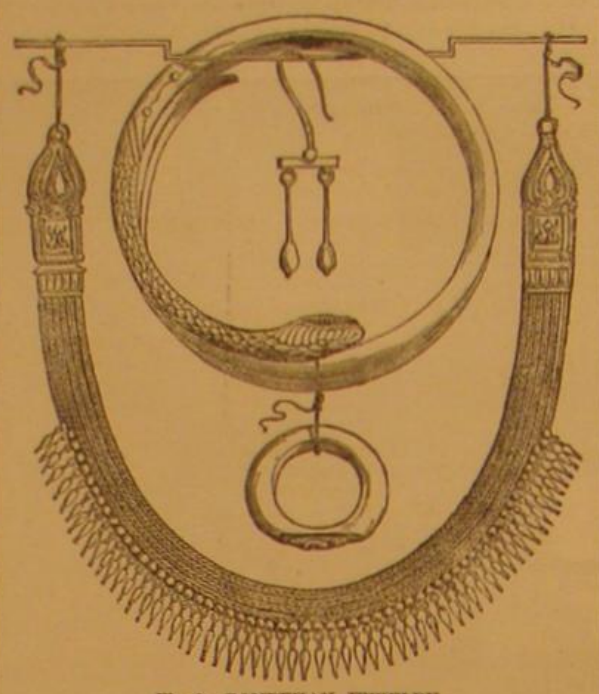


Fig. 7.—POMPEIIAN JEWELRY.

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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