

SCIENTIFIC AMERICAN

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THE LITTLE MONITOR SEWING MACHINE.

We have examined with much interest sundry novel improvements, which have recently been added to the sewing machine the distinctive title of which forms the above caption. These improvements are claimed by the inventor, in connection with the other advantages already possessed, to impart capabilities to the implement of considerable value in their variety and utility, and at the same time to insure for it that popular appreciation which is always accorded to simplicity of parts and facility of operation. We took occasion, some years ago, to describe in detail this machine as then constructed; and as certain important portions are unaltered, a repetition of the description is deemed unnecessary. For the proper comprehension of the improvements, however, the principal features may be briefly considered as we progress.

The machine is one in which two threads are used to form principally a lock stitch. This is effected wholly without shuttle mechanism; and the thread, in lieu of being wound upon bobbins, is used directly from the ordinary spools. One spool is located above, as shown in Fig. 1, the other is somewhat curiously placed directly below the needle, and is previously inclosed in a hard rubber case, shown in Fig. 2, which is exactly the shape of a conical rifle shot. The end of the thread is carried through an opening in this case, and is then wound once or twice about the wire guard. The case is then inserted between two curved metal pieces, A, Fig. 3, and is retained in place by the pivoted stop, B. The end of the thread is carried back between the parts of the case holder and there left. It requires no further care, for the turn or two made around the wire guard of the case gives it the requisite tension. The general construction of the parts last described is new, and is an improvement on that of the similar portions in the older machine.

As regards the manner of forming the stitch, instead of the usual shuttle mechanism there is a rotating hook, represented at C, Fig. 3. Its shank is shown at D, Fig. 1. It is pivoted to a disk which imparts to it its rotary throw. The upper thread, after being carried through the fabric by the needle, is retracted so as to produce a slack loop. Into this the advancing hook catches, pulling it (the loop of course opening out) over the point and the smooth surface of the spool case, until it finally slips off said surface and likewise off the hook. The loop then lies loosely on top of the spool case and incloses the lower thread. The hook, continuing its rotation, takes a second loop from the needle, and carries it along as it did the first. As it opens out the second loop, it pulls taut the slack of the first one, and thus the stitch is completed. The capabilities of the machine in this respect, however, are not

pushed in (the lower thread still absent), the loop catches at once on that obstacle, giving the needle time to come down and pass through loop No. 1, and for the hook to engage loop No. 2, so that the second loop is pulled through the first one and so on, forming the chain. With the lower thread in action, precisely the same operation continues, only the lower thread becomes caught over a portion of the chain made by the upper thread, and literally forms a spiral about it, so that on one side of the cloth is a row of simple, straight stitches, and on the other a chain stitch and a spiral

turns the same forward a distance proportionate to the travel of the arm, L. It is obvious that, by governing this travel, we govern likewise the rotation of the disk, and hence the amount of thread unwound in the direction of the needle. This is easily done by the simple pivoted bar, N, which has an arm at right angles at its extremity, as shown in Fig. 1, which extends directly over the clutch arm, L. By raising or lowering said extremity of N, the clutch arm is pushed more or less down, and consequently the projection, M, strikes it earlier or later, and accordingly pushes it a greater or less distance.

The tension regulator must, of course, be used in connection with the stitch governing devices. To alter the length of the stitches, it is simply necessary to raise the catch, O, Fig. 1, which governs a stop limiting the motion of the feed bar, which is actuated by eccentric devices on the rear of the disk on the left. When a short stitch is used, the tension regulator is set to allow but little thread to escape from the tension disk, and vice versa.

In Fig. 4 it will be seen that the bar, P, to which the bar, N, is pivoted, is curved and extends downward, terminating just below the coiled presser spring. This is a very neat device for yielding, automatically, the extra thread required in sewing thick cloth. In that case, the upward motion of the feed teeth acts on the fabric and lifts both it and the foot; as the latter rises, the bar, P, ascends with it, and consequently the bar, N, also lifts, and is followed by the clutch arm. The ensuing descent of the last causes, as before explained, a partial revolution of the tension disk, and thus a small amount of thread is given off, in addition to that caused to unwind through the movement of the main arm. This arrangement is sufficient to give the extra thread without requiring any adjustment of the tension or change of stitch, and of course adapts itself to varying thicknesses.

Lack of space compels us to summarize briefly the other advantages. These are: An ingenious arrangement whereby the chafing of the thread against the needle is prevented; ball and socket joints which render the pitman and treadle adjustable; a self-setting needle which cannot be inserted wrongly; and the noiseless operation of the mechanism.

We are informed that the demand for the machine is now very large, and has made it necessary for the manufacturers considerably to increase their facilities for construction. This has been done in the purchase of the Union Iron Works, at Rhinebeck, N. Y., with all the machinery therein, so that at the present time 300 machines can be made weekly. A large machine for manufacturing uses, on the same principle as the one that we have described, is now being manufactured. The various devices have been

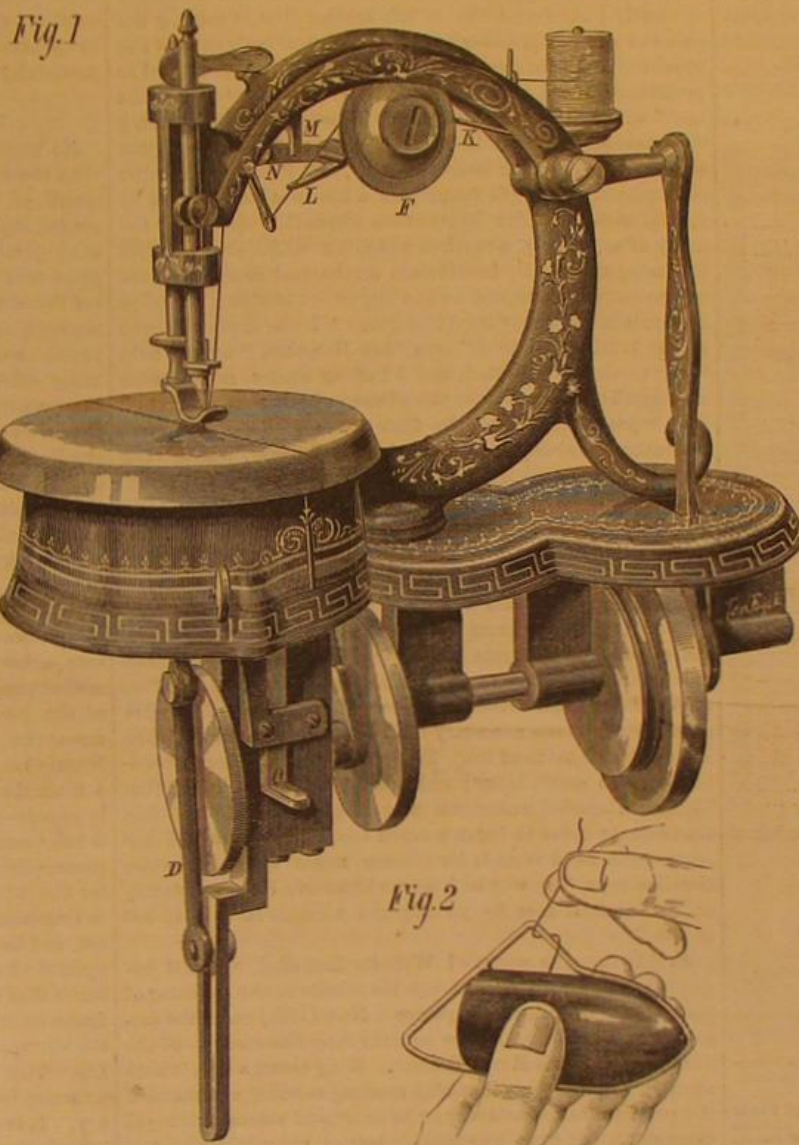


Fig. 2



DU LANEY'S "LITTLE MONITOR" SEWING MACHINE.

thread mingled, the latter not passing through the fabric. The most ingenious portion of the machine, and at the same time the newest, is the device for giving tension to the upper thread, and this is entirely different from any other piece of mechanism, devoted to like purpose, which has come under our notice. Its disposition and its construction will be seen in Figs. 1, 4, and 5. It consists of a metal disk, F, having a sharply grooved periphery, G, and secured by a screw to a lug on the stationary arm of the machine, as represented in section, Fig. 5. This screw serves as an axis, about which the disk revolves. The screw head is countersunk, and beneath it are several flexible washers. The threaded portion enters the lug, as stated, and therefore it is obvious that, by turning said screw inward, the disk may be crowded against the lug, and its rotation, through the friction engendered, rendered less free. This, however, is adjusted by the manufacturers, and the limit of the inward motion of the screw is defined by the small set screw, H, Fig. 5, inserted in the lug from the opposite side.

The principle on which the attachment is constructed is that (the thread from the spool being wound once around it), when every stitch begins, it shall turn so as to release exactly enough thread to make that stitch. This is carried out as follows: In a channel in the disk, and between it and the lug, is placed a clutch, I, Fig. 4, which embraces the axial screw and has a wedge-shaped extremity, J, which bears against the inner periphery of said channel, being thus held by the spring, K. The other end, L, is elongated and is so placed as to be struck and carried down by the projection, M, on the moving arm of the machine. The consequence is that, at each descent of the needle, the arm, L, being forced down, its opposite end, J, is wedged against the disk, and

therein, so that at the present time 300 machines can be made weekly. A large machine for manufacturing uses, on the same principle as the one that we have described, is now being manufactured. The various devices have been



Fig. 3

confined to the lock stitch alone, although that form, owing to its strength and security, is usually the most popular. A very neat embroidering stitch with two threads can be produced, or the lower spool may be abolished altogether and the instrument transformed into a single thread chain stitch machine, and this without any adjustment whatever beyond pushing in the little catch, shown at E in Fig. 3. It will easily be understood that, without the lower thread to lock the stitch, the rotating hook would keep on making loop after loop of the upper thread, which would slip off over the spool case and never be caught. Now, with the catch, E,

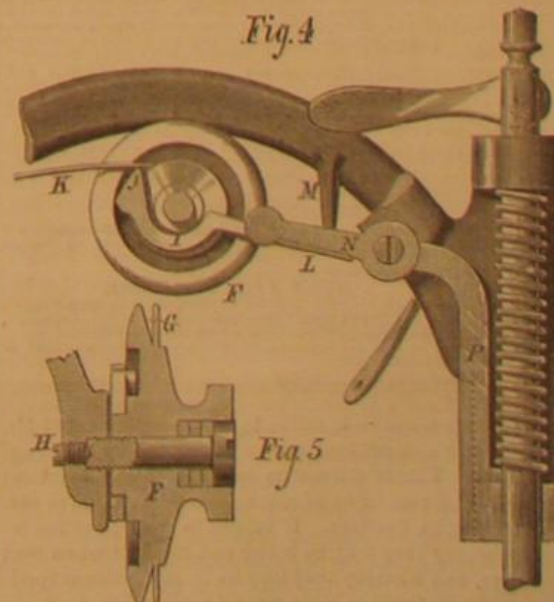


Fig. 4

Fig. 5

patented in this country and abroad by Mr. G. L. Du Laney. For further information address the manufacturers, Messrs. G. L. Du Laney & Co., 744 Broadway, New York city.

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The reader's attention is called to the advertisement of Mr. Fredolin Smith's patent bent wagon hound, on the back page of this paper. This is claimed to be a useful and excellent invention, calculated to be of much economical value to carriage and wagon builders. It relates to a construction of hounds whereby they may be better and stronger when bent than before, and whereby they may be formed without spoiling so many in bending as is unavoidable when they are bent in the ordinary manner. J. H. Cole, of Tiffin, Ohio, is the sole agent of this patent.

A WOMAN'S WORK FOR SCIENCE.

"Great men and great causes have always some helper of whom the outside world knows but little. Sometimes these helpers have been men, sometimes they have been women, who have given themselves to help and to strengthen those called upon to be leaders and workers, inspiring them with courage, keeping faith in their own idea alive, in days of darkness 'when all the world seems adverse to desert.' Of this noble company," says her biographer, in a volume of recently published memoirs, "Caroline Lucretia Herschel was one;" and the record of a life which lacked but two years of a century in length offers a bright example of what a woman's work may be, when an intense personal sympathy and affection enlists her powers. It was to the advantage of Science that those powers were directed to its furtherance: for had Sir William Herschel, unstrengthened in his purpose by her, remained the humble music teacher, he would have passed to posterity as the composer of a few mediocre symphonies, and not as the discoverer of Uranus; she herself, at the close of a vocalist's career, would have sunk into oblivion, and Sir John Herschel, the son of the one and nephew of the other, doubtless would have followed his father's lowly path. It is only necessary to remember the inestimable value of the labors of these three persons in the cause of the grandest of the natural sciences, to realize how great would have been the loss to mankind had the three lives passed away unmarked and unknown.

The life of Miss Herschel was for nearly half a century so closely linked with that of her brother that, in reading her own story of her discoveries, it is difficult to believe that she speaks of her own original labor, so modestly and withal so persistently does she hold herself forward as "merely the tool" which Sir William shaped to his own use "for minding the heavens." It was in 1772, at the age of 22 years, that she left Hanover, her native country, and joined her brother in England, where she found him a hardworking teacher of music, with but a few hours at his disposal to devote to the study of astronomy, a work in which his whole soul was fast becoming absorbed. Insufficient mechanical means aroused his inventive genius, and he had begun to contrive a telescope of eighteen or twenty feet in length. "I was much hindered in my musical practice," says Miss Herschel, "by my help being continually wanted, and I had to amuse myself with making the pasteboard for the glasses which were to arrive." This "pasteboard" was the first crude model of the great instruments subsequently made by her brother, whose then early attempts soon led him to seek larger mirrors, though none were to be had. By good fortune, he obtained the tools of a Quaker resident at Bath, who had made efforts in a similar direction, and forthwith, "to my sorrow," says the sister, dropping the astronomer for the housekeeper, "I saw almost every room turned into a workshop."

In those days the grinding of specula was done by hand, there being no accurate machinery for the purpose. The tool on which they were shaped having been turned to the required form and covered with emery and water, they were ground on it to the necessary figure and afterwards polished with putty or oxide of tin. To grind even a six inch speculum was no small labor; and some idea of the work that William Herschel undertook may be gleaned from the fact that once, in order to finish a seven foot mirror, he would not remove his hand from it for sixteen hours together, while Caroline says, "by way of keeping him alive, I was constantly obliged to feed him by putting the victuals in bits in his mouth."

At this time the name of William Herschel was fast becoming famous, mainly through his reputation as the inventor of instruments of unheard-of power. Now (1781) came the discovery of Uranus, and a few months later the election of the discoverer into the Royal Society. King George III, whose army in America just then was meeting reverses, commanded the presence of the astronomer at court, and solaced his royal disappointment over the probable loss of his colonies by frequently gazing at the new planet, which had been christened Georgium Sidus, after him. Herschel, however, did not fancy following the king about with telescopes; "company is not always pleasing," he naively writes, "and I would much rather be polishing a speculum": but despite this distaste, he chose to be Astronomer Royal at \$1,000 a year, rather than go back to music teaching for a livelihood. "Never bought monarch honor so cheap," caustically said Sir William Watson, when the meager stipend was granted.

"I found," says Miss Herschel, "that I was to be trained for an assistant astronomer, and by way of encouragement a telescope adapted for sweeping was given me. I was to sweep for comets, and to write down and describe all remarkable appearances I saw." Her brother, near her, meanwhile devoted himself to his magnificent observations on the new planet, the nebulae, and the double stars; and to Caroline's labors with her instrument, which consisted mainly in searching for nebulae to be marked in her catalogue, were added the duties of assisting him "either to run to the clocks, to write down a memorandum, to fetch and carry instruments, or measure the ground with poles, etc.": certainly enough tasks without the further implication of the *et cetera*. Often she remained patiently beside Sir William, jotting down his rough notes, when the weather was so cold that the ink froze in the bottle; and then before dawn she would take the manuscript to her cottage, and by morning have ready a fair copy of the night's work. Occasionally her brother did not need her services; and at such times she prosecuted the observations that resulted in the discovery of the comets of 1786, of 1788, of 1791, of 1793, and of 1795 (the last now known as Encke's) and rediscovered three previously found comets. In 1783-4-5, she produced a new catalogue of a thousand stars; in the five years following she added a thousand more stars to

the list; and she discovered the places of five hundred others between 1788 and 1803. Meanwhile she studied mathematics, her brother aiding her only by asking difficult questions at the breakfast table, the answers to which she carefully preserved. She was thus enabled to help him in his numerical calculations, while she unceasingly ministered to his wants during the construction of the famous 40 foot telescope. She tells us in her letters some pleasant anecdotes of that great instrument: how when it was completed a large company, headed by Sir William, entered its huge tube and sang "God save the King." Later King George himself walked through it, followed by the Archbishop of Canterbury. The prelate was portly, and the road was not an easy one for him, so the king graciously extended his hand to assist him, saying "Come, my lord bishop, I will show you the way to heaven."

In 1822, Sir William Herschel died, and the faithful sister returned to Hanover, almost brokenhearted with grief. She did not, however, relinquish her beloved labors, but at the age of over seventy years began the laborious reduction of the places of 2,500 nebulae, presenting in one view the results of all Sir William's observations of those bodies up to the year 1800. It was an instance of touching fidelity, this labor in her old age, for the dead brother for whom she had so earnestly worked during his life. The task was completed in 1828, and won for her wide renown. The twenty years yet remaining to her were passed in Hanover, where from her quiet seclusion she watched the growing fame of her illustrious nephew, aiding him by her mature advice, and welcoming, with an enthusiasm equal to his own, the results of his great efforts. In January, 1848, that long and useful life peacefully and tranquilly closed.

THE PATENT OFFICE APPROPRIATION.

No better evidence of the progress of invention is needed than the fact that the receipts of the Patent Office for the month of March were the largest ever known. They exceeded eighty thousand dollars, which is in excess of the same month of last year by ten thousand dollars; and Congress will act very unwisely if it reduces the appropriation for this department. Such a step would necessarily decrease its working force, which is now hardly sufficient to permit prompt action and careful research on the part of the examining officers. The salaries of the examiners are at present so small that it is impossible to retain for a great length of time those best qualified for the work; and the prosperity of the Patent Office department and the interests of inventors depend largely upon the efficiency of the Commissioner and the examiners, the latter of whom decide upon the patentability of all inventions submitted to the Office.

Commissioner Duell has proved himself one of the best executive officers that has presided over the Patent Office since Judge Mason was Commissioner; and the liberal construction of the laws, inaugurated by the last named gentleman, allowing inventors to receive patents for improvements without regard to the degree of invention, is the wise policy of the present Commissioner. This liberal interpretation meets the approbation of inventors, and at the same time largely increases the revenue of the department.

Since the above was in type a correspondent of one of our daily papers—the *Graphic*—writes from Washington that, "since it has become generally known that our reform House of Representatives has proposed cutting down the appropriation for the support of the Patent Office, every mail has brought to Commissioner Duell letters, from inventors, manufacturers, and business men in all parts of the country, protesting against such retrenchment. It should be constantly remembered that the overburdened taxpayer, about whose sad condition such jeremiads have been chanted in Congress and on the stump, does not pay anything to support the Patent Office. That institution is self-supporting, and, as I showed in a former letter, has over \$750,000 to its credit in the Treasury. It is carrying retrenchment a little too far to deny the inventors of the country speedy and intelligent action at the hands of the government while taking their money for it. In some of the communications sent to the Patent Office, the writers say that, if Congress cuts down the salaries in the way proposed by Randall's committee they will favor the starting of a subscription to pay the examiners proper salaries, so that the Office may not lose their services."

The latter named proposition is, of course, not feasible, and those who have written letters offering to subscribe for such an object cannot but know that no employee of the Patent Office would be allowed to receive any contributions from inventors or others doing business with the department; but that such a thought has entered the heads of a considerable number of persons indicates the objection, felt by persons interested in the prosperity of the Patent Office, against Congress reducing its appropriation. We are not among those, however, who think that there is no room for further economy or improvement at the Patent Office. We hope that Congress will carefully look into the institution, and faithfully do whatever may be necessary to increase its usefulness and efficiency.

STREET TELEGRAPH LINES.

In this misgoverned city of New York, the constant extension of the telegraph has resulted in the lining of all our principal streets with unsightly wooden poles, and the cry is "still they come." The sidewalks are obstructed by them, while the lives and limbs of citizens are more or less endangered by the poles and wires. In winter, especially, the ice-covered wires frequently break, animals are maimed, drivers of vehicles sometimes thrown, pedestrians tripped, etc. In London the wires are, to a large extent, carried underground. The portions above ground occasion more or less trouble. We have before us the details of three serious accidents

that lately took place in that city from breakage of overhead wires during a storm. In one of these cases, the driver of a cab was caught by a sagging wire and fatally injured, his head being nearly severed.

In the Court of Common Pleas, Philadelphia, Judge Thayer presiding, application was recently made to restrain the Western Union Telegraph Company from erecting telegraph poles on 10th street, on the ground that by so doing the company were obstructing a public highway. It appeared in evidence that the company was authorized by charter to place its wires either above or under ground.

It was alleged against the company that the city would be greatly disfigured by the erection of these poles, and it was argued that, in view of the public injury and inconvenience arising from the great extension of the telegraphic system, the great increase in the number of lines, and the consequent increase in the size of the poles and number of wires, telegraph companies should be compelled to lay their wires under the streets instead of over them. Judge Thayer considered that it was impossible to doubt the practicability of successfully working lines laid down in that manner, in view of the fact, which was in evidence, that for the last twenty-five years important wires have been carried underground through the city of London. The extent of the underground wires in London, according to Mr. Fleetwood, is at the present time 3,500 miles. Underground wires are also extensively used in Paris, Berlin, Dresden, and other European cities. In view of such facts, all arguments against the practicability of this method founded upon mere theories and opinions amount to nothing.

Doubtless the time is not far distant when the necessities of public convenience and the great increase of telegraph systems in this country, will, through the instrumentality of legislative enactment, compel all companies to lay their wires underground in the large and populous cities of the country.

"Upon the whole case," said the court, "we are of opinion that the defendants, the Western Union Telegraph Company, have shown no sufficient title to warrant them in erecting their poles and wires on 10th street, between Market and Walnut, and the proposed erections are contrary to law, in violation of the city ordinance, and injurious to the public." The injunction was then continued until further notice.

So much for Philadelphia. We fear it will be some time before any such wholesome lesson is taught to the street-obstructing corporations of this city. Not only are telegraph poles everywhere allowed, but the builders of iron railway bridges are to be permitted to occupy and cover our principal streets. In the name of "Rapid Transit," no less than thirty-five miles of these structures, upon which locomotives are to rattle and roar, have been sanctioned by our local commissioners, and are now in process of erection along some of our finest and busiest streets.

It would seem to be in keeping with common sense that all structures like telegraph lines or steam railways, which can be effectually operated either underground or between the blocks, should be kept out of the public streets. But the citizens of New York, instead of following the enlightened progress of other cities in such matters, are at present actually moving backward.

FREE PASSES AT THE CENTENNIAL.

The Centennial Commission appears to be somewhat perplexed over the question of distributing free passes for the Exposition. Every politician in office, every newspaper man, in fact everybody who can conjure up even the shadow of a reason for the privilege, deems himself entitled to enter the Centennial grounds free, and the consequence is that the Commission is unable to fix any limit as to where this deadheading shall terminate. It seems to us that there is one, and but one solution, to the problem, and that is to issue no free passes at all. No respectable journal desires any such favor, and in fact the prevailing tone of all the press now-a-days is strongly averse to receiving any obligation of the kind on any account. The thousand and one reasons commonly urged for granting privileges to politicians and others should be scrupulously set aside, and in doing so the Commission will act not only for its own, but for the public's, best interests. It must be evident that, in order that the Exposition shall pay back the money invested in it, a very large daily attendance will be requisite, even at fifty cents per head admission. Every free pass given, therefore, is simply a diminution of receipts, and when the number of passes swells, as it easily may, into thousands, the loss will be one to make itself felt. This deficit will have to be made up, and there is only one source available, and that is the pockets of the general public; so that, reduced to its simplest terms, the pass system involves the payment by the people for the admission of a privileged class. Of this class the individuals are ten times better able to pay for themselves than half the masses who will flock to Philadelphia.

The only people who should have free entrance are the employees of the Commission, the exhibitors and their servants, and the judges. The only exception we would have made to the fixed tariff would be in favor of working men. When the latter come to Philadelphia, their means will be limited, and it would be a sensible act for the Commission (of course after proper proof that the applicants are bona fide working men) to sell them tickets at a reduced price, good for several admissions. These tickets might be made of conspicuous color and form, wholly different from any others; and each one should be distinctively numbered and provided with other checks to render it non-transferable. These might be forwarded to the principal industrial establishments in the country, to be disposed of by employers to

their men, and their possession might also entitle their holder to especial privileges in the reduction of railway fares. We believe that it is to the interest of the whole country to have the Exposition made as cheap to working men as it possibly can be; and if any deficit occurs on that account, let it be charged upon the public. The public can much better afford to bear it than to pay for official courtesies which confer no benefit except upon the immediate recipients.

THE PRACTICAL USES OF THE SPECTROSCOPE.

When light, in its way from a luminous body to one's eyes, passes through more or less transparent media, it is more or less absorbed; and the spectroscopy, which decomposes the light into the different kinds of colored and other rays of which it consists, is the apparatus which reveals what portion of the light is thus absorbed by the media through which it passes. This is the simple cause of the dark lines in the solar spectrum; they are generated by the atmosphere which surrounds the sun, which atmosphere absorbs certain kinds of rays and so forms the absorption bands, which we call the Fraunhofer lines, after the distinguished scientist who first observed them. Even our own atmosphere gives some such lines; they are situated between the solar absorption bands, and they have been closely investigated. They increase, both in intensity and number, as the sun approaches the horizon; while they decrease and finally almost vanish as we ascend with our spectroscopy to the summits of high mountains. The absorption bands (caused by transparent or translucent, colored or colorless, solid or liquid, substances) are of much practical importance, for every substance either absorbs different parts of the light or does it in a different manner; so that the absorption lines produced form characteristic properties of many bodies, by which they may always be recognized. To make these observations, it is best to use a white light giving a continuous spectrum, such as is produced by a gas flame, a petroleum lamp, a white hot platinum wire, a hydro-oxygen lime light, or an electric light passing between carbon points. As the solar spectrum has its own absorption bands, it is not to be preferred; however, it need not be totally rejected for this purpose, as the bands are very narrow and well defined, and their positions are well known, while the absorption bands of the solid and liquid transparent substances referred to are wide or broad, with somewhat undefined edges; and therefore they are generally easily distinguished from the solar absorption lines.

The substance to be examined is simply placed before the slit of the spectroscopy, and the light passed through it. If this substance is, for instance, smoked glass (that is, a piece of glass colored gray or black by exposition to a smoky flame), it will be seen that the light of the spectrum is dimmed over its whole extent, and this quite equally. The smoked glass, therefore, absorbs all kinds of rays, all colors, in the same way, and is an example of a continuous or general absorption. Quite different, however, is it when we use colored glass. A red glass, for instance, even when so intensely red as to appear almost as black as the smoked glass, will not absorb the red ray; but it will all the others. Cobalt blue glass admits the passage of the blue rays, and absorbs the green entirely, and the red only partially. Such kinds of glass, therefore, show an elective absorption, and this property of colored glass is made use of for signals on lighthouses, ships, steamers, railroads, etc., to give any desired color to a white light. If it were possible to make a colored glass which could transmit only the reddish or the bluish green rays contained in the solar protuberances, it would be possible to see, every time the sun shines, these protuberances directly, without the help of the spectroscopy.

Most of the colored pigments have already been investigated with the spectroscopy. It would occupy a very large space to recapitulate all the results obtained; and we will only give the general results in regard to the manner of observation and the definite laws which have been ascertained.

Melde has made experiments for determining these laws as far as possible; and he divides the variously colored substances into a number of groups, and gives a general account of the behavior of each class. To the first class belong such substances in solution, or such solid bodies, which, during a gradually increasing concentration, or a gradual increase of thickness of the transparent layers, continue the absorption from the red end of the spectrum toward the violet end; so that at last only a violet luminous band remains. This class does not contain many substances; but one of them is the ammonio-sulphate of copper.

The second class has the opposite property. The absorption progresses by increasing concentration from the violet end of the spectrum toward the red end, so that at last only a red band remains. This class contains a large number of bodies; and among them are many very intensely colored pigments, such as chromate of potassa, picric acid, iron chloride, saffron, etc. To this class belong also several translucent substances, which have in common the property that, when examined in thin layers, they admit the whole spectrum; but if increased in thickness, they absorb the light, first at the violet end of the spectrum, and continue to do so toward the red, until at last all is absorbed. One of the most common substances of this kind is water mixed with soap or with milk, so as to deprive it, more or less, of its transparency.

These two classes thus contain the substances which exhibit a one-sided absorption. A third class contains those

bodies in which the absorption commences in the middle of the spectrum and extends toward both ends, and which may therefore be called two-sided absorbents. There are not many substances of this class. One of them is Prussian blue dissolved in water with help of oxalic acid. In spectroscopy analysis, the bodies belonging to this class may be distinguished, one from the other, by the fact that the most intense portion of the middle band appears in different parts of the spectrum.

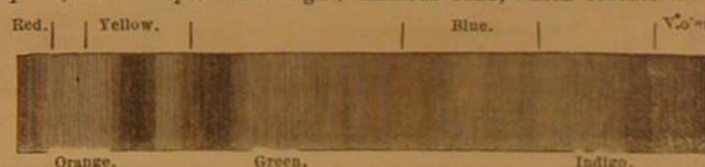
A fourth class contains substances which show luminous bands in two different places, separated by a middle dark band, with other dark bands at the extremities, which increase or diminish in width with the degree of concentration of the solution or thickness of the layer. A great many bodies belong to this class; among them are solutions of aniline blue, fuchsin, ammoniacal solutions of kino and Brazil wood, solution of salicylic acid colored with chloride of iron etc.; and among solid bodies, cobalt blue glass. Each of these bodies is easily distinguished by the different character of the absorption, especially by the fact that the dark bands always occur at definite places in the spectrum, although the bands differ in position for each substance.

To the fifth class belong those bodies which, on increasing the dilution of the liquid, show three different luminous bands, and which, on further dilution, leave two dark absorption bands between them. This class is very numerous, and to it belong the solution of caesium in ammonia, watery dilution of blood, and the alcoholic tinctures of alkanet root and of sandalwood; but the various positions of the two dark bands peculiar to each make it easy to distinguish one from the other.

A sixth class contains substances producing three dark absorption bands. To this belong the ammoniacal solution of alkanet root and the alcoholic solution of chlorophyll, the green coloring matter of plant leaves. This classification may be continued for substances forming merely absorption bands.

In order to make practical and useful applications of the above, Melde made experiments to find out how far the various absorption bands pertaining to different substances were subject to fixed laws, which would explain their origin. He found that, in general, the absorption bands are not independent of each other, and that the absorption, exercised by a mixture, is not simply the sum of the absorptions of the simple substance, as is the case with the spectroscopic lines of the glowing gases. He found that, in colored mixtures, first, an absorption band is often observed between the two nearest bands of the simple fluids; a simple shifting of the bands, however, never takes place. He found, further, that the temperature of the substance had in most cases no influence on the position of the bands, even if the solution were heated nearly to its boiling point. In some cases, however, the absorption proceeded from the violet to the red end of the spectrum. Finally, he found that a greater concentration of the coloring material is perfectly equivalent to a greater thickness of the layers.

Armed with this preparatory knowledge, the determination of the nature of various colored solutions, such as ascertaining the presence of blood in a copious dilution with water, became an easy matter. Stokes, Hoppe, and Valentin made many observations, which led to infallible and therefore highly valuable results. Valentin found that the thicker layers of the light or dark red blood produce in the spectrum a light, luminous band, which reaches from



THE BLOOD LINES IN THE SPECTRUM.

the red to the dark line, D, in the yellow. Very thin layers of fresh blood, or thicker layers of blood diluted with water, give two characteristic bands in the green, both between the lines D and E, at a place where no other substance, as yet experimented upon, caused them to appear. These lines can be faintly seen, even when the blood has been diluted with 7,000 times its volume of water, when it is perfectly colorless to the naked eye by transmitted light, and by reflected light shows, at most, a faint yellowish tinge. The very same apparent color, given with a few drops of any yellow solution, such as saffron, gamboge, yellow wood, aniline, etc., does not produce these lines, which are characteristic of blood exclusively, and are, therefore, called the blood bands.

Valentin's skill in this respect was severely tried by giving him for investigation twenty numbered packages, containing small amounts of dirt of different origin. He emptied each separately in water, filtered the solutions, submitted them to spectroscopic analysis, and pointed out four packages containing blood. The first contained scrapings of a block which had served in the dissecting room of a medical college, but had lain for three years unused in a corner; the next contained scrapings from a block still in use for a similar purpose; the third contained rust from an old iron hook on which meat had been suspended in a butcher's shop; and the fourth contained a piece of cloth from a coat. In every case he could recognize the two absorption lines of the blood so clearly to leave no shadow of a doubt of its presence.

It is a curious fact that England, so interwoven with a network of railways, should supply an American exhibition with road locomotives and road rollers, the United States having at least 20 miles of road to one in England.

THE 51-ton Rodman gun has arrived at the Centennial.

THE INDUSTRIAL USES OF ASBESTOS.

Asbestos is a mineral fiber, composed of silicate of magnesia, silicate of lime and protoxide of iron, and manganese. Mineralogically the name is given to the fibrous varieties of tremolite, actinolite, and other varieties of hornblende, excepting such as contain alumina, and also to the corresponding mineral pyroxene. It exists in vast quantities in the United States, in various parts of Great Britain, Hungary, Italy, Corsica, and the Tyrol. To various kinds of asbestos have been applied the names "mountain leather," "mountain cork," "amianthus," and "chrysotile;" and certain other minerals having characteristics resembling those of asbestos are described as asbestoid, asbestiform, and as lamellar-fibrous. Without entering into any description of these species (for we have to deal only with asbestos proper, in considering its industrial applications), we may at once note the chief characteristics upon which the value of the mineral depends. And these are, first, its indestructibility by fire and its insolubility (except for a few varieties) in acids; secondly, its peculiar fibrous quality.

The material is obtained from the mines in forms ranging from bundles of soft silky fibers to hard blocks. The blocks may be broken up and separated into fibers, which, like those naturally obtained in that state, are extremely flexible, admit of great extension in the direction of their length without cracking, are greasy to the touch, and very strong. The fiber obtained in New York and Vermont varies in length from two to forty inches, and resembles unbleached flax when found near the surface; but when taken at a greater depth, it is pure white. Upon the length, flexibility, and strength of the fiber, the value of the asbestos depends. The engraving, Fig. 1, is drawn from an exceptionally fine piece, and exhibits the fibrous structure very perfectly. The fragment is 43½ inches long, 7½ inches thick, and 21 inches wide, and weighs 114 lbs.

It is a curious circumstance that, although the valuable qualities of asbestos have been known since time immemorial, it is only during very recent years that the mineral has been extensively used. Its employment among the ancients was confined to the manufacture of an incombustible cloth in which the bodies of the dead were cremated, and of napkins which were cleansed by throwing them in the fire. We find record of its employment as lampwick and for fireproof

containing asbestos, but through its composition independent of that material. From Fig. 2, which is a section of the asbestos roofing, its construction will be understood. F is a layer of asbestos-coated felt; A A are layers of acid and



A FINE PIECE OF ASBESTOS.

waterproof composition into which asbestos enters. C is a canvas, and M a manilla lining. These materials are compressed to a sheet resembling leather, about one tenth inch in thickness, and produced in continuous rolls about 40 inch-

Fig. 2.



ASBESTOS ROOFING—SECTION.

es wide, each roll containing 200 square feet. The weight is 50 lbs. per 100 square feet, or about one tenth that of gravel roofing. The manner of applying the rolls to the roof is shown in Fig. 3, the operation consisting in merely tacking the fabric to the boards. This is done with equal facility on either flat or steep roofs. The last process is to go over the laid roofing with a prepared coating of suitable color. This is made of asbestos in a flocculent state, mingled with silica paint body and other ingredients. It is applied with a brush,

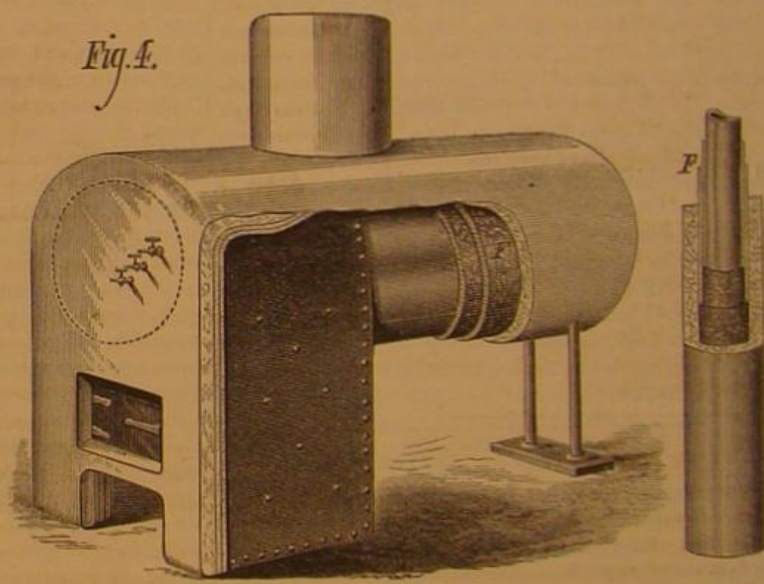
plying the insulating material will readily be understood from Fig. 4, which shows both a boiler and a portion of a steam pipe, covered, F being the felting. We are informed that the materials are very easily and cheaply applied, that the pipes so covered are smaller and neater than is usually the case, and that there is no danger of the envelope cracking through the expansion of the pipes. These feltings were subjected to severe tests, at the New York navy yard in 1874, which they successfully withstood, showing the highest degree of efficiency as non-conductors of heat.

Asbestos steam packing offers in itself utilizations as important in some respects as any other here mentioned. Ordinary packing in engines is obliged to contend with an elevated temperature, moisture, and friction, all agents tending towards its destruction. From the testimony of those who have used asbestos prepared as below described, it appears wholly indifferent at all times to temperature and moisture, while its self-lubricating qualities protect it greatly against wear due to friction. The mode in which the packing is made is shown in Fig. 5. The long flexible fibers of the asbestos are securely covered by a thin braid, forming ropes from three eighths to two inches in diameter, which are put up in coils of 50 lbs. each. It is especially suited for use in cases where the effect of high pressure steam is to be met. We are informed that it has been employed without removal on an ocean steamer which sailed over 90,000 miles, and in another case on a locomotive which ran over 50,000 miles, in both instances showing but slight effects of wear, and necessitating no stoppages.

As a paint body, some varieties of asbestos, through its capability of being reduced into almost impalpable powder, has been found excellently adapted. It is exceedingly tenacious, and so renders the pigments not liable to chalk, crack, or scale, while it possesses superior covering qualities. Less coloring matter is required in the manufacture of these paints than in any other, and they are prepared and sold by Mr. Johns ready for immediate application by the brush. The ingredients are simply the best linseed oil and colors, with the asbestos body; and the paints are not offered as strictly fireproof, although it is believed that they will resist fire after drying, much better than ordinary paint. They are made in all shades, and are especially well suited for outside work, such as railroad cars and bridges, walls, fences, etc.



LAYING DOWN ASBESTOS ROOFING.



ASBESTOS-COVERED BOILER AND PIPE.

gloves and clothes for metal workers and firemen. Not very long ago, we learnt of its entering into a peculiar quality of wall paper made in Rome, Italy. With these few exceptions—and in no case has any of them risen to the level of even a minor industry—asbestos has occupied the position of a mineralogical curiosity, a product reasonably certain some day to find its place in human economy, but nevertheless one which inventors seemed systematically to overlook.

It is to Mr. H. W. Johns, of New York city, that the credit of first using asbestos for industrial purposes on a large scale is due. Some years ago, that gentleman invented a cement in which one of the ingredients was asbestos. Asbestos, however, despite its abundance, was then exceedingly difficult to obtain. It could be purchased only in small quantity at a high price, and certainly offered no very promising prospects of an adequate supply, should a large demand for the cement be realized. Nothing daunted by this scarcity, the inventor advertised his cement widely, through the *SCIENTIFIC AMERICAN* and other journals; and the result of his advertisements (as with considerable shrewdness he had anticipated) was not merely an augmented sale of his invention but an avalanche of letters from all quarters of the globe, in which the writers mentioned deposits of asbestos in their vicinity, and offered supplies. Thus, ere very long, Mr. Johns became possessed of abundant facilities for obtaining any quantity of the mineral, and was free to proceed with the experimenting which led to the other and more important utilizations which we are about to describe.

In a little volume which has been compiled from Patent Office records, we find over three hundred patents for roofing compositions, and probably this number is much below the total of this class of inventions. In all these compounds, there is a general sameness, due perhaps to the presence of gas tar and various conglomerations of gravel, resin, paper, felt, cement, and chemicals in the large majority. From all these, the asbestos roofing differs not merely through its

and forms an elastic waterproof felting. For large and important city edifices, an asbestos concrete may be applied by means of a trowel and in lieu of the above coating. The advantages claimed for the roofing are that it forms a water and airtight smooth surface, which is a good non-conductor of heat, and is practically a resistant of fire; also that it is adapted to all climates, and is unexcelled in durability and cheapness by tin, slate, or shingles, of the qualities ordinarily used.

The second application of asbestos to which attention may be directed is as a covering for steam boilers and pipes. For this purpose it is prepared in various ways. A cement felting, composed of asbestos and a cementing compound, may



Fig. 5.—ASBESTOS PACKING.

be used like mortar and applied directly to the pipes, forming an excellent fireproof non-conductor of heat. It is improved, however, as a covering by the addition of an asbestos lining felt, which is a strong sheathing, to one side of which is attached a layer of flocked asbestos. This is applied, say in two turns, directly around the pipe, and the cement laid on outside. Each layer of asbestos thus forms a sort of air chamber, which adds greatly to the insulating capabilities of the cover. At the same time the felt admits of the expansion of the pipe and also serves to protect hair felts, when the same are placed over it, from charring and other injurious effects of heat. An asbestos-lined hair felt is likewise manufactured, which is especially suitable for covering marine and locomotive boilers. The mode of ap-

Lack of space prevents our describing, in detail similar to the above, the many other productions into which asbestos enters. Of the more important of these we may mention asbestos cements (fire, acid, and water proof) for linings and fillings for iron columns, floors, and for slate and other roofs, for cementing steam and other joints, fire clay retorts, etc. A fireproof coating is also made for wooden structures and shingle roofs, and for surfaces, not exposed to the weather, which are liable to ignition. This is applied with a brush, and may be subsequently coated with asbestos paint. Asbestos board is made from pure asbestos in flexible sheets of various sizes and thicknesses, forming a valuable covering for locomotive boilers, and for flat packing, gaskets, etc., and as a protection for all surfaces exposed to fire. Asbestos paper is used for lining cloth, fire screens, etc., and for filtering acids. Asbestos thread may be woven into fabrics, and an asbestos lubricator is manufactured, designed for heavy machinery, wagon axles, etc.

All these varied applications are the result of continued experimenting and investigation on the part of the inventor, a labor which has lasted since 1867, and which is still in progress. That they are of a high degree of value and utility may perhaps best be judged by the rapid increase which has been felt in the demand for asbestos products, and by the excellent results which actual employment has demonstrated them capable of yielding. Any further information will be cheerfully given by the patentee and manufacturer, Mr. H. W. Johns, 87 Maiden lane, New York city.

CLIPPING HORSES.—M. Veterinary Surgeon Félixet recommends that, instead of clipping working horses in autumn, a good shining coat, free from skin dust, can be secured by giving the horses, from the middle of September, either alone or mixed with their evening feed of oats, one tenth of a quart of bruised hemp seed, and the same quantity of buckwheat in its natural state.

IMPROVED LEATHER AND CLOTH ENAMELING MACHINE.

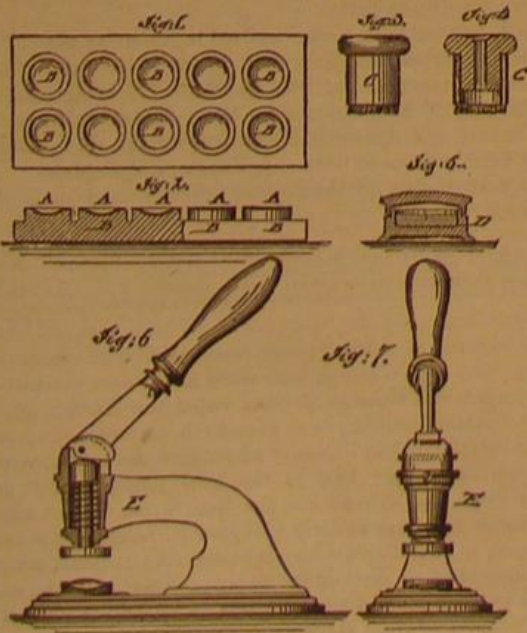
The annexed engravings represent a machine for enameling cloth and leather, which is capable of a great variety of useful applications, such as spreading waterproofing and other compounds on textile fabrics. The inventor gives the following description of the machine, as illustrated in the engraving. Fig. 1 is a view of one side; Fig. 2 is a central vertical longitudinal section; and Fig. 3 is a top view of a portion of the machine.

The cloth or other material to be enameled or to be covered with waterproof or other substance is wound around the beam or roll, *c*, and is then made to pass, by the power communicated to the machinery, under the bar, *d*, and over the top of the bar, *d'*, the corrugated, toothed, or grooved surface of the bars, *d d'*, serving to smooth and evenly spread to its full width the cloth or other material, which is then fed along over the rod or bearing, *r*, and below the hopper, *k*, from which the enameling, waterproofing, or other substance or compound is deposited upon the cloth or other material, and regulated in its delivery through an opening or throat in the bottom of the hopper, *k*, by the action of the sliding gate, *h*, which is raised or lowered by the operation of the lever arm, *l*. The cloth or other material is then carried along between the smooth rollers, *t t'*, which are kept moistened by the dripping of water or other liquid contained in sponges or other suitable substance held in the trough, *v*. The cloth or other material is then brought over the cushion, *H*, and under the blade, *F*, which is raised or lowered by the action of the lever arm, *E*, so as to accommodate itself to the thickness of the cloth, etc., which is then fed over the upper surface of the corrugated, toothed, or grooved bar, *d'*, and thence between the cushion, *H'*, and blade, *F'*, and is then carried between the smooth rollers, *x x'*, whence it is delivered and placed upon drying racks. The blades, *F F'*, serve to spread, distribute, and incorporate the enameling or other mixture evenly upon the entire surface of the cloth, etc., upon which it is firmly and evenly pressed by the action of the rollers, *t t'* and *x x'*. The bars, *d d' d'*, may, if desired, be arranged with heating chambers, and may have either the upper or under surfaces formed with corrugations, teeth, or grooves, and the cloth, etc., be made to pass over or under them, as may be required. Either one or more troughs, or one or more sets of rollers and blades, may be used. The invention may be operated by hand, steam, or any other suitable motive power.

Patented September 3, 1873, to Luther L. Allen, Hallowell, Me.

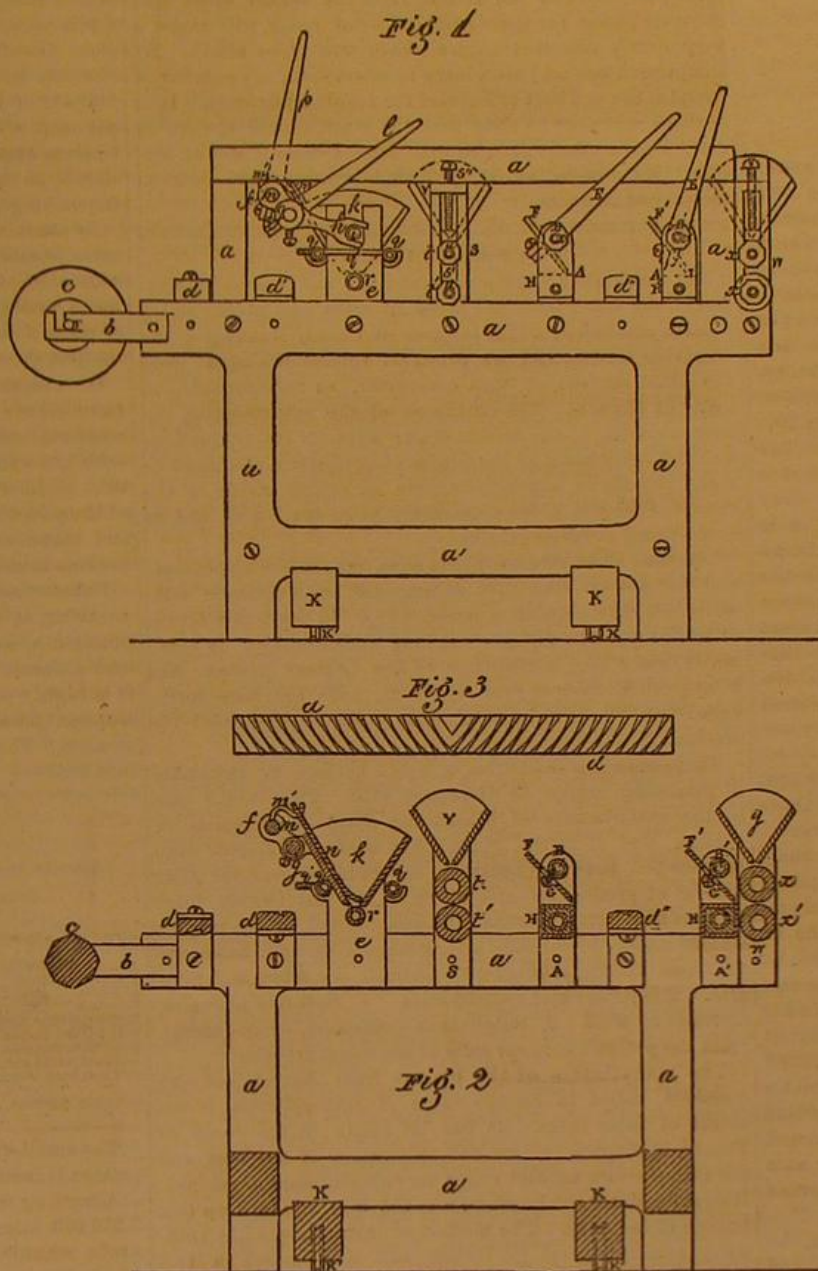
IMPROVED PROCESS OF CAPSULING MEDICAMENTS.

M. S. A. A. Limousin, of Paris, France, has patented, through the Scientific American Patent Agency (February 8, 1876), an improved mode of capsuling medicaments, by which druggists may furnish them in a neat and readily made up form to the public, to be taken in an easy and convenient manner. Disk-shaped wafers, *A*, of different sizes, according to the quantity to be enclosed by the same, are made with concave



central parts, which may be at the same time embossed with the name, address, etc., of the druggist, and the name and quantity of the medicament contained therein. A number of concave stamped wafers are first placed on a series of concave disks, *B*, of the same size and shape, so as to fit exactly thereto, the disks forming the support for the wafers, which are then filled by a graduated measure with the exact quantity of the medicament. The outer edges of a corresponding number of wafers are then moistened by the device, *C*, which consists of a double metallic tube with

interior filling of suitable fabric that retains and distributes the water, taking it up by dipping it in a dish, *D*, with spongy material saturated with water. The main object of the dish and moistener is to supply only so much of the moisture as will be sufficient to produce the adhesion of the edges of the wafers when placed one on the other. The second series of wafers, when moistened at the edges, are then placed on those supplied with the medicaments and transferred with them to the lever press, *E*, to be firmly closed at the edges. The press, *E*, has concave metal disks, corresponding in size and shape to the wafers, so that only the edges are compressed, while the central part of the wafers



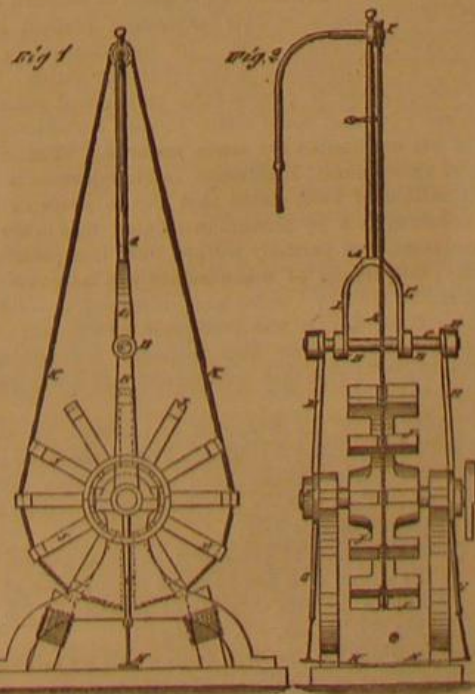
ALLEN'S CLOTH-ENAMELING MACHINE.

is not interfered with. The jointed wafers form a lens-shaped central space in which the powders are contained and held securely enclosed by the wafers.

Any medicament taken in the form of a powder may be made up in this manner, and kept on hand for any length of time without deterioration.

IMPROVED ELECTRO-MAGNETIC DENTAL ENGINE.

Mr. Elihu Pettit, of Philadelphia, has patented a simple contrivance for coupling a magnetic engine to a dental engine, for use instead of the foot power for driving it.



The armature wheel of the magnetic engine is employed in the place of the driving wheel of the foot power for running

the band, and the standard of the dental engine is mounted on the shaft of the armature for its support. Fig. 1 is a side, and Fig. 2 a front, elevation.

A is the crotched standard of the dental engine, which is cut in two just below the bearings, *B*, for the shaft of the driving pulley. The latter is worked by the foot treadle, and fits on a shaft, *C*, which is mounted in bearings, *D*, of standards, *E*, secured to the projecting ends of the armature shaft, *F*, with extensions, *G*, to the base, connecting with a spring, *H*. This serves to keep the standard upright, but at the same time allows it to vibrate for swinging the top forward and backward, as may sometimes be required in the manipulation of the tools. The shaft pulley, *I*, is thus brought directly over the armature wheel, *J*, so that it may serve for the band wheel, for which *V* notches are made in the armature for a round band, *K*, and flat bottomed notches for a flat band.

In making new machines for connection with a magnetic machine, the crotch, *L*, of the standard will be extended so as to serve for the standards, *E*, and fit the bearings, *D*, on the armature shaft, thus dispensing with the shaft, *C*, which is only necessary in the connection of dental engines made for foot power.

Patented through the Scientific American Patent Agency, February 22, 1876.

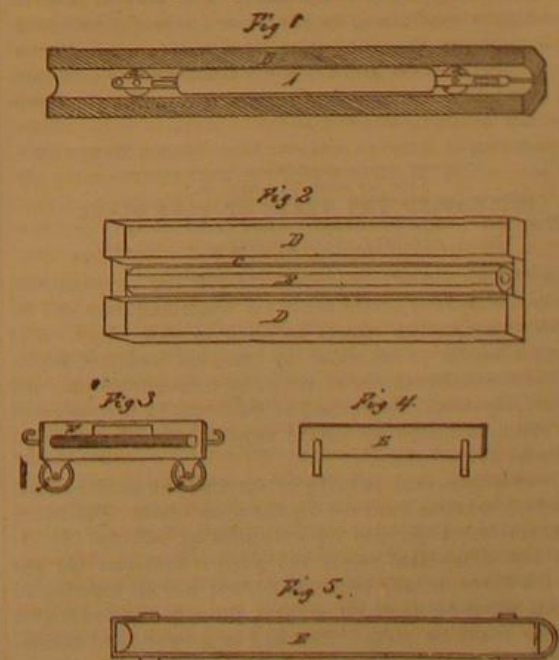
Lightning Rods.

The committee appointed by the Prefect of the Seine to superintend the construction of lightning conductors in Paris has been changed into a permanent one. A sum of \$40,000 has been appropriated by the municipal council for reconstructing all the lightning conductors in Paris, or at least all those which may be found defective or inefficient. This sum is a first instalment, as the whole of the work, it is supposed, will cost \$250,000, although the committee do not recommend the use of copper conductors.

Until the appointment of the committee, lightning conductors were constructed by ordinary blacksmiths, under the superintendence of architects who knew nothing of physics. A competitive adjudication took place recently, between a number of competent electricians, for the construction of all the lightning conductors on the Paris municipal monuments. The successful competitor is M. Grenet, the well known electrician. A list of instructions with seventy carefully drawn provisions has been published. The continuity must be tested yearly, and the contractor will be paid by instalments; so that his claim will be cleared up only when the efficiency of his work shall have been tested during a certain number of years. The platinum cone has been abolished and replaced by a copper cone. The quality of the iron, as well as of the copper and solder, is to be tested by chemical analysis. The insulation of rods has been abolished as being useless. The committee has diminished the diameter of protection area, which was supposed to be twice the height, and has reduced it to 1.45. The consequence is that rods are to be multiplied—Nature.

NEW PROCESS OF PRESERVING WOOD.

The annexed engraving illustrates a recently patented pro-



cess of saturating wood with any liquid which will fill the pores of the wood and solidify on cooling. The method consists of heating the wood till all moisture is evaporated and the pores opened, and then plunging the wood while hot into a suitable liquid. Fig. 1 shows a bored section of a pump log, *B*, cut in half longitudinally; and *A* is the heating apparatus, having a coal fire within it. It will be seen that the cylinder, *A*, is kept from immediate contact with the bore of *B* by the rollers, *a*, which are slightly larger than the cylinder, *A*. The heating cylinder can thus be

moved along the bore of the log so as to thoroughly dry the latter in every part without charring, the heat being intensified by a draft of air passing through the cylinder longitudinally. In Fig. 2 is shown a double fire box, D D, with an internal trough, C, by which the outside of the pump log can be dried in a similar manner. In Fig. 3 is shown a manner of applying the invention to roofs of buildings, decks and sides of ships, etc., the firebox, F, being placed in a case mounted on wheels, *ff*, to be drawn from place to place. Figs. 4 and 5 show the trough, F, made of boiler iron, to contain the saturating substance, a fire being built under the trough to keep the substance liquid.

Patented August 1, 1865, reissued August 20, 1872, to George Palmer, of Littlestown, Pa.

Correspondence.

The Years of the Several Planets.

To the Editor of the Scientific American:

It is the rule, among astronomers and authors on astronomy, to call the sidereal revolution of any planet (the earth excepted) its year, and, so far as practical and instrumental astronomy is concerned, the name will pass; but where truth and proper understanding of the fact is required, it will not do. The reason is obvious. It is not true that the sidereal revolution of any planet in the solar system is the exact year of that planet, whichever one it may be. The sidereal revolution of any and of every planet is more than its year, and that inversely as the number of their respective revolutions round the sun. Thus, Mercury revolves round the sun 107,680 times during the period of precession (25,800 years), and by virtue of the gyration of his poles (which, I claim, is in the same direction as is the gyration of the earth's poles, and that the motion of the one keeps exact pace, so to speak, with the other), he finishes his year at a point, in his orbit or in the heavens, twelve seconds and one tenth of a second (12'1") short of the point at which he finished his previous year. Venus makes 41,876 revolutions round the sun in the same space of time, and hence, by virtue of the like gyration revolution (for planets all gyrate in the same direction, that is, retrogressively and in the same space of time), she completes her year at a point in the heavens thirty seconds and three fourths of a second (30'75") short of the point where she finished her previous year. The earth revolves round the sun, during the same period, 25,800 times; hence she completes her year at a point 50'25" from her sidereal place, or from the point where she completed her previous year. Mars makes 13,731 revolutions; and hence completes his year at a point 1'34" short of where he completed his previous year. Jupiter makes 2,175 revolutions; and he of course finishes his year at a point 9'55" short of where he completed his previous year. Saturn revolves round the sun 876 times in 25,800 years; and of course he completes his year at a point in the heavens 24'39" short of the point at which he closed his previous year. Uranus moves round the sun 307 times in the above period; hence he completes his year at a point distant 1° 1' 21"5" from the point where he finished his previous year. And Neptune revolves round the sun about 156 times; hence he completes his year at a point 2° 18' 28" distant from the point in the heavens where he closed his previous year.

Claiming that, by virtue of solar retrogressive motion, the poles of every planet gyrate as do those of the earth, and that the planets complete their respective revolutions in the same time. I maintain that the year of each planet, as given above, is approximately correct.

I therefore call upon astronomers, especially those having the use of powerful telescopes, to note these facts, and watch the polar movements of the several planets. If the several planets do not gyrate as I say, and if their several poles do not complete revolutions in the time I say (25,800 years about), then my theory of solar retrogressive motion is untrue. But if they do, and I risk my honor on the assertion, then my theory is true, and the sun moves in the plane proper of the ecliptic.

Gloucester, N. J.

JOHN HEPBURN.

(For the Scientific American.)

ESTIMATING THE VALUE OF BONE BLACK.

BY F. L. BARTLETT, STATE ASSAYER, PORTLAND, ME.

The direct value of bone black for refining purposes consists in the capacity of the black for absorbing lime and removing the coloring matter common to raw sugar. The value can hardly be estimated by chemical analysis, which also has the disadvantage of requiring considerable time and no little expense. My method of determining the value of bone black, although not wholly new, has the advantages of quickness and accuracy.

All raw sugars contain more or less lime and coloring matter, which must be removed by the bone black. Following out this idea, I prepare my solutions as follows: No. 1. Take best granulated sugar 195 grains; molasses (45 per cent) 3.5 cubic inches; lime 772 grains; boil all together in 1½ pints water for about 30 minutes, filter, and add sufficient water to make 2½ pints. This will be a solution of saccharate of lime containing the coloring matter from the molasses. Solution No. 2 is made by adding 0.915 cubic inch sulphuric acid to 1½ pints of water. This will be found to very nearly neutralize the lime solution, bulk for bulk; if it does not, water or acid must be added to No. 2 until 3.05 cubic inches of it will just neutralize 3.05 cubic inches No. 1. To use these solutions, 154 grains of the bone black to be tested is weighed out, and powdered fine enough to pass through a 60 sieve; 1.52 cubic inches of solution No. 1 is poured into an evaporating dish and the black added, well stirred, and

thrown on to a filter, and washed with water to make 3.05 cubic inches of the filtrate. This is then slightly colored with a solution of litmus, and enough of the acid solution No. 1 is poured in from a burette to neutralize the lime remaining in the filtrate. The amount of the acid solution required will indicate at once what the value of the given sample is, compared with pure bone black.

I find that pure bone black treated in this way will require about 0.305 cubic inch of the acid solution to neutralize the remaining lime; while an old valueless black requires about 0.6 or 0.7 cubic inch, a fair commercial article will require from 0.4 to 0.5 cubic inch, of the acid solution. Of course the acid only indicates the declining power of the black; the color of the filtrate from the treated black will show its power for decolorizing. Good black will make a very nearly colorless filtrate when treated as above. By comparison one may soon learn to select from any number of samples the one best calculated for refining purposes. It is perhaps necessary to state that the black should always be dried before operating with this test. I usually dry at 300° Fah. My results, so far, with this process have been extremely satisfactory.

The Potassa Industry.

Not more than twenty years ago all the potassa in commerce was made from the ashes of trees and plants which contain potassium. The steppes of Casan, Bukowina, the Moravian forests, and the primeval forests of Canada were the chief sources of this compound, so indispensable in many of the arts. The costliness of the raw material, the extermination of the forests drawn upon for its production, and the remoteness of the places of production combined to make potassa an expensive article, an article which in the course of time it became necessary to be sparing of, and to avoid using as far as possible.

The time when even hard soda soap was made with potassa, and the potassa soap then decomposed with common salt, salted out, has long since passed away. In the manufacture of hard soap, the potassa was long since replaced by soda, which, since the introduction of the Leblanc process, has been getting cheaper year by year. Soda has been introduced into the glass manufacture, and is even used for washing by the housewife.

There are a few industries in which potassa, or carbonate of potassium, cannot be dispensed with. This is the case in the manufacture of lubricating soap, of prussiate of potassa, and of crystal glass. The more the forests were thinned out, the more necessary it became to seek for other sources of production; and hence in the last twenty years various new manufactories have been started, which may be classed under three heads, and, strangely enough, belong to the three different kingdoms—animal, vegetable, and mineral. The three chief sources were: 1. Beet root molasses. 2. Suint of wool. 3. Sulphate of potassium, or, in general, from the potassic *abraum* salts of the Stassfurt mines.

The manufacture of the potassa from charred beet root molasses, called in Europe *savin* or *Schlempekohle*, is the oldest of these three. It had its origin in the north of France, in districts where the cultivation of the beet and the manufacture of beet sugar are extraordinary developed. Robert de Massy, of Rocourt, was the first who took up this branch of industry. The method of manufacture has gradually attained great perfection, and is described in full by F. Kuhlmann in the report on the chemical portion of the London Exposition of 1862.*

Potassa from beet molasses is made, as stated, in Northern France, also in Belgium, Moravia, and the provinces of Hanover, Saxony, Pomerania, Brandenburg, and on the Rhine. The total production at present in all these countries is about 12,000 tons of potassa of 80 to 84 per cent. It is almost exactly proportional to the development of the beet sugar industry in the separate States, and is divided about as follows: 64 per cent in Northern France, 24 per cent in Germany, 4 per cent in Belgium, and 8 per cent in Austria.

The manufacture of potassa from the suint of wool is of more recent date. Maumené and Rogelet, of Rheims, exhibited the first sample of this interesting product at the world's fair in London, 1862. Its manufacture was described by A. W. Hofmann in the reports by juries.

The manufacture of potassa from sulphate of potassium, by Leblanc's process, could attain greater development, because it was not limited for crude material. This industry is also of recent date. Kuhlmann, in his report on the London Exposition of 1862, stated that the sulphate of potassium, obtained as a by-product in refining that made from beet molasses, was partially worked over into potassa. In Germany, this branch of manufacture was introduced on a large scale, in 1861, by Vorster and Grüneberg, at Kalk, near Cologne. Here, too, it was instigated by the sulphate of potassium, obtained from beet molasses, and which contained so much of cyanogen compounds that it was scarcely saleable in market.

The discovery of the Stassfurt salt mines, of course, turned attention in that direction. The methods employed for treating Stassfurt brines have recently been given in our columns, so that we here give but a brief outline of the process employed by this firm:

1. A double sulphate of potassium and magnesium is obtained by the action of a hot solution of sulphate of magnesium, kieserite, on the chloride of potassium: $3KCl + 2MgSO_4 = MgSO_4 + K_2SO_4 + KCl, MgCl_2$.

2. Decomposition of the first double salt by allowing its hot solution to act upon chloride of potassium, or by macer-

ating the undissolved double salt in a cold solution of chloride of potassium: $K_2SO_4, MgSO_4 + 3KCl = 2K_2SO_4 + KCl, MgCl_2$.

3. Decomposition of the artificial carnallite ($KCl, MgCl_2$) by refining, or by maceration with cold water.

Starting with three molecules of chloride of potassium and one molecule of sulphate of magnesium, they obtain as end product one molecule sulphate of potassium, one molecule chloride of magnesium, and one molecule chloride of potassium.

The sulphate of potassium obtained in this way was very pure, and, when put through the Leblanc process, yielded a pure potassa, free from soda. In places where sulphuric acid is cheap, and there is a market for hydrochloric acid at a fair price, it is preferable to convert the chloride of potassium directly into sulphate by the use of sulphuric acid. For this latter process, the chloride of potassium from the refinery of the *savin* of beet molasses, containing 10 to 12 per cent of sulphate, is well adapted. The sulphate of potassium obtained from kelp in the manufacture of iodine should be mentioned among the sources of crude material for making potassa.

In converting sulphate of potassium into carbonate, the same precautions must be taken as in the manufacture of soda ash. If the charcoal used in the reduction contains much nitrogen, like the English Sunderland coal, prussiate of potassa is formed in such quantities during the fusion that, in the latter case, its manufacture pays.

On evaporating the carbonized lyes to 50° Baumé, the ferrocyanide crystallizes out along with the undecomposed sulphate, and can be separated from the latter by extracting with hot water. A second recrystallization produces a beautiful commercial product, which contains about one per cent of the potassa made. Andrae and Grüneberg, and the chemical manufactory of Pommerensdorf, make prussiate of potassa in this way as a by-product.

Potassa made from sulphate of potassium is very pure; it contains, as an average, 92 to 93 per cent of carbonate of potassium, and, as impurities, 2 to 3 per cent soda, 2 per cent chloride of potassium, and 1 to 2 per cent sulphate. It is highly prized on account of its purity, as compared with Russian potassa, which only contains 68 to 70 per cent potassa. The following table shows the analysis of the best kinds of potassa in market:

SOURCE OF THE POTASSA.	Quality.	Carbonate potassium and hydrate calculated as carbonate.	Carbonate Sodium.	Sulphate potassium.	Chloride potassium.	ANALYST.
American potassa	1	104.4	1.4	4.0	2.0	F. Mayer.
" " pearlash	2	71.2	2.2	15.1	3.6	"
Tuscan potassa	3	74.1	3.0	13.4	0.9	Payen.
Illyrian "	4	83.3	0.9	1.2	3.5	H. Grüneberg.
Russian "	5	69.6	3.0	14.1	2.0	Payen.
Stassfurter potassa	6	81.2	6.8	6.4	0.6	H. Grüneberg.
Hungarian house ash	7	44.6	18.1	30.0	7.3	"
Gallician potassa	8	46.9	3.6	29.9	11.1	"
Reddish suint ash	9	72.5	4.1	5.9	6.5	"
French beet ash	10	80.9	2.5	2.8	3.4	"
German potassa	11	80.1	12.6	3.5	3.4	Denimel.
" "	12	92.2	2.4	1.4	2.9	"
" "	13	84.9	8.2	2.8	3.5	H. Grüneberg.

The small quantity of phosphate of potassium in beet root potassa is included in the carbonate.

According to tolerably reliable data, there are at present 7,250,000 kilogrammes (over 7,000 tons) potassa of high grade manufactured in Germany by the Leblanc process. There is no doubt that this potassa, together with that made from the beet, will gradually supplant the Russian potassa. In Russia, the cost of production is increasing from year to year since the emancipation of the serfs, and the production has proportionately decreased. The quantity exported in the last 10 years was 5,171,758 pounds, or 84,717,315 kilogrammes (about 84,000 tons), decreasing from 11,010,910 kilogrammes in 1864 to 5,540,035 kilogrammes in 1873, or nearly one half.

A still greater falling off is noticed in American ash. The quantity exported from New York in 10 years was 10,981,400 kilogrammes; that of 1865 was 2,610,725 kilogrammes, against 388,050 kilogrammes in 1873. These fallings off must be met, and this is doubtless done by the manufacture of artificial potassa in Germany, France, and England.

The present state of the potassa industry is given in the following table:

	Tons
1. Wood ashes: Russia, Canada, United States, Hungary, Galicia.....	20,000
2. Beet ashes: France, Belgium, Germany, Austria.....	12,000
3. Potassa from sulphate: Germany, France, England.....	15,000
4. Potassa from suint: France, Belgium, Germany, Austria.....	1,000
Total.....	48,000

The relation of these figures, compared with those of twenty years ago, at which time wood ashes were exclusively employed, and Russian potassa ruled the market, show that the potassa industry is at present in the midst of a complete revolution. The quantity of potassa made from wood ashes forms scarcely half of the total production; it decreases from year to year, and the time is not distant when wood ashes will have entirely disappeared from the market. The latter is first displaced by the beet root potassa, which is a constant by-product in the beet sugar manufacture, and can be put into market at a very low price, and is produced in the refining of other valuable by-products, such as chloride of potassium, carbonate of soda, etc., which fully cover the cost of manufacture. The manufacture of potassa from the sulphate has now attained a still greater importance, as the Stassfurt salt deposits promise an inexhaustible supply of potassium compounds. The center of gravity for beet root potassa lies in Northern France; that for artificial potassa from sulphate of potassium naturally lies in Germany, which has every prospect of being the chief source of chloride of potassium and the chief country in the production of potassa.

—Dr. H. Grüneberg.

* A. W. Hofmann: Report by Juries, 1862, p. 55; Wagner's *Jahresberichte*, 1864 p. 316.

PRACTICAL MECHANISM.

BY JOSHUA ROSE.

SECOND SERIES.—NUMBER I.

PATTERN MAKING.

Those savans who have read our old earth's unwritten history in and from its strata tell us that, in ages far remote, men made tools and contrivances of bronze, which, being an alloy, necessitated the fusion and casting of the metal. This casting involves the use of patterns, and pattern making may therefore lay claim to the highest antiquity. But the modern idea of the division of labor has exalted it to be a distinctive art: in the last generation, for instance, a good machinist (or rather engineer or millwright, for those terms were then applied to builders of machinery) was required to be alike expert in working upon both wood and metal. He constructed his framing of wood, and made the patterns for his cast metal work; he was to-day a lathe hand, tomorrow a vise hand, and sometimes a blacksmith, and the next day a pattern maker or perhaps a wheelwright.

As, however, the present age of iron dawned, it became apparent that working in wood and in metal must be separated, not only because the handiwork could be more cheaply produced by reason of the increased skill arising from continuous practice, but also because the amount of knowledge, required to make an artisan skillful in either the manufacture of wood or of iron, was too great to be thoroughly mastered in the working lifetime of an ordinary or even an unusually expert workman. Hence modern intelligence soon discovered that better as well as cheaper work could be obtained by a practical education in one particular branch of usefulness, and hence pattern making has taken its place as a specialty. The field of usefulness of cast iron has developed to a remarkable extent during the last twenty years, and the same remark applies to cast steel during the last ten years: both of these materials are steadily encroaching upon the domain of usefulness of wrought iron, stone, and bricks and mortar. So that the field of application for pattern making is stretching outward and onward to the discomfiture of its rivals. From these considerations, we may readily perceive that a real proficiency in pattern making will exercise to the utmost the skill of the workman, on account of the unceasing variety of the patterns, in form and in the purposes for which they are designed; and the advantage of a retentive memory is evident when we consider that years may elapse ere the same pattern maker may be called upon to exercise his skill upon the same or a similar piece of work. In this art, there are to be considered many details that are seldom or never shown in drawings: such, for instance, as the amount necessary to allow on the pattern for finishing certain parts of a casting, and on what part such allowance is required; and the method which has been proved by experience to be the safest and most expeditious in molding from a certain kind of pattern. But above all these considerations lies the fact that drawings merely show the shape which the finished pattern is required to have, leaving it entirely to the judgment of the pattern maker to elect in what way the various pieces of wood (of which the pattern is constructed) shall have the grain lie, and how they shall be fastened or held together. There is, it is true, an unwritten practice which has obtained universal observance in particular branches of pattern making; but in the newer fields into which the art has advanced and is advancing, this unwritten practice is merely in the process of formation, which state of things must continue so long as casting is discovered to have new arenas of application. A goodly store of well remembered experience is therefore invaluable to the pattern maker; and this being so, the quicker it is obtained the better. Hence the learner should always keep a record of the work which falls under his observation, in which record the sizes and proportions of the work, the method of putting it together, the time taken in its production, and (if possible) whether the castings were satisfactory, noting the defects in the latter, if any, together with suggestions for the remedy of those defects. A pen and ink sketch of the pattern made in the margin will add to the usefulness of the record, besides accustoming the hand to making correct sketches and elucidating the explanation. The operative's intelligence will be much exercised in the shaping and building-up of patterns, depending as this does on the strength of the material of which the casting is to be made, the strength of the pattern itself, and the desirability of its molding well. Dr. Andrews has well said (in the *English Mechanic*): "The correct forms to be given to the materials employed in the construction of tools or machinery depend entirely upon natural principles. Natural form consists in giving to each part the exact proportion that will enable it to fulfill its assigned duty with the smallest expenditure of material, and in placing each portion of the materials under the most favorable conditions of position that the circumstances will admit of. Such natural form is not only the most economical, but, strange to say, it is always correct in every respect, and is invariably beautiful and lovely in its outlines."

I may now mention the qualifications necessary to enable an artisan to become a good pattern maker: First. As the idea of the size and contour of the article or work required will be conveyed to him by drawings, it is necessary that he should be conversant with the principles of mechanical and architectural drawing; and it may be of great advantage to him, though it is not absolutely necessary, to be able to make such drawings. It is too often the case that the apprentice pattern maker gains his knowledge of drawing from the drawings from which he operates, which, being simple in the first case and becoming complicated only after the lapse of two or three years, makes the acquisition of a knowledge of drawing possible without either

study or application; but the result is that, so soon as he is called upon in a new field of action, upon a description of work different from that to which he has been accustomed, he becomes timid, gets confused, finds it necessary to ask many questions upon and concerning various parts of the drawings, and then does not obtain credit for the amount of ability to which his skill in handling his tools perhaps entitles him. Furthermore, a knowledge of drawing will enable him to learn his trade in a comparatively short space of time, and give him confidence in, and a retention of, that which he has already learned. Secondly. He should be perfectly familiar with the operations of the brass and iron founder, as it is by him that patterns will be used to produce the required forms. The pattern must be so made that a mold can be made from it, and that it may be made in the most expeditious manner. The pattern maker, it must be remembered, determines how the molder is to mold the pattern, so that the latter is controlled in his operations by the former. For the benefit of those who have been unable to devote sufficient time to the work of the foundry, it will be necessary, as we proceed, to explain the operations of molding different kinds of patterns, selecting those which will best serve as a key to the whole. Thirdly. The pattern maker must be acquainted with some, at least, of the properties of the metals of which the castings from his patterns are to be made: such, for instance, as how they behave in passing from the fluid to the solid state, the strains to which a casting is subject during this transition, to what extent those strains may be modified by alterations of proportion or shape in the pattern, the shrinkage of castings, and the alteration in form which takes place in the cooling of castings of various sizes and shapes. Fourthly. He should, if possible, add to the above qualifications a general knowledge of the manner of fitting up the different kinds of work for which patterns are used.

With regard to the first requirement, it is not my purpose to enter into the subject of mechanical drawing, which will be found in a series of articles, written by Professor MacCord, and now being published in the *SCIENTIFIC AMERICAN SUPPLEMENT*. With regard to the second, I shall, as already stated, refer to it hereafter. The third I shall consider after I have treated upon timber and tools, and the fourth can only be obtained by watchfulness on the part of the student as to what is being done in the workshop in which he is engaged. This latter may seem a trivial matter; but I have on several occasions, by watching where certain castings required to be most operated upon in the machine or vise, had a pattern altered, making it apparently of an incorrect form, with the result that the time necessary to fit the work was reduced by one half. This subject, however, will be treated upon in its proper place.

Checking the Fire Fiend.

The amount of worry and anxiety, and consequent discomfort of living and the shortening of the term of life, caused by the apprehension of danger from fire, is enough to make every one search diligently for safeguards. The danger of loss of property is of course very great, and even the moderate chance of loss of life should not be disregarded.

When the communists tried to burn Paris, they failed, not because the fires were put out by engines of any kind, but because the city was so built that it would not burn. What must be the fate of an American city under similar circumstances is easily foretold. We build fire traps, and protect them by insurance. But money, though a great soother at times, can never pay us for loss of peace of mind. It cannot even pay us for the loss of those articles of daily use to which we have become attached by long associations; the many pictures and books which seem to us like old friends, and, far dearer than these, the mother's old arm chair or the dead child's playthings. We cannot reconcile ourselves to the loss of these, and we all long at times for a home in which they can be made reasonably secure to us. We do not ask for absolute safety. The world can seldom give that. We ask to have our treacherous enemy checked and retarded, to give time, at least, to get our priceless treasures beyond his reach.

Much has been said and written on fireproof construction, and most of it ends with advice to employ cumbersome and expensive work of iron, brick, and tiles. But little has been told to show how a comparatively cheap house can be built so that it will never burn quickly, and so that the chances of saving it altogether can be increased a hundredfold.

Before showing how this can be done, it may be well to transcribe, for the benefit of those whose houses are already built, a few suggestions from the *London Builder* with reference to the prevention of fires.

"Keep matches in metal boxes, and out of the reach of children; wax matches are particularly dangerous, and should be kept out of the way of rats and mice. Be careful in making fires with shavings and other light kindlings. Do not deposit ashes in a wooden vessel, and be sure that burning cinders are extinguished before they are deposited. Never put firewood upon the stove to dry, and never put ashes or a light under a staircase. Fill fluid or spirit (or kerosene) lamps only by daylight, and never near a fire or light. Do not leave a candle burning on a bureau or chest. Always be cautious about extinguishing matches or other lighters before throwing them away. Never throw a cigar stump upon the floor, or into a spit box containing sawdust or trash, without being certain that it contains no fire. After blowing out a candle, never put it away until sure that the snuff has gone entirely out. A lighted candle ought not to be stuck up against a frame wall, or placed upon any portion of the woodwork in a stable, manufactory, shop, or any other place. Never enter a barn or stable at night with

an uncovered light. Never take an open light to examine a gas meter. Do not put gas or other lights near curtains. Never take a light into a closet. Do not read in bed.

"The principal register of a furnace should always be fastened open. Stove pipes should be at least four inches from woodwork, and well guarded by tin or zinc; rags ought never to be stuffed into stove pipe holes: openings into chimney flues for stove pipes which are not used ought always to be securely protected by metallic coverings. Never close up a place of business in the evening without looking well to the extinguishment of lights and the proper security of the fires. When retiring to bed at night, always see that there is no danger from your fires, and be sure that your lights are safe."

To these good rules might be added: Never keep or leave oiled rags or oiled cotton waste in any place where their burning could do any harm. They are more dangerous than gunpowder. Always have an ax, one or more buckets of water, and a small hand pump available at all times to put out a fire in its beginning. Do not allow accumulation of combustible rubbish about, especially in out of the-way corners. These directions may prove of use to those whose houses are already built. Those who have yet to build need to be shown how to use their material properly. The great danger in our present system of construction lies in the inflammable nature of our building materials, and in the opportunity given by the arrangement of partition walls and floors, unchecked, unseen, and out of reach. It is best, if possible, to build outer walls of brick, and with judicious treatment and at moderate expense they can be made to look attractive even in the country. By making a projection or offset inside at each floor, an effectual stop can be put to any passage of fire up the inside surfaces; or if hollow or vaulted walls are used, the plaster can be put directly on the brick without using any wood. But if the outside walls are of wood, the spread of fire can be greatly checked by filling them full, between the joints and against the outside boarding, with brick and mortar or concrete, or any such incombustible material; or if that expense is too great, they may be filled at each floor, and for a short distance above. Then, by treating the partitions in the same way, there will be an unobstructed channel or flue for flame only one story high, and stopped tight at top and bottom. The wood will hold well and burn very slowly, even when only partially protected in this way. In war times, soldiers used to build chimneys with a cob house construction, of small sticks plastered inside and out with clay; and these frail structures would endure the heat of roaring wood fires, simply because the flame could not reach to envelop the wood. Protect a piece of joist on two sides with plaster, and it will be very hard to make the exposed flat surface burn long, and the charred wood soon furnishes a sort of check to further combustion. And this is the correct principle to apply to the protection of wooden houses. Cover the wood as far as possible with mortar, and stop all circulation of air. Having pugged the walls and partitions thoroughly, and treated the stairway in a similar manner by filling in between the supporting stringers or carriages with coarse mortar, we must next make the opening around each chimney tight, where it passes through the floor, by a filling-in of mortar, or by turning trimmer arches against the surrounding timbers on the four sides.

The next vulnerable point is the floor. In France, it is often the custom to cross-lathe the ceilings with lathes considerably thicker than ours, and then to put a flat surface of rough boards a short distance below the under surface of these lathes (supporting it by a staging), and to pour in from above a mixture of plaster of Paris, which hardens into a solid mass between the floor timbers and above and below the lathing. When the whole is sufficiently set, the staging is removed and the ceiling smooth finished from below. Plaster of Paris is at present too expensive here for us to follow this method in ordinary cases, but we have a very good substitute in wire lathing. This is simply what is commonly known as coarse wire netting, which is nailed to the furring strips of a ceiling, and may have coarse mortar spread upon it from above and between the floor timbers. The mortar is to be well worked up with a trowel against the sides of the sticks, and then the under side of the wire may be plastered in the ordinary manner from below. This method unfortunately costs about double what ordinary lath and plaster do, besides occupying more time in construction. Another and less expensive safeguard, which it is well to use in connection with this, or which may be made a partial substitute for it, is to cover the rough boarding of the floor with about an inch in thickness of ordinary plasterer's mortar, smoothed over, between inch square battens nailed to every other floor timber, to furnish a solid ground on which to nail the upper floors. These battens are sometimes taken out after the plaster is hard, and their places filled by fresh plaster, the whole surface covered with sheathing paper, and the upper floors nailed over this. The roofs may also be treated with a coat of plaster or cement, in which the slates should be firmly bedded while it is wet.

All these precautions against fire are also useful to make the house warmer, to deaden sound, and to help to stop leaks. And they are all in one sense economical, they may save expense in insurance. It is a good maxim in war to do what your enemy least wishes you to do. The fire fiend craves light woodwork, loosely arranged and full of draft channels. Let him find everything pugged solid with mortar. Make him dig for every inch of wood he seeks to devour; check him, hold him, worry him, clamp him in close quarters. Then with a little presence of mind, a strong arm or two, and a few homely weapons, you can drive him to a corner and finally destroy him altogether.—J. A. F., in the *Boston Journal of Chemistry*.

IMPROVED GRAIN CLEANER.

In the accompanying engraving is represented a new machine for removing smut and other impurities from grain. The material is subjected to an air blast while passing to the scouring device, and to another current afterward, while a third current jackets the scourer and effectually removes the dust, etc., which the rotating brushes and drum rods take from the grain. The scouring apparatus is tapered in order to render the passage and to grain slower and so to keep it for a longer time under the cleansing process. The grain is discharged from the screen, A, into the leg or spout, C, and thence passes to the spout, B, which conducts it to the scourer. While in the upper portion of the spout, it is subjected to an upward current of air from fan, F (dotted lines) which escapes through the openings where the spout, C, discharges into B, and lifts the dust, smut, and light screenings. The dust passes through E to the fan, while the heavier screenings enter a vacuum chamber, D, and are removed through the aperture at G. At H is a valve which serves to regulate the admission of air to the chamber. This scourer has a perforated case, I, and an open upper head so that the grain can pass to the rods which form the drum, J. Below the latter is a series of revolving brushes, K. The object of tapering both brush and scourer, as shown, has already been stated. Outside of the perforated case is a close case, L, the space between the two acting as a dust space, and is traversed by air currents also generated by the fan, F. This draft removes the impurities loosened by the scourer and brushes. It enters through passages at the bottom, provided with suitable regulating devices, and escapes through openings above.

The grain then passes off through spout, M, into the suction conduit, N, and finally into the stock hopper or bin, while the screenings pass up the conduit, N, into the vacuum chamber, O, and escape at a lower opening in the same. During the passage of the grain through N, it is once more subjected to a strong air blast in order to remove the heavier impurities, and the strength of the current is regulated by means of the valve, P.

The screen, A, is operated by an eccentric on the main shaft, and an adjustable yoke is provided to regulate its action. This arrangement is so contrived as to allow the shaft to be raised by the adjustable stop bearers, Q, for adjusting the brush as the latter wears away. The entire apparatus is run by a single belt, and is simply and easily adjusted.

The invention combines a large number of useful improvements, and is doubtless an efficient and valuable machine. Patented February 29, 1876, through the Scientific American Patent Agency. For further particulars address the Johnson Grain Cleaner Company, Foreston, Ogle county, Ill.

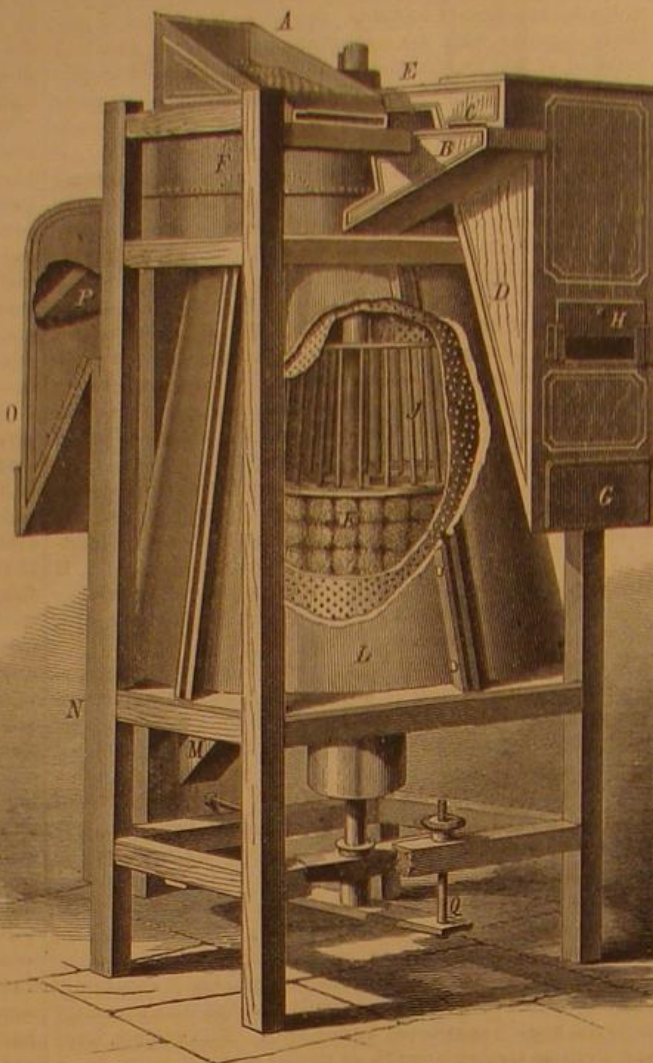
MILLER'S IMPROVED HOSE CARRIAGE.

We illustrate herewith a simple form of hose carriage,



adapted to carrying hose from point to point for watering gardens, washing sidewalks or carriages, extinguishing fires, and many other purposes. The invention is so plainly shown in the engraving that little explanation is needed. It consists of a reel journaled in the curved frame, the rear bar of which serves as a handle. When disposed as represented, with a coil of 200 feet of hose, it can be moved by a child, and forms a very light, useful, and convenient

carriage. On arriving at the spot where the hose is to be used, the whole apparatus is turned upside down, when the ends of the frame rest on the ground, and the wheels are lifted clear, so that their axle becomes a reel from which the hose is readily unwound. Several of our manufacturing establishments have one or two of these carriages on each floor of their buildings, ready for immediate use in case of fire. About a farm where gardens and lawns are to be wa-



JOHNSON'S GRAIN CLEANER.

tered and outbuildings protected from fire, this apparatus will be found of especial convenience.

Patented September 21, 1875. For further particulars address the manufacturer, Mr. Joseph A. Miller, Jr., Providence, R. I.

Improved Process for Silvering Glass.

Up to 1840 mirrors were silvered exclusively by means of an amalgam, a process most destructive to the workmen employed. An important step was effected by an English chemist, Drayton, who conceived the idea of coating mirrors with a thin layer of silver, obtained by reducing an ammoniacal solution of nitrate of silver by means of highly oxidizable essential oils. This process was subsequently modified by several chemists, but only became really practical when M. Petitjean substituted tartaric acid for the reducing agents formerly employed. The glass to be silvered is laid upon a horizontal cast iron table heated to 104° Fah. The surface is well cleaned, and solutions of silver and of tartaric acid, suitably diluted, are poured upon it. The liquid, in consequence of a well known effect of capillarity, does not flow over the edges, forming a layer a fraction of an inch in thickness. In twenty minutes the silver begins to be deposited on the glass, and in an hour and a quarter the process is complete. The liquid is poured off, the glass washed with distilled water, dried, and covered with a varnish to preserve the silver from friction. The advantages are evident. Mercury with its sanitary evils is suppressed; there is a gain in point of cost, as 60 to 75 grains of silver, costing about 20 cents, suffice for 10 75 square feet, which, under the old system, would require 1½ lbs. of tin and the same weight of mercury. A few hours suffice to finish a glass on the new system, while the old process required twelve days as a minimum. On the other hand, the glasses thus silvered have a more yellowish tint; portions of the pellicle of silver sometimes become detached, especially if exposed to the direct action of the sun, and despite the protecting varnish the silver is sometimes blackened by sulphuretted hydrogen. M. Lenoir has happily succeeded in overcoming these defects by a process alike simple and free from objections on sanitary grounds. The glass, silvered as above, is washed, and then sprinkled with a dilute solution of the double cyanide of mercury and potassium. The silver displaces a part of the mercury and enters into solution, while the rest of the silver forms an amalgam whiter and much more adhesive to glass than pure silver. The transformation is instantaneous. The amount of mercury fixed does not exceed 5 to 6 per cent. The glass thus prepared is free from the yellowish tint of pure silver. It is also less attacked by sulphur vapors and the rays of the sun, in which last respect it is superior to mirrors silvered by the old process.—*Bulletin de la Société d'Encouragement pour l'Industrie Nationale.*

Gold Mining in the Black Hills.

Colonel Dodge has published a small work on the Black Hills region, describing the physical features of the country, the soil, timber, climate, etc., and giving much information respecting the precious metals supposed to be deposited there. There is gold in the hills, no doubt, but how much is yet a question. The author thinks it is no place for poor men. The mining is of such a nature that it requires capital to carry it on profitably.

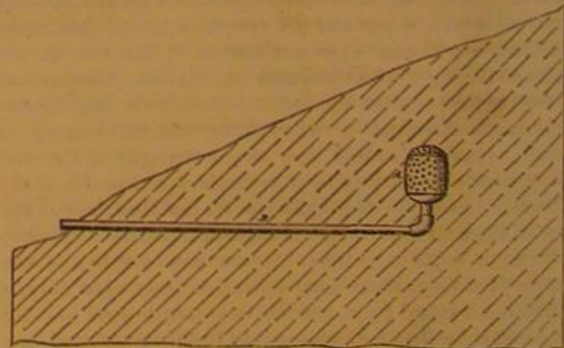
"It has passed into a proverb that 'placer' mining is the poor man's diggings, while 'quartz' mining is only for the rich. Placer mining in the Black Hills will not pay the poor man, unless he be a 'heathen Chinese.' He may make a little money by securing a claim, selling it out to a man or company who has capital to buy up many claims, then looking for and securing another claim with the same intention and result. This is a poor and precarious foundation on which to base a living. No man can make more than the barest wages by pan-working a single claim in the Black Hills. The placer mines, as well as the quartz mines, are here only for the rich man, and I would advise no poor man to go into the hills with the expectation of making money by mining for himself. Of course, he may be fortunate enough to strike rich diggings and do well; but as a general rule, he will make more money as day laborer for some wealthy man or company than he possibly can by working for himself on a single claim. The reports of the enormous wealth of the placer mines in the Black Hills are the most barefaced fabrications, got up by miners who wish to sell their claims. Money is to be made here by men who have sufficient capital to buy up many claims along a creek, sufficient to warrant the expense of dams, ditches, and all works necessary for hydraulic mining. If they have already the means of comfortable livelihood, poor men had better stay at home, unless prepared to work on wages. All this is said on the supposition that the Black Hills will, sooner or later, be opened to the miner. Under present circumstances, in addition to the disadvantages mentioned, he is liable at any moment to be arrested by the troops and sent from the hills a prisoner."

Culture of Asparagus.

W. H. Noble gives, in the *Gardener's Monthly*, an account of a garden lover who planted on good, level soil an asparagus bed of some 12 by 20 feet. When its growth became strong, he year by year covered it with some two or three inches of good rich mold. Up through this shot the stalks and crept the roots. The method was followed up every season, with the result of larger growth and product, till the bed became an oblong mound of some 2 or 3 feet in height, and a perfect wonder in the quality and quantity of asparagus furnished for the table. That yearly blanket of soil was, my friend thinks, the only culture or enrichment given. The bed was never dug with fork or spade.

IMPROVED METHOD OF OBTAINING WATER.

A new plan of obtaining water, in rolling prairie lands where a porous soil rests upon a bed of clay or other formation which resists the downward passage of moisture, has been patented through the Scientific American Patent Agency (February 8, 1876), by Mr. Augustus Byram, of Atchison, Kansas.



The engraving herewith given shows a section of a side hill or prairie roll, with the device for collecting water in position.

A perforated case, A, of metal or other suitable material, is set in the ground at the depth of five feet, more or less, where the soil is moist, with a pipe, B, extending out to the surface of the ground in a horizontal direction, or with a slight downward inclination. With this arrangement the water in the soil will collect in the hollow case, and will flow out through a pipe, and may be received in a trough or other convenient receptacle. The water, the inventor claims, forms natural courses heading to the case, and will have a continuous flow. This will enable farmers in Kansas and in other States where the land is of a similar formation to obtain a supply for watering their stock, and for irrigating purposes, without the trouble and expense of digging deep wells and pumping up the water with windmills or other mechanism.

THE RED FIRE FISH.

The singularly weird-looking fish shown in our engraving* is a native of the Indian Ocean, and the race is represented in all parts of the tropical seas of the eastern hemisphere, on the coasts of Africa, India, Ceylon, New Guinea, and Australia. It is much prized as food by the natives of Ceylon, the flesh being firm, white, and nutritious. The color of the fish is a pinky brown, barred with darker brown, and the head is redder than the body. The pectoral and dorsal fins are very large, and crossed with black bars; the ventral fin is black, spotted with white; and the other fins and the tail are light brown, spotted with black. There are nine or ten species of this genus, and the usual size is seven or eight inches in length. The singular development of the dorsal and pectoral fins has given rise to an idea, in the minds of some naturalists, that they were used for the purpose of flying. This, however, is now known to be a mistake, as the rays of bone which carry the membrane which joins them are not sufficiently supported by the osseous system proper, and are therefore too weak for such use. Indeed the purpose of this abnormal form is unknown, and it adds one to the many thousands of curious problems which make comparative anatomy, especially of fishes, so fascinating a study.

The Cingalese have a belief that the thorny prickles of this fish inflict incurable wounds; but although this is an error, the fire fish is a formidable antagonist, and one which bathers and swimmers near his habitat will do well to keep clear of. The skeleton of this fish is one of the most remarkable known to Science its organization being very complex; and it will well repay investigation by those who can obtain a specimen.

THE FILAMENTOUS GURNARD.

The family of fishes known as *triglidae* or gurnards are in many ways remarkable. Their colors are generally beautiful and often singularly brilliant; and their forms are various, some of them being almost repulsive. They are not strong swimmers, and therefore remain mostly in deep water; but some of them have large pectoral fins which enable them to leap from the water, and endure the air for a brief space. The mouth is mostly large, and the aspect is frequently repulsive.

The filamentous gurnard* (*pelor filamentosum*) is an instance of the capriciousness of Nature, being one of the strangest and most eccentric forms to be found in the annals of ichthyology; the head appears to be crushed out of shape, and is hung with scraps of depending skin. The body is armed with formidable looking spines, which are not suggestive of any purpose but that of self-defence. This gurnard is found in large numbers on the shores of the Mauritius. Its color is a light grayish brown, mottled with a dark shade of the same hue, and it is minutely spotted with white dots. Its usual food consists of crustaceans and molluscs, but pieces of cuttle fish have been found in its stomach. Possibly, the dreaded octopus has here found an enemy dangerous to meddle with, and one whose voracious appetite and defiant digestion may make him terrible in attack.

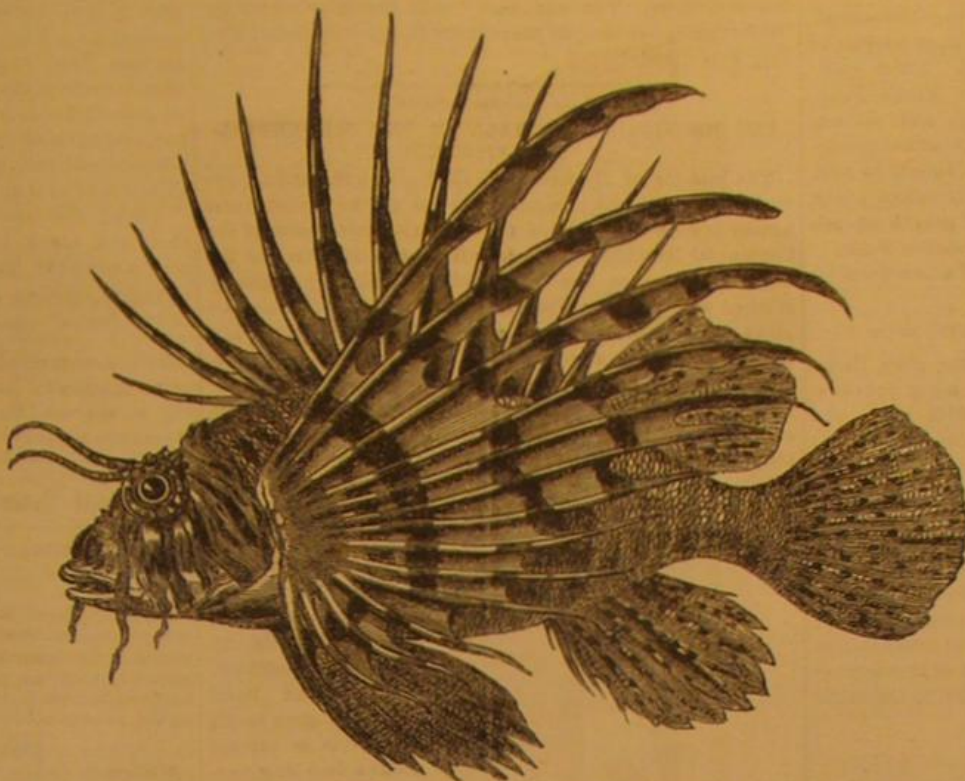
Sham Coffee.

We learn from a statement in the *Journal of the Chemical Society* that sham coffee is manufactured from tough dough, squeezed into little molds and baked until the color becomes dark enough to deceive the eye. Real coffee berries, when small and worthless, are improved in color by rolling them about with leaden bullets in a cask. The green berries, too, are treated by a coloring matter. In coffee sold ready ground, the difficulty of detecting adulterations is greatly increased; beans, beet root, carrots, and carrot-like roots are roasted and mixed in large quantities with the genuine article. In the south of Europe, especially in the provinces of Austria, figs are roasted in enormous quantities and sold as coffee.

The British Ironclad Fleet.

A discussion recently took place in the House of Lords, relative to the constitution of the ironclad fleet. Lord Dunsmuir moved for statistics as to the draft of water of the present sea-going ironclad vessels, especially with regard to their capability of passing through the Suez canal; and he called attention to the necessity of adequate dock accommodation for these large and heavy ships. He also stated that Italy is now having built some 100-ton guns, and armor plates of 22 inches thickness (as described in our last issue) are now being rolled for the same government. Attention was called

to the Russian circular ironclad, already described and illustrated in these columns. On behalf of the government, it was stated that the recently built vessels, of all calibers, were especially constructed with a view to their passage through the Suez canal. Ample dock accommodation is already provided at Portsmouth, and additional docks are to be constructed at Devonport and in Ireland. It was suggested in the course of the discussion that, looking to the

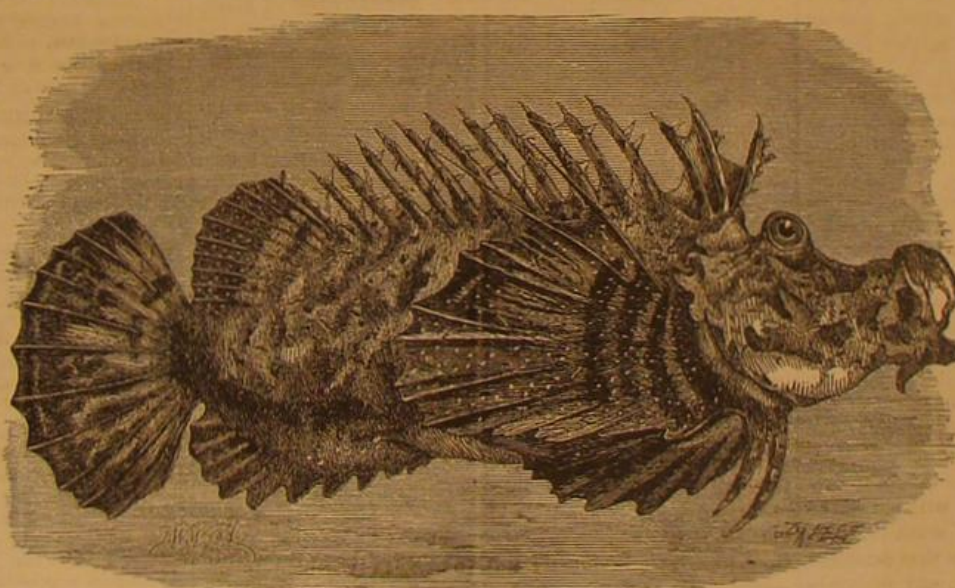


THE RED FIRE FISH—(PTEROIS VOLITANS.)

dangers of accidental collision of vessels fitted with rams, movable rams, to be used only in time of war, should be constructed.

Horse Power and Fuel Equivalent of Storms.

The *Bulletin of the American Iron and Steel Association* says: "One of the most severe wind storms prevailed throughout a large portion of our country the week before last, extending probably 500 miles. It is stated that it exerted a pressure of 30 lbs. per square foot, or $\frac{1}{2}$ lb. per square inch, and traveled at the rate of sixty six miles per



THE FILAMENTOUS GURNARD—(PELOR FILAMENTOSUM.)

hour. It is interesting to estimate the force of such a storm, and the resulting figures are truly startling. There are in a square mile 27,878,400 square feet, or 4,014,489,600 square inches. Assuming that the pressure of the storm was exerted for a half mile of vertical height, we have for each mile in width of the track of the storm an area of 2,007,244,800 square inches, upon which the storm acted with a pressure of $\frac{1}{2}$ lb., and with a speed of 5,800 feet per minute. To find horse power we have the formula:

$$\text{Area in inches} \times \text{pressure in lbs.} \times \text{speed in feet per minute.} \\ 33,000 \\ \text{And our calculation becomes:} \\ 2,007,244,800 \text{ square inches} \times \frac{1}{2} \text{ lb. pressure} \times 5,800 \text{ feet.} \\ 33,000$$

which gives, as a result, 70,557,700 horse power developed for each mile of breadth of the track of the storm. To produce the same horse power, with improved engines consuming but 2 lbs. of coal per hour per horse power, would require 63,000 gross tons of coal. Assuming, as above, the track of the storm to be 500 miles wide, the hourly consumption of coal to generate an equal power would be at least 31,500,000 gross tons, or one and a quarter times the annual product of the entire anthracite coal region.

OWING to the large demand for WRINKLES AND RECIPES, the publisher has been obliged to issue a third edition. See advertisement on another page.

Steam Domes on Boilers.

Mr. Thomas Hoge, of Waynesburg, Pa., in commenting on our answer on this subject on page 171, current volume, states that, after many years' experience with boilers of all kinds, he is unable to find any practical appreciable advantage in the use of steam domes.

"Small-necked cast iron domes, so much used on portable boilers," he states, "are of no use so far as dryness of steam is concerned, even admitting that large-bottomed ones are; and domes are generally placed in about the worst place on the boiler to secure dry steam. Steam should always be taken from the back end of the boiler, or at the furthest possible place from where the most of the steam is generated."

"My experience and reading have led me to have less faith in the steam generating power of fires and to have more in that of the fire box or of the two or three rings of boiler immediately over the fire, in stationary boilers. The greatest amount of ebullition taking place from the fire box, there evidently will be the greatest amount of foam, spray, or water in other form, carried up with the steam, its upward current there being greatest; and the dome being gradually set right over this point, water goes directly into it with the current of steam; and if the neck or entrance to the dome is small (making in effect only a large swell in the steam pipe) the current of steam will there (in the neck) be so strong that no particle of water can ever descend through it while steam is being rapidly used, the only time when priming occurs. I believe that, usually, three fourths of the steam made in a boiler is made in the first third or half of the boiler. If, instead of drawing it off here, it were allowed to pass slowly back to the back end, and there enter the steam pipe, we should, in effect, convert nearly all the steam space along the top of the boiler into a steam dome."

The Use of Glass by the Chinese.

At the last session of the Commercial Geographic Commission, of France, held in Paris, M. Edward Rénard, a former delegate of the Department of Agriculture and Commerce for the extreme Eastern countries, made the following interesting communication: "The product of manufacture which I submit to the Commission is as little known among us as is the process employed in its manufacture, which requires great dexterity. The specimen I exhibit consists of a thin layer of colored glass, which appears to have been cast over a sheet of lead. Its production is a branch of industry which flourishes in many parts of the great and industrious city of Canton, and is practised in many places, even in the streets and in front of the houses, on a small scale."

"While in India and Burmah I was often surprised at the lustrous appearance of the domes on the Buddhist temples, which were covered with curved plates, colored violet, green, etc., or white and yellow, looking like bright silver and gold; and at a distance showing, with surprising brilliancy, a light having the appearance of an electric light, especially when seen from the sea. I was also often surprised to see the Chinese glassblowers, whose labor is ill paid, and who, notwithstanding this, show very remarkable results in their exercise of this curious industry, and who make these brilliant and multi-colored plates while exposed to wind and weather."

"A few days ago, I sent specimens of this singular product to M. Robert, the able director of the Sévres porcelain works, and also to the savant M. Clemendot, whose thirty years service in the direction of our principal glass manufactures has made him the most competent man now in this line. I am confident that, thanks to these men and their investigations, we will be able in a short time to see the effects of such reflected lights in the ornamentation of kiosks and domes of various buildings, in the manufacture of reflectors for headlights, coast lighthouses, street lamps, and several other useful and practical purposes."

Ancient Trademarks.

Examples of the practice of using trademarks, to show the workmanship of various manufactures, have been discovered at Herculaneum, such signs having been in vogue among bakers and others. In modern times similar tokens have been adopted in textile and various other fabrics. The trademark is a recognized part of the system of commerce, by which a guarantee is given to the purchaser, and a legitimate protection afforded to the manufacturer. It is upon the uniform good quality of manufactured commodities that any foreign trade depends for its continuance; and (as the *Textile Manufacturer*, a London journal, says) it is in such cases that the use of trademarks is most useful.

*The engravings are selected from the Rev. J. G. Wood's "Illustrated Natural History."

The New York Academy of Sciences.

The chemical section of this society met on March 27, Professor A. R. Leeds in the chair.

Mr. C. Chamberlain exhibited several magnificent specimens of

AMAZON STONE,

from the collection of Professor A. E. Foote, of St. Louis, Mo., who is now in Philadelphia preparing to exhibit the minerals of the New World to our foreign guests at the Centennial. Amazon stone is a variety of orthoclase or potassa felspar, of a bright verdigris green color, and quite rare. These specimens were brought by Professor Foote from Pike's Peak, Col. The crystals were remarkably large and perfect, while the color was unusually brilliant. The same gentleman exhibited a crystal of beryl found by himself in 56th street in this city. Also a perfect crystal of datholite, $\frac{1}{2}$ inch long, from Bergen tunnel, and a specimen of petzite or telluride of silver, brought from Colorado by Professor Foote.

Dr. H. Endemann exhibited and described a new form of apparatus for the

QUANTITATIVE DETERMINATION OF ACETIC ACID

in crude acetate of lime. It consisted of four glass flasks connected by glass tubes, the first and last being provided with safety tubes. The first flask is filled with water; the substance to be analysed is placed in the second flask along with a sufficient quantity of phosphoric or sulphuric acid. The third and fourth flasks, which are at some distance from the second, and at a lower level, contain a known volume of a standard soda solution. A gentle heat is applied to No. 2, steam is generated in No. 1 and passed into No. 2, and drives out all the acetic acid, which distills over into No. 3 and is absorbed by the soda. The distillation is complete in 15 minutes, and it is only necessary to triturate the soda solution with the standard acid to ascertain how much of it was neutralized by the acetic acid, and then from this to calculate the quantity of acetic acid.

Dr. Elwyn Waller, E. M., read a paper on

MILK AND THE LACTOMETER,

in which were embraced most of the facts contained in the editorial on "Milk and its Adulterations" in our issue of April 1. Dr. Waller has analysed a large number of samples of milk for the Board of Health, and in almost every case found that the only adulterant employed was water. The speaker detailed his experience, and gave figures to prove the unreliability of the method, once strongly advocated by a city chemist, which was to shake the milk with a given volume of caustic potash, add acetic acid, heat, allow to cool, and read off the amount of coagulum formed, from which the quality of the milk is calculated by means of tables prepared for the purpose.

An animated debate took place at the close of the paper, between Drs. Waller, Doremus, Falks and others, during which the hour for adjournment arrived, and further discussion was postponed till Monday evening, April 10, at which time Mr. Mott's paper, on a comparison of the milk of the African and Caucasian races, will also be discussed.

The Odors of Coal Oil.

The refinement of crude petroleum is extensively carried on in the vicinity of Hunter's Point, N. Y., a locality situated opposite the center of New York city, directly across the East river. The distance of the oil works is a little over a mile in a direct line from this metropolis. For a long time the inhabitants of the northerly portion of the city have complained of bad health, due, as they allege, to foul odors that swept across the river from these works. A bill is now before the legislature, intended to effect an abatement of the nuisance. Professor Charles F. Chandler, President of the Board of Health, a well known chemist, is of opinion that, at a trifling expense, chemistry can furnish means for the removal of the odor, if persons complained of will only take the trouble of using them. That the men at work in these factories do not mind the smell does not prove that sensitive women, young children, feeble convalescents, and prostrate invalids do not suffer from it. In a civilized community, the principal, as it is the most beneficent, purpose of law is to protect and help those whose struggle for existence is hard. As for the objection that persons living near the factories do not complain of the smell, it is well known that such odors ascend perhaps one hundred feet from their source before they begin to diffuse themselves; and that great condensation or compression of odors often lessens their power—a bag of musk, for example, is not nearly so fragrant as it is in the handkerchief that has lain beside it.

The cause of this nuisance, said Professor Chandler, is simple enough. Crude petroleum is a liquid of dark, greenish brown color, and of an offensive odor, and must be refined before it is suitable for household use. The process of refining is threefold: First, the lighter oils, which are dangerously inflammable, and the heavier oils, which are not inflammable enough, are distilled; secondly, the product remaining after distillation is agitated with sulphuric acid in order to remove a portion of its color, and all its disagreeable odor; thirdly, the oil thus refined is again agitated with an alkali, either caustic soda or ammonia, in order to neutralize all traces of the sulphuric acid. After the second of these processes there is left a dark, tarry sediment called sludge acid, of an exceedingly disagreeable odor, and it is of this odor that the people of a large part of the city are now complaining.

The effects of inhaling it, said Professor Chandler, are not different from those following the inhaling of any odor which produces or tends to produce nausea. The appetite is impaired, and the general tone of the system injured. It can

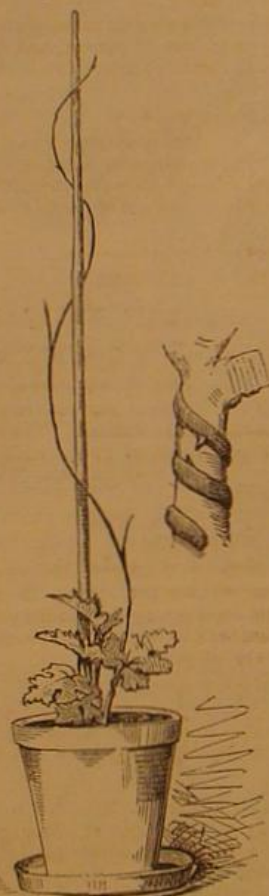
rarely be proved that any particular odor causes any particular disease. But the body becomes degenerated, and the scale is turned against convalescence.

It is not quite certain whether the nuisance originates with the petroleum factory or with the fertilizer factory near it. The sludge acid which is made in the former is sold to the latter, where it is poured over spent bone black and other refuse animal matter in order to produce various sorts of artificial fertilizers. "In any case," said Professor Chandler, "either party can entirely prevent the disagreeable odor, were they so inclined."

[For the Scientific American.]

THE HORTICULTURAL HALL AT THE CENTENNIAL EXHIBITION.

The interior of Horticultural Hall greets the artistic eye very pleasantly, and promises to be, so far as architectural beauty is concerned, one of the most attractive parts of the Centennial Exhibition. The four forcing houses, two on the north and two on the south side, are already partially stocked with trees, shrubs, ferns, and plants, the smallest plant among which is most notable for its rarity. It is a parasite which has attached itself to the petiole on a *pyrethrum*. Our engraving represents the plant and parasite, the latter having two coils wound closely around the petiole or stem just below the leaf, sustaining itself by several small spurs with which it has pierced the petiole, and which are plainly visible from the semi-transparent nature of the stem. The parasite itself is of a reddish brown color, and might easily be taken for a piece of fine twine, were it not for its soft and sappy appearance. It has coiled itself about the stick in the pot, and is at present about a foot long, having no signs of leaves other than two short spurs or stipules which are cordlike and of the same color and diameter as the trunk. Mr. Thomas Mingey, the urbane head gardener of the hall, informs us that his lengthy and varied experience has never afforded him a similar curiosity upon such an order of plant.



The *pyrethrum* is one of the numerous orders of chrysanthemums, which also includes the ox-eye, daisy, fever few, and corn marigold. The *pyrethrum* is an annual plant, having flowers about 6 lines in diameter, with a white ray: others of the same class, however, vary from a golden yellow to the various shades of red. It is indigenous to Europe, Asia, and North Africa; it was introduced into England as a medicinal herb, and has become naturalized in some parts of that country. It runs from one to three feet high, with leaves pennately divided into broad-lobed segments.

The parasite is, we think, of the genus *cuscuta*, or, as it is called in England, "dodder," of which there are in that country five native species, which grow upon hops, flax, and nettles. They appropriate the sap of the plants on which they live, and frequently kill them. They belong to the second order of the fourth class.

Botany affords us no more interesting order of plants than the parasites. In tropical climates, they grow in great profusion, and attain large proportions; in cold climates, the classes are few and the sizes diminutive. Among the most remarkable is the genus *epidendron* (in the 20th class, *gynandria*, of Linnaeus) one species of which, called *flos aeris*, or flower of the air, is found in abundance in the East Indies beyond the river Ganges, and it grows and even blossoms in the air, when hung up, without attaching itself to any solid body. The perfume of the flowers is so delightful that the inhabitants suspend it from the ceilings of their rooms, where it will vegetate for years.

Mirbel, the French botanist, says that in North America there are parasitical trees which grown on other trees; the long roots of the *clusia rosea* (rose colored balsam), a parasite of this kind, descend from the summit of the trees upon which they grow to the ground, and then sometimes become engrafted into each other, and are then covered with the same bark, so as to form an immense case in which the trunk of the stranger tree, supporting the *clusia* in the air, is enclosed.

Among the other plants and trees already in Horticultural Hall is a fine specimen of *monstera deliciosa*, bearing a fruit similar in flavor to the pineapple. Nearly all other trees of its class bear poisonous fruit. A large mango tree is bearing fruit, which is a somewhat rare occurrence in a hot-house. A South American mahogany tree is noticeable for having an unusually clean stem. There is a very fine specimen of the camphor tree in one of the forcing houses on the south side of the hall. Joseph Lovering, of Philadel-

phia, exhibits a collection of orange and lemon trees, so full of fine fruit that the boughs bend from its weight. The lemon trees have ripe and green fruit in profusion, and of a size rarely seen upon them. The trees bearing them have also new blooms, side by side with the fruit. The gardener says that he never saw such fine specimens, even at Hampton Court in England.

Two excellent specimens of the *cybotium*, from the Sandwich Islands, are noteworthy, both for their size and healthy appearance. The mat-like bark contains a profusion of pockets filled with the delicate golden colored and silky fiber for which this tree is famous. One of the hot-houses on the north side of the hall is pervaded with the delicious perfume exhaled by four specimens of the *malurina odorata*, whose small, yellow, buttercup-like flowers gracefully hang their heads as if at their orisons.

Among the trees and plants most notable on account of their size are a cocoa tree, a cinchona or Peruvian bark tree, a camphor tree, an *araucaria Braziliensis*, a Japanese *mespeltus japonica* (bearing an edible fruit), and a *Dicksonia* or tree fern.

JOSHUA ROSE.

The government of Newfoundland has a characteristic emblem upon its postal stamps, a hungry-looking fish swimming in the sea, its mouth open, eyes expanded, anxiously searching for prey.

Recent American and Foreign Patents.

NEW CHEMICAL AND MISCELLANEOUS INVENTIONS.

IMPROVED ROWLOCK.

Francesco Roseti, New York city.—This consists in combining a ball with the oar shaft, so that a ball and socket joint can be employed in the rowlocks. It also consists of a contrivance of the socket to turn the oar around to the line of the gunwale of the boat and to lock it in that position; also, to lock the oar in the socket, so as to hold it while not in use.

IMPROVED SKATE SHARPENER.

William H. Fisher, Selin's Grove, Pa., assignor of one half his right to Charles K. Fisher, same place.—This is a device for sharpening skate runners, which may be readily carried in the pocket. A fine crosscut steel file is placed in the body of the implement, and secured rigidly in position. The file is made flat on one side for sharpening flat runners, and convex on the other for sharpening runners with a groove or gutter. A second crosscut file of coarser grain serves to remove the rough edge, while the finer grained file gives the fine edge or finish to the runner. There is a suitable guide flange and adjustable gage.

IMPROVED BOOT JACK.

George W. Phenix, New Brunswick, N. J.—This boot jack is so constructed that it may readily be folded into a small compass, and conveniently carried in the pocket or in a traveling bag. It is formed of two hinged and one pivoted parts, constructed so, as when folded, as to give no additional thickness.

IMPROVED MACHINE FOR TRIMMING CIGARETTES.

Andrew Montes, New York city.—This invention consists of a spurred endless belt that feeds the cigarettes from a hopper to the revolving trimming knives at the sides of the belt, and then delivers them over an inclined end plane to a suitable receptacle.

IMPROVED SPRINKLING ATTACHMENT TO BAKING MACHINES.

Alexander Rannie, Palmyra, N. Y.—This consists of a nozzle, arranged over the way on which the pans pass into the oven, for moistening the cakes with fine spray as they pass along, the said nozzle being constructed with very fine perforations in the lower end.

IMPROVED CONNECTING POSTS FOR ELECTRICAL APPARATUS.

Jerome Kidder, New York city.—This consists of a sliding collar and a spring on the post under or over the conductor to be used instead of the ordinary binding screw for binding the conductor. The spring presses the collar against the conductor. This binder has the advantage of being operated quicker than the screw, and it cannot be detached and lost, as there is a nut on the top of the post which prevents it from coming off.

IMPROVED BOTTLE STOPPER.

Adolph Luthy, New York city.—This stopper is easily opened and closed, and is retained when in open position in such manner that it does not interfere with the pouring out of the contents of the bottle. It is applied by an eye to an extension of the wire neck band, and closed by a yoke that slides in a curved slot of the stopper cap piece. The yoke is centrally indented or bent, to carry the stopper in position.

IMPROVED TOY PISTOL.

Samuel D. Goodale and Dexter C. Goodale, Du Quoin, Ill.—This invention consists of a toy gun with a slotted barrel, that guides a piece of card paper propelled by the action of a spring hammer. Said hammer is attached to a slot at the breech of the barrel, retained by a catch, and released by a trigger. A practical application of the device may be made for the purpose of throwing messages on board of passing steamships, also to the delivery of important dispatches on board of passing railroad trains.

IMPROVED LAMP-LIGHTING DEVICE.

Frank L. Camm, Brooklyn, N. Y.—This invention consists of a tube fitted in the burner, so as to direct the match up to the wick when inserted from the bottom of the burner. It is provided at the upper end with teeth, across which the tip of the match is forced, so as to be fired by them.

REMEDY FOR DISEASES OF THE THROAT AND LUNGS.

Eden Rohrer, Monmouth, Oregon.—This remedy is composed of tinctures of consumption root and mountain balm, prepared with sirup. It is claimed to be efficacious in the maladies mentioned.

IMPROVED STILT.

F. Braumont, Jr., Dallas, Texas.—This invention relates to a means by which a boy's stilt may be quickly, easily, and securely fastened at different elevations on the standard, and consists in connecting with the standard a stirrup and sliding sleeve, that together form a lever by which a rapid and convenient adjustment is made.

IMPROVED INSTRUMENT FOR FILLING TEETH.

Carl D. Ludwig, Houston, Texas.—After inserting a cement filling in a tooth, this inventor proposes to harden it by the use of instruments made of talc, which are heated over an alcohol flame, and are applied to the filling as soon as it is set. This process is repeated and the filling is rubbed gently until it shows a dull polish on the surface, which polish is brightened by using a polisher of agate or polished steel. The filling is said to be complete and as hard as marble when the patient leaves the operator.

IMPROVED COAT HANGER.

Simon Scheuer, New York city.—This consists of a hanger of leather or similar material, provided with end mountings and wire bent eyes, to be attached to the coat or other article. These form a neater and a more durable device than the coat hangers generally in use, and may have the name of the tailor printed in gold letters thereon.

IMPROVED MACHINE FOR COATING PILLS.

William N. Clark, New York city.—This machine consists of a revolving cylinder with rows of radial needles so arranged in connection with a movable pill tray that the pills are picked up by the needles by the joint revolving motion of the cylinder and the forward motion of the tray. The pills are then dipped into the coating solution, and, after being dried, stripped from the needles by sliding clearer plates.

IMPROVED GAS LIGHTER FOR STREET LAMPS.

James Chapman, St. John, New Brunswick, Canada.—This is a novel arrangement of a lantern on the end of a rod, so that when it is lowered over a gas burner the flame of the lamp may ignite the gas.

IMPROVED METHOD OF PACKING MATCHES.

Joseph Kayser, New York city.—This invention consists of a strip of paper that is crimped or corrugated by suitable machinery, and provided at the upper edge with any suitable friction covering. The matches are placed into the corrugations and secured tightly by a flat closing strip, glued over the intermediate face parts of the crimped strip.

IMPROVED PERPETUAL COUNTING HOUSE CALENDAR.

Frederick W. Luttgen, New York city.—This calendar consists of transferable monthly tablets, printed without the name of any month, and arranged in a case, having within it twelve or more compartments. There is a perforated plate with twelve or more openings for tablets, and having the name of a month formed upon the face of the plate, one adjoining each opening.

IMPROVED HEEL SUPPORTER FOR RUBBER SHOES.

Martin Book, Conyngham, Pa.—This is a little wire supporter for holding up the heel of an india rubber shoe, to prevent it from slipping down at the heel of the boot. Said wire is contrived to stick into the heel of the boot by points, from which it extends up along the heel of the boot a little higher than the shoe, and has a stud near the top, projecting through a hole in the shoe and holding it up.

IMPROVED IRON-HEATING ATTACHMENT FOR STOVES.

Edwin G. Adams, Cohoes, N. Y.—This attachment for heating soldering and other irons is designed especially for oil-burning stoves, but may be used with advantage with stoves burning other fuel. A casing, made with a flaring lower part and a contracted upper part, is provided with a heating chamber made close except at its forward end, and with a smoke pipe to adapt it to be placed over the fire box of the stove. A cap is provided, made larger than the pipe, having its lower end connected with the pipe by a ring plate, and having its closed upper end perforated without the sides of the said pipe. By this construction, should a blast of air strike the cap, it will cushion itself upon the air in the ring chamber of the said cap, and will not blow into the pipe to impede the draft, but will rather increase the draft. The draft being admitted at the front of the stove, the flame will incline to the rearward, so that its greatest heat will be around the inner part of the chamber, where the point of the soldering iron is.

IMPROVED BALE TIE.

John M. Brandenburg, Fort Motte, S. C.—This invention consists in the bale tie provided with three slots, and with the lugs upon the ends of its side edges next the single slot. It is hardly possible to convey a clear idea of the mode of attachment, though the same is very simple and easily secured. The loop of the free end of the band is first passed into a cross slot of the tie, and then, after other adjustments, a novel brace, designed by the same inventor, tightens the whole.

IMPROVED FARE REGISTER.

Joseph G. Moody and Edwin E. Glaskin, New York city, and Theodore Miner, Brooklyn, assignors of one half their right to Eugene F. Daly, New York city.—This invention consists of one or more sliding and revolving face buttons and dials, according to the different classes of fares to be collected. Said revolving dials are thrown by suitable cog wheel mechanism and pawl detents into gear with cog wheels mounted loose on a central bearing, operated by a swinging lever and spring pawl, in such a manner that the turning of the dials and the clicking of a bell are produced at the same time, and the gear connection of the dial cog wheels then interrupted. The device is incapable of work when the required depression of the sliding button and the swinging of the lever is not jointly attended to. The revolutions of the dials are registered by a differential gear connected therewith.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED TUG BUCKLE.

William J. Darr and John W. Bowman, Leon, Iowa, assignors to themselves and Alonzo Robbins, same place.—This invention consists of a buckle made with tongues, in line with each other and with the length of the buckle, and in the ball made with lugs upon the rear parts of its side bars to rest against the side bars of the buckle frame. This construction is claimed to enable the tug to bear without splitting as many times the strain that would split it with a single tongue buckle as there are tongues used.

IMPROVED WAGON END GATES.

Samuel F. Adair and Evan K. Adair, Oasis, Iowa.—This consists of strap cleats for guiding the end gate, in connection with swinging cam hooks pivoted to the same, that enter staples of the cleats, and lock the gate securely thereby.

IMPROVED SASH BALANCE.

Wilson E. Facer, Toronto, Ontario, Canada.—This invention relates to certain improvements in that class of sash balances, in which the tension of a coiled band spring operates through a toothed wheel and a rack bar on the window sash to balance the same; and it consists in the peculiar construction and arrangement of devices for locking the wheel, and thus holding the window sash in any desired position against the uneven tension of the spring, or the attempts of burglars.

IMPROVED SHUTTER WORKER.

Abraham W. Scaver, 2d, Northborough, Mass.—This consists of blind hangings, which are so constructed as to enable the blind to be opened and closed to any desired extent, and locked in place when adjusted, without its being necessary to raise the sash.

IMPROVED FASTENER FOR THE MEETING RAILS FOR SASHES.

John J. Dinnan, New Haven, Conn.—This invention consists of a pivoted locking plate, that is thrown across the sashes by a swinging and spring-acted bar that bears, by a cam, on a recess of the locking plate. The latter has a shoulder and guard to embrace and retain the handle securely in closed position.

IMPROVED SPRING FASTENER FOR CARRIAGES.

Franklin Miller, Indianapolis, Ill.—This consists of a seat block and a cap plate of peculiar construction, for mounting and securing the springs of carriages on the axles. The new features are mainly bolt hole projections of both plates, which are extended beyond the faces, to prevent lateral movement of the springs.

IMPROVED WHIFFLETREE.

Peter P. Kunz, Florence, Iowa.—This is a new device for connecting the tugs with the ends of the whiffletree. One arm of a V-shaped rod passes through a lug, and is retracted by a special spring. The other arm passes through two lugs and the eye of the tug, said tug being between the lugs. The spring can be compressed enough to enable the arm to be drawn out far enough to allow the eye to be inserted and withdrawn.

IMPROVED COMBINED REIN HOLDER AND WHIP SOCKET.

John W. Weddel, Mount Carroll, Md.—In this device, the whip is held in a socket having one side movable, and acted on by a spring which causes it to clamp the reins. By this construction, a whip socket and rein holder are combined in one device.

NEW AGRICULTURAL INVENTIONS.

IMPROVED SPIKE FOR THRASHING MACHINES.

Christopher Wilde, Canton, O.—This invention consists in spikes for thrashing machines, formed of wrought iron, faced with steel upon their forward edges and heads, in order to resist wear.

IMPROVED MIDDLING PURIFIER.

Albert Greenleaf, Kingston, Wis.—This is a new arrangement of passages, sieves, and fans for purifying middlings by the compound actions of gravity, suction, and blast currents of air and sieves.

IMPROVED FLOW.

Eugene R. Knight, Omaha, Neb.—This consists in the application of a colter, bent horizontally to the width of furrow, and turned up at the outer end to a mold board made of rods. This is claimed to afford a lighter draft.

IMPROVED GANG FLOW.

Enoch C. Eaton, Pinckneyville, Ill.—This is an improvement on a device patented to same inventor. By loosening a single screw a frame may be slid laterally upon the axle to move the plows toward or from the land, or may be slid forward or back to adjust the plows longitudinally.

NEW HOUSEHOLD ARTICLES.

IMPROVED BOOT JACK.

John Green, Greenville, Mich.—This boot jack is composed of a base piece and standard jointed together, so that they will fold together very compactly. When being used, the standard is placed and held vertically, and the base lies inclined, one end resting on the floor, the other being supported by the standard. The base is cut out to receive the boot, and also provided with a sliding toe piece or rest, which adapts it to various sizes of boots. The toe piece readily adjusts itself to the foot.

IMPROVED STEAM WASH BOILER.

James T. Brown, Saranac, Mich., assignor to himself and Marion Crane, same place.—The object of this is to improve the construction of the apparatus known as the Munger boiler. The water and steam pass up through pipes, are discharged upon the clothes, pass through the clothes, and pass back to the heater through another pipe, washing the clothes very quickly.

IMPROVED FOOT REST.

Edward B. Lovett, Amherst, Mass.—This is a pivoted foot rest, supported by standards, and having a newspaper pocket and slipper-holding loops attached to its opposite faces. The base frame has a boot jack formed in it.

IMPROVED APPARATUS FOR ADJUSTING MOSQUITO BARS.

Isaac A. Abbot, New Orleans, La.—This consists of a small pulley near each foot and corner of the tester, on the under side, through which run cords connecting with a traveling rod, running through other pulleys at the head of the bed, and terminating in a knot, which, being pulled down, will draw the traveling rod to the foot of the bed, and thus extend the mosquito netting, which is attached to the rod. Other cords terminate in a hanging knot for pulling the traveling rod up to the head of the bed, for gathering up the netting thereat when it is not required to be spread.

IMPROVED CLOTHES DRYER.

John J. Reed, Lyons, Iowa.—The arms in this device are adjusted for use by raising them into a horizontal position, drawing them forward, passing the heads of screws through the enlarged outer ends of slots in a horizontal semicircular supporting head, and pushing them in to bring the bodies of said screws into the narrow parts of said slots. When not required for use, by reversing this operation the arms may be lowered into a vertical position against the wall and allowed to hang.

IMPROVED QUILTING FRAME.

John H. Sheets, Hartford, Minn.—This apparatus consists of parallel rollers for holding and adjusting the quilt, together with their holding ratchets, mounted on a couple of bars, one at each end of the rolls. Said bars are suspended by cords from a traveler on an overhead rail, so that the quilt can be shifted along a sewing machine, or by a hand sewer, readily for stitching.

READING AND WRITING DESK ATTACHMENT FOR CHAIRS.

Ceydora B. Sheldon, No. 7 State Street, New York city.—This well known inventor still finds a profitable business in working his patented inventions, of which he has a great number. His last invention is a handy and light desk attachment, to be fastened to a chair and used either for reading or writing. It consists in the peculiar form of clamping device for attachment to the chair, and in the combination therewith of a vertical standard passing through a socket in the clamping device, and carrying at its upper end a radial swinging arm or bracket which supports the desk. The desk is adjustable in inclination upon a segmental plate with binding screw, adjustable upon a slide either to or from the occupant, adjustable in horizontal planes upon the swinging arm, and adjustable vertically upon its standard. The device is readily portable, easily attached and removed, and, by reason of its varied adjustments, is applicable to beds, tables, and lounges as well as to chairs.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED BALE BAND TIGHTENER.

John L. Sheppard, Charleston, S. C.—This invention relates to improved means or devices for applying bands or hoops to bales of cotton, hay, straw, etc., the same consisting mainly of a bent or angular lever, pivoted to the top portion of the baling press, and provided with a pivoted arm carrying tongs or clamps, for holding one end of the band and drawing it firmly around the bale into position for the other or free end (which is held meanwhile by any suitable fastening) to be attached to the buckle in the usual manner.

IMPROVED FINISHING CLOTH.

Charles E. Serlinghouse, Almonte, Canada, assignor to Rosamond Woolen Company, same place.—This invention has for its object to improve and facilitate the finishing of cloth in the process of steaming its face; and it consists in means for subjecting the face of the cloth to the action of vapor generated from water, to remove the gloss and creases resulting from the ordinary pressing process. The apparatus consists of the combination of a water tank having induction steam pipe and outlet vapor pipe connected with a perforated cylinder and boxing or other distributing device for applying the vapor.

IMPROVED CRACKER MACHINE.

Daniel M. Holmes, New York city, assignor to J. Cutler Fuller, Orange, N. J.—This is a very ingenious machine for molding in dough the fancy crackers, jumbles, and similar articles which hitherto have been produced entirely by hand. It includes eight entirely novel devices. The dough box is made with an extension and offset, to receive the cutters and enable them to operate at right angles with the plungers. Its discharge openings are at right angles with the line of motion of the plungers that force out the dough, and it is divided by partitions into two or more compartments, each provided with a discharge opening and with a plunger. The cutters work within the dough box, and are embedded in the dough when at work. They are made with beveled edges and outer plates having openings with beveled edges. Two endless carriers, working in line with each other, and with a space or opening between them beneath the discharge opening of the dough box, convey the material for the cutters.

IMPROVED SAFETY VALVE APPARATUS.

Leonidas Moore, Louisville, Ky.—This is an improved safety valve arrangement for rag and straw boilers in paper mills, and for other purposes; and it consists of two valves arranged in such a manner that the pressure on the rag boiler is kept up at a uniform degree from the battery of boilers, and that the back pressure of the rag boiler assists in closing the main valve when the required pressure is established.

IMPROVED DREDGING BUCKET.

Theodor Smith, Jersey City, N. J.—In order to improve the construction of dredging buckets, so as to make them stronger, less liable to break or get out of order, and simpler in construction, this inventor makes the arms formed of the jaws, the bearings, and the slotted upper parts, which constitute a portion of the tripping arrangement of the bucket, in one solid piece.

IMPROVED CAR COUPLING.

Charles H. Briggs, Black Hawk, Col. Ter.—This consists of a combined link and hook-headed coupler, in combination with a catch in the drawbar behind the hole for a coupling pin, which may be used with cars only adapted for the ordinary link and pin connection. The catch is contrived to work vertically in opening and closing, so that it will fall and couple self-actingly, and can be uncoupled from the top of the car or from the side.

IMPROVED SANDING ROLLER.

George A. Crocker, Stockton, Me.—This inventor arranges a pair of rollers inside of the roller on which the sand paper is fastened, to hold the paper on tight and smooth by receiving the ends between them through a slit in the roll. The inner rollers are extended out through one end of the large roller, so as to be operated by hand and are geared together so as to be turned alike.

IMPROVED LEVER POWER.

Edward Fales, Edina, Mo.—This invention presents a novel construction of lever power which is especially adapted to the pulling up of stumps, but generally applicable also for other uses for which a lever power may be employed. It consists mainly in a long lever having a draft attachment at one end, and at the other two pivoted clutch arms or grippers. Between these two grippers is a foot or bearing plate, upon which this end of the lever rests, and also an attachment for a chain, which is to pass around an immovable object which holds the lever. The two grippers are held together by a spring, and are adapted, as the lever is worked back and forth, to alternately seize a chain attached to the stump and gradually pull it to one side.

IMPROVED PLANE FOR MAKING EXCELSIOR.

Albion K. Hall, Box 125, Jackson, Mich.—This is an improved power plane for making what is known as "excelsior," a thin shaving of wood, used for filling beds and for other upholstering purposes. The invention consists of a bit, with parallel rectangular grooves at the upper side, combined with a stock having corresponding grooves in its under side. The bit produces a two-fold cutting of the shavings, one set at the outer edges of the raised ribs, and the other at the bottom of the grooves, so that two distinct and separate shavings are formed for each groove of the plane. The inventor is desirous of disposing of State, county, and shop rights.

IMPROVED SHAFT COUPLING.

Herman Albrecht, Philadelphia, Pa.—This shaft coupling locks the shaft securely, and has the advantage of coupling shafts of different diameters with equal facility as shafts of the same diameter. A connecting sleeve has a central partition that divides the sleeve into two sections. To each section the end of a shaft is coupled, by means of eccentric wedges, a main key with top and bottom tongues, and a longitudinal key-binding bolt. The sleeve has circumferential flanges to protect the nuts of the bolt ends. As each shaft forms an independent coupling with the sleeve, shafts of different diameter may be coupled to the sections of the sleeve, the jaws and key more or less varying in size.

IMPROVED OIL PRESS MAT.

Joseph L. Perkins and George O. Baker, Selma, Ala.—This consists of an oil press mat made of wood or metal plates, and covered with leather. The plates impart to the mat the main strength, and admit thereby of a higher degree of pressure than the hair mats while lasting longer and being more effective than the same.

IMPROVED BOBBIN WINDER FOR SEWING MACHINE.

Charles L. Noe, Bergen Point, N. J.—This consists in hinging the guide and spring held presser roll of a bobbin winder to facilitate the putting in and taking out of the bobbin.

IMPROVED FLOOD GATE.

Robert H. C. Rhea, Waverly (Uniontown P. O.), Ky.—This flood gate is formed of sections, hinged to each other in such a way that the lower part of each section may overlap the upper part of each lower section upon the upstream side. By this construction, as the water rises, the lowest section will float upon it; and as the water continues to rise, the following section in consecutive order will float. Any drift that may be on the water will strike against the smooth surface of one or the other of said sections, glance down, and pass beneath it, so that there can be no obstruction of the water and no consequent damming and back flow.

IMPROVED VIBRATING PROPELLER.

Louis Gugler, Milwaukee, Wis.—This consists of a series of vertically hinged paddles or wings that are mounted to a reciprocating frame, sliding in horizontal guides of the vessel. The position of the paddles for forward or backward motion is produced by a lever-operated rack bar, engaging pinions of the bucket standards. The inventor considers the device well suited for canal boat use.

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Wanted—2d hand battery for Electric Light; also induction coil. Particulars to J. T. O'Connor, 151 West 4th St., New York.

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For Sale—A Valuable Patent. See first page of Scientific American of July 3, 1875. Address C. S. Keyes, Bennington, Vt.

Second hand Iron Working Tools for Sale. For list, apply to New Haven Mfg Co., New Haven, Conn.

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Notes & Queries.

W. T. R. will find directions for purifying mercury on p. 131, vol. 30.—T. T. L. should consult a lapidary.—W. T. C. can waterproof his cloth by the process described on p. 347, vol. 31.—M. A. S. can utilize old rubber by the process detailed on p. 349, vol. 26.—W. J. will find directions for bronzing on pp. 11, 85, vol. 31.—E. J. K. should use marine glue. See p. 42, vol. 32.—McG. B. can cement pieces of marble together with plaster of Paris.—W. W. can dye his billiard balls red by the process given on p. 362, vol. 30.—W. T. B. will find an answer to his query as to church ventilation on p. 356, vol. 29.—R. M. C. will find on p. 74, vol. 31, particulars of the lifting power of hydrogen.—H. H. S. can mold rubber by the process given on p. 363, vol. 30.—L. R.'s trouble with the wind wheel is an optical delusion.—W. F. D. W. can anneal his lamp chimneys by the process given on p. 42, vol. 26.—J. G. G. will find a description of the compression engine on p. 66, vol. 34.—L. H. E. will find an answer to his query as to a cannon on a moving car on p. 273, vol. 32.—W. L. C. can unite glass with brass with the cement described on p. 117, vol. 32.—A. S. can paste paper labels on tin with the preparation described on p. 26, vol. 34.—C. D. T. can bleach straw hats by the process given on p. 11, vol. 32.—C. H. R. will find a full description of felted processes on p. 50, vol. 34.—D. J. I. will find a description of the tallest chimney in the world on p. 311, vol. 32.—W. C. R. will find directions for making furniture polish on p. 315, vol. 30.—C. L. B. will find directions for renovating gilt picture frames on p. 27, vol. 31.—F. W. K. will find directions for hardening tallow on p. 202, vol. 24.—H. B. L. can remove inkstains from marble by the process described on p. 58, vol. 30.—G. A. R. will find the table of weights of iron castings in proportion to those of wooden patterns in *Wrinkles and Recipes*.—J. W. C. should consult an oculist.—A. M. M. will find an article as to pressure on slide valves on p. 299, vol. 31.—E. N. C. will find a description of a small furnace for melting brass and iron on p. 233, vol. 32.—M. C. will find directions for making a battery for electrotyping on p. 26, vol. 32.—G. M., Jr., will find on p. 75, vol. 34, a recipe for eau de Cologne.—H. B. P., A. S., D. K. H., R. J. W., C. A. S., W. W., W. S., J. D. H., J. B. E., J. G., and others, who ask us to recommend books on industrial and scientific subjects, should address the booksellers who advertise in our columns, all of whom are trustworthy firms, for catalogues.

(1) G. W. A. says: I am about to put a flag pole on top of our store, and I am somewhat fearful of lightning striking the pole. How shall I arrange it? A. If you have a good lightning rod on the house, provide the pole with a good sized copper wire and connect the latter to the rod.

(2) H. W. G. asks: 1. Can I deposit aluminum or wrought iron by the electro process? A. It is difficult to do. Several processes have been published, but they do not appear to be of any practical value. 2. Can I coat wrought iron with the aluminum by melting and dipping, as with zinc? A. We believe this has never yet been successfully accomplished.

(3) X. Y. Z.—You do not furnish sufficient data to have your question answered with any degree of accuracy. To what use is the flow to be put? How thick are the walls that are to support it? If for warehouse purposes, how high is the story to be for which this is to serve as a flow?

(4) J. W. asks: 1. How can I make one of the ink wheels used on printing telegraph instruments? A. Cut circles of beaver cloth, and place them together until the required thickness is obtained. Fasten with a small bolt and nut. 2. How is the ink put in the wheel? A. The wheels are thoroughly saturated with ink at first, and a little added daily while the wheel revolves.

(5) D. A. W. says: You recently described an electric pile in sesquioxide of iron, having one pole formed of a prism of charcoal, containing sesquioxide of iron in its pores. Is the prism composed of common charcoal, and how is the sesquioxide of iron placed in its pores? A. Charcoal or carbon will answer. Try soaking the carbon in an aqueous solution of the sesquioxide.

(6) C. M. B. asks: 1. In constructing a battery, how must I connect the wire to the disk of zinc? A. By solder. 2. How must I connect the insulated wire to the coil of copper wire, and also to the wire leading from the zinc of the next cell? A. The insulated wire may be connected to the wire coil by solder or by twisting the two ends together. It is usual and more convenient to employ binding screws for connecting one cell with another. 3. What is the most readily obtainable form of insulated wire that I can substitute for the gutta serena covered? A. Gutta serena or kerite is the best covering.

(7) E. B. K. says: I am desirous of constructing an electric light sufficient to illuminate a medium sized room. How many cells of Daniell's battery will it require? A. If a steady light is desired, it will be useless to operate without an electric lamp, and this, as usually made, is a costly apparatus. Forty or fifty large sized cells, of the form commonly called the tray battery, will give a good light.

(8) T. M. B. says: 1. I wish to build a small telegraph from one room to another. How can I soften ordinary round iron for the poles? A. It is not absolutely necessary to soften them, but

you can do so by heating them red hot and allowing the fire to die out very slowly while they remain in it. 2. How shall I connect them, and what should they be wrapped with? A. Connect by means of a piece of soft iron, and wrap with copper wire covered with silk or cotton. 3. Please give me full directions for making a small sulphate of copper battery. A. See answer to E. M. C. on this page. 4. How many cells shall I need, and how shall I connect the battery with the poles? A. Four or five cells should be sufficient. Connect the zinc of one cell to the copper of the next in order; join the copper of the first cell to one end of the line and the zinc of the last to the other. Insert the coils of the magnets in the line circuit, so that the current shall traverse their whole length.

(9) G. A. T. says: I made a small induction coil for lighting a gas jet. Instead of putting my iron wires in a bundle in the center of the primary coil, I reversed them, putting the wires outside and surrounding the primary and next to the secondary coil. It works admirably. Has it ever been tried on large coils? A. We believe so; at any rate the idea is not new.

(10) E. M. C. says: 1. How can I make a battery for running a magnetic engine? A. A good form of sulphate of copper battery can be made thus: Fill a large jar about two thirds full with water in which about 1/4 lb. zinc sulphate has been dissolved. Place a disk of copper, to which a gutta serena covered wire has been soldered, at the bottom of the jar; suspend a zinc casting or plate from the top, and drop a few crystals of copper sulphate on the copper disk. A wire from the zinc and one from the copper form the poles. The plates should expose considerable extent of surface if large wire is used for the machine. 2. What is the best form of such an engine? A. One of the easiest to construct consists of two electro-magnets, between which a piece of soft iron mounted on an upright is made to vibrate. The upright may be suspended or supported on an axis below. It also carries an attachment by means of which the current is shifted from one magnet to the other as it vibrates to and fro. The magnets are thus charged alternately, beginning with the most distant from the soft iron. Expensive machinery is not required for the construction of such an engine.

(11) F. L. H. says: I have a small electrical instrument known as a vibrating shaker. Will such an instrument give a current with Bunsen's cells, strong enough to decompose water? If so, how many cells will be required? A. Such an instrument, with a single cell, will probably decompose water, but we fear the quantity of the current is so small that the process would be a slow one.

(12) M. A. W. says: 1. In a plate electric machine, how large in diameter should the plate of glass be, and how thick? A. The plates are made of various sizes. One of 12 or 15 inches in diameter, and 1/4 or thereabouts in thickness, will be found easy to manage. 2. What would be best to make the cushions of? A. Make them of leather and stuff with horsehair. 3. Would iron wire 1/4 inch in diameter do to connect the cushions to the ground? A. Yes. 4. Would an iron rod 1 1/2 inches in diameter do to make the prime conductor of? A. Make the prime conductor of brass or tin tube, about 2 1/4 or 3 inches in diameter, and have the ends rounded. 5. What diameter ought the arms to be, that connect the prime conductor and plate? A. About 1/4 inch. 6. Of what metal should the points be? A. Any kind of metal will answer for the collecting points.

(13) E. W. asks: 1. Will a common unglazed earthen cup answer for a porous cup for Bunsen's battery? A. Yes, if not baked too hard. 2. How can I make a piece of wood a non-conductor? A. Soak it in melted paraffin.

(14) P. W. M. says: I read an article in your paper on taking life by electric shocks instead of hanging. I have experimented with a rat. I laid him on a table, and took a coil giving an 18 inch spark. I made connections with his mouth and tail, put on 6 large Grenet cells, and left the current on about 5 minutes, and apparently it did not affect him. I then made the connection through his two ears; this seemed to have killed him; but when I put him in the cage, in 5 minutes he opened his eyes and was as wild as ever. Please explain this. A. We are not in favor of practising cruelty to animals, not even to rats; and we do not wonder that your victim was wild. Had you placed him on a glass or ebonite plate, and arranged the connections so that the full force of the machine should be transmitted through him, we doubt if there would have been any occasion for repeating the experiment with that particular rat.

(15) J. S. asks: 1. What kind of a battery will produce the decomposition of water? A. Two or three ordinary Bunsen cells will answer. The same number of Daniell cells might do, but the action would be much less rapid. 2. How large a battery will cause 9 feet of No. 30 platinum wire to get red hot? A. It will probably require forty cells of Bunsen battery of very low internal resistance.

(16) E. says: 1. Have an eight day clock which I am causing to make and break an electric current once every second. What is the proper metal or other substance to use in making the points of contact? How can I make and break the contact infallibly? I want to use the force of the current for lifting when I have the contact made. A. Nothing better than platinum is required for the contact points. If the spark arises from the extra current in the magnet coils, it can be cut off by using a condenser or resistance coil, one terminal of which is to be connected on each side of the break. If a resistance coil is used, it must be adjusted for the particular circuit in which it is to be placed. 2. Is the Hill

gravity battery the best? A. Hill's is one of the best forms of the sulphate of copper battery. For light, however, or when strong currents are desired, the form known as the tray battery is better. 3. Is a horseshoe magnet the best form for lifting, and what size of wire will be the best? A. Yes. If the cups are connected in series, the resistance of the wire forming the coils should equal about 12 ohms. 4. How can I produce an electric light to illuminate a circle of 3 feet, to be kept going all night in the most simple and economical manner? A. Perhaps a carbonic acid vacuum tube, as arranged by Gassiot in connection with a small induction coil, would answer. It would certainly be the cheapest. See a description in the "Student's Text Book of Electricity," by Noad.

(17) W. C. A. says: How much wire and of what size will I require for a relay of about 120 ohms resistance? A. Nine ozs. of No. 28 pure copper wire will be about right.

(18) W. E. D. asks: 1. Would 6 pairs of magnets 3 inches long, 1 1/4 diameter, with 1/4 inch iron for core, covered with No. 23 or 24 wire and placed at equal distances around a revolving wheel be of good proportion and have sufficient power to run a sewing machine if proper batteries were used? A. Ten or twelve bar magnets so placed would answer; we should, however, prefer larger wire, say No. 20, and use six cells, coupled three in series and two in parallel circuit. 2. How does the Eagles metallic battery compare with the Calaud for strength and durability? A. The electromotive force is the same; as a general thing, however, the Eagles battery gives a stronger current on short circuit, in consequence of its lower resistance. 3. Does an ohm denote a unit of power or resistance? A. An ohm is the unit of electrical resistance. 4. In connecting batteries for quantity or tension, would quantity give more power or strength for lifting weights, etc., and tension greater power for overcoming resistance, as on a telegraph line? A. Yes.

(19) H. H. M. asks: How can I fasten pieces of sponge on to rubber, tin, or glass? A. Melt together in an iron pot equal parts of common pitch and gutta serena, and stir well. Use while hot.

(20) W. M. says: 1. Suppose I have a 100 feet weight at the bottom of a stream 20 feet deep. What amount of hydrogen would it require to bring it to the surface? A. If the iron weighs 100 lbs. in the air, it will weigh only about 87 lbs. when immersed in the water. As iron weighs nearly 8 times as much as an equal volume of water, in order to balance 87 lbs. of the iron we shall have to displace about 696 lbs. of water. If we should measure our water we would find that it required about 28 cubic inches of water to weigh 1 lb., and consequently our 696 lbs. of water would measure 19,488 cubic inches, or about 11 1/4 cubic feet. An equal volume (19,488 cubic inches) of hydrogen will weigh 417 grains, or about the same as 1 65 cubic inches water. We must, therefore, add to the above quantity (19,488 cubic inches) sufficient measure of gas to displace about 2 cubic inches of water. 2. What amount of zinc and sulphuric acid would be required to generate the hydrogen in two minutes? A. Good zinc and strong hydrochloric acid would furnish hydrogen in large quantity and quite rapidly; but so much depends upon the apparatus employed, the purity of the materials used, and the temperature at which the operation takes place, that we can furnish you with no definite figures.

(21) H. P. B. asks: Can eggshells be utilized? A. We do not know that they have ever received any practical application in the arts. If obtainable in large quantities, they might be employed for fertilizing purposes.

(22) J. S. C. says: I send you a piece of a brown stocking which we purchased for a little girl 2 1/2 years old. She soon complained of feeling badly, and was slightly sick at the stomach. Her mother took off the stockings, found her feet and legs discolored, and washed them off, and put on other stockings, when she felt better. I should not have thought so much about it, but I have heard of a case of decided poisoning from brown stockings, which had been colored with picric acid. A. The specimen seems to have been dyed with one of the aniline colors. If you will send us a larger piece of the material, we shall be happy to give the substance a chemical examination.

(23) B. C. Jr. says: I want a dye for coloring pine wood green, of a shade like that of trees and plants. A. To 3 pints of strong vinegar add 4 ozs. best verdigris, ground fine, 1/2 oz. sap green, and 1/4 oz. indigo. Boil the wood in this for several hours.

(24) R. L. L. asks: 1. How can I make a good waterproof boot grease? A. Take 1/4 lb. of shoemaker's dubbing, 1/2 pint linseed oil, 1/2 pint strong solution of India rubber. Dissolve the whole with a gentle heat (it is very inflammable), and apply with an ordinary blacking brush. One application will insure dry feet for several months. Of what substances and in what proportions is the camphor barometer made? A. See p. 230, vol. 33.

(25) W. T. asks: If an apparatus made from 1/4 inch sheet iron be galvanized in every part after completion, will it have a tendency to corrode or rust if worked in either hot or cold water? A. Provided the water is pure, and the iron well galvanized, there should be no appreciable corrosion.

(26) J. D. J. asks: How can I make a phosphorus lamp that will work? A. If a strong solution of clear (not red) phosphorus be made in any of the essential oils, and a thin film of the solution be exposed to the air in a dark room, a strong phosphorescent glow will be observed. Advantage has been taken of this slow but luminous oxidation of phosphorus to construct numerous toys

one of which is aptly termed the phantom lamp. It is commonly a strong solution of phosphorus in olive oil, half filling a small phial having a wide mouth for the admission of air when in use. A better plan is to have a piece of porous earthenware (biscuit) fastened to the lower portion of the stopper and dipping beneath the oil; and when it is desired to use the lamp, the stopper (cork) is reversed, when the whole surface will glow quite strongly with the characteristic phantom light.

(37) C. A. J.—Send us your address; we will be happy to accommodate you as to the Stevens Institute.

(38) B. H. S. asks: Would it be dangerous or unhealthy to sleep in a new bedstead painted with Paris green and varnished over? A. If the wood has been well varnished, we think not; but if the bed has not already been painted, we would advise you to employ some other variety of pigment, that does not contain arsenic.

(39) C. H. R.—We are not familiar with the particular gas machine you speak of. You should state concisely what the mode of operating the machine is, or send us illustrations or drawings of the same. Generally speaking, machines of this character, unless constructed and operated with the greatest care, are not safe.

(30) J. McD. asks: 1. What chemical change takes place in milk when it turns sour? A. When milk is allowed to stand for a short time it sours and curdles, that is, its casein changes from the dissolved to the solid state. This is brought about by a series of interesting changes, originating in the unceasing activity of atmospheric oxygen. Casein is insoluble in water, but in the milk it exists combined with soda, and this compound is soluble in water. When fresh milk is exposed to the air, its oxygen seizes upon a portion of its casein and causes it to ferment; this takes effect upon the milk sugar and converts it into lactic acid, which causes the sourness of the milk. 2. How can it be restored and made sweet again? A. When a sufficient quantity of lactic acid is formed, it seizes upon the soda, takes it away from the casein, and forms lactate of soda. The casein thus set free shrinks in bulk, and gathers into an insoluble curdy mass. This precipitated casein may be readily redissolved by the addition of a little soda; the milk, however, although it may still be palatable, will by no means recover its original flavor, owing to the partial decomposition of the milk sugar.

(31) R. E. D. asks: 1. Will a 6 horse engine do to run a circular saw or a good sized corn mill? A. An engine of the size you mention will run a circular saw from 48 to 50 inches in diameter, or your corn mill. 2. How large a sawmill will it run, and how much lumber will it cut per day? A. If your saw is run at the regular speed, say 9,000 feet per minute at the periphery, every $\frac{1}{4}$ inch feed to every revolution will cut on an average 1,000 feet of lumber per day; $\frac{1}{4}$ inch feed will cut 2,000 feet; 6 inserted teeth in the saw will be plenty to saw this amount of good smooth lumber.—J. E. E., of Pa.

(32) W. A. W. asks: Why, if you make the bottom of a cistern concave, will it present a greater resistance to the action of the water than if it were flat? A. In some localities the water in the ground rises to within a few feet of the surface; and in such places, when a cistern is sunk to a good depth, the pressure from beneath on the bottom is considerable. The sides, being built in arched form, can withstand this outside pressure very well, but the bottom, when flat, has no power of resistance except what is given to it by its weight. When the cistern is filled with water the construction is firm enough, but when it becomes empty, as frequently happens, the upward pressure cracks the bottom, and a movement commences which eventually destroys the work. If, in a dry time, the water then lies lower in the ground, the cistern will leak and become useless. The answer referred to said "that, if the bottom were built concave, it would present a greater resistance to the action of the water beneath." We know of one instance, somewhat in point here, where it cost \$1,000, spent in experiments, to protect the bottom of a vault from the upward pressure of water coming from a saturated under stratum.

(33) E. A. K. says: In villages it is possible to arrange, for water supply, a tank of boiler iron to receive the rain water from the roofs; but it is difficult to obviate rust, which discolors the water. To procure an easily working and durable faucet is also difficult. Can you help us to solve these difficulties? A. Cast iron tanks do not rust with the rapidity of wrought iron, and always keep tight. If you use what are called compression faucets, you would not be subject to the other annoyances complained of.

(34) S. F. S. asks: Can you give me a recipe for an ink that will be invisible when written, but which can be brought out by heating? A. Use a dilute solution of chloride of cobalt in water.

(35) W. C. asks: 1. When should timber be cut to give best results against rotting? Is it too late now (March) to cut timber here, where there are 2 feet of snow on the ground? A. Yes; it should be done before the sap begins to flow. 2. What is dry rot? In our mill the floors are constantly damp, our ceilings are (between the doors and ceiling) dripping wet from condensed steam that rises from the drying apparatus. One mill built six years ago is so rotten from foundation up that you can push your thumb into the timber. A. The rotting in your case is not dry rot, but decay of the wood from the constant absorption of water from the surface, and the consequent disintegration of the fibers. Dry rot manifests itself in cases where the material is closely enclosed in iron, brick, cement, etc., so as to be entirely excluded from the preservative influences of the at-

mosphere, and is most frequently found at the ends of timbers which have been let into a wall or encased in an iron shoe. A prominent instance of the latter occurred where the tie beams of the principal roof trusses of a church were discovered, from a slight settlement, to have been rotted off at the ends, where they were encased in a very large airtight iron shoe. The remedy in your case would seem to be to protect the wood from contact with the water, and at the same time to give it free access to currents of air; there should be sufficient change of air to carry off all the moisture without depositing it upon the surrounding surfaces of the room. 3. Would good sound and dry hemlock or chestnut, buried in hydraulic cement concrete, be proof against decay of any and every kind? A. No.

(36) J. A. asks: How can I build a filter on the side of a stream of water which is subject to sudden rises of from 2 to 8 feet, getting at such times very muddy? A. Several attempts have been made to filter large quantities of water from rivers without success; the filter beds were soon rendered useless by the great amount of filtered material deposited into them. The plan that has been adopted after the failure of the filter beds is that of a reservoir with a central dividing wall. One of the compartments thus formed is periodically filled, the water allowed to settle and then drawn off clear into the other, from which a constant distribution is made. The authorities at Poughkeepsie, N. Y., as also the Hudson River Hospital for the Insane, at the same place, have both passed through this experience.

(37) W. S. C. and others.—Wherever the waste water of a house can be conveyed away by a drain, it should be done, instead of letting it stand in a cesspool or suffering it to settle into the ground. Thirty-six feet of filtering material, as you mention, ought to purify the water as far as it can be satisfactorily done by mechanical and partially chemical means, but not wholly; a drain is better.

(38) J. C. asks: Does galvanizing cast iron tend to weaken the iron? A. We think not.

(39) F. P. asks: 1. Will a shaft or a spindle of a machine that is run at 2,000 revolutions per minute take more power than one run at 4,000 a minute. A. No. 2. Is not the balance wheel of an engine merely to govern the motion of the crank shaft? A. Yes. 3. Will a circular saw spring more from heating of the saw mandrel, or will it spring more from having any set. 4. Is it a good plan to give a saw set enough, so that it does not bind on its sides? A. Yes. 5. Is an engine which runs at 150, or one which runs at 200, revolutions a minute more economical? A. Quick piston speeds are the most economical.

(40) S. F. B. asks: What are the comparative lasting qualities of upright tubular boilers and those of locomotive or horizontal tubulars? A. So far as we know, there is not a great deal of difference, if the boilers are well built.

(41) A. W. S. says: I have seen several references to cutting copper and other soft metals by means of a disk of iron running at high speed. We have to cut up a great deal of $\frac{1}{4}$ inch No. 18 gage seamless copper tubing into short lengths; and using a fine saw, we have considerable trouble with its running. Can we cut it in the former way? A. Yes. Use a disk running about 25,000 feet per minute, of about 10 inches diameter, made of best charcoal iron.

(42) W. F. R. asks: What is meant by the axis of a magnet? A. The straight line joining the poles.

(43) A. J. says: 1. I have a 12 x 20 inches engine which will run two planers, rip saw, and scroll saw, with 20 lbs. steam; yet it takes hard firing under a boiler 42 inches x 18 feet, with two 13 inch flues. The engine runs at 125 revolutions per minute. Would it not be better to speed the engine down? A. Yes, if the engine would still be powerful enough for this duty. 2. How should the valve be set to use steam most economically? A. If a common slide valve, set it to cut off at three fourths of the stroke. 3. What would be the proper shape of the furnace? We have a good draft. A. We cannot say, unless we know the description of your boiler.

(44) L. B. C. & S.—There is probably something wrong in the arrangement of your pipes or valves, as the ram ought to do very well under the given circumstances. We think the wheel you speak of will give plenty of power. It would be better to have a valve in the delivery pipe.

(45) F. W. B. asks: What are the objections to the use of clockwork as a motor, to run a churn? A. The principal objection is the labor required to wind the spring. There are numerous light spring motors in the market, and by corresponding with their manufacturers you can doubtless obtain information about details. It has occurred to us that spring motors, suitable for household operations might be devised, to be wound up by a steam engine at some central locality, and distributed where desired.

(46) T. H. asks: How is the water got to the working barrel of a pump? Is it by suction, or atmospheric pressure? A. By atmospheric pressure. See article on "Suction," p. 352, vol. 31.

(47) W. D. M. asks: The grist mill in this place is driven by a 10 x 16 inches horizontal engine. The exhaust comes out on the under side of cylinder into a $\frac{3}{4}$ inch tin pipe which runs horizontally for about 8 feet, then turns up $2\frac{1}{4}$ feet, and enters the heater. They are troubled by the tin pipe collapsing. This always has happened when starting the engine. What is the cause? A. The steam condenses in the pipe, so that a vacuum is formed. Attach a vacuum valve on the upper part of the pipe near the place where it collapses,

or use an ordinary cock, which can be opened on starting the engine.

(48) W. A. says: I am making some experiments with a machine in which I wish to light kerosene in a place inaccessible with a match: is there not some cheap magnetic machine by which I can accomplish it? A. Yes. Two or three cells of Bunsen battery will heat a short length of No. 36 platinum wire red hot, if the resistance of the circuit is not too great.

(49) J. H. S. asks: What is the best method of renewing a carbon plate used in an electrotype battery? A. Soak the carbon in warm water. If it is to be used in the porous cup of a bi-chromate battery, you will find it slightly advantageous to place it for a short time in nitric acid.

What is the proper proportion of zinc to muriatic acid in making a soldering solution? A. Add zinc until the acid is nearly exhausted.

(50) J. L. asks: 1. Must steel be tempered before being magnetized? A. Yes. 2. At what heat does steel lose its magnetism? A. At a red heat.

(51) J. H. says: 1. What is meant by the brass rim of the lens, which the pieces of looking glass are fitted into, in your description of a home-made microscope of October 30, 1875? A. Magnifying glasses are usually mounted in a brass or hard rubber ring. We presume such is the rim referred to. 2. Where can I procure the lenses required? A. At any optician's. 3. Would the same sized stand do for a microscope to magnify 1,000 to 1,500 times? A. Yes.

(52) H. S. T. says: In regard to propellers, I used a two-bladed, one of the ordinary kind, for two seasons, and the vibration was very unpleasant; but for the last two summers I have used a modification of Dr. Collis Browne's (illustrated in the SCIENTIFIC AMERICAN some time ago); with that, the speed was increased about one third and all vibration ceased, and she glides along with all the smoothness of a sail boat. I make my propellers with cast iron hubs, into which I screw wrought iron arms and rivet on sheet iron blades, making very cheap and efficient wheels.

(53) R. W. R. says, in answer to W. H.'s query as to the tension of a cotton rope: Midway between the two buildings is a post holding 2 idler pulleys, elevated 20 feet, over which the rope runs. The sag of the rope, which is about 3 feet out of a straight line on each side of the idlers, keeps up the tension when the rope stretches.

(54) H. S. T. says, in answer to many correspondents: I will give you my experience with a small boiler. I constructed a boiler for a steam carriage; it is 15 inches in diameter and 30 inches high. The firebox is 14 inches in diameter and 12 inches high, with 207 copper tubes $\frac{1}{2}$ inch in diameter and 10 inches long. Plates are only $\frac{1}{2}$ inch thick, of the best steel. Total weight, including all fixtures, is 200 lbs. It made steam for 2 cylinders of $3\frac{1}{4}$ inches bore by 10 inches stroke, and ran the carriage (weighing 550 lbs., complete) on a smooth road a mile in 4 minutes, with one person and fuel and water. I have the boiler now in a boat, 21 feet long and 5 feet wide; it drives two cylinders of $2\frac{1}{4}$ inches bore and 5 inches stroke. Propeller is 22 inches in diameter. It makes plenty of steam, and, with good dry wood, I have the furnace door open much of the time to keep down the steam. I usually run at 60 lbs., and at that pressure it runs the boat about 7 miles per hour with about a bushel of wood.

(55) L. L. L. says, in answer to E. P.'s query as to printing in gold and bronze: To print clearly, use the finest quality of powder and size; use as little size as possible, and distribute it well; roll it thoroughly on the type, use only two sheets of smooth paper on the platen (for blanket), place five or six thicknesses of soft paper beneath the form, pull a light and quick impression, apply the powder carefully, and dust off thoroughly with a camel's hair pencil.

(56) C. R. L. says, in reply to T. C. M., who states that, in a sheet copper vessel, the sulphate of copper solution, after being allowed to stand for a few weeks, has deposited a hard, greenish coat, which prevents the working of the battery of which it forms a part, and asks how it can be removed: This is by no means unusual where the copper salt is very impure or contains a considerable excess of sulphuric, nitric, or acetic acids. When a piece of sheet copper is placed in a solution of sulphate of copper, already saturated with the salt, and containing a free acid in excess, a thick scum of copper salts soon forms on the surface of the copper, which, if allowed to remain or accumulate long enough, not only very materially weakens the current (in case the copper plate is a negative element in a battery) but offers a nearly perfect protection to the copper, so much so that the addition of strong nitric acid is without action, or nearly so, upon it.

(57) J. G. V. says, in reply to W. A. F., who asks for a plan for straightening wire: Fix three collars on a frame, two on the same level and the third one above and between the others. This last one can be moved up and down by screws. The lower ones should turn freely on their centers, but have no other motion. Grooves of different sizes are cut on the rollers, and the wire is passed between the rollers in the groove nearest to the exact size of the wire.

(58) L. S. W. says, in reply to J. C. W., who asks how large a cube can be cut out of a ball 12 inches in diameter: The largest cube has for one of its sides the side of a square inscribed in one of the large circles of the ball. If x is this unknown side, $x = \sqrt{2} \cdot r$, that is, $x = 8.485281$ inches. The volume of this cube is 610.4026 cubic inches.

(59) J. H. asks: What cement is the best to harden quickly and resist the action of dampness the longest, without losing its firmness? A. Portland cement.

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

G. G.—It is iron pyrites.—W. H. S.—It is lignite containing iron pyrites.—A. J.—One is quartz, and the other is iron pyrites in limestone.—A. W. S.—No. 1. The shining particles are scales of mica. No. 2 is crystallized carbonate of lime. No. 3 is quartz. No. 4 is impure limestone. No. 5 is gneiss rock.—C. M. D.—It consists of carbonates of soda and lime.—I. R.—It is a variety of brown ocher. It is of no particular value.—J. L. L.—They all consist of clay and sand cemented together by a small amount of oxide of iron. They are not iron ores.

J. J. W. asks: How are glass marbles of different colors made?—J. I. asks: How can I preserve speckled or brook trout in cans, etc.?

COMMUNICATIONS RECEIVED.

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

On a Raft in a Stream. By R. K. B.
On a Scroll Saw. By C. A. S.
On Barbecues. By C. S.
On Incubation. By G. N. S.
On Man in Limestone. By M.
On Small Engines. By J. S.
On Sailing Faster than the Wind. By J. G.
On Italy. By C. E.

Also inquiries and answers from the following:

C. B. H.—A. B.—W. K.—J. H. M.—W. S. G., Jr.—P. C. N.—H. B.—E. E.—M. B. H.—E. W. N.—R. C.—B. P. K.—L. & W. W.—E. F. W.—J. E. W.—R. G.—H. J. G.—J. C. W.—B. F. M.—S. M. G.—L. B. S.—T. S. L. G.—F. McD.—E. M. L.—A.—W. H. M.—W. H. S., Jr.—J. N. H.—J. D. G.—C. F.—E. B. R.—R. S., Jr.—J. M.—C. C. R.

HINTS TO CORRESPONDENTS.

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

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

Hundreds of inquiries analogous to the following are sent: "Who makes elevators, worked by hydraulic power? Who sells waterproof matches? Who sells cracker-making machinery? Who makes chilled iron or cast steel balls, turned up to a perfectly spherical shape?" All such personal inquiries are printed, as will be observed in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

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A complete copy of any patent in the annexed list, including both the specification 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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Wringer, F. Way.....	175,218
Wringer, F. & M. Way.....	175,217
Yoke, ox, E. A. Farr.....	175,060

DESIGNS PATENTED.

9,145.—GLASSWARE.—B. Bakewell, Jr., Pittsburgh, Pa.	175,082
9,146.—SEAT BACKS.—D. Buckler, Listowel, Canada.	174,965
9,147.—UMBRELLA FRAME.—A. Hirsh, St. Louis, Mo.	175,169
9,148.—BADGE.—H. Newell, Philadelphia, Pa.	174,977
9,149.—TOY CARRIAGE.—F. W. Porter, Springfield, Vt.	174,944
9,150.—BADGE.—E. M. Regus, New York city.	175,093
9,151.—PAPER WEIGHTS.—N. J. Simonds, Woburn, Mass.	174,993
9,152.—CAN STAND.—Z. R. Traver, Detroit, Mich.	175,088
9,153.—CASSIMERE.—W. A. Walton, Providence, R. I.	175,212
9,154 to 9,157.—BREASTPINS.—L. S. Beals, Astoria, N. Y.	175,200
9,158.—PLAYING CARDS.—J. Duthie, New York city.	174,892
9,159.—ROSETTES.—J. C. Reed, New York.	175,228
9,160.—BOAS.—W. Skinner, Lyons, Iowa.	174,967
9,161, 9,162.—BADGES.—B. B. Tilt, Passaic, N. J.	175,011

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Vol. XXXIV.—No. 18.
(NEW SERIES.)

NEW YORK, APRIL 29, 1876.

\$3.20 per Annum.
(POSTAGE PREPAID.)

A NEW BRIDGE IN PHILADELPHIA.

The river Schuylkill, at Philadelphia, is becoming renowned for the many handsome structures which cross it. Whatever other attractions the good city of brotherly love may boast, it certainly possesses more beautiful bridges than any other city on this continent. The Market street bridge, recently destroyed by fire, is to be replaced by one of the most solid and ornamental structures in the country. The Girard Avenue bridge, an engraving of which appeared in these columns some time ago, has attained wide celebrity; and a very excellent specimen of modern bridge architecture has recently been completed at Callowhill street, replacing the historic wire bridge, which was one of the earliest suspension bridges in this country. It is from the design of J. H. Linville, Esq., C. E., President of the Keystone Bridge Company, by which corporation the bridge was erected. It consists, as will be seen in our engraving, for which we are indebted to the *Polytechnic Review*, of one span only, 350 feet in length; there is a span of 80 feet over Callowhill street, five arched colonnades on the east side of 105 feet, ten on the west side of 230 feet; a bridge over 30th street of 90 feet; seven spans of plate girders, 300 feet; span over the Pennsylvania Railroad, 140 feet; total 1,295 feet. The upper floor of the bridge is 32 feet above the lower roadway, and is 48 feet wide; the roadway is 32 feet wide, and the sidewalks 8 feet each. The lower floor is 50 feet wide, accommodating a roadway and two sidewalks.

On the eminence on the right of the picture is situated the main reservoir of the Fairmount water works; and descending this hill to the river side, the tourist will pass the structures containing the wheels and the pumps which lift the water from the river and force it up into the reservoir. The wheels are worked by water brought from the dam (which crosses the river just below the hill shown in the center of the illustration) by a canal.

About Scarecrows.

Now that the planting season is at hand, we have no doubt but that many a farmer will rummage through his garret to find the cast-off garments, which, stuffed with straw, are to be set up in the cornfield to warn off the marauding crow. We have never had much faith in this artifice. Crows are possessed of much more wisdom than is generally credited to them; and while an immovable bundle of rags may drive them away for a short time, we believe that eventually they discover the humbug, as we have seen the birds complacently picking up young corn almost within the shadow of an elaborate stuffed scarecrow as ever was erected. We, however, have heard suggested a couple of plans which are calculated to intimidate even the boldest of these birds; and as they are easily carried out, perhaps our farmer readers may make use of them. The first and best is a suspended looking glass. Take two small cheap mirrors, fasten them back to back, attach a cord to one angle, and hang them from an elastic pole. When the glass swings in the wind the sun's rays are reflected all over the field, even if it be a large one; and even the oldest and bravest of crows will depart precipitately should one of its lightning flashes fall on him. The second plan, although a terror to crows, is especially well suited to fields subjected to the inroads of

small birds and even chickens. It involves an artificial hawk made from a big potato and long goose and turkey feathers. The maker can exercise his imitative skill in sticking the feathers into the potato so that they resemble the spread wings and tail of the hawk. It is astonishing what a ferocious-looking bird of prey can be constructed from the above simple materials. It only remains to hang the object from a tall bent pole, and the wind will do the rest. The bird makes swoops and dashes in the most headlong and threatening manner. Even the most inquisitive of venerable hens has been known to hurry rapidly from its dangerous vicinity, while to small birds it carries unmixed dismay.

Singular Explosion.

Mr. J. M. Krapp, foreman at Pioneer Tunnel, St. Louis, Cal., in commenting on our account of the explosion of a bucket of water, published on page 81 of our current volume, states that a similar accident happened in the works under his charge. Cartridges of Hercules powder are there usually stood round a bucket of hot water to thaw them out, as they cannot be exploded when frozen; and a helper put a bucket

A New Mode of Hospital Disinfection.

Dr. John Dougall, of Glasgow, Scotland, has recently made the important discovery that, when organic matter undergoes decomposition in the presence of an alkali, the putrefactive process is induced, and that this takes place much more readily than when organic matter undergoes decomposition in the presence of a neutral substance; but when organic matter undergoes decomposition in the presence of an acid, the fermentative process is induced, accompanied by a not unpleasant moldy aroma and innocuous products. These conclusions Dr. John Day, of Geelong, Victoria, has been led to consider with relation to their bearing upon the outbreaks of pyæmia, erysipelas, and puerperal fever in hospitals, and he reaches the opinion that such diseases may directly be traced to the alkaline walls, alkaline ceilings and alkaline floors (the latter rendered alkaline by soap) with which the patients are environed. Such diseases hitherto, we may remark, have been considered due to ferments in the air, to bad ventilation, to uncleanness, and even to the poisoning of walls by organic effusions; and various plans have been suggested for their prevention, among which were coating the walls with silicate of soda and even with solid sheets of glass.

Dr. Day's plan, however, differs from any yet broached, and we take a description of it from a pamphlet for which we are indebted to him. The philosophy of the method is the generation of peroxide of hydrogen. All substances which spontaneously generate this at the same time require an acid reaction. On the other hand all alkalies destroy peroxide of hydrogen, and, when added to those substances which spontaneously generate it, prevent its formation. Thus it would seem that acids are the natural allies of peroxide of hydrogen, for they are not only simultaneously generated, but

they give it stability and act in concert with it as deodorisers and disinfectants.

In order to generate the peroxide, and at the same time to abolish the alkaline surroundings, Dr. Day proposes to rub hospital walls smooth and coat them with a varnish composed of paraffin and oil of turpentine; or they may be covered with silicate paint and then rubbed down and varnished. The floors he brushes over with equal parts of gasoline and boiled linseed oil, to which a little benzoic acid has been added, and, when dry, polishes them with a thick paste composed of beeswax and turpentine, with benzoic acid added in the proportion of 2 drachms to the pound. Boards prepared in this way, he considers permanently disinfected. The gasoline, linseed oil and oil of turpentine all get imbedded in the wood and generate peroxide of hydrogen; the benzoic acid is added on account of its great power of destroying all the forms of lower organic life, and the wax is of course used for the purpose of combining these substances and affording a polish.

An excellent sedative water for external application, for bruises or aches of any kind, is composed of ammonia 2 ozs., tincture of camphor 2½ drachms, common salt 2 ozs., and water 2 pints. Mix and dissolve without heat. This is largely used in France, and is sold this country under a patent medicine name. It is an excellent liniment for cattle when strengthened by the addition of 10 drachms more ammonia.



ALLOWHILL STREET BRIDGE, PHILADELPHIA, PA.

of cold water (an iron bucket, we presume) on the fire, when a violent explosion took place. It is surmised that a portion of the powder may have adhered to the bottom of the bucket. The former accident may have arisen from a similar cause.

Electricity as an Aid to Egg Hatching.

The *Ostereische Landwirtschaftliche Wochenblätter* states that Dr. Virson, Superintendent of the Italian experimental silk farm at Padua, has discovered that the hatching of silkworm eggs, of suitable age, may be accelerated by a period of 10 or 12 days, and a yield of at least 40 per cent of silkworm caterpillars secured, by exposing the eggs to a current of negative electricity from a Holtz machine for a space of 8 or 10 minutes. It is suggested that the same method might perhaps prove useful in promoting the hatching of hens' eggs and in hastening the germination of various seeds. — *Quarterly Journal of Science*.

A Solar Phenomenon.

Mr. James Cassidy, of the United States Signal Office, Milwaukee, Wis., reports the occurrence, on March 18, of a remarkable exhibition of parhelia or mock suns, lasting from 2:30 P. M. to 3:10 P. M. The sky was covered with a whitish haze, and the prismatic colors on one of the parhelia were well developed. The other parhelia moved away from the sun in a circular direction towards the west, and continued to do so till it faded away.

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Laundry Blue.

A good washing blue is made as follows: Make a solution of prussiate of potash, 2 ozs., and another of protosulphate of iron, 1 oz.; add the second gradually to the first, until the precipitate almost ceases to fall, then strain through linen, add water, add continue the washing until the blue color begins to dissolve in it, when it may be at once dissolved in distilled water and dried.

THE PRACTICAL EFFECTS OF PHYSICAL STRAIN.

Dr. B. W. Richardson, in his recent admirable work on the "Diseases of Modern Life," devotes a chapter to a subject to which we have repeatedly alluded, and to which, in view of the athletic competitions to occur during the Centennial, the attention, not only of those in training for such contests, but of those who favor athletic sports in all forms, may well be directed. We mean disease induced from physical strain, physical overwork in short, which too often reduces the fairest specimens of muscular humanity to abject wrecks. Dr. Richardson brings to the consideration of this important topic a variety of new thoughts and suggestions, and these all tend to show, first that excessive physical culture is useless, and second, that it is hurtful. The first question which he places before us is: "Do these arts contribute to the health and vitality of a race, either collectively or individually: that is to say, are they necessary in order that a race may obtain the means of subsistence, and (whether necessary or unnecessary) do they contribute to the longevity and tenacity of the life of the men or race through whom or through which they are represented? He first points out that, in a nation so uncivilized as to be obliged to trust to individual force alone for its means of life, no physical culture can be too high or too highly prized; then he shows that in a later age, when none but brute power is at man's service, the predominance of the physical over the mental faculties is still natural. But finally, removing the doctrine of necessity and separating the individual from the community, the picture is reversed. There is no evidence anywhere, he asserts, that the greater culture of the physical strength has favored the longevity of the individual or the vital tenacity of a race. All the observations handed down to us by the physicians of the Greek, Roman, Arabian, and Italian schools, reinforced by the vital statistics of modern France and Prussia, point unmistakably to the fact that in each country, within its own population, the value of life is influenced to the favorable side by the reduction of physical expenditure. A most curious instance is afforded in the history of the Jewish race, in which as a people there has never been a vestige of studied development of physical capacity. And yet the broad truth stands forth that, despite centuries of oppression and suffering, the Jewish is the first in vitality of all civilized races. Dr. Richardson gives a quantity of statistical information supporting this assertion, showing that the period of life among Jews is considerably longer than among a like number of Christians, and the causes, he says, are simply summed up in the term "sobriety of life."

It is not difficult to find answers to the question: "In what manner does overwork of a physical kind injure or kill?" During life the forces by which the life is manifested are balanced against time. The active animal machine must rest and recruit; time, an absolute immateriality, flows on unceasingly, destroying as it flows silently and surely. Again, the powers or forces of the body are limited by the size and capacity of the organism. If the force put forth in a certain period be greater than that which ought to be put forth in that period, the extra force is expended at the expense of the organism itself, and, by so much as is lost in any present effort, will be so much shortened in the future. For the body is not constituted to make up time against the slightest breath of force it has once lost. Were it so, the problem of renewal of life would be solved.

Generally speaking, physical overwork injures by the destruction of those parts of the body on which the involuntary acts of life depend, namely, the muscles and nervous structures engaged in the digestion of food, the circulation of blood, and the respiration. When these organs fail, every other portion of the system dependent on these likewise succumbs. The particular characteristics of the changes induced, and of the work itself which induces such changes, are by no means complicated; and such as are noted by Dr. Richardson are well worth examination, since they are the results of his own matter-of-fact observation.

The first disease mentioned is aneurism of the aorta, the large blood vessel which rises from the left side of the heart to convey arterial blood to the body. Its cause is a simple mechanical result. The heart during violent exertion (as in rowing sprints), working at high pressure, drives ahead a current of blood which, instead of making its course in steady circuit through the aorta, is brought back by concussion, and falls like a water hammer at the place where the semi-lunar valves prevent its return to the heart. This mechanically injures the wall of the artery, which loses its elasticity; and eventually the resilient tube becomes a passive pouch, ready to give way upon some extra exertion, to let out the contained blood and so cause instant death. In four cases, the author has found life terminated in this way.

The second injury is wearing out of the heart. This is common to persons who practice physical exertions, not violently but persistently. The right ventricle of the heart, which maintains the circuit of blood through the lungs, is much thinner than the ventricle on the left side, which carries the blood over the body. If this ventricle, which drives some 18,750 lbs. of blood in twenty-four hours, be overtaxed, it must necessarily weary; and as the heart not only supplies the rest of the body but also itself with food, it follows that, if it fails to supply the body, it fails to supply itself. This enfeeblement is very gradual. It begins to show itself by slight difficulties in breathing, susceptibility to fatigue, to cold and heat, to congestion of the lungs, and finally to actual organic changes of the lungs, kidneys, or nervous centers, or congestion of the venous side of the body, leading to dropsical effusion and resulting in death.

A third disease is just the reverse of the preceding, and is due to the heart becoming too powerful. Its muscular structure is unduly developed on both sides, its stroke is too

severe, and, if the nervous power by which it is governed be not proportionately balanced, it becomes intermittent in its work. These conditions follow closely upon boat and foot races and all fierce competitive exercises. Of the undue action of the organ, the affected person is painfully conscious, the breathing is oppressed, the muscular tone decreased and the end of all is premature disorganization of remote organs and comparatively early death.

"By skillful training," says our author in conclusion, "it is quite true that men may be and are brought to a fine external standard; but the external development is so commonly the covering of an internal and fatal evil that I venture to affirm that there is not in England a trained professional athlete of the age of thirty-five who has been ten years at his calling who is not disabled. He may hold on sustained by a will which cannot bend to defeat; he may win bravely; then win, and only just win; then tie some new antagonist; then lose and, urged by friends whose ardor is damped, retire, but he will soon die. The falling off which has been observed by patrons or admirers before actual failure means not want of skill nor stiffness of joint, but actual overwork, worn-out heart and blood vessels; it means, in fact, now a race for life rather than for fame."

THE VALIDITY OF PATENTS.

The inexperienced purchaser of a patent does not generally appreciate the importance of having its claims examined, and their validity and scope defined by some person experienced in such matters, before parting with his money. It is not unusual for the assignee, just as he is commencing the manufacture of articles under his recently purchased patent, to find that it is an infringement upon some previously issued patent, and that he has not only made a worthless investment, but that he is likely to get mulcted in damages if he proceeds with his manufacture. Cases are continually coming to our knowledge wherein parties have made purchases in good faith, and paid considerable sums of money on the assurances of the patentee and a mere glance at the patent, presuming that all that the drawing of the invention showed was protected by the claims, when, in fact, the point covered was almost infinitesimal. Another manner in which purchasers are sometimes deceived is that the claims, although broad enough and worded properly to cover the invention, contain a single element protected by some prior patent, which covers the very part in the new machine which is necessary to insure its efficiency. The Howe sewing machine patent illustrates this. It protected but little that any of the manufacturers cared to use, except the one small part essential to all sewing machines; and all manufacturers had to pay Howe a royalty, and he derived from that apparently trivial item an immense income.

We therefore recommend any person who is about to purchase a patent, or about to commence the manufacture of any article under a license, to have the patent carefully examined by a competent party, and to have a research made in the Patent Office to see what the condition of the art was when the patent was issued. He should also see that the claims are so worded as to cover all the inventor was entitled to when his patent was issued; and it is still more essential that he be informed whether it is an infringement, as above suggested, or not. Parties desiring to have such searches made can have them done through the Scientific American Patent Agency, by giving the date of the patent and stating the nature of the information desired.

WHAT THEY SAY ABOUT US.

We should be lacking in appreciation of a great deal of kindness did we not occasionally acknowledge a few at least of the good wishes and compliments which our labors call forth. It would be impossible to publish all or even a tithe of our correspondents' good opinions; but the limited number which we make room for may be taken as samples indicating the drift of all. A writer, to whom *Wrinkles and Recipes* has been sent as a premium, says: "I do not send you clubs to be rewarded for it, but I feel it a duty to distribute the SCIENTIFIC AMERICAN among my fellow men, because they cannot benefit themselves any better for the money, and nobody ought to be without the paper." And we, let us add, also feel it a duty, when any one kindly promotes our interests likewise, to serve his, and certainly we can do so in no better way than by presenting him with such valuable works of practical and useful information as the *Science Record* and the volume above named, or with so fine a work of art as "Men of Progress." Apropos of this engraving, another writer, who has received it as his premium, says: "Your beautiful engraving 'Men of Progress' came to hand: I am very grateful to you for your kindness, and I will do all in my power to promote the circulation of the SCIENTIFIC AMERICAN."

The SCIENTIFIC AMERICAN SUPPLEMENT is likewise meeting a wonderful share of public approbation. Speaking of the excellent series of illustrated articles on mechanical drawing, now in progress of publication, one writer considers them "worth much more than the subscription price of the paper;" and he adds: "While the SUPPLEMENT is so fine, it in no way lessens the value of the SCIENTIFIC AMERICAN." It enhances the worth of the older journal, we might continue, because, through the large accession of space gained by its pages, we are enabled in both journals to present not only a wider range of valuable information, but to treat the same more elaborately and completely than otherwise would be practicable. One more notice, this time from our excellent illustrated contemporary *In Door and Out*, and we terminate this tax on our modesty. "The SCIENTIFIC AMERICAN," says the editor, "like wine, has gradually grown better and better in its field of usefulness, and today has a circulation

probably exceeding the combined subscription lists of all mechanical journals in the country." (Let us interrupt to say that it is a fact that the circulation of the SCIENTIFIC AMERICAN and SUPPLEMENT combined is unquestionably larger than that of all other mechanical journals in the world.) "We have read its pages for years, but never with greater satisfaction than the present volume No. XXXIV. To the mechanic it is really indispensable, while it is valuable to everybody."

DEATH OF THE MILLIONAIRE MERCHANT.

The recent death of Mr. A. T. Stewart, the great dry goods merchant of New York city, on April 10, has called forth from a large number of people a variety of curious and often striking anecdotes relating to his early life and struggles, as well as to his habits after he had attained his enormous wealth. Perhaps not again in this generation will any one man accumulate by legitimate trade so immense a sum as he acquired; and it is a natural curiosity which prompts all to examine closely those traits, customs, and habits through which the great fortune was amassed. Mr. Stewart was born in Belfast, Ireland, in 1803. His parents were well-to-do people, but died while he was quite young, leaving him under the care of his grandfather. He was well educated, and had begun to prepare for the ministry, when his grandfather's death caused him to change his plans, and at the age of 20 to embark for America. Here he started as a school teacher, and was pursuing that calling when he lent a small sum to a friend who desired to open a dry goods store. The friend failed, and Mr. Stewart, partly from a desire to enter trade, and partly in order to protect his investment, took charge of the store. Soon after, he returned to Ireland to obtain his patrimony, some \$3,000, and this he laid out in cotton trimmings for dresses, which were then very fashionable in New York. In Belfast he purchased the goods at some two pence sterling a pound, and afterwards sold them in this city at two shillings a pound, and this stroke of success, he always stated, convinced him "that money could be made in the dry goods business." Of Mr. Stewart's honest and rigidly fair dealing in the little store in which he began, there are abundant stories. "What do you mean by saying what you know to be untrue?" he once angrily demanded of a clerk who was exercising all possible powers of persuasion to convince a woman that the colors in a piece of calico would not fade. "The calico won't wash; she'll demand her money back, and she'll be right. I don't want the goods represented for what they are not." It was this perfect honesty toward all his customers that was Mr. Stewart's most prominent characteristic, and it was his invariable custom, when questioned as to his explanation for his great success, to reply with great emphasis: "Truth, truth is the talismanic word; and if I have one earthly wish or desire greater than another, it is that in this respect my example may be commended and followed by young men entering into business, and especially by young merchants."

On this firm basis of truth and honesty he reared his gigantic transactions: not by bold ventures or colossal speculations, but through steady application, perfect organization, and minute attention to every detail. The discipline in his establishment was rigid. "Do you see all these people about here?" he once asked of Mr. Peter Cooper, pointing to the scores of busy salesmen and ushers in his great retail store. "Well, there isn't a man of them who is allowed the slightest discretion. Every one is taught to do precisely and simply what he has been told. He is a machine working by rote and according to rule." Hagging over prices was to him an especial abhorrence. There was but one price for everything and everybody; but on the other hand he was no believer in holding for high prices, when by lower ones he could realize promptly. An old employee of his recently told us that Mr. Stewart seemed to watch each individual class of goods "as if his fortune depended on them only." If in making his rounds through either store, he noticed an unusual quantity of any material on hand, he would question the salesmen closely about it; and if he found its sales slow, he would mark down the price to such figures that its very cheapness would attract customers. It is said, moreover, that he knew the contents of his warehouses better than those in his employ; while he watched the latter much more closely than they ever imagined. If he saw too much jewelry worn, he deemed it a suspicious sign, and placed the wearer under special surveillance. "He never spoke to me but once," says an old clerk, "and then it was when I tore a piece of wrapping paper roughly across. He came and told me that I should have folded it and made even edges. People," he said, "didn't like to get shiffted bundles." At another time, a clerk wound a package with an extra turn of cord. Before he could cut the string, Mr. Stewart quietly took the bundle from him and unwound the extra turn, saying: "Never waste even a piece of string; waste is always wrong."

The principles illustrated by these brief anecdotes carried him from the possession of the humble little store to that of his magnificent buildings on Broadway in New York, to emporiums in Boston, Philadelphia, Paris, Lyons, Manchester, Berlin, Glasgow, Chemnitz, Belfast, and Nottingham, and to mills in various parts of the United States.

Gigantic as was the business he controlled, Mr. Stewart likewise managed real estate operations of sufficient magnitude to be a life's work for an ordinary man. In New York city alone, he was the absolute owner of over one hundred pieces of improved property, free from encumbrances and valued at about ten millions of dollars. This magnificent estate included, besides his two stores, two theaters, the Metropolitan Hotel, the Working Women's Home (an im-

mense iron building on Fourth avenue), his superb marble residence on Fifth avenue, the finest private dwelling in the country, besides dwellings and stores scattered in the most desirable quarters of the city. In Saratoga, he owned the enormous Grand Union Hotel. Probably his greatest real estate scheme was the founding of Garden City on Long Island, a work of genuine philanthropy undertaken in order to supply cheap and good homes for those unable to pay high New York rents. He bought a tract of land on Hempstead Plains, ten miles long and one mile wide, and built a city as he would a single house. Gas and water works and a railroad to New York were begun with the foundations of the houses; and when some forty fine dwellings were complete, he offered to rent, not to sell, them at prices ranging from \$1,200 to \$250 per year, and only a few weeks before his death he contracted at one time for thirty new houses.

Personally Mr. Stewart was of a retiring disposition, free from the ostentation which might legitimately follow the possession of such vast wealth; and while philanthropic and charitable, he was inclined to temper his benevolence with prudence. Miscellaneous appeals for charity he heeded little; but on the other hand, cases recommended to him by those in whom he had confidence met bountiful attention. With seven thousand employees to control, rigid impartiality and discipline was a necessity; but outside the business connection, there were many who felt his aid in time of need and suffering. The world knows nothing of such good works, for he was the last to publish them. It is reported that he was inclined to superstition, and was a firm believer in Baron Rothschild's maxim: "Never have anything to do with an unlucky man;" but the many anecdotes based on this are hardly reconcilable with his character. An educated man himself, he possessed an educated man's taste. He used to say that, if ever he retired from business, he would "go to school," for he loved study for its own sake, and in the midst of all his concerns he found time to keep up his knowledge of classics and the languages, and to read his fifty lines of Homer or Virgil in the morning before going to his office. He was a liberal patron of the arts, and some of the most celebrated of modern paintings are in his private gallery. It was he who recently paid \$60,000 for a single picture by Melissouier, and in the same apartment are works by Rosa Bonheur, Zamacois, Gérôme, and other great artists, besides statuary, the whole valued at half a million dollars.

Mr. Stewart has, by his will, bequeathed the whole of his immense property to his wife, with the exception of a number of small bequests to relatives, old employees, and servants, and the magnificent legacy of \$1,000,000 to Judge Hilton, his counsel, business manager, and adviser. No reference is made in the instrument to any appropriation of money to public purposes, save a recommendation to Mrs. Stewart to carry out such charitable undertakings as the testator had begun.

Mr. Stewart's death is a public loss. Few men could have controlled his vast wealth so as to benefit the public as he did; for apart from the direct advantage occurring to all from his colossal business, there stands the grand example of honesty, industry, and perseverance, crowned with a reward gigantic beyond all precedent.

ANIMAL PARASITES.

Professor Van Beneden, of the University of Louvain, France, has recently written an interesting little work entitled "Animal Parasites and Messmates," in which he has contrived to compress a great deal of curious information regarding a subject much more extended than the reader not versed in modern progress of natural history would suppose. He divides the strange creatures of which he treats into three classes: first, messmates, or those who join others to obtain a living or a home or protection; second, mutualists, or animals which live on each other without being either parasites or messmates, and third, the parasites, whose profession it is to live at the expense of their neighbors, and whose only employment consists in taking advantage of them, but prudently, so as not to endanger their lives.

While it would be impossible here to follow the writer in the numerous distinctions which he draws among the members of these different classes, it will perhaps prove interesting to note a few of the most odd and novel peculiarities of the creatures belonging to each. There is a fish, he tells us, called the *holothuria*, which is a living boardinghouse for the *flaserfer*, an eel-like animal. The latter is lodged in the digestive tube of his companion, and, without any regard for the hospitality which he receives, seizes on his portion of all that enters. The angler or *beudroie* of the Mediterranean often harbors, in the bronchial sac, a kind of eel, which is abundantly able to take care of itself, but prefers to live a life of idleness and share its host's spoils. The shark is accompanied by the pilot fish, which does not, as is often reported, exist on the leavings of his larger companion, but on his own industry, and doubtless finds some advantage in piloting his neighbor.

Another remarkable fish, the *remora*, literally moors itself to the body of the shark, thus converting the latter into a vehicle which carries him about without exertion on his part. When he becomes hungry, he lets go and hunts for prey wherever he may happen to be. This tenacity of the remora in attaching itself is taken advantage of by the fishermen of Mozambique Channel, in order to capture turtles and large fish. They pass through the tail of the remora a ring to which a cord is attached, and then send it in pursuit of the first passer-by which they consider worthy to be caught. The fish holds on to its prey so firmly that it only remains to haul victim and captor in by the line.

There is a crab, of the family of the *majda*, which conceals itself in the substance of a polypidom; it is common in

the Viti Islands, in company with a gastropod mollusc, and both of them assume the exact color of the polypidom. This is a new kind of mimicry. Another crab appropriates a sea anemone to form a living cloak to hide it from view, in order that it may spring out from its ambush to attack prey. Remarkable marine creatures are the *birgi*, a kind of crustaceans which grow very large, and conceal their abdomens no longer in a shell, but in the crevices of rock. In the East Indies they remain on land, and even climb trees. They have so much strength in their pincers that it is related that one, while stretched on the branch of a tree, "raised a goat by the ears." A family of isopods are rather dangerous messmates, it would seem, for they cut into the walls of their host's stomach and live like Sybarites on its contents.

The most interesting fixed messmates are the *cirrhipedes*, which cover the skins of whales, which they never quit after once choosing their abode. Each whale lodges a peculiar species; so that the crustacean messmate is a true flag, which indicates, in some respect, the nationality. It would not be without interest for voyagers who are naturalists to study these living flags.

Among the mutualists may be mentioned the ticks, one generic division of which has twenty species, one of which lives on the dog, another on the cat, and another on the ox. Fishes harbor crustaceans instead of ticks, and these sometimes multiply so rapidly that they cover their host as though they took the place of scales. The cod gives lodging to a species of very beautiful shape, which in its turn affords a resting place for a still smaller organism. In the midst of the eggs of the lobster, there lives an animal of extreme agility, which our author considers the most extraordinary being ever subjected to the eyes of a zoologist. "Let us," he says, "imagine a clown in a circus, with his limbs as far dislocated as possible, displaying tricks of strength and agility on a heap of monster cannon balls which he struggles to surmount: placing one foot formed like an air bubble on one ball, the other foot on another, alternately balancing and extending his body, folding his limbs on each other, or bending his body upwards like a caterpillar: and then we shall have but an imperfect idea of the attitudes which it assumes, and which it varies incessantly."

There is no organ which is sheltered from the invasion of parasites; even in man, *cysticerci* have been found in the interior of the lobes of the brain, in the eyeball, in the heart, and in the substance of the bones, as well as in the spinal marrow. Each kind of worm has also its favorite place; and if it has not the chance of getting there, in order to undergo its changes, it will perish rather than emigrate to a situation which is not suitable to it. One kind of worm inhabits the digestive passages; another occupies the *fossa* of the nose; a third, the liver or the kidneys. Each animal has its proper parasites, which can only live in animals having affinity to their peculiar host. Thus the *ascaris mystar*, the guest of the domestic cat, lives in different species of *felis*, while the fox, so nearly resembling in appearance the wolf and the dog, never entertains the *tania serrata*, so common to the latter animal. The same host does not always harbor the same worms in different regions of the globe. Thus the large tapeworm of man, called *bothriocephalus*, is found only in Russia, Poland, and Switzerland; a small tapeworm, the *tania nana*, is observed nowhere except in Abyssinia, and, strange to say, the natives consider their absence from the body a sign of ill health; the *anchylostoma* is known only in the south of Europe and the north of Africa, the *filaria* of Medina in the east and west of Africa; and the *Bilharzia*, a terrible worm, has been found only in Egypt.

SCIENTIFIC AND PRACTICAL INFORMATION.

THE STARTING OF THE GREAT ENGINE AT THE CENTENNIAL.

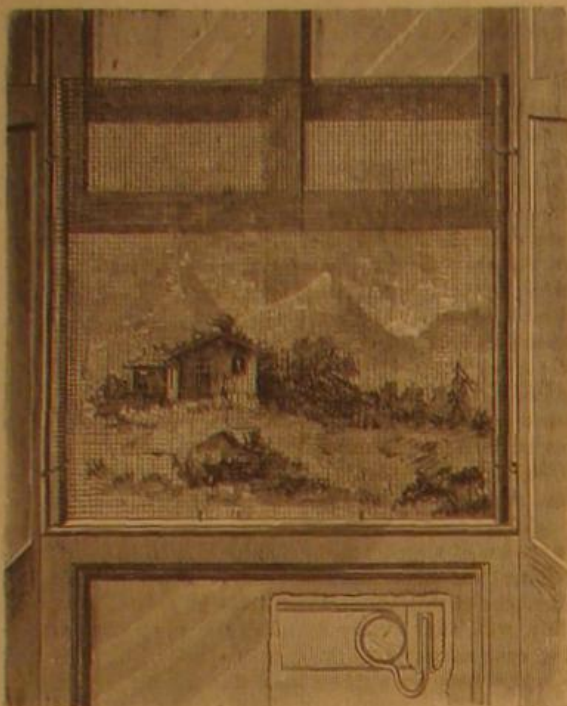
Pursuant to the terms of the contract between the Centennial commission and the builder of the Corliss engine which is the principal motor at the Exposition, the great machine was started running on April 10. Steam was generated in four of its twenty boilers; and when a pressure of fourteen pounds was reached, everything was in readiness to open the throttle. Director General Goshorn stationed himself between the two cylinders, gave the signal, and the immense walking beams slowly began to move. The operation is quite noiseless and easy, despite the huge dimensions of the engine; and the builder may be congratulated on the successful completion of a work creditable alike to himself and to the Exposition.

EFFECT OF THE SEASONS ON THE BODY.

The curious fact has recently been pointed out by Dr. B. W. Richardson that the changes of the seasons have a potent physical influence upon the body. Some years ago, in a convict establishment in England, a number of men were confined amid surroundings (of clothing, room, food, etc.) practically the same for each individual. The medical superintendent of the jail undertook investigations, extended over some nine years, and during which over 4,000 individuals were weighed. It was found that during the months of winter the body wastes, the loss of weight varying in increasing ratio: that during summer, the body gains, the gain varying in an increasing ratio: and that the changes from gain to loss and from loss to gain are abrupt, and take place, the first at the beginning of September, and the second at the beginning of April. This is shown in the following figures, indicating the ratio of loss or gain: Loss: January 0.14, February 0.24, March 0.95. Gain: April 0.03, May 0.01, June 0.59, July 0.08, August 0.70. Loss: September 0.21, October 0.10, November (exception) a slight gain, December 0.03.

IMPROVED WINDOW SCREEN.

The annexed engraving represents a wire cloth screen, which is adjustable without alteration to windows of differing widths. It is an efficient guard against the ingress of flies, mosquitoes, etc., is durable, and not costly. It consists of a broad band of wire cloth secured to rollers as shown.

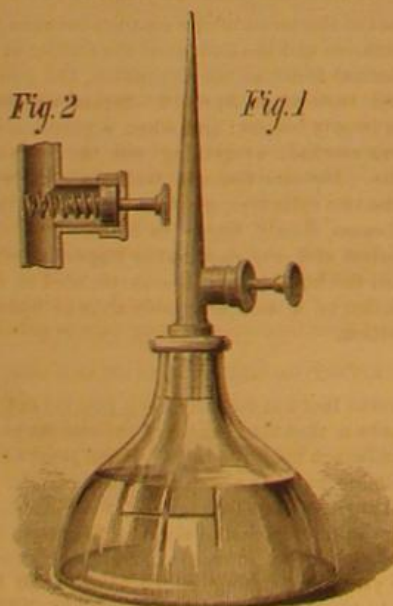


These rollers, about which the cloth is wound so as to adapt it to the width of the window, are held in place by two brass wire clasps, arranged one on each side, and constructed as represented in the sectional view below. On large windows four such clasps would be used. The shanks of the clasps are inserted in closely fitting metal sockets, which last can be easily placed in the window casing by the aid of a gimlet or bradawl. The device is exceedingly simple and very easily adjusted.

Patented November 16, 1875. For further particulars regarding sale of patent or portions of the same, or relative to purchase of screens, address W. D. Walbridge, 322 Degrav street, Brooklyn, N. Y.

IMPROVED OIL CAN NOZZLE.

We have occasionally directed the attention of inventors to the fact that some simple adaptation of a glass bottle, so as to render it utilisable as an oil can for sewing machines, is needed, since such a device would probably diminish the cost of the oiling apparatus, and at the same time would admit of selling the oil in the bottle from which it subsequently would be used. Mr. R. H. Hasenritter, of Herman, Gasconade county, Mo., has recently contrived a neat little arrangement for the above purpose, which seems to answer the requirements satisfactorily. The bottle itself may be made in the usual oil can shape, shown in our engraving, Fig. 1, or after any other pattern, since the means of forcing out the oil lies in the nozzle, which is easily inserted in the mouth of the vessel. The inventor simply forms, on an ordinary nozzle, a little cylinder, in which he places a piston sustained by a spiral spring, as shown in the section, Fig. 2. The bottle having been turned so that the oil will run into the nozzle, by pressing slowly down upon the piston the oil is caused to run out gradually, or by a sudden push it is made to escape in a jet or stream.



The inventor points out that the device may be used on any kind of oil can now employed in shops, and may prove an advantageous substitute for the usual spring bottom, which is difficult to repair when injured. By making a screw thread on the end of the tapering nozzle, it can be applied to metal vessels having different sized mouths; and thus the nozzle, being complete in itself, can be manufactured for the market independently of every bottle or can. To adapt it for bottles, it is of course only necessary to wind packing about the screw thread so as to cause a tight fit. The inventor,

who may be addressed as above, desires to sell the patent in two parts—for glass oilers and for metal oilers, respectively. Patented February 29, 1876.

Temperature Fatal to Animals.

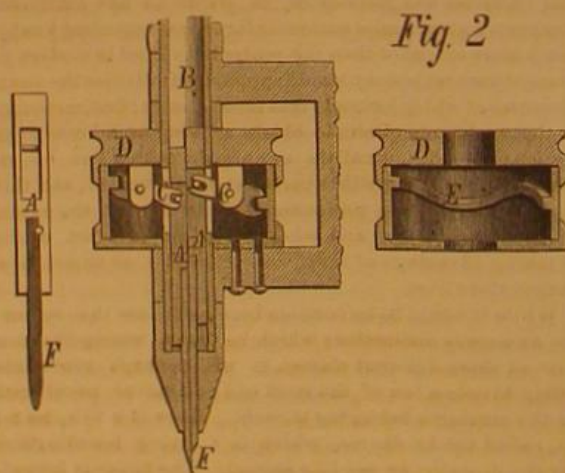
Dr. B. W. Richardson has determined, from observations on man and various other warm-blooded animals, that the increment of heat which proves fatal is from 11° to 12° Fah. above the natural temperature of the animal. In the human subject a steady elevation of temperature to 100° Fah. indicates fever; an elevation to 105° indicates danger; above that, great danger. At 109°, 11° above the natural temperature (98°), the condition is fatal.

ATCHISON'S ENGRAVING AND CHASING MACHINE.

In the accompanying engravings is represented a new machine for making engraved or chased groundwork on gold or plated jewelry, silver, silverplated, or washed ware. It can be applied as well to the lightest plated surface as to solid metal, and will produce beautiful matting, on gold rolled to the thickness of note paper. A perspective view of the apparatus is given in Fig. 1, and the working parts are exhibited in section in Fig. 2.



Two tool stocks, A, are arranged side by side in the hollow revolving mandrel, B, so as to slide up and down freely while being rotated. At C are levers suspended by hangers from the pulley, D, which turns the mandrel. These levers are each connected at one end with a tool stock, and at the other embrace the cam ring, E, which is within the casing. As the pulley revolves, the tool stocks are caused to move up and



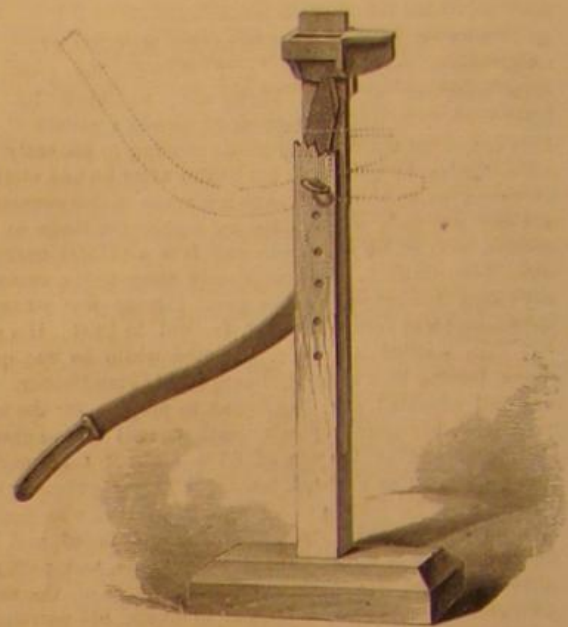
down, so that the tools, F, have a reciprocating as well as a rotary motion. The mandrel is mounted in a bearing attached to a stand, and has guide pulleys, as shown, for leading the belt from above to the horizontal pulley. The engraving tools are easily fitted into and removed from the stock, so that they may be changed in accordance with the kind of work to be executed.

The groundwork is produced on the metal with great rapidity, the tools delivering 5,335 cuts per minute, and the apparatus can be attended by a child. As the sale of jewelry and silverware depends almost entirely upon the ornamentation, it need hardly be added that a machine of this description, making a very excellent imitation of handwork, is one of considerable economical value to the jeweler and plate manufacturer. We are informed that the machine produces fourteen styles of ground work, claimed to be superior to satin, or pearl, or sand blast finish in depth, durability, and beauty. It is also adapted to wood carving, especially for panel work and for the routing of engravers' blocks.

Patented through the Scientific American Patent Agency, March 14, 1876. For further particulars relative to purchase of patent, address the inventor, Mr. R. R. Atchison, Room 8, 388 Washington street, Boston, Mass.

VIBERT'S IMPROVED LIFTING JACK.

Mr. F. C. Vibert, of Hockanum, Connecticut, has patented (November 17, 1874) a simple form of lifting jack, which, while an efficient and useful implement, can be made and sold at a very cheap rate. The standard is of oak, and is fixed above to receive the curved cast iron handle, which is



secured by an adjustable pivot. The upper part of said handle is rounded, and takes against a similarly formed portion of the lifting step, as indicated by the dotted lines. This arrangement of parts is one well calculated to apply the leverage of the handle at great advantage, so that, light and simple as the device is, very heavy weights can readily be lifted by it. When the step has reached the summit of the standard, the extremity of the handle steps under it, as shown (the parts being broken away for the purpose), so that the handle forms a firm support for the load. For further information, the inventor may be addressed as above.

Stencilling Materials for Painters' Use.

Stencilling is an art by which the painter can execute ornamental work very quickly. The articles required in making a stencil are a sheet of well sized writing paper, a lead pencil, and a sharp penknife. Fold the paper, allowing the edge of the fold to form the center of the pattern, then draw any desired design, leaving bars to hold the parts together. Place the paper upon a piece of glass and cut out the figure with a penknife. The tool used is a camel's hair brush with hair not over one half inch long, bound with quill and wire on a round wooden handle. The small sizes are preferable. Color mixed with vinegar and sugar will be found best. The paint must be quite thick, and a small quantity only must be taken on the brush, and then well rubbed out on a dry plate before applying it to the work. Placing the stencil on the panel as desired, hold it down firmly, and rub over with the brush carefully until the cut portions of the figure are well coated. Then lift off the stencil and the work is completed.

IMPROVED ADJUSTABLE PIPE TONGS.

The novel feature in the improved pipe tongs herewith illustrated is the means of adjusting the movable jaw by the use of the pivoted bar and set screw represented. The arrangement of parts will be clearly understood from the engraving, so that further description is unnecessary. The tongs will perform all the ordinary duties of the implement in gripping pipes and studs, and is especially adapted for brass or other pipes which are liable to be injured by tongs of the usual construction. From the peculiar formation of the jaws, the present device holds the pipe without flattening or cutting it. It will readily be seen that the mechanical movement governing the jaws is such that they will hold without slipping, even, it is claimed, when worn or dull.

Patented through the Scientific American Patent Agency, September 25, 1875. For further information address Macdonald, Box 377, Halifax, Nova Scotia.

MESSRS. HENRY DISSTON & SONS, of Philadelphia, Pa., once said that they would sell American saws in Sheffield, England, and they have carried out their determination by filling orders received from Sheffield for small lots, while orders from Liverpool, England, for quantities up to 100 dozen, have been filled by them. They have received an order for saws for Japan, the Japanese workmen having minutely examined the temper and quality of the steel. This order has been followed by one for 2,000 plane bits.



BROKEN STONE ROAD-MAKING --BLAKE'S CRUSHER.

As the present is the period of the year in which the building of new roads and the repairing of old ones are usually undertaken, the practical information below given, relative to road construction and to a standard machine for the crushing of stone for that purpose, will prove of timely interest. Road coverings, says General Gillmore in his recent treatise on "Roads, Streets, and Pavements," have for their object the reduction of the force of traction to the lowest practicable limit, at the least cost for construction and maintenance. They should be composed of hard, tough, and durable materials, laid upon a firm bed, or upon an artificial foundation from which water is excluded by suitable drainage. Roads, as distinguished from paved streets, may be classified with respect to their coverings as follows: 1. Earth roads. 2. Corduroy roads. 3. Plank roads. 4. Gravel roads. 5. Macadam or all broken stone roads. 6. Stone sub-pavement with top layers of broken stone (Telford). 7. Same, with the addition of gravel. 8. Stone sub-pavement with top layers of gravel. 9. Rubble stone bottom with top layers of broken stone, gravel, or both. 10. Concrete sub-pavement with top layers of broken stone, gravel, or both. With the six classes into which broken stone enters, we have only to deal; and before passing to a brief consideration of their relative modes of construction, we may refer to a standard machine for the crushing of stone which, for several years, has been in extensive use both in this country and abroad, namely, the Blake stone breaker, manufactured by the Blake Crusher Company, of New Haven, Conn.

As will be seen from the illustration, Fig. 2, the construction of the machine includes a massive pitman, F, which is caused to ascend and descend through the eccentric, D, on the fly wheel shaft. This motion of the pitman is applied

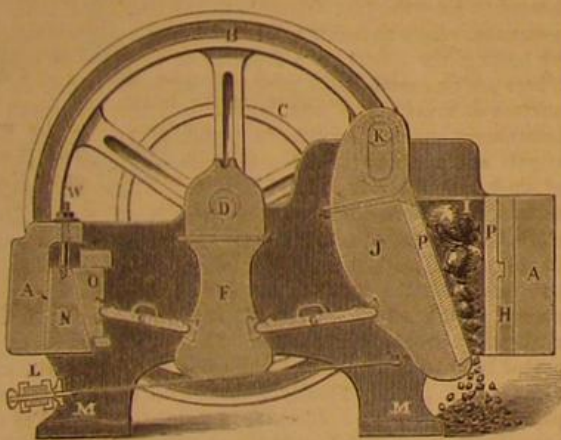


Fig. 2.—BLAKE'S STONE CRUSHER.—SECTIONAL VIEW.

to the toggles, G, one of which presses the movable jaw, J, toward the stationary jaw, H. The jaw, J, when the toggles relax their pressure, falls back, partly through the action of a spring, L. The stone is crushed between the jaws, to which the power is applied obviously to the best mechanical advantage. A method of locating the machine, while in use for breaking stone for road purposes, is represented in Fig. 1. It is placed with its driving engine upon a platform extending from a hillside, and is therefore easily accessible to carts loaded with the stone hewn from the quarry shown in

ground, but at a great disadvantage in the handling both before and after the crushing, while no means for an accumulation of the product is afforded. Generally, however, it is estimated that there is no way in which the machine can be so economically located and used as that above described. To the right of the platform is shown an apparatus for screening the product and separating it into two or more sizes. This is not a necessary part of the combination, and is sold separately; but in making macadamized roads it is desirable to use the screening device. The machine is constructed of solid castings of great strength, and such of its parts as are liable to wear out may be replaced without dif-

center to the sides. One and a half inches of good gravel forms the top layer. It is a good plan to rest the lower pavement on brushwood or fascines, especially where the soil is loose, in order to give a better support and to avoid ruts.

In localities where material cannot be obtained of sufficient toughness for the top layer of broken stone, the road may be finished with three or four inches of gravel, surmounted by a single top layer of stone obtained elsewhere; or if this plan prove costly, a second layer of gravel alone may be used.

To secure firmness and unity of mass on soft ground, a layer of rubble stones, varying in thickness from 3 to 5

inches, and in width and length from 8 to 10 inches, is sometimes used as a foundation to the Telford pavement. When the Telford plan is not followed, a good road can be made as shown in Fig. 5, in which there is a foundation of 6 or 7 inches of rubble to 10 inches of covering. Where motion of the foundation seems possible, the stones may vary in thickness from 3 to 6 inches, in width or depth from 6 to 9 inches along the middle of the road and in length from 8 to 18 inches. Even flat cobble stones can be used, mixed in with irregular fragments, and it is better to set the stones on their edges.

Difficulty is often experienced, in wet and elastic subsoils, in keeping a foundation of rubble stones firm and intact, and in preventing

the stones working up and destroying the surface. A remedy is found in the use of hydraulic concrete between the stones, as shown in Fig. 6. The largest stones are laid down side by side and firmly set. The concrete, in which the ballast should be composed of stone fragments not exceeding three quarters of an inch in longest dimensions, is well tamped in



Fig. 6.—RUBBLE STONE AND CONCRETE ROAD.

between the stones. If a thickness of 6 or 8 inches is secured in this manner by one course of stones, this will suffice, and the road may be finished in the usual manner with layers of broken stone or gravel.

The first important matter for a road contractor to consider is the requisite machinery for enabling him to fulfil his contract; and as the popular road of the present day is one in

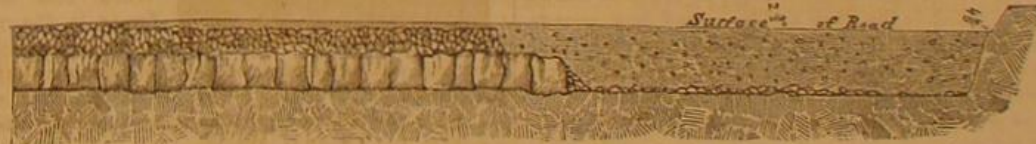


Fig. 3.—THE TELFORD ROAD.

ning with the light and ending with the heavy roller. Ruts must be carefully raked in as fast as formed. As soon as the surface is well compacted, a second layer of stone of like thickness, with gravel or earth at the wings, is applied and rendered solid as before. The top layer is spread and consolidated in the same manner. The roller should pass over every part of the surface, perhaps a hundred times, and if the weather be dry the materials should be kept damp by sprinkling carts. Finally, a binding layer, about one inch in thickness of gravel or the finest pulverized stone, should

which broken stone forms a great part of the material, many will be interested in knowing that the most important part of the machinery, necessary for making such roads, can be had of the Blake Crusher Company, New Haven, Conn.

The Decalcomanie Process.

The proper way to put on decalcomanie pictures, as ornaments for carriage panels, etc., is to varnish the pictures carefully with the prepared varnish purchased with them, with an ornamenting pencil, being sure to get the varnish on

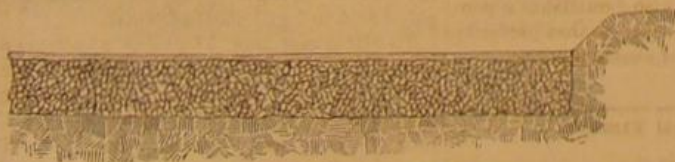


Fig. 4.—THE MACADAM ROAD.

the background. The loads are dumped in proximity to the breaker, and the carts proceed to the spout below, as represented. There they are filled with the broken stone as it escapes from the machine, and are at once driven off to the road bed. While this arrangement avoids considerable handling, still further may be saved by placing the breaker under the platform so that the rocks may be shoveled directly into the jaws, which come on a level with the dumping floor. It is not necessary to plant the machinery close by the ledges. Any point on the route, between the quarries and the streets to be paved, where a good accessible side hill is found, convenient for the erection of the works, will be equally advantageous. The crusher can of course be worked on leve-

be spread over all. When thoroughly consolidated, the finished road surface will not show any tendency to rise up and form a ridge in front of a 9 or 10 ton roller.

The Telford road, Fig. 3, is made with layers of broken stone resting upon a sub-pavement of stone blocks. The lower stones are set on their broadest edges lengthwise across the road, and for a 30 foot roadway are 7 inches deep. The interstices are filled with stone chips firmly wedged. The middle 18 feet is coated with 6 inches of broken stone, 4 inches being first applied and consolidated, and then the remaining 2 inches added. The paved spaces on each side of the 18 feet middle are coated also with broken stone, so as to make the whole convexity of the road 6 inches from the



Fig. 5.—ROAD WITH RUBBLE FOUNDATION.

the white paper. In a few minutes the picture will be ready to place on the panel, and the paper can be removed by wetting it. When thoroughly dry, it should be varnished like an oil painting. Be particular to purchase none of these transfer pictures except those covered with gold leaf on the back, when they are to be applied to dark grounds.

Speaking of sunflowers, the *Maryland Farmer* says: For absorbing malaria, and preventing diseases caused by malarial influences, for prime food for fowls, for a home remedy, sure and safe, for founder in your horses, and for market as a profitable seed to be sold for making oils, be sure to sow sunflower seed.

Correspondence.

Dividing Circles.

To the Editor of the Scientific American:

As there are very uncommon and odd numbers of teeth in some of the wheels of astronomical clocks, which cannot be cut by any common engine, it may be proper to show how to divide the circumference of a circle into any given odd or even number of equal parts, so that the number may be laid down upon the dividing plate of a cutting engine.

There is no odd number but from which, if a certain number be subtracted, there will remain an even number, easy to be subdivided. Thus, supposing the given number of equal divisions on the circle to be divided to be 69, subtract 9 and there will remain 60. Every circle contains 360°; therefore, as the given number of parts in the circle, which is 69, is to 360°, so are 9 parts to the corresponding arc of the circle that will contain them; which arc, by the rule of three, will be found to be 46.95°. Therefore, by the line of chords on a common scale, or rather on a sector, set off 46.95° with your compass, in the periphery of the circle, and divide that arc or portion of the circle into 9 equal parts, and the rest of the circle into 60; and the whole will be divided into 69 equal parts as required. Again, suppose it is required to divide the circumference of a circle into 83 equal parts; subtract 3 and 80 will remain. Then as 80 parts are to 360°, so, by the rule of proportion, are 3 parts to 13.01°; the small fraction may be neglected. Therefore, by the line of chords, with compasses, set off 13° in the periphery of the circle, and divide that portion or arc into 3 equal parts, and the rest of the circle into 80. Once more: Suppose it is required to divide a given circle into 365 equal parts; subtract 5 and 360 will remain. Then, as 360 are to 360°, so are 5 parts to 4.93°. Therefore set off 4.93° in the circle, divide that space into 5 equal parts and the rest of the circle into 360, and the whole will be divided into 365 equal parts, as was required.

I have often found this rule very useful in dividing circles into an odd number of equal parts, or wheels into odd numbers of equal sized teeth with equal spaces between them; and now I find it just as easy to divide any given circle into any odd number of equal parts as to divide into any even number. And, for this purpose, I prefer a line of chords on a sector to that on a plain scale; because the sector may be opened so as to make the radius of the line of chords upon it equal to the radius of the given circle, unless the radius of the circle extends the whole length of the sector, when it is opened so as to resemble a straight ruler, or scale, and this is what very seldom happens. Any person who is used to handle the compasses and the scale or sector may very easily, by a little practice, take off degrees and fractional parts of a degree by his eye, from a line of chords, nearly enough to the truth for the abovementioned purpose.

CAMBRIDGE.

The Legal Horse Power of Steam Boilers.

To the Editor of the Scientific American:

In your article on "Power of Steam Boilers," page 225 of your current volume, you seem to doubt the legality of my formula for horse power of steam boilers, and say that "it is certainly not legalized."

The unit of horse power was established by James Watt, and has since been legalized all over the civilized world, differing only slightly in different countries to accommodate different units of weight and measure; it is 33,000 minute footpounds, which is the same as 550 second foot pounds. My formula is based upon this unit, and is therefore legalized; but being transformed into power of evaporation, you do not recognize it to be the same as Watt's rule.

The power of the same volume of steam measured in the ordinary way through a steam engine will give precisely the same result as that by my formula, which has been tested on different boilers and engines by different engineers. The legalization of Watt's rule makes my formula legal, and the same rule can be expressed by a great variety of formulas. The English custom of referring equivalent evaporation from and at 212° has caused much confusion and discordance in steam engineering; but on the continent of Europe, the evaporation is referred to the temperature 32° Fah., and my conviction is that the latter is the proper point of reference.

Philadelphia, Pa. JOHN W. NYSTROM.

[We are still of opinion that no legal status has yet been given to Mr. Nystrom's formula for translating foot pounds into evaporation of water.—Eds.]

The Wisconsin Steam Wagon Reward.

To the Editor of the Scientific American:

The Wisconsin \$10,000 reward for a steam wagon is, I think, more likely to ruin many over sanguine inventors and mechanics than give them a fortune. To overcome all the obstacles mentioned is a mechanical impossibility.

I have had considerable experience with road wagons, and have tried and seen many very ingenious combinations, but they have all proved failures except as amusing toys. All builders of road wagons that I have seen say that they had no idea of the immense power it took to run them; and obstructions like loose sand or mud make them nearly helpless, to say nothing of steep hills, stones, etc. Another great drawback is the great weight of fuel and water necessary to carry. My carriage, the total weight of which was only 550 lbs., would use up 40 to 50 lbs. of water per mile. Therefore I think that a locomotive, complying with that Wisconsin law and running in ruts half way up to the hub, over stumps and stones and up steep sand hills, and averaging 5

miles per hour for 200 miles, trusting to luck in getting fuel and water, would have a sweet time of it. The idea is simply preposterous.

H. S. TAYLOR.

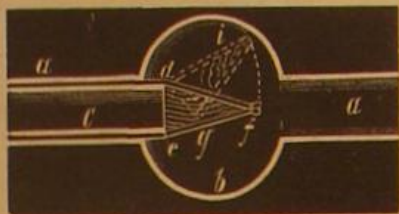
Derby Line, Vt.

Valve for Laboratory Use.

To the Editor of the Scientific American:

I herewith send you a drawing of a valve which is not, I believe, new, but is not well known, although it is very useful in the laboratory, and might be of service to some of your readers.

a is a glass tube with a bulb, b, blown in it; c is a short glass tube, smaller in diameter than a; d is a piece of rubber tube, a little longer than the tube, c, and of such a size as to fit tightly between the tubes, a and c; one end protrudes over the end of the tube, c, into the bulb, b. Into



this end of the rubber tube a small cone-shaped piece of wood, g, is slipped, with its base tight against the end of the tube, c; the end of the rubber tube is now drawn tightly over the piece of wood, g, and then tied at f. The rubber tube, d, is then cut almost off at e, the uncut portion serving as a hinge. The valve is shown open by the dotted lines at i. It will of course be understood that the rubber tube is to be drawn over the tube, c, the cone of wood put in the end, and the end tied and cut before it is put in the tube, a. When the foregoing operations are performed, the rubber tube, d, inclosing the tube, c, is run into a, until the end of c extends a short distance into the bulb, b.

Monticello, Pa.

E. G. ACHESON.

New Rule for Calculating the Power of Steam Engines.

To the Editor of the Scientific American:

I have made a rule for calculating the horse power of steam engines, by which I get rid of nearly two thirds of the figures. It is as follows: Square the diameter of the cylinder, multiply by length of stroke in inches, multiply by the number of revolutions per minute, multiply by the pressure of steam, multiply by 4 as a permanent number, and cut off six figures to the right.

Allentown, Pa.

DANIEL SHINE.

Device for Protecting the Finished Parts of Screw-Cutting Dies.

To the Editor of the Scientific American:

The enclosed engraving represents a very simple and effective method of protecting the cutting parts of a die while the workman is finishing it after it has been tapped. A is a thin piece of soft steel, say one sixteenth inch thick, which is placed flat upon the die, B, so that the edge projects a very little beyond the points, C. When both are held firmly in the vise, the part, D, may be filed away without any danger of the file touching the points of the cutters.

I think the above might be classed among the useful wrinkles, and I send it, thinking it may be handy to some of your many readers.

Haydenville, Conn.

J. P. LEWIS.

Ammonia as a Cure for Rheumatism.

To the Editor of the Scientific American:

Permit me to inform your readers that caustic ammonia is no infallible cure for rheumatism. I read your paragraph on this subject on the day on which I was treated to the novel experience of acute rheumatism in my left leg. Several drops of ammonia were taken at once without effect, and similar doses a few days later. The complaint has steadily grown more aggravating since.

This rheumatic experience of mine also demolishes a popular fallacy, to which I admit I gave credence, that perfectly abstemious habits act as a prevention of such afflictions.

New York city.

R. d'H.

The Proper Time to Fell Timber.

To the Editor of the Scientific American:

Some years since, I wrote an article for your paper in which I contended that after the tree was in full leaf was the proper time to fell timber. Since then I have seen an article stating that actual experiments made by the Prussian government had shown that the winter was the best time to fell timber. Thirty-one years ago, I was engaged in clearing up a large plantation, and building houses, stables, etc., with logs cut from the woods. I soon discovered that there was a difference in the lasting of different trees of the same kind. I also noticed that, in killing the trees to clear the land, some trees would decay much earlier than others; and that trees girdled in the early spring, just before the budding of the leaf, would rot off at the place where the tree was girdled; and that trees girdled in August would soon

decay in the sap wood and bark, but that the heart would remain sound for years. The conclusion I came to was that the presence of sap in wood caused it to decay, and that the sap left the body of the tree during the time it was making leaves, new sap wood, and bark; and thus, at the fall of the leaf, the sap went into the heart or body of the tree.

If any one will cut a green tree after the fall of the leaf, and put one end in a hot fire, he will soon see sap ooze out of the whole stick, even in the middle; but cut a stick after full leaf, and the sap will run out near the bark. All timber that lasts well has but little sap at any time; all timber that decays easily has a great deal of sap, such, for instance, as the sugar maple, elder, and sycamore. All carpenters have seen large timbers that were perfectly rotten in the middle while the outside was apparently sound. This decay must have been caused by the presence of something besides heat and moisture. As the outside was sound while the inside was decayed, this must have been sap, and nothing else.

Oakley, Ark.

J. H. MOORE.

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

Laboratory flasks which have contained oil or fatty matter may be easily cleansed by a solution of permanganate of potassa. To remove turpentine, petroleum, photogene, etc., wash with an ounce or so of sulphuric acid and rinse with water.

The comparative value of horse feed is found by experiment to be as follows: 100 lbs. of good hay is equal in value to 59 lbs. of oats, 57 lbs. of corn, 275 lbs. of carrots, 54 lbs. of rye or barley, and 105 lbs. of wheat bran.

A recent English patent, for the production of a glazed or vitrified surface on cast metal, sets forth the coating of molds with powdered glass, furnace cinder, or enamel, which is vitrified by the heat of the molten metal when the same is poured into the molds.

A new process for making tinned iron wire consists in first immersing it in a bath of muriatic acid in which a piece of zinc is suspended. After the acid has produced a new surface on the wire, it is placed in communication with a sheet of zinc in a bath of 2 parts acetic acid in 100 parts water, to which 3 parts chloride of tin and 3 parts soda are added. The wire is allowed to remain 2 hours in this mixture, after which it may be polished.

In the following will be found valuable details relative to the coloring of brass. An orange tint inclining to gold is produced by first polishing the brass and then plunging it for a few seconds in a warm neutral solution of crystallized acetate of copper. Dipping into a bath of copper, the resulting tint is a grayish green; while a beautiful violet is obtained by immersing the metal for an instant in a solution of chloride of antimony and rubbing it with a stick covered with cotton. During this operation the brass should be heated to a degree just tolerable to the touch. A *moiré* appearance, vastly superior to that usually seen, is produced by boiling the object in a solution of sulphate of copper. There are two methods of procuring a black lacquer on the surface of brass. The first, which is usually employed by instrument makers, consists in polishing the object with tripoli and washing it with a mixture composed of nitrate of tin 1 part, chloride of gold 2 parts. Allow this wash to remain for fifteen minutes, then wipe it off with a linen cloth. An excess of acid increases the intensity of the tint. In the second method, copper turnings are dissolved in nitric acid until the latter is saturated; the objects are immersed in the solution, cleaned, and subsequently heated moderately over a charcoal fire. This process must be repeated in order to produce a black color, as the first trial only gives a dark green. Finally, polish with olive oil. Much pains are taken to give objects "an English look." For this purpose, they are first heated to redness and then dipped in a weak solution of sulphuric acid. Afterward they are immersed in dilute nitric acid, thoroughly washed in water, and dried in sawdust. To effect a uniformity in the color, they are plunged in a bath consisting of 2 parts nitric acid and 1 part rain water, where they are suffered to remain for several minutes. Should the color not be free from spots and patches, the operations must be repeated until the desired effect is produced.

Paper may be prepared for bank cheques and other documents so that any writing in ink, once made thereon, cannot be altered, without leaving plainly visible marks, by passing the sheets through a solution composed of 0.015 grain gallic acid to 1 gill distilled water.

To silver cast iron, 15 grains of nitrate of silver are dissolved in 250 grains of water, and 80 grains cyanide of potassium are added; when the solution is complete, the liquid is poured into 700 grains of water wherein 15 grains of common salt have been previously dissolved. The cast iron intended to be silvered by this solution should, after having been well cleaned, be placed for a few minutes in a bath of nitric acid of 1.2 specific gravity just before being placed in the silvering fluid.

The base used in making artificial gems is strass, obtained by melting together 6 drachms carbonate of soda, 2 drachms burnt borax, 1 drachm saltpeter, 3 drachms minium, and 1½ oz. purest white sand. To imitate in color the following minerals, add to the strass the ingredients named in connection with each gem: Sapphire, 10 grains carbonate of cobalt; opal, 10 grains oxide of cobalt, 15 grains oxide of manganese, and from 20 to 30 grains protoxide of iron; amethyst, 4 to 5 grains carbonate of peroxide of manganese; gold topaz, 30 grains oxide of uranium; emerald, 20 grains protoxide of iron and 10 grains carbonate of copper.

ENGINES AND LIGHTNING RODS.

Our extracts from Knight's "Mechanical Dictionary," for this week, include some illustrations and descriptions of interesting forms of engines, and of a large number of lightning rods. Fig. 1 is a

COMPRESSED AIR ENGINE

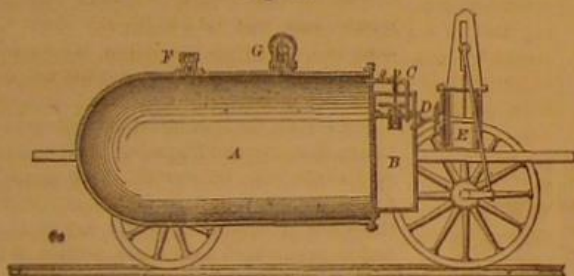
used in the lower shaft of a mine in Scotland. The steam cylinder, C, is 15 inches in diameter and has 3 feet stroke. It drives two condensing air pumps, P P, which work alternately, one on each side of the beam center, delivering the air into the center reservoir, N N, from which it passes into the main pipe, M. The beam is connected at the other end to a crank and fly wheel, F, for the purpose of equalizing the motion. The air pumps are inverted and are worked with cross-heads sliding in vertical guides, by means of side rods, from the beam. They are fitted with ball valves, of which there are three sets to each pump, each set consisting of 44 balls, two inches in diameter. The balls are confined by separate cages to a lift of half an inch. A stratum of water, supplied by a pump, W, covers the piston valves and the delivery and inlet valves, through which all the air has to pass. The water flows from the central reservoir through the small pipes, O O, into each of the air pumps during the period of their downward stroke. Locomotives of the type shown in Fig. 2 are also driven by compressed air. In the reservoir, A, the air is compressed and is admitted to the chamber, B, where it is expanded to working pressure. The emission is regulated automatically by a plunger in a tube passing through the roof of the chamber, B. Above the plunger is a spring which yields to the normal pressure of the air in the chamber; but when, owing to the withdrawal of air to the working cylinder, the pressure in the chamber is relaxed, the spring depresses the plunger, and the connections of the latter turn a faucet valve in the pipe, C, and allow the passage of air from the reservoir, A, to the chamber, B, to restore the working pressure in the latter. The compressed air passes by the pipe, D, to the cylinder, E, where it acts in the manner usual with the double-acting steam engine, and exhausts into the atmosphere. F is the supply aperture through which the reservoir is charged, and G the safety valve. The piston rod, crosshead, and pitman connect in the usual way with the crank and driving shaft.

A curious form of rotary steam engine known as the

DISK ENGINE

was invented by Captain Ericsson, and improved by Bishopp and others. In the Ericsson engine, the disk revolves, and

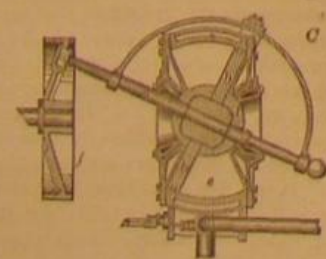
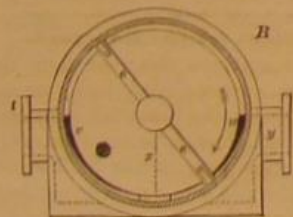
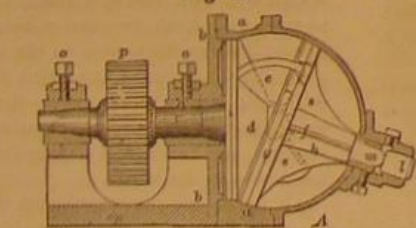
Fig. 2.



Parsey's Compressed-Air Engine.

in the Bishopp engine the disk oscillates. Ericsson's machine is shown at A B, in Fig. 3. Steam is admitted into a spherical chamber, a, by the neck, t, and opening, v, and being there prevented from passing the line, x, by the pressure of the disk against the cone at that place, it presses

Fig. 3.

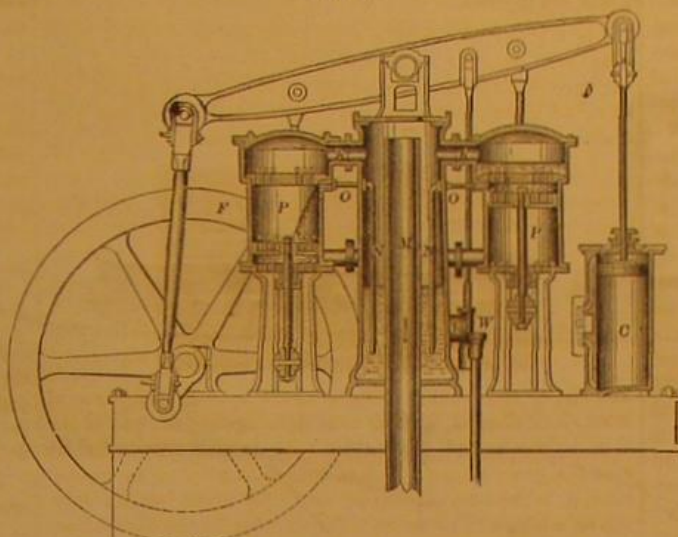


Disk-Engines.

against the upper leaf, e, which, together with the cone and disk, is thereby carried round in the direction of the arrow. When the leaf has passed the upper part of the opening, w, the steam that has been acting upon it escapes; but at the

same time, the opposite leaf has passed the top of the steam opening, v, and is carried round in a similar manner. The engine has no valves, the action of the piston is at all times direct, and the machine can be stopped, started, or reversed at any position of the piston. In Bishopp's engine, shown at A, the disk and shaft do not reverse on their axis, though the ends of the shaft describe circles as the disk "wobbles" on the lines, keeping one radius on each side in constant contact with them respectively. An abutment is formed by a

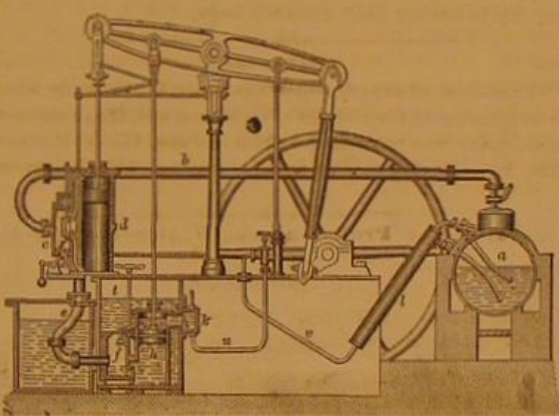
Fig. 1.



Compressed-Air Engine.

plate, e, which divides the annular space in which the steam works, the lower portion of the disk having a radial slit which enables it to slip back and forth on the abutment plate, e. The steam is admitted on one side of the abutment, and exhausted on the other, the live steam pushing the disk before it, by crowding between the disk and the conical head, and causing the outer end of the arm to communicate

Fig. 4.



Delaporte's Ammoniacal Gas Engine.

rotary motion to a wheel, f, to which it is connected by a universal joint.

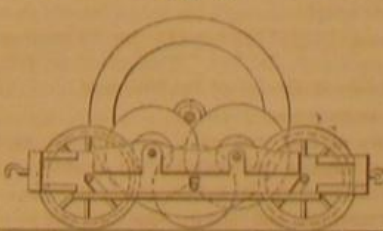
DELAPOURTE'S AMMONIACAL GAS ENGINE.

shown in Fig. 4, is operated by ammonia vapor; a is the boiler; d, the cylinder; and b, the tube communicating between the cylinder and boiler; c is the valve box, and x the slider, by means of which the gas is introduced alternately above and below the piston; e is the suction pipe, and f, the condenser and dissolver. The injection water is introduced by a pipe, at the top of the condenser, f. The solution passes from f to h, from which it is withdrawn by the piston, and passes through the reservoir, k, and the tubes, u and v, by which it is returned to the boiler, a small forcing pump aiding in this operation. The water, which has been deprived by heat of its ammonia, is withdrawn from the bottom of the boiler by the lower tube, and passes into the jacket, l, where it imparts a portion of its heat to a solution in the tube, e, which is on its way to the boiler.

THE MAHOVO

is the name given by its inventor, Captain Von Schubersky, of Russia, to an adaptation of a fly wheel to accumulate a reserve of force to be used at intervals when a greater power is needed. The device is shown in Fig. 5. A pair of heavy fly wheels are mounted on an independent truck, which, in railway trains, is attached in rear of the locomotive. In the

Fig. 5.



Von Schubersky's Mahovo.

intervals between the three pairs of running wheels are placed two pairs of friction wheels, resting immediately on them. In the angle between these rests the large axle of the mahovos, huge fly wheels which overhang the track. When the train moves, the running wheels impart motion to the friction wheels, and the latter transfer this movement to the fly wheels. As the train moves from

rest, the velocity of the fly wheels is gradually accelerated until it attains a maximum corresponding to the maximum velocity of the train. If steam now be shut off, the fly wheels become a source of power, and will return a portion of the work stored up in them, so that they may be used to assist the engine in ascending grades.

We add, in Fig. 6, a large number of shapes of

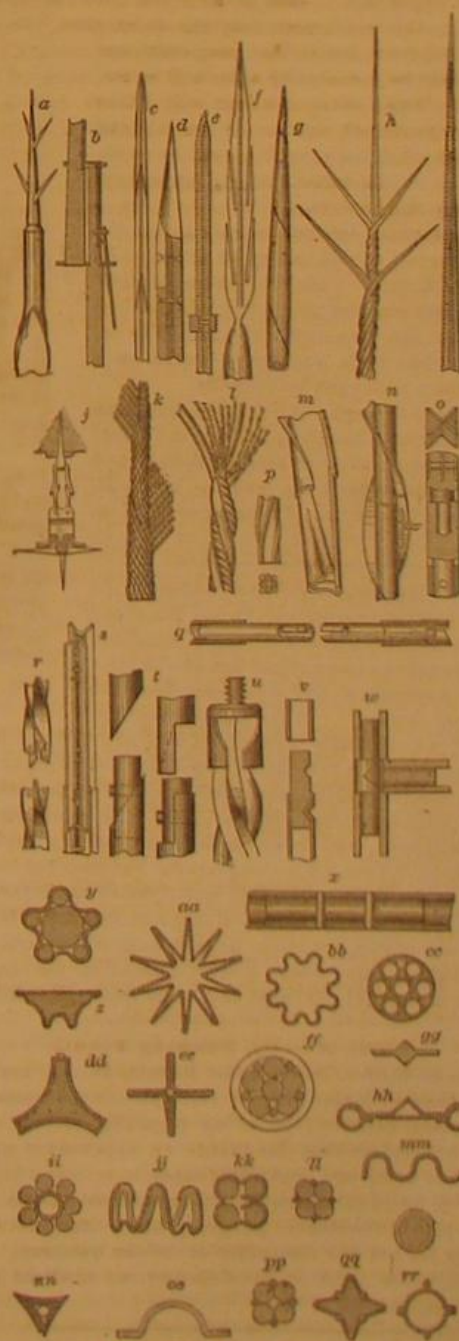
LIGHTNING RODS,

which may be described as follows:

a has a series of points formed of spiral coils, combined with a tubular portion, forming the tip. The conductor is a flat strip. b is a jointed tubular conductor for vessels. It is divided at the head of the lower mast, a branch leading down the shrouds on either side to the water. c is an iron rod tipped with copper, the point of which is gilded. d has a central copper slip inclosed between iron side pieces; the points of connection have interposed zinc plates. At e the iron rod is grooved to receive a copper slip. The joints are secured by screw-threaded washers. At f the point is formed with two opposite wings. The rod, g, is composed of a single strip of copper wound spirally so as to form a tube. h is composed of several strands of wire laid together so as to form a rope, and having several tips. The point, i, is formed of three or more metals inclosed one within the other, the most fusible outside. j is an insulating attachment with additional conductor points at the coupling of rod sections. k is a copper cable, composed of a central wire rope and two exterior strands laid up in opposite directions. l comprises two or more copper wire ropes intertwined with an equal number of iron rods. m is a series of metallic strips, forming a tube, are joined together. n is a metallic strip, doubled up or corrugated so as to form a tube with spiral flanges.

At o the joints of the rod are coupled by pieces cross shaped in section and secured by rivets and bolts. p has four twisted rods with wire warming. At q the tubular sections are united by short pieces, slotted inside so as to form a species of bayonet joint, and held by pins. r is composed of two strips of sheet metal, riveted together at their angles and twisted spirally. The strips in s have slots through which staples fasten them. t is connected by short pieces fastened by pins, u is an exterior cable stiffened by a spirally flanged core, and the sections of v are secured by plugs fastened by indenting the tubes into suitable depressions. At w the sections are coupled by an interior cylinder and a tapering plug projecting from each of its ends. At x an interior tube with

Fig. 6.



Lightning Rods, Points, and Attachments.

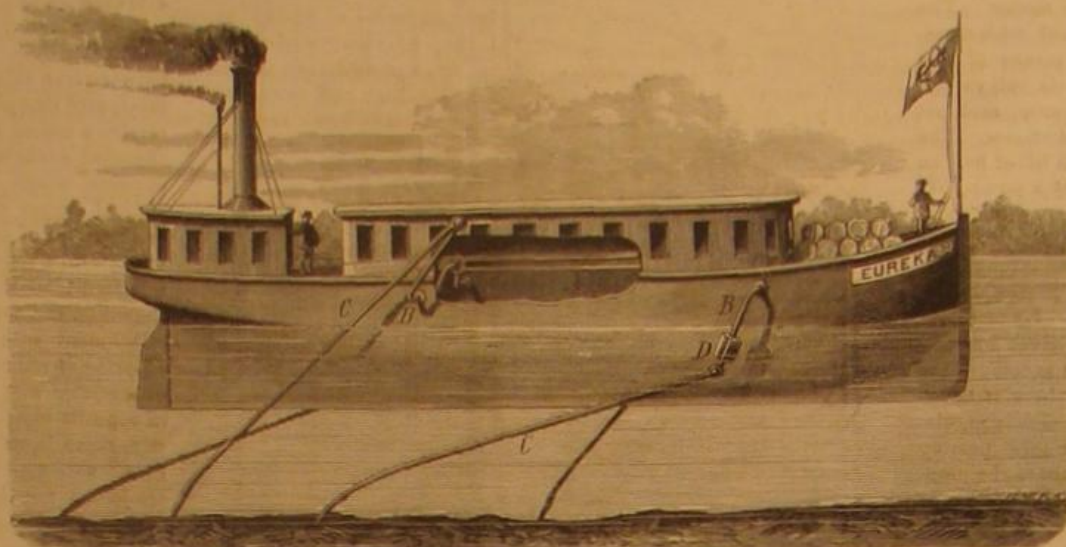
pins holds the ends of the tubular sections together. y to r inclusive represent sections of various kinds of patented rods.

IMPROVED METHOD OF PROPELLING CANAL BOATS.

We illustrate herewith a new mode of propelling canal boats, which consists mainly in mechanism for actuating a series of push bars. The device is certainly simple, and, in the opinion of the inventor, when applied to boats, will prevent any loss of power by slip and any washing away of the banks of the canal. It may easily be arranged in the ordinary boats in use.

Placed thwartships the boat, and revolving in bearings attached to the framework of the same, are two shafts having cranks at their centers. These cranks are connected by a rod, A, so that the shafts may move together. To one end of the connecting bar the piston rod of a steam engine is attached. On the ends of the shafts are formed cranks, B, to the extremities of which are pivoted the push bars, C. The lower ends of the latter are formed to take hold of the ground on the bottom of the canal and push the boat forward. The cranks, B, are so arranged that one rod on each side of the boat may be working while the others are moving forward. The weights shown at D are intended to balance the cranks and give uniformity of motion to the shafts.

Patented through the Scientific American Patent Agency, February 15, 1876. For further particulars relative to purchase of patent, address the inventor, Mr. Louis F. A. Legouge, Wheatland, Yuba county, Cal.

**LEGOUGE'S METHOD OF PROPELLING CANAL BOATS.****IMPROVED FLOOD GATE.**

We illustrate herewith a novel and simple floodgate which any farmer can make from a couple of trace chains, a dozen stout staples, and a few boards. Its advantages are that it allows the water to flow past freely, and so not only obviates any danger of sediment or floating material blocking the channel, but favors the washing and deepening of the latter; it is entirely drift-proof and self-adjusting, and needs no skill to manufacture.

It consists simply of a series of boards united by the chain staples in such a way that the lower part of each may overlap the upper part of each lower board upon the up stream side. By this construction, as the water rises, the lowest board will float; and as the rising continues each board in consecutive order will be carried up. Any floating material will strike against the smooth surface of the gate and pass beneath it, so that there can be no obstruction of the water and no consequent damming and back flow.

The gate may extend entirely across the water course, or stakes may be driven at its ends, as shown. This last construction renders it less easy for stock to push the barrier open and pass down stream. The invention has been practically tested on a large farm with excellent results.

Patented through the Scientific American Patent Agency, March 7, 1876. For further particulars, relative to sale of county and State rights, address the inventor, Dr. R. H. C. Rhea, Uniontown, Union county, Kentucky.

Ill Advised Procrastination.

As matters now appear in the American section of the Centennial main building, there is going to be a repetition of the farce yearly enacted at the American Institute shows in this city. At the time of writing, beyond a floor neatly ornamented with chalked and lettered boundaries, and a few show cases, there are no signs of preparing the full exhibit promised from American exhibitors in the main structure. In Machinery Hall, more energy has been displayed, and progress is comparatively rapid; but elsewhere, it remains a disagreeable but none the less true fact that the French, English, and Spanish entries are much further advanced than those of our own country. It will be very unfortunate, not to say humiliating, if the opening day, now scarcely three weeks distant, shall find the American section a chaos of confused and badly arranged exhibits.

The Western Tanning Plant.

Messrs. Moffat Brothers, of Buffalo, N. Y., send us a letter from a Chicago firm in reference to the western tanning plant, described by us on page 181, current volume. The firm report that they made an experiment with the plant two years ago, and distributed it to other firms, the result in every case being that there was not tannin enough in the plant to preserve the green hides from decay; and making leather was altogether out of the question. If any one can throw light on the difficulty, we shall be glad to hear from him.

Danger from Street Telegraph Wires.

During the recent high winds in London, the following accident occurred in Farringdon street. Charles Holmes, a cabman, was driving a cab, and, when near the viaduct, one of the post office telegraph wires passing over the road

snapped, and fell about the horse's head and body. The animal took fright, and bolted for some distance down the road, until it got entangled in the wire in such a manner that it was thrown completely over. It was with great difficulty that it could be extricated, and it was then found to be so severely injured that it would probably have to be killed. The driver had a narrow escape.

A similar accident occurred about the same time in St. Bride street. A telegraph wire broke, and a cab driver was caught round the neck by the broken wire, but fortunately he was not injured.

Another accident of the same kind in Islington was unhappily fatal. A Brompton omnibus, after finishing its journey at about five minutes past two o'clock, pulled up as usual at the York Hotel; and one of the horsekeepers, named William Stevens, was driving it to the stables, when a telegraph wire was blown away, and it fell round the poor fellow's neck, and nearly cut his head from his body.

Lightning.

The celebrated experiment of Benjamin Franklin, by which he demonstrated the identity of lightning and the common electric spark, was performed by him in June, 1752, at Philadelphia, Pa. Having made a small cross-stick kite, he covered

**RHEA'S FLOOD GATE.**

it with a silk handkerchief instead of paper, so that it would stand rain, attached a tail, etc. The upper end of the cross had an iron point, connected by a string to the usual kite cord, which was of hemp. To the lower end of the cord an iron key was attached, and to that a short length of silk ribbon, as a non-conductor, by which the kite string could be safely held in the hand. On the approach of a thunderstorm he proceeded to a common near the city, and, with the assistance of his son, sent up the kite. Ere long the thundercloud approached, the electricity came down the kite string, and Franklin, standing under a shed, received the electric sparks through his knuckles which he applied to the key, and charged his Leyden jar by putting its conductor in contact with the key. The rain then fell, which improved the conductivity of the kite cord, and the electricity appeared in increased quantity.

The news of this wonderful experiment rapidly spread over the world, and was extensively repeated. In France, Professor Romas made a kite seven feet high, with a fine wire interwoven in the string. The kite was raised five hundred and fifty feet, and is alleged to have yielded flashes of electric fire ten feet in length. In St. Petersburg, Professor Richman, while attempting to repeat Franklin's experiment, received so heavy a charge of electricity that he fell dead. This was in 1793.

ONIONS given to horses in the first stage of the epizootic are said to be very beneficial. They cause the animal to cough and sneeze and discharge freely from the mouth.

Brains and Brain Nutrient.

There was once a gentleman who used to argue that the soul is seated in the pineal gland; and that there are special regions of consciousness in the brain, different parts of which have different functions, is a doctrine now establishing itself on what may be considered sufficient authority. Further investigation in this direction may avail to show what should be the remedy for an atonic or hypertrophied ideal or other function. Meanwhile we have the assurance of Mr. Frank Buckland, who has lately passed a brilliant examination on the *ostrea edulis* before a House of Commons committee, that "brain power in those engaged in business and literary pursuits was greatly strengthened by phosphorus conveyed in the form of oysters." This assurance, although weighted with the statement that oyster meat costs \$2.24 per pound, cannot fail to be of immense value to all those—not a large class—who have need of their brains. Candidates for the Indian Civil Service, Newdigate prize poem men, common jurymen, and the holders of foreign bonds will now, no doubt, eat, who never ate before; and city men, with whom, for their easy digestion, oysters are a favorite food, will eat the more. We cannot understand why "those engaged in business" should take precedence, in the repair of brain waste, of those engaged in literary pursuits, but can readily believe in the possibility of the proposal—a direct corollary to Mr. Buck

land's assurance—that, as we have compulsory nurture of the mind, so we must have compulsory nurture of the brain. We wonder, says *Iron*, how much more luminous some of our most brilliant writers would have been had they but seen to a proper supply of phosphate of iron and osmazome.

The Railroads and the Centennial.

The various railroad companies whose lines lead to Philadelphia have met in convention and decided upon a reduction of twenty-five per cent in fares to the Centennial, and also that round trip tickets shall be issued for a period of sixty days. The Union Pacific is the only dissenting line, consequently the above reduction applies on all roads and east of Omaha. From St. Louis the Centennial fare will be \$40.50, and from Chicago \$33, for the round trips; and an additional dollar is charged if a route via New York city be chosen.

For use on the Pennsylvania railroads between this city and Philadelphia, two kinds of tickets will be issued. One good for fifteen days will cost \$5 for the round trip; the other is restricted to the day of issue, and is subdivided into three classes. The first class is good after 7 A. M., and costs \$4; the second, between 6 A. M. and 7 A. M., costs \$3; and the third, available for early birds, who prefer the cool of the morning for their journey, and hence start prior to 6 A. M., costs but \$2. The first class tickets are good for express trains, which will run through from terminus to terminus in from two and a half to three hours, landing the visitor on the Centennial grounds. The second and third class trains will yield the right of way to those above-mentioned, irrespective of relative hours of starting, and hence will occupy from four to five hours in the trip.

All trains, no matter whence they come, will run into the Centennial depot of the Pennsylvania road, which is located in Elm avenue, fronting Machinery Hall.

A New Plant for the Dooryard.

Among the plants distributed this year from the botanic garden in Washington, says the *Star*, is the *aralia papyrifera*. This plant produces the beautiful substance known as rice paper; it has soft, downy, palmate leaves; it grows ten feet high, with a stem four inches in diameter, full of white pith like the elder; in a full grown specimen the pith is about one inch in diameter. It is divided into pieces three inches long, and by the aid of a sharp instrument is unrolled, forming the thin narrow sheets known as rice paper, greatly used by the Chinese for drawing figures of plants and animals, and also for making artificial flowers. Until about 1850, the source of this substance was unknown to scientists. The Chinese, on inquiry, gave very fanciful figures and descriptions of it, illustrating the fact that then, as now, "for ways that are dark, and for tricks that are vain, the heathen Chinese is peculiar." It was first introduced from the island of Formosa to Europe, at Kent gardens, in 1853; from there it has been widely disseminated. It is almost naturalized in some parts of Australia; in the Southern States, and perhaps California, it will flourish. As an outdoor ornamental foliage plant, it is well worthy of cultivation in any part of the country.

J. C. S., Jr., says: I take seven papers, but would rather part with all others than with the SCIENTIFIC AMERICAN.

A CHINESE SCIENTIFIC JOURNAL.

There lies before us a very curious periodical. It is a pamphlet of about thirty pages, stitched with green silk in covers of the brightest yellow. On the back, or rather the front, for the book is read backwards, there is a strip of bright pink paper, covered with hieroglyphics. The pages are each double, that is to say, instead of the print appearing on each side of the sheet, it is impressed on one side, the sheet is folded, and the free ends bound inwards, so that the edge of every leaf is a fold. The paper is of that soft India variety used here for engravers' first proofs. Finally, the characters are all Chinese and printed in vertical lines. Such is the appearance of the first Chinese scientific journal, the *Chinese Scientific Magazine*, a page of which the reader has before him in the annexed engraving, reproduced in facsimile.

The editor, Mr. John Fryer, of Shanghai, writes us that it is his "ambition to make this magazine to China what the *Scientific American* is to every country where the English language is known. My aim is high, but perseverance will enable me to succeed, even if only in a small degree;" and he tells us in his prospectus that the journal is to "serve as an introduction to the translation of scientific books already existing in Chinese; it will contain notes or lectures on scientific subjects," and in brief is intended to disseminate useful scientific and practical information throughout the country. It is published monthly at 50 cents per year and will be illustrated copiously; a specimen of the pictorial embellishments is here shown. We admit our inability to read the letter press, and hence are in the dark as to the table of contents of the present number; but there seems to be an interesting variety of articles (if we may judge from the engravings) relating to the solar system, the seasons, eclipses, etc., a circular saw, a steam hammer, and various other mechanical apparatus.

It may justly be considered that the establishment of this journal—and we trust it may meet with unbounded success—marks another breach in that wall of exclusiveness with which for centuries China has encompassed herself. That country is beginning an era fraught with the deepest significance to all western nations, an era when a great people, capable of high development, undertake to arouse themselves from a lethargy of ages, and, by acquiring the knowledge which the world has learned during their long sleep, to place themselves on a level with the vastly younger nations which have far outstripped them in civilization and progress. In the past the Chinese have been great engineers (as witness the colossal canals, cities, bridges, and temples still existent) and greater inventors, for, very many years before such things were thought of in Europe, they invented the compass, gunpowder, paper, porcelain, and printing. No people have approached them in agriculture, none have so wide a knowledge of the use and value of artificial fertilizers; for centuries past, no matter for the enrichment of the land has escaped their utilization. Moreover they are cunning, even wonderful, workmen, scarcely to be approached in the marvellous delicacy of their productions or for the patience with which they attack herculean tasks. In no country is education so highly prized, and among no other people does political preferment depend, as it does in China, almost wholly upon scholastic acquirements. Now all that seems wanting is the extension of that education, beyond the lore of Confucius and ancient tradition, to the world's modern progress; and the barriers to this, so long maintained, China herself is now tearing away. The very vastness of her population is the most serious obstacle to her advancement, even from the single view that the consequent cheapness of manual labor will militate against the introduction of machines for its replacement; but that this in time will be overcome, perhaps through the immense industries which it is possible to establish, or through the development of the great unworked mineral resources of the country, there is no reason to doubt. Chinese students are now all over the world studying the habits and customs of the most advanced people, in order to return and instruct their own countrymen; the first railroad has recently been introduced into the country; and China is organizing a navy of modern ironclad vessels. The signs of progress are everywhere. It is scarcely within the reach of prophecy to predict that the next, if not the present, generation will feel the industrial competition of China, not alone through her emigrants here or elsewhere, but through her own people working within her own borders.

Education in China.

Wong Chin Foo, the Chinese lecturer, was present at the Teachers' Institute of Adams county, Pa., not long ago, and delivered an interesting address on the subject of education in China. He said that the first lessons inculcated in Chinese schools are obedience and reverence for parents and respect for teachers. He claimed that in no country in the world is education so general as in China, and that in no other country are intelligence and moral worth so promptly and so liberally rewarded by the government. He also alluded to the

Great Wall of China, the immense number and size of its walled cities, its palaces and works of art, its canals, and other public improvements, its wars and its civilization, its geography and history, and its systems of religion. He closed with a demonstration of the Chinese method of computation, which was truly wonderful for rapidity and accuracy. By means of an ordinary abacus he performed the most difficult operations in addition and subtraction with the utmost dispatch and correctness, throwing the so-called lightning calculators completely in the shade. The lecturer also described the manner and customs of his people, using good English and speaking with but a slight accent. We quote his language, as reported in *Home and School*: "The capitals of the different divisions of the empire are all walled cities. There are seventy-five thousand of these walled cities in China. The material in these walls is sufficient, in the aggregate, to construct a wall thirty feet high and twenty feet thick entirely round the world, and leave brick and stone enough to build all the houses in the United States besides. This may seem wonderful, but it is true. In China everything is done in a different way from what it is done in this country. The manners and customs of the people are different. In this country when a gentleman enters a parlor or drawing room, or goes into society, he is expected to remove his hat; in ours, he is expected to keep it on. In China it is considered very rude and uncivil to go into company with the head uncovered. In your country, when friends

The Origin of Our Earth.

The following curious experiments, recently made by a German observer, M. Sicher, may perhaps be regarded as throwing some light on the mode of origin of our earth.

By mixture of water and alcohol prepare a series of spirit solutions of the following densities: 0.9, 0.82, 0.88, 0.87, 0.865, 0.86, 0.85, 0.83. Into a glass cylinder, or a high, broad beaker glass, pour first some distilled water, then spirit solutions of 0.9, 0.89, 0.93. By careful pouring, the cylinder being held inclined, you may obtain the liquids stratified over one another without mixing. Heat the remaining less dense spirit solutions simultaneously, in beakers over five spirit lamps, up to near the boiling point (to about 167°), and then pour them carefully, in the order of their density, on the cold spirit solution. Over a sixth spirit lamp heat 3 to 5 ozs. of spermaceti in a beaker to 194° or 213°; dip a pipette into the fused mass, allowing about 0.25 cubic inch to enter. Then cover the opening with your thumb, and put the pipette so far down in hot alcohol that equilibrium occurs. By slowly drawing out the pipette, with thumb removed, you can, after a little practice, cause the fused mass of spermaceti to form one or several balls, floating in the liquid. The density of the fused spermaceti quickly diminishes with increasing temperature. The ball, therefore, does not, in each experiment, remain floating in the same spirit layer. By quick introduction you obtain it in the density 0.85; then, in cooling, it sinks slowly to the density 0.87.

These fused and slowly sinking balls now afford an opportunity of observing the solidifying of a body simply left to its cohesion. The following phenomena may be noticed:

1. The balls which, through currents in the alcohol, come very near each other, unite. The most frequent unions occur in the moment of solidifying.
2. When a ball comes into a spirit layer, the temperature of which is under 112° Fah. (the melting point of spermaceti), solidification occurs at the surface. If this solidification begins first at one side or above, the balls begins to rotate.
3. Frequently one observes the sudden ejection of a small mass from a ball.
4. The rind consists at first of a smooth, thin skin. With increasing thickness, however, this becomes uneven.
5. The unevenness still increases, even after the rind has formed a complete spherical shell round the inner fused mass.
6. In the majority of balls, when the cooling does not proceed too slowly, there occurs a very remarkable phenomenon. As soon as the rind has acquired such firmness that a wrinkling of it is no longer possible, it sinks in at the thinnest part, and an opening is formed, through which alcohol penetrates into the interior.
7. The balls now sink pretty quickly into the denser and cold spirit solutions, and one may soon take them out and examine them with a microscope. After some time, however, there is a further interesting change in them.
8. The surface of the ball, after a few days, is found to have become crystalline. While the elevated parts, after extraction, are mostly smooth and transparent, they become later untransparent, white, and rough. If you examine this surface with a microscope of 60 magnifying power, you find in it a striking similarity to a bare mountain landscape.
8. By rotation of the fused balls, one may flatten them, and allow them to solidify during rotation.

Calla Lilies.

Mrs. Rollin Smith, of Swanton, Vt., writes to the *Burlington Free Press* as follows: "Since your recent notice of my possessing a continually blooming calla, I have received several letters from different parts of the State asking me for the treatment which produces such favorable results. I use a four gallon jar, and give an eastern exposure. In the summer, I keep it wet enough so the water may stand on the top, and at all times very wet. Once a year I take the plant, shake the earth from the roots, and fill the jar with earth taken from under old sod. As soon as a blossom commences to wither, I cut it down, never allowing a flower to die on the plant. The result is that in sixteen months I have had eighteen blossoms on the same plant, and at the present time it has two very large full blossoms."

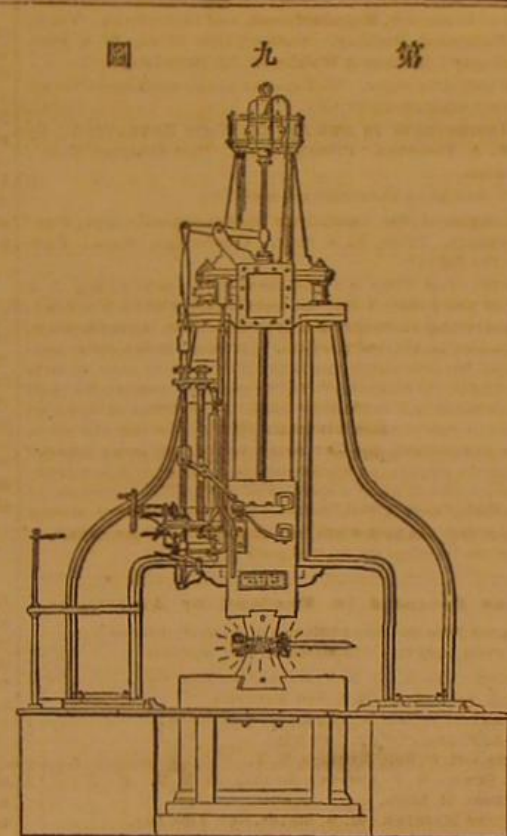
Suet Butter.

The Waverly Butter Company, of Charlestown, Mass., call attention to their continued operation of their patent for the manufacture of butter from suet and cream, and deprecate the statements, now so common, that the artificial butter processes have all proved failures. They are doing a large business, with perfect satisfaction to their customers.

ALL interior fences should be portable and easily removed from place to place, and removed entirely and stored away when not wanted. Every farmer has long lines of fences which, for half the time, are of no use whatever.

格致彙編
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為錘之柄則錘自落之來往能
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試造一個但初造之汽錘為
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CHINESE SCIENTIFIC LITERATURE.

and acquaintances meet, they seize and shake each other by the hand; with us, when friends meet, each clasps his own hands and shakes them to his satisfaction, at the same time giving expression to his feelings in a suitable manner. You read and write from left to right; we from right to left. This is altogether a habit and education, and one method is just as good as another, provided one understands it. With you, black is the prevailing color of mourning; with us, white serves the same purpose. Your young people, previous to marriage, usually spend much time cultivating each other, and trying to ascertain their mutual adaptability and congeniality; we leave the matter in the hands of our parents, who manage our matrimonial affairs in a way at once satisfactory to themselves and to us. And I am free to say you will find as much conjugal happiness among a given number of families in China as you will find in any other country of the world."

Wear of Railroad Rails.

We recently called attention to the reported fact that, on a railway running north and south, the eastern rail wears out the faster. This has been attributed to the earth's rotation. We recommended that the eastern rails and wheels should, therefore, be made stronger than the western. The *Chicago Standard* accuses us of making an error, as "the wheels running on the eastern rail going south run on the western rail going north." A journal that can print such an absurdity as this only exposes its ignorance of common things.

DECISIONS OF THE COURTS.

United States Circuit Court—District of Massachusetts.

TRADE-MARK CONTRACT.—ANDREW COE vs. WILLIAM L. BRADLEY.
(In equity.—Before Shepley, J.—Decided October term, A. D. 1875: To wit, February 17, 1876.)

Shepley, J.: This bill is filed upon a written contract between the parties, dated February 13, 1862, by which the defendant assigns to the plaintiff the exclusive use for seven years of his trademark, "Coe's Superphosphate of Lime," reserving a limited right previously granted to the firm of Coe & Co. Coe covenants that he is the exclusive owner of said trademark, with the exception above named. He constitutes Bradley his attorney, irrevocably, with authority to prosecute any suits necessary, to make his rights available, and protect himself in their full enjoyment.

These are the only express covenants and agreements on the part of Coe. Bradley covenants to energetically prosecute the business of manufacturing and selling the superphosphate, and continue to make it of as good quality as that before made by Coe; and so long as the agreements above mentioned shall be kept by Coe, Bradley shall have use of the trademark, to pay him one third of the net profits of the business, and of other "bone business," first reserving one of the profits of the business, as his own compensation, three thousand dollars.

This clause is also to be found at the close of the contract: "Any breach of the agreements above cited by either party or his representatives shall be a release to the other party and his representatives from all obligations by him or them to be performed but for such breach." Between Coe and Bradley, and himself and Coe, and Elmore Coe, the plaintiff's share of profits is reduced from one third to one sixth part.

During the existence of this contract Coe (in violation of his agreement, as implied from his conveyance of the exclusive right of the trademark to Bradley), at Onondaga and other places, manufactured and put on the market a fertilizer of an inferior quality, sometimes under the trademark of "Coe's Superphosphate of Lime," and sometimes "Andrew Coe's superphosphate of Lime," which last name so nearly resembled the original trademark that it was calculated to deceive, and did deceive, purchasers, and therefore the use of it was as much a violation of his implied agreement with Bradley as the unauthorized use of the words "Coe's superphosphate of Lime." A court of equity will examine to see if the differences are merely colorable. (Dixon Crucible Co. vs. Guenther, 10 American Trade Mark Cases, 251; Kent's Com. 122 Ed., 346, cases in note. Meriden Britannia Co. vs. Parker, 99 Conn., 420.)

It is one of the duties of the defendant that such unauthorized use of the trademark by Coe himself, in violation of the letter and spirit of the contract, was such a breach of the contract as exonerated the defendant from any liability to account and pay over to the complainant one sixth part of the profits of the manufacture under the contract. In support of this position reliance is placed on the clause in the contract that "any breach of the agreements above cited by either party or his representatives shall be a release to the other party and his representatives from all obligations by him or them to be performed but for such breach." The effect of this clause in the contract is only to enlarge the right of rescission and abandon his rights, at his election, in case of the failure of the other party to perform some portion of the contract not otherwise regarded as an essential part of one entire act. (Wallace vs. Shovel Co., 44 N. H. 521.)

But, although Bradley well knew that Coe was manufacturing and selling under the trademark in violation of his implied agreement under the contract, and of an express agreement under a later and supplementary contract, he did not elect to rescind the contract, but continued to manufacture in great quantities, and to put the manufactured article upon the market under the trademark. No construction can be given to this clause which would enable one party to the contract to enjoy the fruits of it without compensation, upon the ground that the other party had failed to perform some stipulation on his part which was not so essential to the contract, but that the breach of it could not be compensated by damages.

The claim of the defendant that the covenants broken by the complainant were of such a nature that no recovery can be had by him of the defendant cannot be sustained. The consideration of the promises of Bradley was the conveyance by Coe of the exclusive right to the trademark, and there is no question but that the conveyance was operative to vest in Bradley the exclusive right to it for the term of seven years, subject only to the exception in the contract itself. The express covenants of Coe were only of a collateral nature, and to put the manufactured article upon the market under the trademark. There has been no breach of this express covenant. The implied covenant that he would not himself be a trespasser or infringer on the right and title he had vested in Bradley is the one which he violated, and Bradley had a right to elect to retain the title and claim damages against Coe for infringement of his right, or to rescind the contract under the last clause enlarging his right of rescission.

Where a covenant goes only to a part of the consideration on both sides, and a breach of it may be paid for in damages, it is an independent covenant, and an action can be maintained for a breach of the covenant on the part of the defendant without averring performance in the declaration. Where the plaintiff's covenants which form the consideration of the defendant, yet if part of the consideration be accepted and enjoyed by the defendant, and the plaintiff have no other remedy than on the covenant, and the breach on the part of the plaintiff can be compensated in damages, the plaintiff may recover without alleging performance of the residue. (Stevens vs. Carling, 3 Bing., 1 N. C. 35; Cutter vs. Powell, 2 Smith, L. C. cases in note; Fordage vs. Cole, 1 Sand., 333, and Williams' Note; Campbell vs. Jones, 6 T. R. 573; Carpenter vs. Cresswell, 4 Bing., 491; Foster vs. Purdy, 5 Met., 418-441; Wallace vs. Shovel Co., 44 N. H. 521.) These are the well settled rules applicable to proceedings in courts of law.

Courts of equity are still more liberal in their interpretation of contracts, allowing a specific performance of a contract sometimes to be enforced at the suit of a party who has not punctually performed the contract on his own part, but has been in default, where the default on his part is such as admits of compensation. In Hayward vs. Angell (1 Vera, R. 223), the Lord Keeper said: "In all cases where the matter lies in compensation, he the condition precedent or subsequent, he thought there ought to be relief."

The defendant relies upon certain other contracts set up in his answer between himself and the complainant. Two of these are prior in date to the contract of February 13, 1862, and it is not perceived how that contract is affected by them. The subsequent contracts recognize the right to the trademark which Bradley has under the contract of February 13, 1862, but do not confer upon him such a right independent of that contract. The contract of August 1, 1862, recognizes the existence and validity of the previous contracts.

The case should be referred to a master to report the amount to which the complainant is entitled for his one sixth part of the net profits under the contract, and also to report what sum is to be allowed the complainant in reduction, by way of compensation in damages for the infringement of the defendant's exclusive right to the trademark by the complainant by his use during the term of the trademark "Coe's Superphosphate of Lime," or of the trademark "Andrew Coe's Superphosphate of Lime."

Decree for reference to master in accordance with the opinion to be prepared and submitted to the court.

[George S. Boutwell, for complainant.

H. G. Parker, for defendant.]

NEW BOOKS AND PUBLICATIONS.

WATER WHEELS, OR HYDRAULIC MOTORS. By M. Bresse, Professor of Mechanical Science at the School of Bridges and Highways, Paris, France. Translated by F. A. Mahan, U. S. A. Price \$2.50. New York city: John Wiley and Son, 15 Astor place.

The author of this book is one of the most eminent of contemporary civil engineers; and his work is the standard authority in Europe on its subject. The value of such a treatise to our professional men cannot be over-rated, as there is no country in the world which is so liberally endowed with water power as ours, nor one in which that grand gift of Nature is so thoroughly and ingeniously utilized. Professor Bresse treats the whole subject in an exhaustive and authoritative manner, and he places before his readers some methods of utilizing water power which are not generally known in this country. The analysis of the turbine is excellently shown in this work, and 4 chapters on pumps form a treatise which will be of value to the many engaged in manufacturing the thousands of these machines sent out every month. Lieutenant Mahan has executed his task with care and fidelity, and has rendered the book more valuable to the general reader by translating the French measures with English.

MODERN AMERICAN HOMESTEADS. Illustrated by Forty-Six Plates.

By Daniel T. Atwood, Architect, Author of "Designs for Country Houses," etc. New York city: A. J. Bicknell & Co., 27 Warren street.

Among the many books on this subject which have reached us lately, there has been none to compare, in excellence and variety of designs, with this volume. The illustrations include cottages and homesteads, dairies and ice houses, stables and outbuildings, as well as residences in all parts of the country, varied to suit different climatic conditions. Full descriptions, specifications, and statements of probable cost accompany the designs. This work will be especially useful just now, as many persons commence building at this season of the year; and to such we cordially recommend the book as a practical authority.

THE TEXTILE COLORIST, a Monthly Journal of Bleaching, Printing, Dyeing, and Finishing Textile Fabrics, and the Manufacture and Application of Coloring Matters. Edited by Charles O'Neill, F.C.S., Author of "Chemistry of Calico Printing, Bleaching, Dyeing," etc. Nos. 2 and 3. Subscription Price, \$12 a year. New York city: John Wiley & Son, 15 Astor Place.

As our printed cotton manufacturers are now opening a large trade abroad, the efficiency of the dyeing processes and the permanency of the tints are matters of especial importance, as their products are to be placed in competition with the renowned fast colors of England and the simple and correct taste with which the French manufacturers ornament their textile fabrics. The publication now before us is likely to be of eminent

use in aiding our manufacturers to improve their wares. It is edited by an undoubted authority, and filled with contributions by the best practical men of the day; and the illustrations consist of pieces of stuff, dyed and finished, affixed to the pages. Although a thoroughly technical journal, it is full of interest, the article on dyeing wool and silk at the celebrated Gobelins factory, near Paris, France, being especially commendable.

THE AMERICAN SOCIALIST, devoted to the Enlargement and Perfection of Home. Published Weekly. Subscription Price, \$2 a year. Oneida, N. Y.: The Oneida Community.

The peculiar views of domestic morality which have made the Oneida community notorious are advocated in this publication with as much temerity as in the Oneida Circular; and they are not likely to find much favor with the world at large, whose wholesome prejudices in favor of conjugal fidelity is the safeguard of society, and who view with especial disfavor any attempt to elevate promiscuous intercourse into a religion.

THE ENGINEERS' AND CONTRACTORS' ILLUSTRATED BOOK OF PRICES OF MACHINES, TOOLS, IRONWORK, AND CONTRACTORS' MATERIAL, FOR 1876. New York city: E. and F. N. Spon, 446 Broome street.

This book is one of the best trade manuals we have seen for some time. It consists of complete priced catalogues of the manufactures of nearly 100 large firms, printed uniformly and illustrated. Machinists, architects, and builders will find it especially useful, as in it may be found descriptions and engravings of nearly every kind of work in metal, with the price at which each article is now put on the market. It is very creditably got up, and is a handsome volume.

THE STATIONER'S HANDBOOK, a Practical Business Guide for the Use of Retail Stationers and Booksellers. Edited by H. D. Monachese and A. B. Yohn. Price \$1.50. New York city: Office of the Publisher's Weekly, 37 Park row.

This volume contains a large amount of practical trade information, embodied in interesting treatises on various branches of the trade. These are supplemented by full and comprehensive price lists of the leading stationers.

THE AMERICAN MECHANIC, an Illustrated Journal devoted to the Interests of Inventors, Manufacturers, and Consumers. Vol. I., No. 1. Published Monthly. Subscription Price, \$1 a year. New York city: Munson & Wilkinson, 239 Broadway.

Another new industrial paper. We hope our young contemporaries are not crowding each other uncomfortably.

PRACTICAL INSTRUCTION IN THE ART OF WOOD ENGRAVING. By Charles W. A. Emerson. Price 50 cents. East Douglas, Mass.: J. Batcheller.

A handy little treatise on a beautiful and useful art.

PSYCHE, the Organ of the Cambridge Entomological Club. Published Monthly. Price, \$1 a year. Cambridge, Mass.: Published by the Editor.

THE METRIC DIAGRAM.—This is a neat chart, published by Messrs. A. & T. W. Stanley, of New Britain, Conn., the main object of which is to familiarize the student with the metric system of measurement. A yard measure, subdivided into feet, inches, and fractions, is printed beside a meter measure, also divided, but into decimal portions. This gives at once, by mere inspection, an idea of the relations of the two systems. Besides, the chart includes various tables and explanatory notes. Publications of this kind are both useful and needed, since it is eminently desirable that the public should become familiarized with the metric system. A treaty between this country and the majority of all the nations in the world is now pending, whereby the meter is made a standard of international measure, so that it is reasonably certain that, before very many years, our present clumsy system of feet and inches will have given place to that in which, as in our currency, the fractions are decimal parts of the whole.

Inventions Patented in England by Americans.

(Compiled from the Commissioners of Patents' Journal.)

From February 4 to March 23, 1876, inclusive.

BREACH-LOADING CANNON.—J. R. N. Owen, Hamilton, Nev.
BRICK MACHINE, ETC.—E. R. Gard, New York city.
CAR.—J. H. Small (of Buffalo, N. Y.), Glasgow, Scotland.
CAR MOTOR.—A. P. Thayer, New York city.
CARTRIDGE, ETC.—H. C. Bull, Brooklyn, N. Y.
CENTRIFUGAL PUMP.—W. P. Andrews, Brookhaven, N. Y.
COMPASS.—S. Bent, St. Louis, Mo.
DIAMOND-CUTTING MACHINE.—H. D. Stover, New York city.
DYEING FABRICS, ETC.—J. Harley, Lowell, Mass.
FEEDING FURNACES.—W. C. Ford, Brooklyn, N. Y.
FIRE ALARM, ETC.—W. B. Watkins, Jersey City, N. J.
FOLDING MACHINE.—S. D. Tucker, New York city.
GLOVE FASTENING.—C. R. Ferguson, Washington, D. C.
HEATING THE LEAD.—O. E. Kirtland, Milwaukee, Wis.
HOBBSHOLE MACHINERY.—W. M. Greenwood et al., Cincinnati, Ohio.
JOINING KNIT GOODS.—J. Bigelow, Boston, Mass.
LAMP FILLER, ETC.—J. F. Collins, New York city.
LANTERN.—J. M. Dietz, New York city.
LIGHTING WITH OIL.—C. Godfrey, Huntington, N. Y.
LOOM PICK.—H. McManus (of New York city), London, England.
LUBRICATOR.—N. Selbert, San Francisco, Cal.
MOWER AND REAPER.—W. A. Wood, Hoosick Falls, N. Y.
NEEDLE MACHINE.—Cook and Porter Company, Boston, Mass.
OIL SEPARATOR.—G. S. Bedford et al., Chicago, Ill.
PRINTING METAL.—L. B. Smith, New York city.
PROJECTILE.—H. M. Quackenbush, Herkimer, N. Y.
PROJECTILE.—R. P. Parrott, Cold Spring, N. Y.
ROTARY ENGINE.—T. E. Stewart, Boston, Mass.
SHIP'S TABLE.—E. P. S. Andrews, Boston, Mass.
SLIDE VALVE INDICATOR.—J. S. Wallace, Breittland, Ohio.
SOLAR CHROMOMETER.—M. Wheeler, Big Rapids, Mich.
SPINNING MACHINERY.—J. Hunter et al., Adams, Mass.
STEAM VALVE.—E. Cope et al., Hamilton, Ohio.
STEAM WHISTLE.—C. McKiernan, Paterson, N. J.
STRAW-SEWING MACHINE.—M. P. Carpenter, New York city.
TREADLE.—C. Brandtner, Reading, Pa.
VARNISHING AND LINING MACHINE.—G. L. Jaeger, New York city.
VENNERING, ETC.—C. W. Spurr et al., Mass.
VENTILATOR.—W. H. St. John, New York city, et al.
WHEEL SKATE.—S. O. Brown (of San Francisco, Cal.), London, England.
WIRE-BENDING MACHINE.—H. W. Putnam, Bennington, Vt.

Recent American and Foreign Patents.

NEW CHEMICAL AND MISCELLANEOUS INVENTIONS.

IMPROVED BELT FASTENING.

Thomas D. Brady, Baldwin, Pa.—In using the coupling, a certain number of holes are formed in the ends of the belt, which ends are then passed through the cavity of a frame. The holes are then passed over pins on a wedge-shaped bar, which is dropped into place in the cavity of the said frame. As the belt is run upon the belt wheel, this bar will be drawn down to its seat, securely clamping the ends of the belt between its sides and the sides of the frame. The object in view, in addition to providing a strong and secure fastening, is to leave a surplus of perfect belting at each coupling, to provide for the shortening up by breaks, and to leave no necessity for piecing at said breaks.

IMPROVED LAMP FUNNEL.

William Hodey, Galion, O.—This is simply a metal funnel for filling lamps, made of conically tapering shape, with a side slot for inserting the spout of the oil can.

IMPROVED COMBINED DATING AND CANCELING STAMP.

Joseph Jay Scholfield, Salt Lake City, Utah Territory.—This invention consists in the particular construction of a postmarking stamp and a canceling stamp made in one and the same piece, in combination with a vertically moving handle held up by a spring, which handle is provided with a laterally attached and interiorly screw-threaded tube or sleeve, which, passing down over a screw threaded shaft carrying the canceling disk, causes the latter to revolve, which, being provided with a series of sharp pins, tears a series of concentric circles and blots the postage stamp at the same stroke, at which the postmark is made.

TOOL FOR SHAPING THE NECKS OF GLASS BOTTLES.

John L. Stewart, Elliott City, Md.—This invention relates to the construction of a tool for forming the necks of that class of bottles which are to be closed by a stopper, having a bit upon the lower end, which, when turned, binds against a cam ledge. The invention consists mainly of a pair of jaws carrying a centrally located rod, surrounded by a loose tubular sleeve. The rod and sleeve each carry a key-shaped bit; and as the jaws clamp the neck of the bottle and are turned, the bit of the sleeve, being imbedded in the plastic glass, imparts to the rotating rod (through a cam) a longitudinal movement, which causes the bit of the rod to form a rising and falling cam in the plastic glass, with a keyhole-shaped orifice for the bottle.

IMPROVED CHEMICAL FIRE EXTINGUISHER.

Jacob B. Van Dyne, Louisville, Ky.—This invention relates to certain improvements in that class of chemical fire extinguishers, which are stationary and provided with a standpipe running up through the different stories. It consists in devices for mixing the chemicals from any of the upper stories without descending to the tank, and in devices for agitating the mixed chemicals simultaneously and with the same movement by which they are mixed.

IMPROVED INDEXING ROLLER.

John W. Dirhold and Henry F. Linnemeyer, St. Louis, Mo.—This invention relates to a novel construction of an adjustable indexing roller, or devices for printing the letters of the alphabet upon the margins of the front pages of a book. It consists mainly of a radial series of type-carrying sockets combined with a central adjusting screw, having a tapering middle portion, which, when the screw is turned, projects the type sockets farther from the center and expands the roller, so as to leave a greater space between the type or accommodate a larger size of type. The said type sockets are held in fixed position by a clamping ring with binding screws, and the device is rolled over the leaves to be printed by means of a detachable handle.

IMPROVED METHOD FOR PREPARING HAMS.

Alden B. Richardson, Dover, Del.—This invention relates to an improved method for preparing hams for the market; and it consists in first withdrawing the bone from the ham, and then packing the ham into a specially constructed can, after which it is hermetically sealed, and then cooked until it is sufficiently done to be ready for the table. The ham is thus cooked with all of its natural juices and flavors preserved; and in consequence of packing and cooking, the space left after the bone is withdrawn is perfectly closed, making the ham solid and homogeneous all through, so that the whole ham may be sliced through and through; and with the exception of a slight seam, the manner of preparing leaves no evidence of the former existence of a bone.

IMPROVED METALLIC SEAL.

Alphonse Friedrick, Brooklyn, N. Y.—This invention consists in the combination, with the compressible soft metal disk or button, having holes therethrough, of a loop made of lead, which is of such low degree of tenacity that when the button is compressed upon its ends the connection of the button with this loop is stronger than the tensile strength of the loop, so that the latter will break before it can be withdrawn.

IMPROVED EMBROIDERY FRAME.

Ernest W. Karker, College Point, N. Y.—This invention consists of a couple of parallel rollers in a vibrating frame for holding and adjusting the canvas as the work progresses, the said roller frame being pivoted to a stand, which supports parallel rods below the rollers, on which a work box is fitted to slide along the frame from end to end for convenience of the operator. The roller frame is pivoted to the stand by clamping bolts and nuts, which hold the roller frame at any required inclination. The roller frame may also be used for drawing maps and the like, and is adapted for being mounted on a stand, suitable for field use by engineers.

IMPROVED SPONGE CUP.

William Robert Gratz, Baltimore, Md.—The object of this invention is to provide an improved sponge cup which will not become dry so soon and require such frequent wetting. It consists mainly in a sponge contained in a perforated receptacle maintained in an elevated position in a water reservoir, by means of a spring, so that, as the sponge becomes dry, its humidity may from time to time be renewed by simply depressing the sponge, which brings it in contact with the water in the reservoir.

IMPROVED TAG.

Joseph I. Donahue, Brooklyn, N. Y.—This inventor proposes a new metal eyelet for the string, constructed of two metal disks and fastened to the tag, one at each side. On each are tongues struck out of the hole for the string and locked through the hole of the opposite disk, also through the tag. This makes a very simple and secure contrivance.

IMPROVED OIL CAN.

William Young, Clarkston, Mich.—This inventor attaches to an oil can a small cylinder, having a spring piston. The forcing down of the latter drives the oil out through the nozzle of the can.

IMPROVED PIANO PEDAL ATTACHMENT.

Charles F. Cheesman, San Antonio, Texas.—This consists of a stool with foot levers and connecting wires, so constructed that it can be applied to pianos, for the use of children not large enough to work the ordinary pedals, merely by hooking the stool to the ordinary pedal support and setting the connecting rods in little sockets in the piano pedals.

IMPROVED REVOLVING FIRE ARM.

Freeman W. Hood, Norwich, Conn., assignor to the Hood Fire Arms Company, same place.—This consists in a pivoted spring pawl of the hammer with the ratchet of the cylinder, and a pawl stopping recess of the stock, to securely lock the pawl when the hammer is placed in cocked position. The cylinder may be reversed while the hammer is dropped, and the common stop device entering the notches of the cylinder is dispensed with.

IMPROVED BALE TIE.

James S. Herron, Pensacola, Fla., and Charles R. Herron, Savannah, Ga.—This consists of a band end with a closed L-shaped slot, in connection with the opposite band end, having notches at alternate sides, that lock into the slotted end. The notches are drawn through the L-shaped slot until they bind tightly on the bale.

IMPROVED AXLE GREASE.

William Peters, Logansport, Ind.—This is a compound of black oil, hard tallow, wood ashes, white lime, salt, sulphur, and black lead.

IMPROVED FEATHER RENOVATOR.

Nathan P. Chaney, Pottsdam, N. Y.—The hollow drum for holding the feathers is constructed in two parts, of which the upper one is detachable and reversible for convenience in operating the machine. In the lower part is a perforated tube for introducing the steam, and a canal for carrying off the water of condensation, the canal being covered by a wire screen to prevent the feathers from falling into it. The drum also contains a revolving shaft with arms for stirring the feathers, and there is a steam jacket to the lower part, to which steam is admitted from a suitable boiler.

IMPROVED ANIMAL TRAP.

Henry F. Barnett and William Carpenter, Weston, Mo.—The animal sees the bait upon a hook through the open front end of a decoy box, and, approaching it, he enters the said box, walking upon the tilting platform. His weight causes the back end of the platform or door to descend, and he is precipitated into a lower box, whence he cannot escape. The door returns to a horizontal position as soon as its back end is released from the weight of the animal, and the trap is reset.

IMPROVED SPIRIT LAMP.

Sylvanus S. Robinson, Holden, Mo.—This invention provides an improved combined spirit lamp and blowpipe for the use of mechanics, chemists, and students. It consists in the particular construction and arrangement of a detachable water receptacle or boiler, located above some of the burners of the lamp, and provided with one or more steam pipes with small orifices, which open near one of the burners, so that the heat of a part of the burners generates steam, which, issuing from the orifices of the steam pipes, forms a blowpipe, which directs the flame of the burner outwardly to a point or focus for convenient use.

IMPROVED GAS REGULATOR.

Leander E. Fish, Washington, D. C.—This improvement rests in the construction and arrangement of purifying pans in the base of a gas regulator for the purpose of eliminating the heavy hydrocarbons which would have a tendency to impair the sensitiveness of the regulator. The pans are formed with inwardly inclined sides, so that each pan forms a support for the next one above, the inclination also affording means for lifting out the pans. The improvement further consists in a tapering water sealing trough, which is made by simply attaching a single strip of metal to the perpendicular side of the tank, thus simplifying and cheapening the construction of the seal, and diminishing the chances of overflow. The regulator proper is also of an improved form, being constructed conformably to the principle of the tapering water seal.

IMPROVED PLANISPHERE.

Paul Kuhnle, New York city.—By this device a view of both the terrestrial and celestial hemispheres is obtained, the course of the sun on the ecliptic (and thereby the increase and decrease of the days and nights during the year) illustrated, and also the distance and latitudes of different places on the earth, as well as the steamship connections of the different parts of the globe, indicated. The invention consists of two centrally pivoted and jointly revolving disks, provided with polar projections of the two halves of the earth on one side, and polar projections of the heavens on the other side. The ecliptic is indicated by arc-shaped grooves, along which a movable carriage, representing the sun, traverses. A graduated scale indicates the latitude and distance of any point on the globe.

IMPROVED FIREMEN'S SUITS.

John W. Ostberg, Stockholm, Sweden.—This is an air and water proof suit that covers the entire body, and is continually flooded with water, which is introduced by pipe connection with the hood, covering the head gear or helmet of the dress. The helmet is tightly applied to the body-covering dress, and the dress strapped to the body, air being supplied to the inside to keep out the smoke by an air supply pipe and pump. The helmet is provided with a hollow valve mask, through which the water is continually flowing, passing by a connecting tube to the hood that is fitted on the face mask and extended over the dress to shed the water over the same.

NEW AGRICULTURAL INVENTIONS.

IMPROVED CORN PLANTER.

John V. Reams, Midland City, Mich.—The essential features are ingenious and novel devices, for throwing the seed-dropping mechanism out of gear and raising the furrowing plows from the ground simultaneously, and also for operating the seed wheel independently, when thrown out of gear with the revolving axle.

IMPROVED FLOW.

William R. Pool, Havana, Ala.—This invention consists in a stock, which is combined with a forked piece, having sharp projections and a pair of blocks. The attachment is used with a narrow share for forming a smooth surface at bottom of furrow for the reception of cotton seed, and the working face is provided with forks that embrace the standards, and are fastened thereto by a bolt or rivet. It has also a shoulder. Small blocks press out the upper part of the furrow, that it may more conveniently receive manure and corn when the same are to be inserted.

IMPROVED FENCE POST.

Eugene Powell, Delaware, O.—The upper ends of wooden blocks inserted in the ground are notched transversely to receive the cross head, which is made of wrought iron, bent to form eyes, which receive the sharpened ends of the stakes. The ends of the rails of the adjacent panels are placed alternately between the stakes and one upon the other. The upper ends of the stakes are secured to each other by staples.

IMPROVED ANIMAL-WEANING BITS.

Alfred Bartlett and Alfred J. Bartlett, Jr., Toledo, Iowa.—This is an improved anti-sucking bit for calves, etc., which is not liable to be stopped up by hay or grass, and which allows the ready removing of the same without taking the bit out of the mouth of the animal. It consists of a hollow bit, with central perforated swell, stationary end loops, and open ends. It is cleaned by introducing a wire rod through its hollow portion.

IMPROVED FLOW.

Asa H. Piland, Margaretsville, N. C.—This relates to plows of that class in which detachable sweeps are employed, for the cultivation of cotton and corn in the earlier stages of its growth; and it consists in the peculiar construction of a combined moldboard and sweep or bat wing, made in a single piece, whereby, it is claimed, the plow is enabled to stand much greater service and harder strains without requiring repairs.

IMPROVED WIRE FENCE BARB FORMER.

Rheubin B. Pooler and William T. Jones, Seneca, Ill.—The object of this is to apply three-pronged barbs to the wires of wire fences. In applying the barbs, the single prong is inserted in the cavity of a pair of pinchers, with the outer side of each parallel prong resting against a jaw of said pinchers. The barb and pinchers are then made to straddle the fence wire, and the pinchers are closed, which forces the parallel prongs across the wire in opposite directions.

The pinchers are then opened and removed, leaving the barb firmly attached to the wire.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED CHILDREN'S CARRIAGE.

William E. Crandall, New York city.—The body of the carriage has the two frames of its top, the cover, and sashes in the frames made severally independent and detachable to facilitate packing and transportation.

IMPROVED ADJUSTABLE KEY GUARD.

James S. Wilson, Trenton, N. J.—This device includes a bar which, after the door is locked, is slipped into the keyhole beside the key and is turned partially round. Attachments of the bar are then firmly secured to the key handle, so that it is impossible to turn the key without first detaching the said device, and that cannot be done from the outside of the door.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED SOLDERING TOOL.

August Goetze, Baltimore, Md.—This invention relates to an improved construction of soldering iron especially adapted to capping cans of preserved fruits, vegetables, oysters, and other articles of food. The invention belongs to that class of soldering irons in which the copper block is attached to a hollow tube which is provided with a handle and adapted to be rotated about a central shaft, and also made vertically adjustable thereon. The improvement consists in the mode of attaching the soldering blocks to the tube to insure greater strength and durability.

IMPROVED SELF-ACTING GRAPNEL.

Jean Baptiste Toselli, Paris, France.—According to one arrangement, this grapnel is expanded by being suddenly raised while immersed in the water. The second arrangement, on the other hand, is made to expand by the act of lowering in the water; but in both cases the resistance of the water is the agent by which the arms of the grapnel are caused to expand or close together without any mechanical aid. This device, which is as simple as it is ingenious, will be found fully described and illustrated on page 214, volume XXXI of this journal.

IMPROVED TRACK CLEANER.

Silas T. Bentley and Jacob Estep, Union, Iowa.—This invention relates to a novel construction of machine mounted upon a platform car, to be used for cleaning snow from railroad tracks whenever the same become blocked by drifts. It consists in the particular construction of a derrick mounted upon a platform car and pivoted in the center so as to turn readily to one side, with the devices operating in connection therewith. Said derrick carries at one end a frame work in which is pivoted a scoop which may be raised and lowered by a windlass with pulleys and a cord attached to a bale on the said scoop. To the derrick above the scoop is pivoted a frame carrying a cut-off for the scoop after it is forced into the snow bank, which cut-off divides the snow in the scoop from that outside, and is operated through a cord, pulley, and windlass. The rear of the frame carrying the scoop is provided with a spring catch, with cord and windlass for dumping and restoring the scoop to its proper position upon its pivots.

IMPROVED RAILROAD RAIL.

Samson Sutton, Lisbon, Iowa.—This is a railroad rail constructed of two symmetrical rail sections joined in longitudinal direction and having a central wooden core. As the joints of the rail sections reach only half way across the rail head, the other half bears the wheel, and allows the wheels to pass thereby over any shrunken joint without battering, jolting, or breaking.

MACHINE FOR DESCRIBING AND CUTTING REGULAR CURVES.

Frank A. Polsley, Jackson Court House, W. Va.—In using the machine to describe a curve, a cone is so adjusted that, when revolved, the edge of a wheel may describe the required curve upon the face of the said cone. The paper upon which the curve is to be drawn is secured to the table, and the pencil is adjusted to rest upon it. Then, by turning the table, the point of the pencil will describe the desired curve. When the curves are to be cut, a table is substituted which has two dovetailed grooves formed across its face at right angles with each other, and intersecting each other at the center of the table. In these grooves are inserted four dovetailed blocks, to which are attached two pins at a little distance apart, to receive and hold the object to be cut. The blocks are so adjusted that the cutter, while cutting the curve, may pass between the pins.

IMPROVED PISTON PACKING.

William W. St. John, Pisgah, Mo.—This consists of a piston packing wider on the under side than elsewhere, for the purpose of bearing the weight of the piston and piston rod, in addition to the packing pressure, without greater wear than in the other parts.

IMPROVED WATER WHEEL.

Nelson M. Prince, Concordia, Kas.—This is a contrivance of two gates, so pivoted on opposite sides of the wheel and connected together that the water pressure is balanced. It is claimed that the gates work easier, and the form is such that each one makes two chutes, through which the water enters upon the wheel tangentially, giving good results.

IMPROVED BOOT HEEL AND EDGE POLISHING MACHINE.

Leopold Graf, Newark, N. J.—This is a polishing machine for finishing the edges of the heels and soles of boots and shoes, whereby two polishers—one for the heel and the other for the sole—are operated by one and the same driving shaft, in such manner that both operations may be carried on at the same time. There is, beside, a simpler and better contrivance of the gear by which the polishers are operated; an arrangement for obtaining a better action for the polishers, and a higher speed of them for a given speed of the driving shaft, an improved contrivance for guiding the polishers to edges of different thicknesses, and of an improved clamp frame for holding the shoe.

IMPROVED HOLDER FOR GRINDING NEEDLES.

Henry M. Dixon, Brooklyn, E. D., assignor to himself and Robert E. Dunham, Jamaica, N. Y.—This consists of a little tube with notches in the side, suitably shaped for inserting sewing machine needles, so that the points will project at the end suitably for grinding them. The tube forms a holder, which can be held and turned uniformly, so as to grind the points round and true.

IMPROVED FIRE ENGINE.

Clinton W. Clapp, Wappinger's Falls, N. Y.—This consists of a couple of receivers for carbonic acid gas and a steam pump, so combined and fitted with hose and nozzle for discharging the water and the gas that, by alternately charging the receiver and working off the gas through the pump, the gas can be employed as the motive agent for the pump, and, at the same time, the exhausting gas can be used separately or together with the water for extinguishing the fire.

IMPROVED MIDDINGS SEPARATOR.

Morris N. Elwell, Oneonta, N. Y.—This inventor proposes a verti-

cal draft box, in the upper part of which are a number of inclined slats, for breaking and distributing the stream of middings and the current of air. Said slats are at the entrance of a horizontal box, along which the particles carried over from the vertical box are carried over a hopper, into which the final separation is made by a lighter current up the spout. The middings are fed into the upper end of a box from a hopper, shoe, and regulating slides, and the bran is discharged through a fan. Below this apparatus is a duplicate set, in which the middings are treated again in the same manner by air currents set in motion by another fan.

IMPROVED WATER WHEEL.

Henry Waltner, Hamilton, Ohio.—This invention consists of buckets hinged to the periphery of the wheel to close in for passing cut-off partitions, employed to utilize the dead pressure of the water. The said buckets are provided with an arm which extends inside of the periphery of the wheel and strikes a stud on the lower part of the case. This throws out the bucket so as to take the water immediately after passing the cut-off. Among the advantages claimed is that the device works with any head of water, also under back water. It employs the whole periphery of the wheel for the utilization of the water power, and gives the advantage of the full pressure of the solid column of water of a given head of water, without the necessity of an accelerated motion.

IMPROVED PUMP.

Benjamin Eby and Jacob S. Fiester, Kinzer, Pa.—To the pump barrel beneath the frost line is attached a right angled spout, against the mouth of which is pressed a valve. The valve is pivoted to an arm attached to the spout, and to its inner end is attached the lower end of the connecting rod, which is pivoted to a trigger, which is pivoted to the pump barrel in such a position that, when the handle is lowered, it may strike and press it downward, uncovering the mouth of the nozzle and allowing all the water above the frost line to flow out, so that it cannot freeze. As the handle is raised to work the pump, the valve plate is again raised against the spout by a spring, to prevent the entrance of air into the pump barrel.

IMPROVED LIFTING JACK.

David Hiltabidle, York Road, Md.—This invention relates to that class of lifting jacks in which two lifting links are pivoted to an oscillating lever upon opposite sides of its fulcrum, and are arranged to operate alternately upon opposite sides of a double ratchet bar to lift the load. The invention consists in the construction and arrangement of devices operating in connection with the links for the purpose of releasing them from the ratchet bars.

IMPROVED PROPELLER FOR BOATS.

John W. Dolch and George Haydn, Baltimore, Md.—This invention belongs to that class of propellers in which a long spiral propeller is arranged to revolve in a cylindrical channel in the bottom of the boat, which channel opens into the water at both ends, and through which the water is discharged by the revolutions of the propeller to urge the boat forward. The invention consists in making the cylindrical channel with a detachable upper half, which is fastened by means of bolts to the said lower half, the upper detachable portion being provided with hangers, in which the ends of the propeller shaft are journaled so that the propeller is removable with the upper section of the channel.

IMPROVED SHINGLE MACHINE.

Moses Stewart, Dallas, Texas.—The object here is to improve the construction of the shingle machine known as the Everts rotary twelve-block shingle machine, in such a way as to prevent the blocks from jumping when the dogs strike them. The invention consists in an incline formed upon the rear ends of the guide plates for the stems of the dogs to slide down upon, so that the dogs may take hold of the blocks gently and without moving them from their place.

IMPROVED RUDDER-INDICATING APPARATUS FOR VESSELS.

Justus A. Briebach, Clapton, England.—This is a device operated automatically by the rudder for the purpose of showing, at a distance, the position of said rudder, and, consequently, the direction in which the vessel is steering. The rudder is connected by rods to colored glass slides in a lantern, located in the forward part of the vessel. When the rudder is amidships, the slide carrying the colored glasses will be in its central position, and an equal amount of light of each color will be exhibited through the opening of the lantern; but when the rudder is moved over in one or other direction, the slide will be raised or lowered, and a greater amount of one or other color will be exhibited.

IMPROVED SAFETY APPARATUS FOR RAILROADS.

John B. Prohbas, New York city.—This invention consists of an elevated rail at each side of the track and hook-shaped or grooved roller projections attached to the car. In case the main rails sink or otherwise fail, or the car wheels or axles break, the cars will catch on these side rails by the projection, and thus be prevented from injury. The contrivance is also designed to be such that, in crossing places where the ordinary rails cannot be well laid, the cars may run altogether by the grooved wheels on the guard rails, the latter being firmly supported on piles, and the wheels being suitably connected with the power.

IMPROVED MACHINE FOR FINISHING BARRELS.

Edmund W. Gillman, Long Island city, N. Y.—This is an apparatus for evening the staves, pressing on the hoops, dressing off the ends, and crozing and chamfering the barrels. The barrel, having truss hoops, is rolled into position between the presser rings, which at the time rest between the pushers. The latter are then pushed forward so as to press the ends of the staves strongly between the rings, to even the staves lengthwise. Pressure is next applied against the hoops, for pressing them on and tightening up the joints of the staves. As soon as the staves are pressed endwise and evened by the rings, they are dressed off true by a rotary cutter. A gage then runs against the ends of the staves to gage the distance of the evening, crozing, and chamfering tools from the ends, said tools being carried by a rotary cutter head.

IMPROVED GOVERNOR.

Bernard W. Johnson, Barry, Ill., assignor to himself, Joseph D. Partello, and John M. Ryan, same place, and Miller T. Greenleaf, Quincy, Ill.—Through the lower part of the valve stem passes a lever pivoted to some suitable support. The lever passes through a cage, in which is inclosed a glass cylinder half filled with mercury. The governor is so adjusted that the cylinder may be in a horizontal position when the governor is running at its proper speed, with about half the machinery to be driven in gear with the engine. If, now, some of the machinery is thrown out of gear with the engine, the rise of the balls tends to close the valve, and also raises the outer end of the cylinder. This causes the mercury to flow toward the inner end of said cylinder, and changes the leverage, so that the engine does not have to keep up its speed to keep the valve closed. If, on the other hand, more machinery is thrown into gear with the engine, the balls lower, and the outer end of the cylinder is depressed, causing the mercury to flow toward the outer end of said cylinder, giving more leverage against the centrifugal force of the balls, and bringing the engine to its proper speed quicker than the balls could do alone.

Business and Personal.

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

Agricultural Implements and Industrial Machinery for Export and Domestic Use. R. H. Allen & Co., N. Y.

How to lay out the Teeth of Gear Wheels. Price 50 cents. Address E. Lyman, C. E., New Haven, Conn.

Wanted—Inventors of Harrows and Harrow Teeth, to send samples of teeth, descriptions, and price for right, to "Harrow Co.," Dayton, Ohio.

Wanted—At low prices, good small 2d hand Iron Planers, Lathes, Drill Presses, and other Machine Tools. Send particulars to J. & H. Kelsey, 186 Kentucky Avenue, Indianapolis, Ind.

Owners of Steam Engines—We guarantee 25 per cent extra power or an equal saving in fuel, by applying the Hanson Syphon Condenser. T. South, Consulting Engineer, General Agent, New Haven, Conn.

Wanted—A first class mechanical draughtsman. Address, with particulars, Draughtsman, Box 639, Providence, R. I.

Steel and iron drop forgings all shapes, 1/4 oz. to 5 lbs., far superior to malleable and steel castings. Steel slide wrenches a specialty. Call before purchasing elsewhere. Wm. Rose, Bro. & Co., 36 & Filbert sts., W. Phila.

Wanted—A man (fully competent) to erect and take charge of a Cotton Ginning and Wadding Factory. Address, with references, J. M. Ferguson, 440 Prytanis St., New Orleans, Louisiana.

We have on hand a large lot of Machinist's Tools, second hand, which must be sold in order to close up an old partnership. For pamphlet, giving full description of each tool, address Steptoe, McFarlan & Co., 214 West 2nd St., Cincinnati, Ohio.

Wind Mill Rights Cheap—One county in each State to give for introducing the mill. For terms, &c., address E. S. Smith, Good Hope, Ill.

Wanted—Address of Makers of Papier Maché Ceilings. Address J. Parmelee, Des Moines, Iowa.

The French Files of Limet & Co. have the endorsement of many of the leading machine makers of America. Notice samples in Machinery Hall, Centennial Exposition. Homer Foot & Co., Sole Agents, 22 Platt St., New York.

Wanted—The agency of some good Engines, Boilers, Machinist's Tools, and Wood-working Machinery; also Steam and Gasfitter's Tools, Brass Goods, &c. Address G. H. B., 213 North Fourth St., Philadelphia.

Top for Baby Carriages—Pat'd March 14, 1876. Rights for Sale. Address W. E. Crandall, 569 3d Avenue, New York City. See notice on page 281.

Second Hand Machinery—Large Stock of Iron and Wood Working Machinery in Store at Great Bargains. George Place, 121 Chambers and 103 Reade Sts., New York.

Vertical Tubular Boilers, all sizes. Send for price list. Lovegrove & Co., Philadelphia, Pa.

For 2d Hand Portable and Stationary Boilers and Engines, address Junius Harris, Titusville, Pa.

Corrugated Iron—Iron Buildings, Roofs, Shutters, Doors, etc. Moseley Iron Bridge and Roof Company, Office, 5 Day St., New York. Send for circulars.

Bung Machine Makers—Please send address or circular to W. H. F., Box 713, New York City.

Bargains in new and second hand Machinery. Send for our printed list, No. 5, describing 300 machines. Forsyth & Co., Manchester, N. H.

Centennial Exhibitors, buy your Belting in Philadelphia, from C. W. Army, 145 North 3d St., and save freight and trouble. Satisfaction guaranteed.

Wanted—2d hand battery for Electric light; also Induction Coil. Particulars to J. T. O'Connor, 151 West 41st St., New York.

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Notes & Queries.

A. B. can color gold by the process described on p. 363, vol. 33.—P. M. H. will find an answer to his question concerning the commencement of the day on p. 401, vol. 28.—B. E. will find a description of the toughened glass on p. 402, vol. 32.—R. F. B. P. can cement straw boards together with marine glue. See p. 43, vol. 32.—F. B. L. can make an excellent incubator by following the description on p. 273, vol. 33.—J. S. can find a good recipe for cement for glass on p. 379, vol. 31.—F. S. H. can prevent rust on his skates by the method given on p. 169, vol. 33.—W. F. F. can find a description of bisulphide of carbon on pp. 306, 363, vol. 28. The numbers are out of print.—H. E. J. will find full directions for setting shafting, etc., on p. 388, vol. 31.—B. H. will find a recipe for hair stimulant on p. 138, vol. 33.—P. F. will find mention of a process for making gas from coal oil on p. 65, vol. 32. Coal gas is purified by passing it through quicklime.—C. A. W. will find directions for taking casts on p. 58, vol. 24. In molding the male human face, the beard, etc., should be well oiled to prevent its adherence to the mold.—W. H. B. will find directions for bluing iron and steel on p. 123, vol. 31.—B. L. can make sulphate of indigo by the process given on p. 250, vol. 34.—B. P. F. will find directions for utilizing bones on p. 251, vol. 28.—D. N. C. will find a recipe for a black enamel on iron on p. 208, vol. 36.—A. H. S. will find that rice glue is a good cement for making transparent cards. See p. 155, vol. 32.—J. C. S. Jr., will find a recipe for remedying the rancidity of butter on p. 119, vol. 30.—C. H. S. can raise his water by wind power. See p. 241, vol. 32.—J. L. W. will find a description of the Russian circular ship on p. 87, vol. 32.—W. E. will find a recipe for rubber cement on p. 203, vol. 30.—H. F. P. can extract silver from waste solutions by the method described on p. 219, vol. 29.—W. C. M. will find directions for making carmine red ink on p. 200, vol. 30.—E. S. A. will find directions for making Professor Tyndall's respirator, which is suitable for his purpose, on p. 178, vol. 32.—X. Y. Z. will find directions for building a windmill on p. 241, vol. 32.—R. D. T. will find a description of soluble glass on p. 315, vol. 31.—E. R. will find directions for making sulphate of indigo on p. 250, vol. 34.—C. C. will find directions for making imitation rosewood on p. 154, vol. 30.—J. P. will find directions for gilding on wood on p. 90, vol. 32.—F. V. D. C., G. W. D., W. K., F. W., and G. R. S., 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. H. B. asks: Can you tell me how bevel gears are tapered on a regular gear cutter? A. The chucking spindle is made adjustable, to suit the taper.

(2) J. M. H. says: The brasses on the forward end of a locomotive's main rods are continually wearing out, not quite so much on one side as on the other. The brasses are hard, yet they do not heat nor cut. I have to chip and file the brasses a great deal too often for the amount of work done. The engine works well and we make good time with her. A. It is probable that your journals have not sufficient wearing surface, or else the brasses are not made of the proper mixture of metal.

(3) G. V. B. asks: At what speed should I run a polishing wheel 2 feet in diameter, on which flour emery is used with oil? A. At 320 revolutions per minute.

(4) X. Y. Z. says: I am preparing a machine to split pieces of wood 2 feet long and 6 inches in diameter by means of two axes working horizontally and connected by an axle with a double crank or a fly wheel. The wood is about as hard and splits like pine. About what size and weight of fly wheel do I need to work the machine by water power? A. If you make a fly wheel 3 feet in diameter, with a rim having a cross section of 12 square inches, we think it will answer.

(5) H. F. asks: What is the best water proof cement, that the sun will not affect, for putting glass tiles in iron frames? A. Use a cement made of white lead ground in oil, with as much dry red lead added as will make it to the proper consistency. Cut up some hemp into short fibers, and mix the whole by well hammering and kneading it.

(6) J. A. L. asks: 1. How large a boat would it require to carry 6 or 8 persons? A. Make a boat 15 to 20 feet long. 2. What kind of boiler and engine will be best? A. Use an engine 3 x 3 inches, and a boiler 28 to 30 inches in diameter and 4 feet high. 3. Will the man running the engine have to get papers licensing him to run her? A. It will be necessary to have a licensed engineer.

(7) S. C. H. asks: In heating a large piece of steel to temper it for cutting wood, it scales off. Would it do to put the steel in molten lead instead of heating it in the fire? A. Yes. Heating in lead will answer excellently.

(8) R. P. asks: 1. What would be the striking force of a man weighing 150 lbs., jumping from a railroad train running at the rate of 30 miles per hour, the distance from the car to the ground being 4 feet? A. The amount of work to

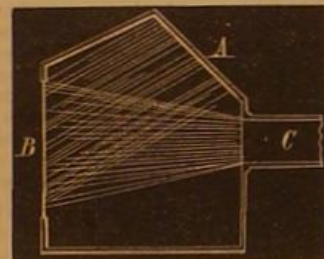
be overcome in bringing the man to rest would be: His weight x (velocity in feet per second with which he strikes the ground).

Now if you can find through what distance this resistance is overcome, by the compression of the earth and of the man, the quotient of the whole work in foot lbs., divided by this distance in feet, will be the striking force in lbs. 2. If 2 men of the same weight jumped from the same height, could one strike the ground with less force than the other? If so, why? A. From the above answer, you will see that if one jumped harder than the other, or if he or the ground on which he jumped were more compressible, there might be some difference in the striking forces, which would, however, be sufficiently severe in any event.

(9) F. P. asks: How can I make the cores for the steam ways for an engine 1 1/2 x 3 inches? I have used 1 part clay and 1 part molder's sand, but it falls to pieces. A. Strengthen the cores with wires.

(10) F. E. H. asks: How do you measure a safety valve? I measure it as follows: I hang the lever on a spring balance at the point where the valve rests, the lever and valve showing a weight of 20 lbs. Then I measure the bottom of the valve, which is conical, the bottom being of the size of the pipe on which it is placed. It was 4 inches in diameter, and the weight on the end of the lever was 50 lbs. The lever is 24 inches long in all, the short end being 4 inches from the fulcrum. I calculate as follows: 4 x 4 = 16 x 0.7854 = 12.5664 square inches area of valve. Lever is 24 inches long, short end 4 inches: 24 ÷ 4 = 6 x 50 lbs. = 300 lbs. + 20 lbs. for lever and valve = 320 lbs. 320 ÷ 12.5664 = 25.47 lbs. steam. Am I right? A. If the valve fits perfectly tight, it is proper to measure the lower diameter; but if it leaks, the steam acts on an area corresponding to the larger diameter. You seem to have made a mistake in your calculation. The weight of the valve and lever acts at their common center of gravity, which can be found by balancing the lever on a knife edge.

(11) F. P. asks: Can stereoscopic views be reflected upon a white curtain in a dark room, so that they can be shown and explained to a company of spectators? A. Yes. It can be done by attaching a box, as shown in the accompanying en-



graving, to an ordinary magic lantern at A, the picture being placed at B and the objective at C. The light coming from the condenser is reflected from the picture and passes through the objective, and the image is formed on a curtain at a short distance from it in front.

(12) J. D. G. says: I have an upright vessel containing 10 gallons, with a watertight piston on the top. What weight would be required on the top of piston rod to make a pressure of 40 lbs.? A. If you mean a pressure of 40 lbs. per square inch, it would be necessary to have a weight equivalent to the weight of a column of water having the diameter of the vessel, and a height of about 93 feet. To find approximately the weight of such a column of water, multiply the cross section of the cylinder in square feet by 5,800.

(13) J. L. and others.—In the United States marine engineers are licensed by the government inspectors, after passing satisfactory examination on the principles, management, and repair of steam machinery.

(14) G. A. B. asks: I am going to put up a fountain, and I have no water supply but a well. I propose to put a tank on a shed which is 24 feet high and 60 feet from the proposed location of the fountain. 1. Is it practicable? A. Yes. 2. Would a 40 gallon tank give as much force as a 100 gallon one? A. Yes, if of the same height. 3. What size of pipe would be suitable? A. Use a 3/4 inch pipe. 4. Which would be the best, lead or iron? A. Iron pipe coated with tar and laid 8 1/2 feet in the ground. 5. About how high would it play through a 1/4 inch hole? A. Not very high. 5. What would you advise me to do? A. To provide a much larger tank and set it much higher, so that your fountain may play higher and the supply of water last longer.

(15) T. S. O. asks: Are the finest fret saws stamped or filed out? A. Stamped.—J. E. E., of Pa.

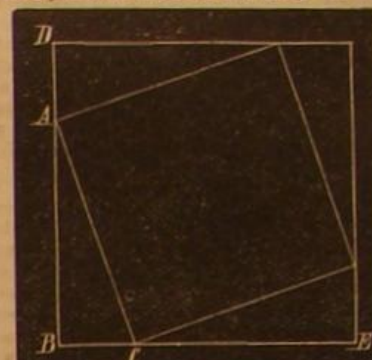
(16) C. S. says: I have put a burglar alarm in a house; it has been in use 3 months and works well, but in one place where the 6 wires run they seem to get eaten off as with acid. It occurs where the wires run through a brick wall. What is the cause? A. It is caused by the electricity which flows across the moisture on the wall and destroys the wire by local action.

(17) A. B. asks: How much silk-covered copper wire and what number of wire do I want to wind on a soft iron core 3 inches long by 3/4 diameter, to lift the greatest weight? A. Use 100 feet of No. 14 copper wire.

(18) E. C. T. asks: 1. If a circular saw, 10 inches in diameter, must run 3,000 revolutions per minute to do good work, how fast must saws 6 and 4 inches in diameter, respectively, run to do good work? A. A 10 inch saw should run at 3,000 revolutions per minute, a 6 inch saw 5,000, and a 4 inch saw 7,500; half the above speed will answer, and the saws do good work. 2. Is it possible to get

sufficient speed to run a 4 or 6 inch circular saw, with two pulleys, the driving pulley of 20 inches diameter and 1 1/4 inches face, weighing 20 lbs., driven by a foot treadle? A. We do not think you can get speed enough unless you use gears, or use an intermediate shaft between treadle and pulley, to increase the speed. 3. Can I successfully run a scroll saw, the treadle furnishing motion to the abovenamed 20 inch pulley, and this pulley to the smaller one by friction, effectively and without slipping? A. We should think so, if well constructed. 4. Should both pulleys be faced with leather or rubber, or only one, and which one? A. Either will answer. Rubber makes an excellent friction face. The large wheel may be faced with rubber or leather, and the small one should be wood or iron. 5. What should diameter of smaller pulley be? A. About 2 or 2 1/2 inches diameter will answer for the small wheel.

(19) J. D. L. says: The following is, I believe, a new solution of the well known Pythagorean problem, Euclid I, 47: The square of the hypotenuse of a right angled triangle is equal to the sum of the squares of the other two sides. In the tri-



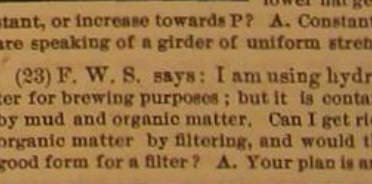
angle, A B C, prolong B A to D, making A D equal to B C; prolong B C to E, making C E equal to A B, and complete the square. Erect a square on A C. Then we have (A B + A D) x (B C + C E) = area of larger square. But this area is composed of the area of the four triangles (which, having the sides equal, each to each, are equal to each other) and the square of A C; hence (A B x A D) + 2 x (A B x B C) + (B C x C E) = area of larger square. Then D B^2 = A B^2 + 2 (A B x A D) + A D^2 = 2 (A B x A D) + A C^2. Therefore A B^2 + A D^2 = A C^2.

(20) L. K. asks: I have a box made of black walnut. Some parts of it are nicely covered with a fine coat of copper. How is it put on? A. By first covering the box with wax, then with black lead, and then depositing by the regular electrolytic process.

(21) G. E. Y. asks: What is the difference if any, between the temperatures of steam and water in a boiler, at from 10 to 50 lbs. per square inch? A. In ordinary practice, there is probably only a difference of a few degrees in the two temperatures; but by depriving the water of air, and heating it gradually, the temperature of the water has been increased more than 100° above the temperature of the steam.

(22) W. M. says: A girder has the load uniform and top flange with sectional area uniform, the lower flange being a parabola whose vertex is at A. Should the sectional area of lower flange be constant, or increase towards P? A. Constant, if you are speaking of a girder of uniform strength.

(23) F. W. S. says: I am using hydrant water for brewing purposes; but it is contaminated by mud and organic matter. Can I get rid of the organic matter by filtering, and would this be a good form for a filter? A. Your plan is an admir-



able one, and, we think, will answer all the requirements of the case. The columns of sand and charcoal should be about 10 feet high and about 5 feet in diameter. Use well washed gravel and only perfectly carbonized charcoal. If the latter provision is not carefully attended to, the water may become still more contaminated by contact with the green charcoal.

(24) J. H. T. asks: I wish to make a relay for a short telegraph line. I have about 6 ozs. No. 22 silk-covered wire. Will you please tell me of what size and length the iron core should be to get the best results, the current being very weak? A. About 1/4 inch wide by 5 inches long. 2. Does it take more wire to magnetize a 1/4 inch bar than it does a 1/4 inch one with the same current? A. Yes.

(25) W. W. asks: Is there anything in the form of a one half balance wheel applied to the shaft of a sawmill? A. The half balance for a sawmill shaft is old. It is a very common way of counterbalancing the weight of gate and pitman.—J. E. E., of Pa.

(26) J. D. W. asks: Do thermostats made of brass and steel last or set well for a considerable time? A. If properly constructed they do.

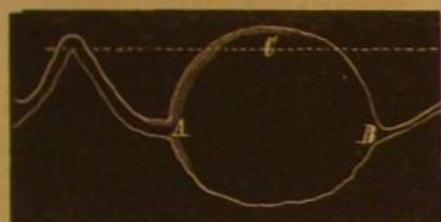
(27) J. F. R. says: I am building an icebox 8 feet deep, 8 feet high, and 5 feet wide, ice being suspended in a grate. There is an air chamber inches wide all round it. Is ventilation necessary? A. A certain amount of ventilation is necessary. We would suggest an opening 3 inches in diameter upon one side at the bottom, and a like opening upon the opposite side at the top, these openings should be covered with wire cloth. The openings should communicate with the interior and not with the 2 inch space.

(28) D. P. W. asks: If a tube *mirabilis* stop in an organ be weighted 15 inches water gage pressure of wind, what will be the relative pressure on a steam gage? A. About 0.65 lb. per square inch.

(29) A. C. C. asks: Does the friction increase with the diameter of the journal, the weight and the velocity remaining constant? A. Under these circumstances the friction would not vary.

(30) J. E. D. asks: 1. Will quicksilver remove the lead from gun barrels? A. Yes, but the black lead (carbon) and oil with which the bullets are covered, and the percentage of arsenic with which the metal is alloyed, often renders this method unsuccessful. 2. If so, how can the lead be separated from the quicksilver so that the latter can be used again? A. Heat the alloy in a suitable iron retort, the beak of which, or its connection, must dip beneath the surface of a quantity of water. The mercury will distill over and condense beneath the water, while the lead will remain behind.

(31) J. S. O. says: The generally accepted theory of intermittent springs is that a cavity in the earth has two water channels, one leading into it, the other out, the former being the smaller, as in the engraving, which represents the section of an intermittent spring. Let A be the outlet, 2



inches in diameter, and B the inlet. If water flows in through this channel, it will rise to the level, C, and instead of filling the channel, A, which is necessary to create a siphon, it will flow out in a steady stream as long as water flows in at B. Can any one give another theory to take the place of the long accepted but evidently incorrect one? A. In accounts of several intermittent springs which we have seen, it is stated that the water first issues with great velocity, and runs for some time with a continually decreasing velocity. It would not be difficult, therefore, to believe that the cavern might be so supplied as to be full at times, the supply being sometimes greater than the discharge and sometimes less. Perhaps some of our readers have devoted more attention to the subject than we have, and will send us their views.

(32) W. F. T. asks: 1. How high will an hydraulic ram raise water? A. In general, it should not be more than 15 times the head under which the ram works. 2. If I attempt to raise all the water that runs from my spring with an hydraulic ram, what proportion of the water will the ram raise? A. It may raise from $\frac{1}{4}$ to $\frac{1}{10}$ the whole amount. 3. Can an hydraulic ram of any size be made to work, or is there a limit to the size at which it can be made to operate successfully? A. As a general thing, the size of a ram is approximately fixed by the conditions under which it has to work. You will find the whole matter fully explained on p. 259, vol. 31.

(33) B. W. S. says: The head of a horse rake, being green when manufactured, has warped in drying. How can I remedy the defect? A. Possibly by steaming the wood, and securing it in the proper position, you may give it the original shape.

(34) M. W. H. asks: At what angle should a rifle be held to throw a ball to the greatest distance over level ground? A. A general value would be difficult to ascertain. In practice, the angle will probably be between 30° and 40° .

Can a horse do more work walking at 30 or at 60 yards per minute, in both cases pulling his best for the space of one minute? A. He could probably do more, for a short time, at the greater speed.

What steam pressure would a vat (made of grooved and matched 2 inch oak plank, of 10 feet high and 8 feet diameter, sustain, being bound with nine $\frac{1}{4} \times 2$ inches iron hoops? A. Between 30 and 40 lbs. per square inch.

(35) R. H.—If, as we understand you, the thrashing machine runs with sufficient steadiness at present, we do not see that any advantage would be derived by using a heavier cylinder.

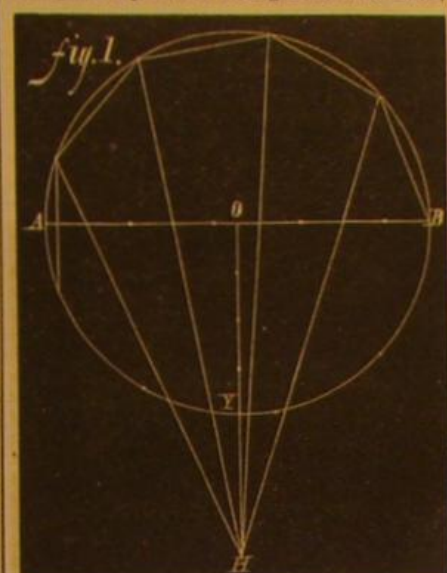
(36) C. W. C. asks: 1. Is a screw steamer, of 1,000 horse power, faster or slower than a side wheeler of the same power? A. In still water the screw would have no great advantage; but in the case of adverse winds and heavy seas, its superiority over the side wheel is very decided. 2. Is a two-bladed screw more powerful than one with more blades, other things being equal? A. Experiments seem to show that screws with two blades are not as efficient as those having three or four, other things being equal.

(37) I. J. H. asks: Can I cover steel-pointed poles with any preparation that will prevent their attracting lightning? I want to use those I have to make a garden fence, but am half afraid to do so. A. Metals do not attract lightning. The idea that they do is a popular delusion.

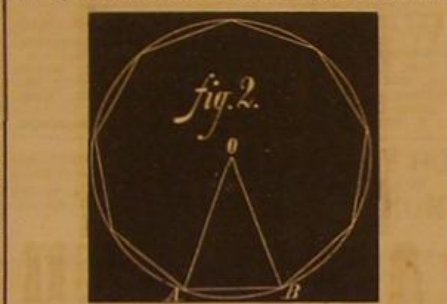
(38) F. A. S. asks: Can you inform me what is the best contrivance for grinding centers in a lathe? A. A revolving emery wheel.

(39) F. N. W. asks: In connecting a tank in the top of a building with the standpipe from the pump, will there be any difference in the pressure on the pipe whether it be connected at the bottom or at the top of the tank? A. If the tank is kept full, there will be no difference. This also answers S. F.'s plumbing question.

(40) S. C. says: I offer the following as an easy method of dividing circles. In a given circle (Fig. 1) divide the diameter, A B, into as many equal parts as you wish the figure to have sides;



erect the perpendicular; O H, divide the radius into 4 equal parts, and set off 3 of these parts from Y to H; draw lines from H to each division on diameter, and produce them to cut the circumference. Join any two of the points by a chord, and it will be the side of required polygon. When the polygon is to have an even number of sides, divide diameter in half the number and draw from H through each division. Join any two points where they cut the circumference, and the chord so drawn will be the side. To do the same (Fig. 2) when each side is to be a definite length: Divide 360° by the number of sides in polygon, deduct the

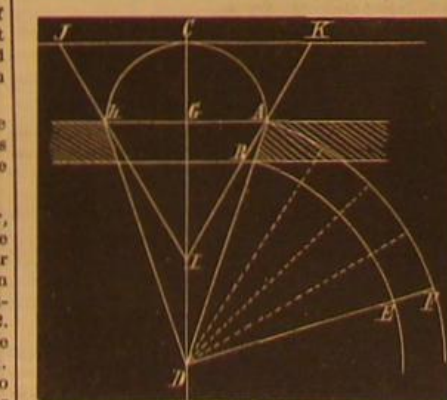


quotient from 180° , the remainder will be the number of degrees in each polygon; at the points, A and B, one inch or whatever length you wish for a side apart, make the angles, O A B or O B A, each equal to half the angle of the polygon; from O as a center, with O A or O B as radius, describe a circle, in which place A B continually.

(41) M. D. asks: Can you inform me what colors or combinations of ingredients I must use to produce a silver color, like silver leaf, on leather? A. Try the bisulphide of tin. Apply with a hot iron.

(42) W. C. asks: Will dry steam, taken from a generator, at 100 lbs. pressure, passing into water in a closed boiler, the blow-off valve being set at 80 lbs., evaporate that water, or will the steam from generator condense and increase the quantity in closed boiler? A. After the water is heated up to the temperature due to the pressure, the steam would merely escape through the blow-off valve.

(43) S. S. H. says: 1. I have a window, the head of which is circular, and the inside casing is on the splay. Is there a rule by which I could cut out a board to bend around it, and make the marks across it so that I can saw-kerf it? A. We presume you have reference to the splayed soffit of your jamb instead of the casing. Let A B be the width and splay of the jamb, and C D a line drawn through the middle of the window, at right



angles to the direction of the wall. Prolong A B to intersect C D at D. With D A for radius, draw the arc, A F, and with D B for radius draw the arc, B E. With G H for radius, draw the semicircle, H C A. Make H I and A I each equal to H A, and from I, through A and through H, draw the lines, I J and I K. Make A F equal to J K, and join F and D. Then A F E B will be the shape of the soffit required. 2. What is a transom? Is it what is called the fanlight over the door, or is it the rail across the head of the door? A. The latter.

(44) F. S. B. asks: Please give me a recipe for cleaning white rubber coats. A. Try rubbing the coat with a little benzine, but do not allow it to remain too long in contact with the rubber. You fail to state with what the material has become stained.

(45) I. H. W., of Ouchy, Switzerland, says: Why is it that many (perhaps all) liquids will percolate more rapidly through two than one thickness of filtering paper? My theory is that, with one thickness, the paper, becoming saturated, adheres to the funnel sides, and checks the circulation of air, whereas, when two thicknesses are used, a circulation is established between the papers themselves. Am I correct? A. Yes.

(46) C. F. M. asks: What is the strongest and best kind of alkali for bleaching oil? A. Use a strong solution of caustic potassa or soda in water.

(47) M. asks: What is a good plan for compressing air on a small scale? A. Try a small air pump or bellows.

(48) W. B. W. asks: What acid will do to bite figures, etc., in mica? A. Try a mixture of strong sulphuric and hydrofluoric acid.

(49) W. L. asks: In casting gun metal or hard brass upon a smooth iron surface, or chill, what is the best coating or parting to put on the iron in order that the gun metal may form a smooth surface in close contact to the iron, without any blow holes? A. Use plumbago for a parting and dry the mold.

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

F. W. R.—It is decomposed granite, and the shining scales are small pieces of weathered mica. H. A. B. Jr.—You are mistaken in supposing the specimen is an ore. It is composed of quartz, mica, and the black portion of hornblende, which is a silicate of alumina, lime, etc., and some oxide of iron. A. W. S.—No. 1 is siliceous alumina, and a small percentage of hydrated oxide of iron. No. 2 is earth containing scales of mica. No. 3 is siliceous oxide of iron. No. 4 is silicate of alumina with oxide of iron. The percentage is so small that they are not to be considered as iron ores. T. L.—No. 1 is graphite (black lead). No. 2 is mostly iron pyrites, but you should send a larger piece and have it assayed.—G. C. R.—It is the American holly (*Ilex opaca*). The deep green foliage is less glossy than that of the European holly. R. W. B.—It is Epsom salts, as you have stated. The discovery is of the greatest interest and value.—B. M. R.—It is a small fragment of fossil, with clay and oxide of iron.—G. S. M.—It consists mostly of siliceous scales of mica, magnesia, and alumina. It is not of much value.

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

On Footprints in the Carboniferous Sandstone By J. L. G.
On a Day's Work. By E. L.
On Saving Life. By M. P.
On Supply and Demand. By W. L.
On the Newfoundland Railway. By H. A. C.
On Machinery and Labor. By W. P.
On Type-Setting Machines. By T. E. A.
Also inquiries and answers from the following:
J. P. S.—P. D.—A. H. L.—W. T. H.—R. L. D.—B. B.—F. H. W.—O. N. S.—B. B.—W. A. J. R.—W. S. T.—W. E. F.—H.—W. S. G.

HINTS TO CORRESPONDENTS.

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

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

Hundreds of inquiries analogous to the following are sent: "Who makes toughened glass? Who sells machinery for manufacturing starch? Who sells incubators? Who sells hydraulic rams? Who makes the machines used in the manufacture of friction matches?" 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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March 28, 1876,
AND EACH BEARING THAT DATE.
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A complete copy of any patent in the annexed list, including both the specification 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., 57 Park Row, New York city.

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SCIENTIFIC AMERICAN

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

Vol. XXXIV. - No. 19.
[NEW SERIES.]

NEW YORK, MAY 6, 1876.

[\$3.20 per Annum.
[POSTAGE PREPAID.]

IMPROVED AUTOMATIC SMALL STEAM ENGINES.

We have from time to time, during the last few years, suggested that if some one should produce a really good small engine at a moderate cost, the sales would amply repay the outlay. Our suggestions have been responded to from every part of the country, and we are enabled, in this number, to present to our readers some fine illustrations of an engine which, although small apparently, possesses all the features of a first class motor. It is made self-acting as far as possible.

Fig. 1 is a vertical central section of one of these engines and its boiler. The latter is of the vertical tubular type with the fire box eccentric to the outer shell; from this fire box the products of combustion pass up through tubes, as shown by the arrows, into a space beneath the feed water heater, which is above the boiler, and thence through drop tubes and up the smoke stack, as shown in Fig. 2. Fig. 2 is also a vertical section, cut perpendicularly to the axis of the crank shaft and at right angles to the plane of Fig. 1. There are air spaces in the base which prevent the radiant heat from burning the floor, on which the machine may be placed with no other foundation. The engine is of the slide valve type, the cylinder being located in a large exhaust jacket, and that again in the feed water heater. The exhaust steam, therefore, not only prevents radiation and condensation in the cylinder, but also heats the feed water. There are two pipes for conveying the exhaust steam from the jacket. The pipe, H, extends to the bottom, and through this all the water of condensation may be removed, while the larger portion may be allowed if necessary to escape, through pipe, I, into the smoke stack, and force the draft. Dry exhaust steam is, therefore, always available to force the fire. The advantage of locating the feed water heater on top of the boiler, and making it a base for the engine, is obvious, as it protects the engine from the great heat of the boiler and saves all radiation from the top. The cylinder is 3½ inches in diameter by 4 inches stroke; the crank makes 300 turns per minute. The speed may, however, be changed at will by changing the tension of the governor springs. The feed pump is cast in the crosshead slide, and is inside of the frame, giving the engine a neat and uniform appearance, and it also enables the belt pulley to be placed very near to the pillow block bearing. It is provided with a safety valve, E, having a handle to turn the valve in its seat at each starting, thereby preventing it from ever becoming cemented down or stuck. Oil cups, gage cocks, and a glass water gage are also attached. The boiler pressure is kept uniform by an automatic damper regulator.

A novel and important feature about this engine is its governor. We believe the present is the first instance of a small engine being provided with an automatic variable cut-off, the governor operating, as in the largest and best machines, directly on the point of cut-off. The economical advantages of this system are too well known to be recapitulated here. The object is attained in a direct and simple manner, no perishable belt being used. Two heavy weights, which constitute the balls of the governor, are placed inside of the fly wheel, and revolve with it, the centrifugal force being balanced with suitable springs, which may be adjusted at will, as shown in Fig. 1. The weights are attached to a bell crank, one end of which extends centrally

and embraces a sliding cam, attached to the main shaft in such a manner that, while it is free to move in the direction of axis, it cannot turn on the shaft but rotates with it. This cam has two projections corresponding to the up and down stroke of the engine, as shown in Fig. 2. The advancing faces of these projections are parallel to the axis, and open the cut-off valve at the same time at any lateral position. The slide valve is made to cut off at ¼ stroke, and the relation of the projection on the cam arc to the eccentric is such that, on the closing of the port by the slide valve, the balanced valve, G, is opened, and a full boiler pressure is let into the steam chest, which is very small. The valve, G, only remains open during the time that the follower is resting on the projections. The terminations or receding faces of the cam projections are cut spirally in such a manner that, when the weights, A A, are thrown outward by a too rapid motion, it brings a shorter portion of the projections beneath the follower, and thus cuts off the steam at an earlier

turns back to the tank from which the suction is taken. In this return pipe is placed a globe valve, E, with a sliding stem or spindle, which extends downwards and rests on the top of the shell, F. When the valve, E, is open, it is obvious that no water would enter the boiler, as it would discharge back to the tank; thus, when no water is being pumped into the boiler, the pump is not liable to become filled with air, but is always ready. The automatic part of the device relates wholly to the opening and closing of the valve, E. When the pump is working, it has to discharge its water somewhere; and if the valve, E, is closed, its only discharge is through the other branch and into the boiler. The shell, F, being full of water and oil and securely sealed, it forms a little boiler of itself; and steam is raised in it by the water falling in the main boiler and thus allowing the steam to displace the water in pipes, K and L, when the heat of such steam is rapidly communicated to the water in the shell; a pressure is raised, the elastic steel tap is expanded,

which closes the valve, E, and the water at once enters the boiler; when sufficient water has entered, it closes the pipe, L, and soon fills the pipe, K. Then the shell, F, cools, a depression takes place, and the relief valve, E, is opened, which at once allows the water to return to the tank and not enter the boiler. When it is desirable to take water from mains which have a pressure in them, then the pipes, I and J, may be connected to allow the water to circulate when not going into the boiler. Should a larger amount of water be required in the boiler at any time than that due to the height of the pipe, L, then the globe valve, B, may be closed; and the pump will throw its whole volume into the boiler, and it may be controlled in the usual way, by closing off, more or less, the angle valve, A. This feed water regulator is perfectly reliable, and in practice does not allow of a variation greater than the internal diameter of the pipe, L (½ of an inch).

Fig. 4, page 290, is a view of a noiseless, automatic pumping engine, using gas or coal as a fuel. It is automatic to a remarkable degree, the pressure, feed water, and fire taking care of themselves. They are highly finished and very neat in appearance, the boiler casing being 16 inches in diameter and 36 inches high; 25 cubic feet of gas per hour pump 250 gallons of water 100 feet high, or a larger quantity to a correspondingly less

height. This pump is very light running, and is practically noiseless, making less noise than a sewing machine. There is both an air chamber and a vacuum chamber; thus all noise from the impact of water and its disagreeable pounding in the pipe is avoided. With coal as a fuel, it is provided with a larger pump, and raises thrice as much water per hour as with gas. Fig. 5, page 290, is a vertical central section of the gas-burning pumping engine. The burner is a double argand, with 60 No. 60 holes, being the same size and once and a half the number used in a common argand as used for illumination. A represents the safety valve, B the heater, C C the boiler, D the counterpoise of float; E operates the boiler feed, G G are the pendent tubes, filled with water and forming a part of the boiler, H the burner, I the valve for automatically controlling the fire, by means of the piston, P, the lever, L, and spring, M; an inspection of the engraving will enable any one to comprehend the rest.

Fig. 6, page 290, represents a small oscillating engine, on (Continued on page 290.)

Fig. 1.

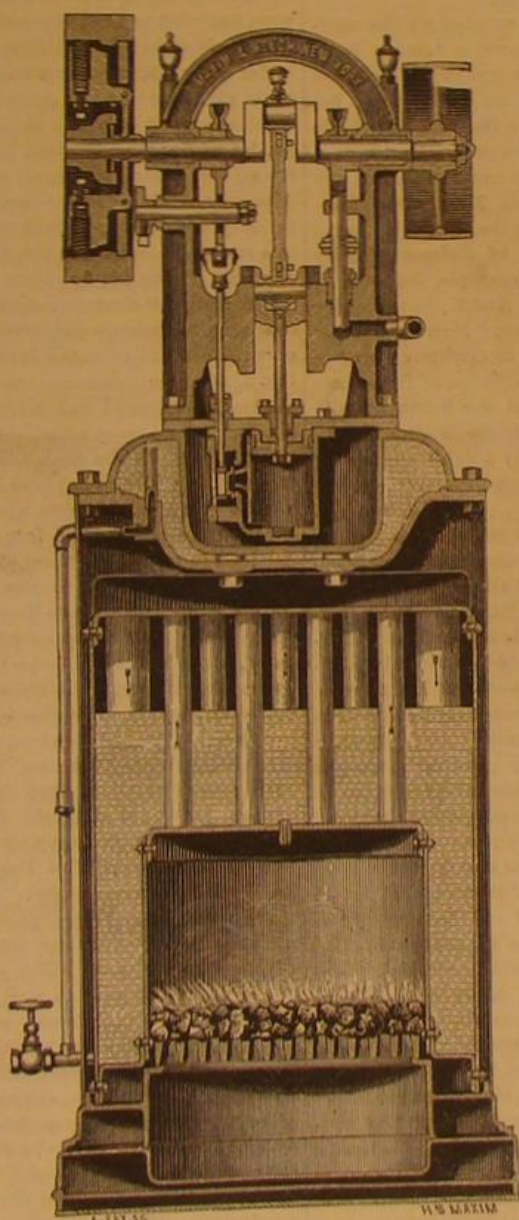
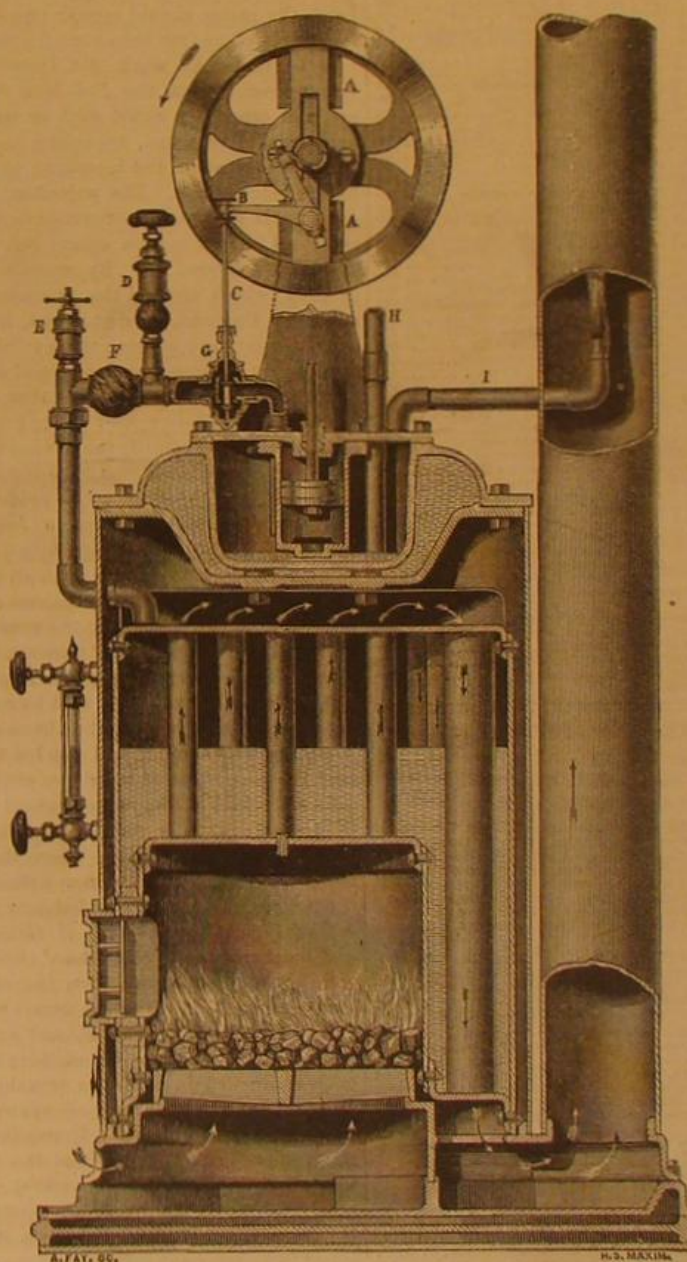


Fig. 2.



MAXIM'S AUTOMATIC STEAM ENGINE.

point of the stroke. Should the speed diminish, then the springs press the weight inward and allow the steam to follow the piston for a distance due to the work being done.

This governor may be applied to a larger class of engines, and would prevent waste drawing the steam and its attendant loss to a very considerable extent. Moreover, it is free from the dangers inherent to all governors requiring a belt to drive them, since the belt is liable to break, slip, or come off, and thus allow the engine to race, to the great danger to life and property, as many accidents attest.

One objection raised against small engines is the constant watching required to keep the right quantity of water in the boiler.

Fig. 3, page 290, is a view, partly in section and partly in elevation, of an ingenious automatic feed attached to these engines. The feed pump is of the ordinary solid plunger kind, with suction on one side and discharge on the other. There are two branches to the discharge, one of which passes to the boiler through the heater, and the other re-

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NEW YORK, SATURDAY, MAY 6, 1876.

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The best way to destroy thistles is to cut through the roots just before the buds form, with a spade, at a point 2 inches below the surface.

DARWIN ON CONSANGUINEOUS MARRIAGES.

There are few questions in social economy which have given rise to more scientific discussion than that of the intermarriage of near relations. While some attribute to those marriages no sinister results, others, on the contrary, affirm that they are fraught with the gravest danger to society, and that the offspring are, as a rule, disposed to be lymphatics, deaf mutes, idiots, epileptics, or sufferers from some one of the maladies of the nervous systems. Various investigations have been set on foot from time to time with a view of reaching some definite data on which to base a general law, without, however, attaining the desired object. A large number of instances of marriages between first cousins were at one period collected in France, among which were some terrible examples. In a Protestant family of the Isle de Ré, three brothers married three sisters, the parties bearing the above-stated relation. Out of eighteen children, the issue of these alliances, but one was exempt from infirmity; of the others, some died young, and the rest dragged out wretched lives as idiots and invalids. On the other hand, a French physician, Dr. Bourgeois, gives a history of his own immediate family, in which there were records of seventy-four consanguineous marriages, not one of which resulted in misfortune to the descendants.

Some new investigations on this important subject have recently been undertaken by Mr. George Darwin, the son of the celebrated naturalist, and carried through in a striking and novel manner. The questions to be settled were, first: What is the rate of consanguineous to ordinary marriages in the entire English population? And second: In asylums for idiots, deaf mutes, and the blind, what is the proportion of inmates, who are the offspring of consanguineous marriages, to the total population of the institution? It is clear that, if the second ratio should exceed the first, danger in consanguineous marriages might be inferred. If, on the other hand, the ratios should appear equal, such alliances might be considered as free from harmful results.

In beginning his work, Mr. Darwin counted all the marriages announced in the *Pall Mall Gazette*, a London journal, and especially noted such as were contracted between persons of like name, regarding such as taking place between first cousins, and intending to use the data as a basis for his calculations. The objection, however, at once suggests itself that many persons have the same name but are not at all related to each other; but this Mr. Darwin foresaw, and provided for. By consulting the English census of 1853, which showed the frequency of different family names in England, he discovered, for example, that out of every seventy-two persons there is one Smith; out of every seventy-six persons, one Jones, and so on. Now by the law of probabilities, which teaches that a composite event has for probability the product of the probabilities of the events of which it is composed, the chance that one Smith marries is $\frac{1}{72}$, and the chance that he will marry another Smith, not a relative, is $\frac{1}{72} \times \frac{1}{72}$ or $\frac{1}{5184}$, evidently a faint shadow of probability. Similarly, that a Jones will marry another Jones, not a relative, the chance is $\frac{1}{76 \times 76}$. Mr. Darwin calculated these probabilities from all the well known names, and deduced from these the chances of the less common appellations. Then, by taking the sum of all the probabilities, he found that the chance of persons, of like name but of different families, contracting marriage is only about 1 in 1,000, a probability so small that he considered himself justified in neglecting it; and thus he substantiated his first assumption, above-noted, and was led to conclude that in England the proportion of marriages contracted between cousins (of any degree) of like name is about $\frac{75}{1000}$ of the marriages in general. It now remained to deduce the proportion of consanguineous marriages, when the two parties bore not merely the same but different names.

First cousins may be divided into four classes: 1. Children of fathers' brothers; 2. of fathers' sisters; 3. of mothers' brothers, and 4. of mothers' sisters. If these categories were all of them equal, then the ratio of cousins of like names to cousins of different names would be about $\frac{1}{4}$. Such an assumption is untenable, and very many cases can be cited where it would be impossible; therefore the investigator is compelled to resort to actual statistics. Mr. Darwin prepared questions which were answered by the members of 283 families; and from the figures thus obtained he deduced that the ratio of first cousins of the same name to first cousins of different names is about $\frac{1}{4}$. But so hypothetical a conclusion needed more direct confirmation; and therefore Mr. Darwin distributed another set of questions, in which he asked to be informed relatively to the marriages between cousins which took place among the nearest relatives of the persons addressed. The results thus obtained confirmed the first ones, and the investigator was able to affirm that the sought-for ratio is comprised between $\frac{1}{4}$ and $\frac{1}{3}$. Applying this to the proportion of marriages of the same names, as previously stated, Mr. Darwin obtains the response to his first question, namely, that in England the ratio of marriages between first cousins is between 2 and 3 per cent of all marriages occurring. Other though more limited researches, by means of genealogical works and records, confirmed the above result, and showed further that in London the ratio falls to $\frac{1}{4}$ per cent, while in the rural districts it rises to $\frac{1}{2}$ per cent. Among people in good circumstances it reaches $\frac{1}{4}$ per cent, and among the titled aristocracy attains its highest figure, $\frac{1}{2}$ per cent.

The second portion of Mr. Darwin's work consists in researches made in about twenty insane asylums, and in a number of institutions for deaf mutes and blind children. He obtained information relating to the families of 4,822 idiots; and out of this large total he found that but 170 marriages between first cousins had insane issue, or from 3 to

4 per cent of the total number. The families of 366 deaf mutes (so born) contained but 8 (or 2 per cent) marriages of first cousins. This ratio is founded on too few a number of observations to merit complete confidence; but such as it is, it is far from being unfavorable to consanguineous marriages.

This is the present extent of Mr. Darwin's labors; and the accumulation of future researches will, of course, place them in more definite shape. As far as can be now judged, it would seem that there is no such serious danger attendant upon consanguineous marriages as has been stated and popularly believed. It is a misfortune that the suggestion of Sir John Lubbock, relative to adding a question regarding consanguineous marriages to the queries to be annexed to the English census papers of 1871, was not adopted, since the statistics thus obtained would have been of great value in Mr. Darwin's hands. Mr. Darwin's investigations, however, are remarkably bold, and certainly his deductions in the beginning are ingenious. Besides, in common with all similar work, they add to our knowledge of the science which underlies the welfare of the community; for it will be evident that, should such researches eventually prove that consanguineous marriages are dangerous to posterity, it then becomes the plain duty of society, for its own preservation, if not to interdict them, at least to prevent their occurrence as much as possible.

AN ENERGETIC EMPEROR.

The Emperor of Brazil (or rather Dom Pedro de Alcantara, as he is registered in the book of arrivals at the Fifth Avenue hotel, and as he prefers to be called, seeing that he travels as a private gentleman), together with the Empress and suite, arrived in this city on Saturday, April 15, and, after a stay of some forty-eight hours, departed for San Francisco. Brief as this flying visit was, it has been amply long to demonstrate the fact that the sojourn of his majesty in this country is not going to involve a repetition of the ovations which were accorded to the Prince of Wales and the Russian Grand Duke. Not that Dom Pedro does not merit, or would not under other circumstances receive, the grandest welcome we could give him; for as a potentate he outranks both the above dignitaries, and as a man he is immeasurably their superior; but he wishes it understood that his imperial paraphernalia are all left behind in Brazil, and that here he is simply Mr. Alcantara. Therefore no one need look for a royal progress, for they will be more likely to meet his majesty ensconced in a street car, as he was the other day in the suburbs of this city, and paying his five cents fare like any other passenger.

The Emperor characteristically began his visit by promptly declining to undergo the ceremonious reception which the government had provided for him, wholly regardless of the fact that three cabinet ministers, a vice-admiral, a major general, one man of war, a tug, and a steam launch had been dispatched to convey him from the Brazilian steamer to the city. When the high officials boarded his vessel, they found him in slouch hat and traveling garb, chatting pleasantly with a band of newspaper reporters, and their formal proceedings degenerated into a solemn farce. Dom Pedro declined to accompany them, so perforce they returned alone, and received the royal salutes thundered forth by mistaken forts and ships: while the Emperor quietly remained on board the steamer until she reached her pier, and then, with his party, hired hacks and drove to the Fifth Avenue hotel. Two hours after his arrival he visited one of the principal theaters and witnessed one of Shakespeare's plays, Henry V, on his return to his hotel he received a serenade, and then, at an hour (one o'clock Sunday morning) when it might be supposed that even royalty would become sleepy and tired after the long voyage, he started off to the *Herald* office, and watched the whole process of stereotyping and printing the morning edition of the paper. The Emperor's sight-seeing capacities are certainly extraordinary. At six o'clock the same morning he was wandering over Central Park; and during the next twenty-four hours he found time to attend church, to devote two hours to being photographed, to inspect the Croton water works, to visit Messrs. Moody and Sankey's meeting at the Hippodrome, and to spend the greater part of the night curiously examining the newsboys' lodging house, a police station, and the practical workings of the fire telegraph system in an engine house. On the subsequent morning, at an equally early hour, the Emperor was driven over to Jersey city (narrowly escaping a serious accident on the way, by the collision of his vehicle with a heavy cart) and made a thorough inspection of the vicinity. He was particularly pleased with the horse car elevator which lifts the street cars bodily up the Bergen heights, and mentioned the need of such engineering works to several Brazilian towns. On his return to the city, he visited several of the public schools and two hospitals, received an address from a committee of citizens, and at 6 P. M., after declining the proffered courtesy of a special train, installed himself with a portion of his suite in a Pullman car on the Erie Railroad, and started for San Francisco. The Empress remains in this city; Dom Pedro will proceed direct to San Francisco, remain there five days, and return by way of Denver, Salt Lake city, and Chicago, in time to reach Philadelphia at the opening of the Centennial.

The remarkable energy manifested by the Emperor in this city, in acquiring the utmost information in the brief time at his disposal, typifies his whole character. He is utterly averse to ceremony of every description, and even in his own capital throws off the seclusion peculiar to royalty, and mingles with his subjects at public places without restraint. As a ruler, none has done more to benefit his country. He has abolished slavery in his dominions, built railroads, successfully carried on great internal improvements, consolidated

his government, and raised Brazil to a position of undisputed pre-eminence on the South American continent. As a man, Dom Pedro possesses great literary and scientific acquirements. He was a warm friend of Agassiz, and rendered that naturalist invaluable aid in his studies on the Amazon; he is a member of the French Academy of Sciences, and for many years has been a reader of the SCIENTIFIC AMERICAN. His ideas on scientific subjects are broadly liberal. To a correspondent on board the vessel coming from Rio Janeiro, while discussing Darwin's theory, he said: "The theory advanced by Darwin is undeniable, but I do not agree with the deductions of some of Darwin's followers. I often recommend our young men to read Darwin's work, because I am a partisan of truth; and the more I read the more I am convinced that all truth is one, and that all Science meets in the point of truth. Therefore no obstacle should be thrown in the way of the development of any science." With such an advocate in the cause of Science, progress and enlightenment in Brazil will make rapid strides.

In conclusion we desire especially to bespeak for the Emperor a warm welcome from the scientific and progressive people of our land. And that welcome, we ask, shall not be meaningless displays or ovations, but the careful exhibition and explanation to his majesty of all industrial operations, of all new machinery, and all engineering and mining works which he may encounter in his journey. We can assure inventors, mechanics, engineers, and all scientific men that they will meet a most appreciative and eager listener, one who is well informed as to what American genius has already accomplished, and beyond all a man who discards the name of Emperor for the self imposed title of student.

SELF-IMPROVEMENT.

There are many young working men who are anxious to improve their minds by reading and study out of business hours. But too many grow discouraged and fail in their efforts for self-improvement, although they begin with the best intentions.

A want of thoroughness in whatever is undertaken is, perhaps, one great cause of such failures. A practical writer on that topic gives the following good direction: "Never leave what you undertake to learn until you can reach your arms around it, and clench your hands on the other side." It is not the amount of reading you run over that will ever make you learned; it is the amount you retain. Dr. Abernethy maintained that "there was a point of saturation in his mind," beyond which it was not capable of taking in more. Whatever was pressed upon it afterwards crowded out something else. It is probable that few of us have minds more sponge like than that of the great doctor.

Every young man should endeavor to perfect himself in the science of the business he has chosen. Without this, he must always content himself in the lower walks of his calling. The cost of a few cigars will buy all the books he requires, and his own diligence may be made to well supply the place of a tutor. Without such diligence, the best teacher in the world could not manufacture him into a scholar. If once going over a point will not master it, he must tackle it again. Better give a week's study to a page than conclude that you cannot comprehend it.

But though it is wise to give your main strength to your own specialty, you should not confine yourself to such studies exclusively. The perfection of all your powers should be your aspiration. Those who can only think or talk on one subject may be efficient in their line; but they are not agreeable members of society in any of its departments. Neither have they made the most of themselves. They become one sided and narrow in their views, and are reduced to a humiliating dependence on one branch of industry. It costs nothing to carry knowledge; and in times like these, to be able to put his hand to more than one branch of industry often serves a man a good turn.

Do not attempt too much in the way of study to begin with; you will surely lose heart if you do. Be humble and modest in your aspirations, and if you are diligent never fear but that you will hear a voice saying: "Come up higher." Be content to gather the precious gold of learning grain by grain; you will soon be able to see the pile growing, and will learn from it the wonderful power of the littles, which is felt and shown in mental as well as in golden gains.

THE GREAT SUSPENSION BRIDGE BETWEEN NEW YORK AND BROOKLYN.

It is a curious circumstance that, while the government of the United States has, at an enormous expense, undertaken the removal of the Hell Gate rocks from our East river, it has at the same time given its formal sanction, through the Secretary of War, to the erection of new impediments to navigation on the same river, at a point only a short distance from the first named obstructions. We allude to the suspension bridge over the East river, between New York and Brooklyn. In our paper for August 7, 1869, Vol. XXI, page 85, we gave a diagram showing the elevation of the intended bridge; and public attention was called to the fact that, unless the level were fixed higher, it would seriously obstruct the navigation of the river. But no notice was taken of the matter by our shipping merchants, and the construction has gone steadily forward until the towers are almost ready for the stretching of the wire cables. A vigorous protest is now in circulation by prominent citizens, who are making an effort to have the level of the bridge altered or the work stopped.

They aver "that the Brooklyn bridge will, if completed, inflict almost incalculable damage to the commerce of this port by preventing the passage of sparred vessels of any considerable size, as the height of the roadway at the towers will be 115 feet, and the center of the span will be only 135

feet above high water mark, while the masts of ships and barks vary in height from 150 to over 200 feet. The petitioners also state that subscriptions are now being made by the citizens of New York, with a view of legally contesting the right of the Secretary of War to authorize the erection of the bridge, believing it to be at variance with the spirit of the Constitution of the United States, and in non conformity with the acts of Congress."

The principal objection to the raising of the level is the additional expense, and the increased grade of the approaches to the bridge. But these are minor considerations, compared with the importance of preserving unimpaired the splendid water way now existing, which will be still more necessary to commerce when the Hell Gate and Harlem river improvements are completed.

We give in our this week's SUPPLEMENT views of the great towers of the bridge, with particulars and dimensions of the various parts. We also give an engraving and description of the new drawbridge proposed for the Thames river at London. It will be seen that the Brooklyn Suspension Bridge, even if carried out on the present level, will be a very small obstruction to navigation as compared with the proposed London structure.

OPENING OF A REMARKABLE RAILWAY IN LONDON.

The London papers announce a further extension of rapid transit in that city by the completion and opening for public traffic, on April 5, of the East London Railway, which is another of those gigantic underground enterprises for which the metropolis of England is so distinguished. The most remarkable feature of this new work is the fact that a considerable portion of the line is built under water. The commerce of the world may be said to float and navigate directly over a part of the roof of the tunnel, which extends south easterly, from the Liverpool street station of the Great Eastern Railway, passing directly under the warehouses and water basin of the London Docks, thence under the embankment, across and under the Thames river, to the New Cross station of the Southeastern Railway, thus connecting all the roads named, and also the London and Brighton and South London lines. At Shadwell and Whitechapel, magnificent stations, each four hundred and fifty feet in length, have been erected. The total cost of this new line, which is a little less than six miles in length, has been £3,200,000, or sixteen millions of dollars. Of the advantageous nature of this line to the public, the London papers say there is no doubt. That portion of the line under the Thames passes through the old Thames tunnel, built by the celebrated engineer M. I. Brunel. This work was commenced in 1824, and opened for foot passengers in 1843, but never proved of much value to the public until brought into use several years ago as a railway tunnel. The masonry comprising this remarkable work is 38 feet wide and 22½ feet high, and was carried across underneath the bed of the river by means of a great shield, within which the masonry heading was erected, and the shield then pushed ahead step by step, by jack screws, the masonry being built up as fast as the shield advanced.

ARTIFICIAL EYES MADE SENSITIVE TO LIGHT.

Among the curious developments of Science is the recent production, by Dr. C. W. Siemens, of an artificial eye that is sensitive to light. We wish we could add that it gives vision to the blind; but we cannot, though perhaps it contains a germ of promise in that direction. The new eye is composed of an ordinary glass lens, backed by an artificial retina of selenium. This mineral resembles and is allied to sulphur; it is distilled from bodies that contain sulphur in conjunction with metals, such as iron pyrites, a compound of sulphur and iron.

Mr. May, a telegraph clerk employed at the Valentia station of the Atlantic cable line, first observed, in 1873, that the electrical resistance of selenium was instantly altered by light, the resistance being diminished by increase of light.

Dr. Siemens makes use of this peculiarity of selenium in the construction of his novel eye. An electrical circuit is arranged, of which a bit of selenium forms a part, and constitutes the retina. When a strong light is admitted into the lens and falls upon the selenium retina, the current of electricity flows (and by acting upon small magnets) may be made to work the artificial lids of the eye, opening or closing them according to the intensity of the light.

It is well known that the vibrations of musical sounds may, by an ordinary conducting wire, be electrically transmitted and successfully delivered to the ear. It remains to be determined whether light vibrations can, by means of selenium and electricity, be transmitted to the brain in the absence of the natural eye.

THE WOODBURY PLANER WAR.

The contest between the Woodbury Patent Planer Company and the manufacturers and users of woodworking machinery continues with undiminished acrimony. The former seem to be leaving no means untried to compel the payment of an unjust royalty for the use of the pressure bar from people who have undisturbedly employed that attachment on their planing machines for many years, while numbers of the latter have organized defense associations, banded together to resist the extortion to the last. The most recent tactics of the Woodbury people, if we may credit the assertions of the Northwestern Mechanical Journal, the organ of the Northwestern Planing and Molding Machine Association, representing some 300 machines, is to avoid the consolidations and confine their offensive efforts to individuals not included in the membership. The associations are wealthy; and can afford to fight the aggressors for any length of time, but on the other hand few isolated concerns would care to

undertake a conflict with the Planer Company, when a sum comparatively small to that which defending an expensive lawsuit would cost them, would secure their immunity. Of course yielding to the demand would be a sacrifice of principle and a submission to the superior force, but on the other hand there are scores of small manufacturers who care nothing for either side of the controversy and would willingly keep themselves and their business clear of it. The Woodbury Company are evidently aware of this fact, and therefore naturally prefer bringing their forces to bear upon isolated opponents rather than upon members belonging to associations likely to prove powerful antagonists. Even if this course has no better results, it is probable that it may secure to the company the means of existence until a decision of the courts settles the question definitely. Obviously the present work of the Association is to strengthen their memberships, otherwise it may be found that the present tactics of the Woodbury people, so far from being a sign of weakening on their part, as our abovementioned contemporary intimates, are likely to work more harm than the open system of attack which they have abandoned.

THE LOUGHBRIDGE AIR BRAKE.

The use of the air brake has for many years been persistently advocated by Mr. William Loughbridge, of Baltimore Md., who ranks among the earliest inventors and patentees in this line. To some extent others have obtained laurels that were in strict justice his due. Recent trials upon the Baltimore and Ohio Railroad appear to have practically established the superiority of his devices.

On one of these occasions a train of ten cars, drawn at the highest attainable speed, by the best engine owned by the company, was brought to a stop, from a velocity of 42 61 miles per hour, within a distance of 590 feet, in 16 seconds time. This, we believe, beats anything heretofore accomplished, either in this country or England. The following are the particulars:

EXPERIMENT WITH LOUGHBRIDGE AIR BRAKE, AS TRIED ON WASHINGTON BRANCH, B. & O. R., BETWEEN BRANCHVILLE AND ALEXANDRIA JUNCTION, 1876.

No. of engine.....	323
Direction of movement.....	southward.
Weight of engine.....	76,700 lbs.
Weight of tender.....	38,370 "
Average weight of cars.....	37,808 "
Total weight of train.....	245 1150-2240 tons
No. engine driving wheels.....	4
Diameter engine driving wheels.....	69 inches.
Size of engine cylinder.....	17x24 "
Size of air cylinders under cars.....	11x11½ "
No. of cars.....	10
Total length of train.....	635 feet
Total number of wheels in train.....	96
No. of wheels to which brakes were applied.....	92
State of steam gage at start.....	130 lbs.
" " " on shutting off.....	120 "
" " " when train stopped.....	125 "
" air gage at start.....	60 "
" " at time of applying brakes.....	80 "
" " when train stopped.....	50 "
Distance run for speed.....	12,180 feet.
Time consumed in running last 1,000 feet before shutting off.....	16 seconds.
Distance run after shutting off steam before applying brakes.....	300 feet.
Speed of train when brakes were applied.....	42 61 m. per h.
Time occupied in making stop.....	16 seconds.

REMARKABLE OCEAN STEAMING.

The recent voyage of the Pacific Mail Steamer Company's new steamer City of New York, from this port to San Francisco, was in some respects remarkable. The total distance, 13,552 miles, was performed in 59 days, the actual steaming time being 54 days 14 hours. The entire passage was made on the coal shipped at New York, none having been taken on board en route. The runs made were as follows:

New York to Cape Virgin, west entrance of the Straits of Magellan.....	7,074 miles.
Through the Straits.....	340 "
Cape Pillar, east entrance of Straits of Magellan, to San Francisco.....	6,138 "

13,552 "

Prior to the famous first trips between England and New York, of the steamers Sirius and Great Western, in 1838 when the subject of ocean steam navigation was under discussion in England, Dr. Dionysius Lardner predicted that steamers could not be run with commercial success across the Atlantic until the consumption of fuel was reduced, as the cost and bulk of coal would eat up all profit. And he was right. For over twenty years after the opening of the Cunard line in 1840, it required the payment of enormous special subsidies by the governments, in order to make good the losses to owners. First class steamers between New York and Liverpool consumed nearly 100 tons of coal a day. The largest vessels now only require about one fourth the above fuel, and are also in other respects more economical than formerly. The following are some of the particulars of the City of New York's voyage:

Total revolutions of the engines.....	3,338,105
" distance by observation.....	13,552 miles.
" distance by screw.....	14,235 "
" amount of coal consumed (dock to dock).....	1,455 tons.
Total amount of coal consumed at anchor (port consumption).....	45 "
Total amount of coal consumed for steaming.....	1,440 "
Average consumption of coal per day.....	26 4 "
" " " mile.....	239 lbs.
" revolution per day, running time.....	61,250
" " " minute.....	42 53
" speed per day, running time.....	248½ miles.

The dimensions of the City of New York are as follows: Length 353 feet, beam 40½ feet, tonnage 3,019. Engines 1,000 horse power.

Continued from first page.

the boiler, (Fig. 5). The cylinder is 2 inches in diameter and has 2½ inches stroke of piston. It is supplied with all the attachments used in large engines, the governor being inside the belt pulley, and operating directly on the point of cut-off, enabling a small amount of steam to do a large amount of work. The engine is ready to work in ten minutes from lighting the gas, and will run all day without any attention whatever. With a supply of gas and water, it is its own engineer and fireman. It is admirably adapted to the use of dentists, jewelers, tea merchants, and amateurs.

These engines were patented by Hiram S. Maxim, of New York city, December 22, 1874, and July 20, 1875. The engravings accompanying this article were photographed on the wood from Mr. Maxim's drawings, and represent the parts of the engine as they actually exist.

These engines are manufactured in six sizes, varying from 2 horse power downward, by Messrs. Maxim & Welch, of 176 Center street, New York city, who may be addressed for further particulars.

How It Happened.

The following explanation was recently given by an English bankrupt to his creditors. We find the account in the *London Grocer*. It is rather unusual for such unfortunate men in business here to take the trouble to explain the calamity in the candid manner which the English tradesman adopts towards his creditors. The statement bears upon its face truthfulness, and it is to be hoped that his friends accepted his statement and afforded him credit:

"Gentlemen; The fact of my having stopped payment being known to you, I wish to lay before you some of the reasons for doing so. I came into this business, as is well known, under very great disadvantages, the premises being in a very dirty and dilapidated state, connection gone, with the exception of a sprinkling of ready money and the tail end of an unsound book-keeping trade; and on using every effort to get the thing in working order and recover the connection, I am, so to speak, for the moment come to the ground. When I came in I paid to the trustees of Nicholson's estate \$4,350, \$2,825 of which was for a drained out stock, \$350 for horse, van, etc., not worth at the outside \$125, having sold the horse for \$35; trade utensils \$150, consisting only of five counter scales, there not being a scoop or any other utensil in the place (which to a business man seems almost incredible, but such was the fact, so utterly had the thing throughout become a wreck);

not even a canister for tea or coffee fit for use, or drawers in counter; also not a tap to draw treacle from, my predecessor usually knocking out the head of the cask and dipping it out with a biscuit tin: \$1,050 for goodwill and fixtures not worth \$200. You will thus see the disadvantages under which I came in. Add to this \$225 for valuation and introduction to the business, and \$105 paid Nicholson for house fittings, etc., removing furniture \$125, thus making altogether nearly \$5,000 before I could make a start; and finding the place in such an unworkable state, my preliminary and working expenses have of course been exceedingly heavy. I need not to have stopped, as I had the entire confidence of my creditors, but on taking stock found that my position was not satisfactory, and deemed it prudent, rather than abuse the confidence of my creditors, to stop payment at once, which I did immediately. You are, doubtless, aware that I left a firm of high standing (after being with them sixteen years, fourteen and a half of which I had the entire management and buying of their grocery department, the returns of which were large) to come here, working day and night under great mental anxiety, being of a naturally high, nervous temperament, and now find myself utterly ruined. I came here, saw, and in some unaccountable manner was, so to speak, captivated; I rushed into it without legal or private advice on my part, and the result would be, were I to go out now, without further expense in getting rid of all assets, that I should leave behind between \$5,500 and \$6,000: this through no fault (as is well known, except the fact of my coming here) of my own, but my misfortune.

"As one of the disadvantages which have to encounter, I must not forget to mention the fact of my predecessor (who had been here for years underselling everyone, thereby gaining popularity) having again re-opened premises just below me, and of course, as a natural consequence, taking part of his old connection, thus weakening the already drained out wreck."

For mending valuable glass objects which would be disfigured by common cement, chrome cement may be used. This is a mixture of 5 parts gelatin to 1 of a solution of acid chromate of lime. The broken edges are covered with this, pressed together, and exposed to sunlight, the effect of the latter being to render the compound insoluble even in boiling water.

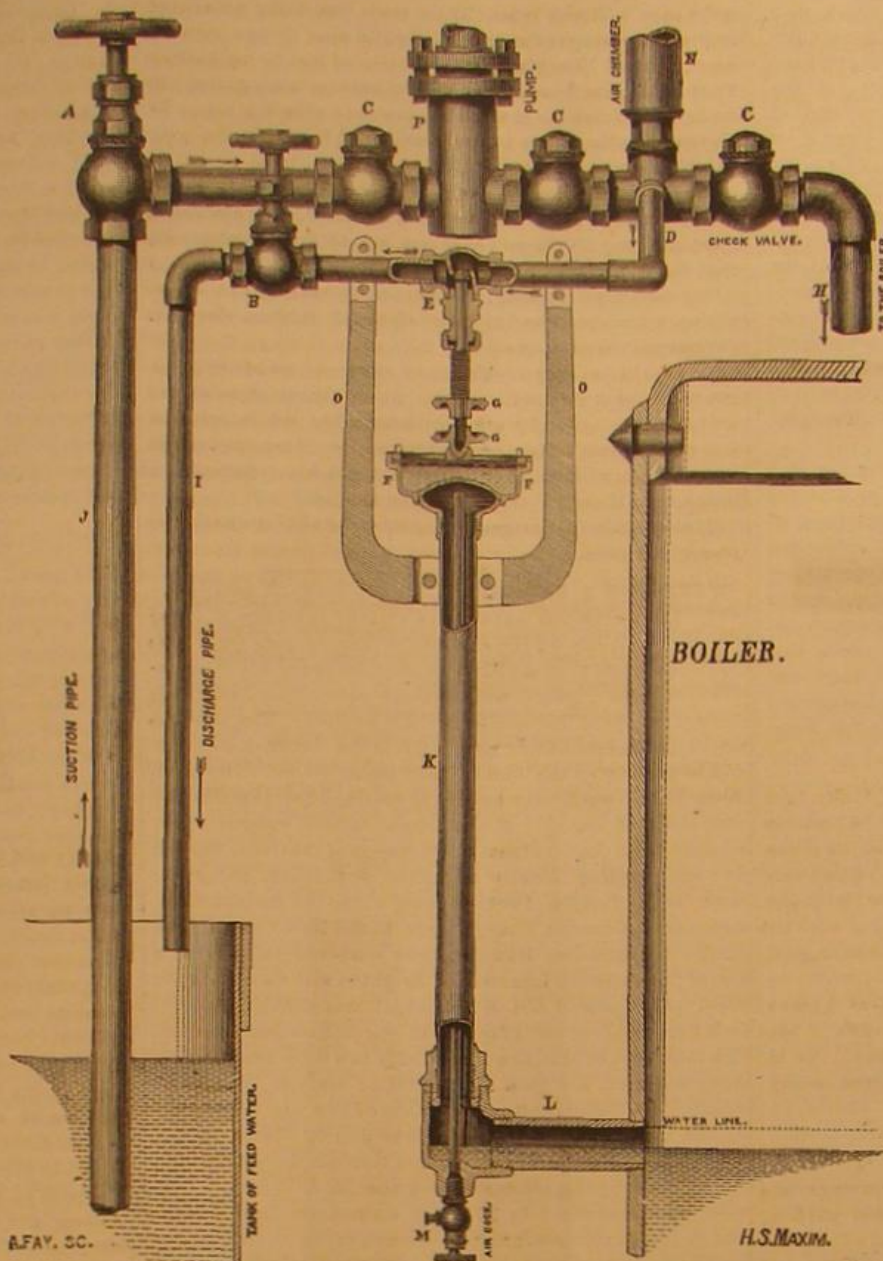


Fig. 3—MAXIM'S AUTOMATIC ENGINE FEED PUMP.

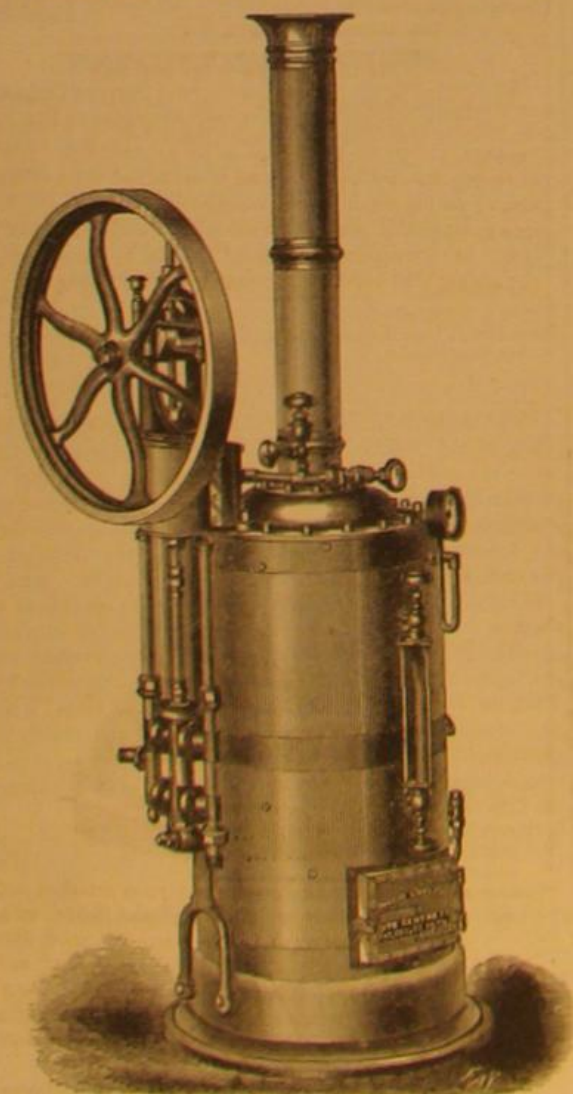


Fig. 4.—PUMPING ENGINE.

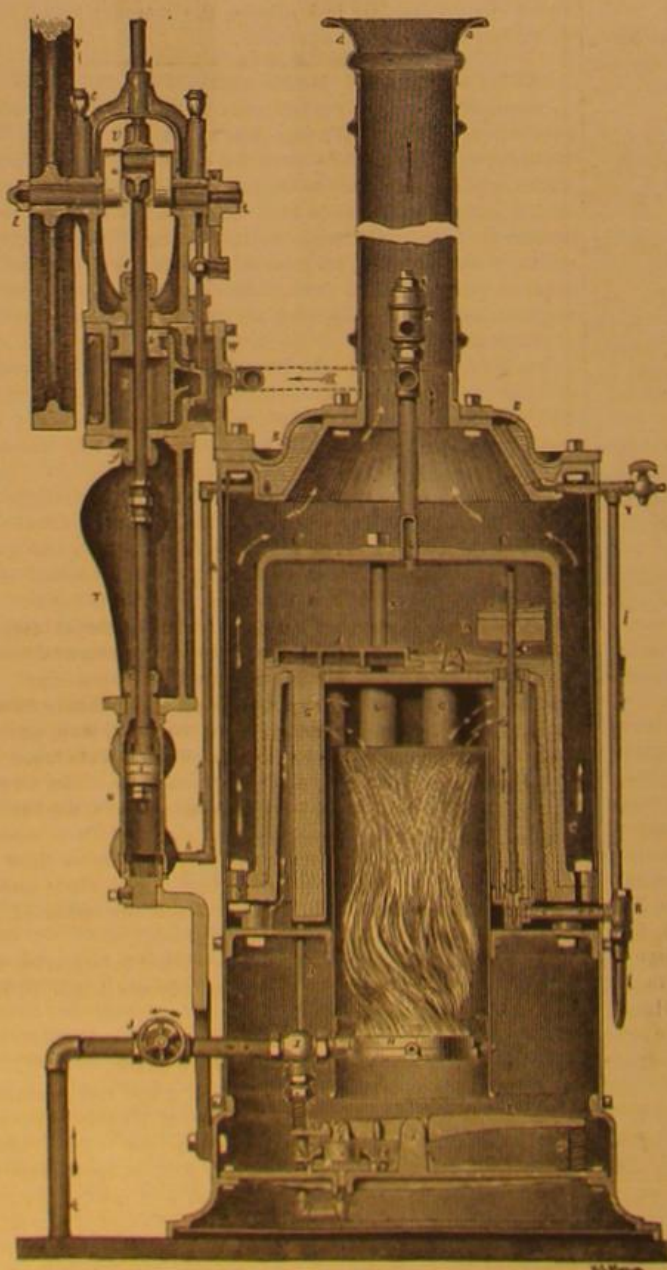


Fig. 5.—SECTION OF PUMPING ENGINE.
MAXIM'S AUTOMATIC STEAM ENGINE.

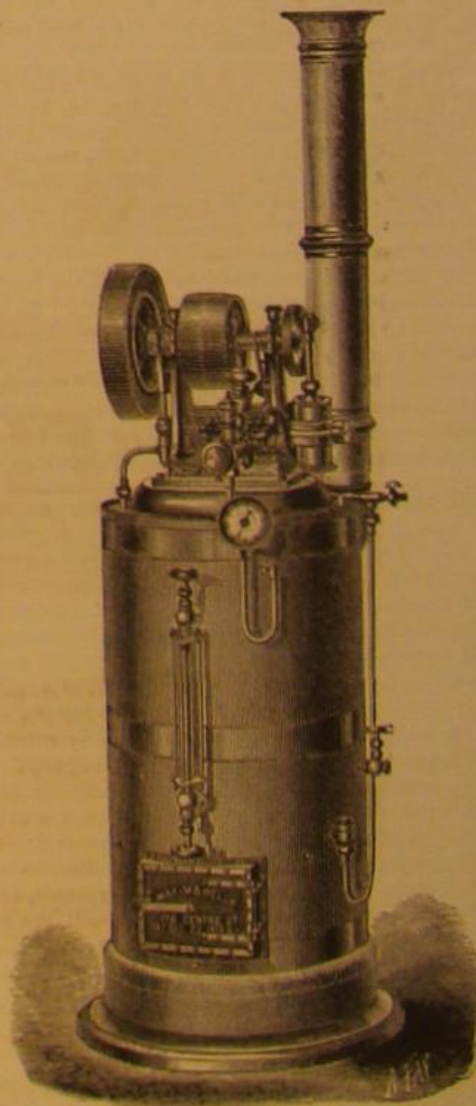
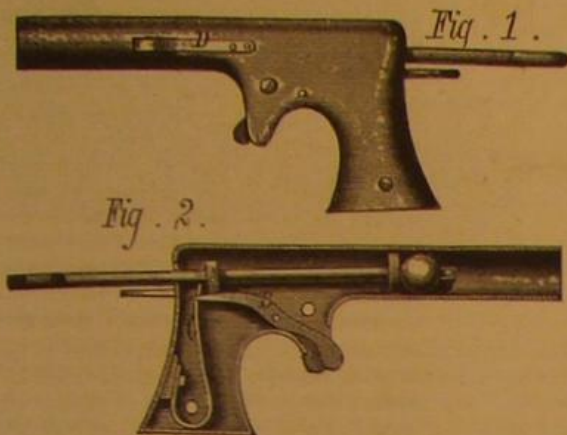


Fig. 6.—OSCILLATING ENGINE.

IMPROVED TOY PISTOL—MECHANICAL MARBLE PLAYING.

This is a new way of playing marbles, which we have no doubt will greatly please the boys. Instead of holding the marble between thumb and finger, and propelling it in the somewhat disadvantageous position of "knuckling down," the inventor of the present device proposes to shoot it out of a spring pistol. This change, he thinks, will increase the sport and add to the enjoyment of the game.

The construction of the pistol is represented in the annexed engravings, Fig. 1 showing an exterior, and Fig. 2 a sectional view. The stock is made of metal, in two sections, and is held together by screws. The piston rod carries a disk, A, which rests against the trigger, B. Also on the



piston rod is a shoulder which, when the rod is drawn back against the spring, C, which bears against disk, A, catches on the handle plate, as shown in Fig. 2. The marble is prevented from rolling out when the piston is aimed downward by the side spring, D. By pressing on the trigger the piston rod is raised so that its shoulder no longer engages with the handle plate, when it is pushed forward by the spring, C, thus throwing out the marble.

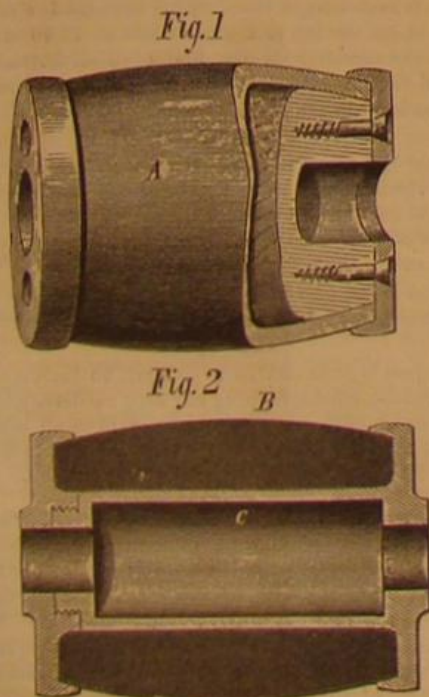
Patented through the Scientific American Patent Agency, February 29, 1876. For further information relative to sale of rights, royalties, etc., address (until May 20 next) the inventor, Mr. O. C. Butterweck, Newcastle, Lawrence county, Pa.

HEER'S DRIVING PULLEY.

The invention represented in the annexed engravings is a new driving pulley, provided with an india rubber surface, the object being to gain lightness in weight and effectually to prevent the belt from slipping or leaving the pulley. It is claimed to be especially adapted to the spindles of circular saws and lathes, to the shafts of planing machine cutters, and to other shafts which have to revolve at a high rate of speed. The engravings represent two different forms of the invention.

In Fig. 1 a block of wood is turned nearly to the size of the required pulley, and larger at the diameter at the middle. To this is fitted a short rubber tube, A, which very tightly embraces it. The ends of the tube are confined to the block by flanges of the end plates, which are secured by ordinary wood screws, as shown. A hole is then bored through the block for the shaft, and a slot is formed for the securing key.

In Fig. 2 the block B, is made wholly of rubber, and one of the end plates has a hub, C, extending entirely through. On the end of the hub a thread is cut, and on this the opposite plate screws, so as to confine the rubber tightly. In this case the hub may be furnished with ribs adapted to recesses in the rubber block to prevent the latter turning; in the pre-



ceding form this precaution is unnecessary, as the rubber tube adheres with sufficient firmness to the wood. The device, we learn, has been successfully tested.

Patented February 29, 1876. For further information address the inventor, Mr. David Heer, care of H. D. Hirst, 1,126 Charlotte street, Philadelphia, Pa.

Mechanics should Read and Reflect.

The young mechanic of the present day should be an earnest reader. Whether learning a trade, operating a machine, or drafting designs for the builder, he should be a lover of useful books. They will serve as an adjunct to his success. They will make him a broader and happier man, giving him continually fresh themes for thought and pleasing topics for meditation. Books are to the mind what food is to the body. They fill and strengthen it. They add vim, force, and vitality to its every function. They furnish that life blood which is the main spring of all action; and benefit their admirer in manifold ways. Do not then neglect so rich a boon. But read much and read carefully.

We cannot all be rich, or great, or powerful; but we can all build for ourselves inviting palaces of wisdom, where the noblest and best of every age may come through the silent but immortal agency of books, to store our minds with the rarest samples of their genius. These choice legacies, too, will stand by us, and remain with us, when trades, fortunes, and friends fall, to comfort and satisfy our drooping spirits. Who then would think of living without the association of interesting books? No young man should.

The world is full of reading matter, and it is utterly impossible to peruse all; still every apprentice and tradesman can find leisure enough to acquaint himself with so much as is necessary to perfect him as a mechanic and broaden him out as a citizen. Read, then, by all means. Read slowly; read carefully; read with reflection; and reflect with reading.—*Northwestern Lumberman.*

HAPTONSTALL'S DIAMOND FILE.

The annexed illustrations represent a new mode of cutting files, Fig. 1 being a single cut, and Fig. 2 a double cut tool.



The abrading surface is formed by two series of diagonal teeth arranged in alternate sections and at relatively opposite angles. This is clearly shown in the engravings. The advantages claimed are that both single and double files cut much smoother than those made in the usual way, and that they are not liable to choke, so that they operate faster and last much longer than is commonly the case. The files run square across the stock and are intended to be used in that way. The inventor states that the single cut file is especially adapted to woodwork, as the reversed angles allow the escape of the dust in both directions. A gun file is made on the same principle, oval in form to suit the inside of the gun barrel.

Patented August 17, 1875. For further information relative to sale of patent or of rights, address J. & J. S. Haptonstall, Adel, Iowa.

The Effect of Cold on Milk.

The *Lancet* says that the effects of a low temperature on milk have been carefully examined by M. Eugène Tisserand, who recently communicated his observations to the Academy of Sciences. He found that if cow's milk is, immediately or soon after being drawn, placed in vessels at various temperatures between freezing point and 90° Fah., and the initial temperature is maintained for twenty-four or thirty-six hours, it will be found that, the nearer the temperature of the milk is to freezing point, the more rapid is the collection of cream,

the more considerable is the quantity of cream, the amount of butter is greater, and the skimmed milk, the butter, and the cheese are of better quality. These facts, he believes, may be explained by Pasteur's observations on ferments and their effect on the media in which they live. It is probable that the refrigeration arrests the evolution of the living organisms which set up fermentation, and hinders the changes which are due to their growth.

NASH'S LIFE-PRESERVING STOOL.

The annexed engraving represents a new life preserving stool which, if employed aboard vessels, would doubtless



greatly add to the security of passengers. Experience has amply demonstrated that life preservers, not merely when they are stowed away, but even when prominently exhibited about decks, are too frequently overlooked in the confusion of sudden disaster; and being secured in place, in case of the ship sinking, they are carried down with her, and thus become of less use than hen coops, skylight covers, or other movable buoyant articles. The present inventor has conceived the excellent idea of converting the ordinary furniture of the vessel into life preservers. He simply provides stools with cork seats, as shown in the illustration.

Two disks of cork are fastened upon a base board, another board is placed over them, and the whole is bolted together. There is no air chamber to become punctured and therefore useless, and the cork will always float and support persons clinging to the stool. The cork seat is of course applicable to chairs and all loose pieces of furniture, and thus articles always ready at hand are converted into efficient devices for saving life. The invention might be applied to the long settees used in the cabins of ocean steamers, so that three or four of these lashed together would form an admirable raft, which could be rigged in half the time required to make one of spars. There is nothing costly about the plan. We consider it an excellent idea, and one well worth the notice of owners of vessels of all kinds.

Patented through the Scientific American Patent Agency, October 5, 1875. For further information relative to sale of rights, etc., address the inventor, Mr. Henry H. Nash, 233 South Eutaw street, Baltimore, Md.

BACKUS' IMPROVED OIL CAN.

The novel feature in the oil can illustrated herewith, and on which the patent is based, is the glass body, a point of advantage which can hardly fail to be appreciated. It admits of seeing exactly how much oil is contained at any time, and also of noting when the oil becomes dirty or gummy. The device is especially adapted for use with sewing machines, since it will save frequent refilling of the can by guesswork, and the consequent danger of greasing clothes and carpet. The



bottom and nozzle are of metal, the former attached around a bead and fastened by cement introduced inside, so as to form a neat and strong joint. The nozzle is a solid, durable piece of Britannia metal, easily straightened if bent, and attached to the can by a screw thread on the glass. The glass is thick and amply strong to resist breakage by any ordinary fall, and it is easily cleansed, and of course it is not subject to corrosion.

For further information address the manufacturers, Messrs. Backus & Co., cor. Wright st. and Avenue A, Newark, N. J.

THE CORAL ISLANDS.—THEIR NATURE, GROWTH, AND GEOGRAPHICAL DISTRIBUTION.

LECTURE DELIVERED AT THE STEVENS INSTITUTE OF TECHNOLOGY BY
PROFESSOR A. GUYOT, OF PRINCETON, N. J.

In asking his hearers to accompany him on a sailing excursion, notwithstanding the stormy weather outside, the lecturer assured them that they would be most likely to encounter a calm sea and fair weather on the magnificent waters of the Pacific ocean, with its thousands of islands far away from any coast. Those who are familiar with the glowing narrations of Captain Cook and other navigators will remember that the presence of an island is recognized, long before it becomes visible, by clouds directly above it in the otherwise clear sky. The land absorbs the heat of the sun and accumulates it faster than the water; soon an ascending current of warm air is formed, carrying up moisture into the colder regions of the atmosphere, where it is condensed and forms clouds. A similar phenomenon is observed in our western plains, where the sky is frequently clear early in the morning, but by 10 or 11 o'clock enough heat has been accumulated to cause the formation of clouds.

The islands of the Pacific are of two kinds, called the lower and the higher. The lower rise but 7, 10, and rarely as high as 100, feet above the level of the sea; while the higher islands reach an elevation of 10,000, 12,000, and even 15,000 feet. There is no transition between them. The most remarkable are the lower islands. Their appearance is very peculiar. In the first place, the eye is arrested by a white beach; then comes a line of verdure, due to tropical trees; then a lagoon of quiet water of a whitish or a yellowish color, then another line of verdure, and finally, beyond all, the dark blue waves of the ocean. A picture of Whitsuntide Island illustrated the structure. It is a ring rising 7 or 8 feet above the sea level, enclosing a lagoon, and presenting the characteristics just described. The lagoon inside is but a few fathoms deep; but on the outside of the island, the water is 15,000 feet deep. Here then we evidently have a tower-like structure reaching up from the bottom of the sea, and having a depression in its summit. Some of these lower islands are 50 miles across, but most of them are not so large. In some the ring is broken at several points, and these are designated by the Malay word *atoll*.

The island of Tahiti, the principal one of the Society Islands, is a good example of the second class or higher islands. It rises 7,000 to 8,000 feet above the level of the sea, has no lagoon in its center, but a crater, and the water around it is very deep. It may in fact be considered as a mountain rising to a height of some 18,000 feet from the bottom of the sea. Outside of it is a double girdle of low islands, one near, which Darwin calls a fringing reef, and one further out, to which he gives the name of a barrier reef.

On examining these reefs and the lower islands, their structure will be found made up entirely of animal remains, generation after generation having left their homes, consisting of limestone, to accumulate there. On the top we find these animals living and growing, in all colors, shapes, and sizes. The higher islands, on the contrary, except those near the continent, like Borneo, Sumatra, etc., are entirely volcanic, and do not contain sandstone, granite, or gneiss, like the mountains of the continent.

The limestone of the lower islands is not due to sedimentary deposits from the ocean, but is the work of the coral animal, the great architect of the sea. According to Agassiz's description, which is here followed, these animals are but a sac, like the finger of a glove, only more leathery. Around the mouth is a series of tentacles, formed by a prolongation of the skin. They are all skin, in fact, and have no special organs, yet they digest food with tremendous rapidity, absorbing it directly. It makes no difference if you turn them inside out; they will digest just as well as before. You cannot kill them by dividing them; for they live all over, like a plant. For this reason they have been called *zoöphytes*. If you cut one into eight parts, each part will live and set up in business for itself. Like all other animals, however, they grow out of eggs. The eggs are formed within the skin, which is double, and divided into cells by partitions or septa. When mature, they detach themselves, move about in the water until they find a favorable place, and then establish a new colony. They do not contribute to the growth of their parent colony, which is effected in another way.

On examining a piece of coral, it is seen to be full of little holes, popularly supposed to be the places for the stomachs of the animals, but this is not so at all; the coral animal does not form a secretion around it like the mollusks, but inside, between the two folds of its skin. Coral is, therefore, the bones and not the skull of the animal. As before stated, these animals work in societies or colonies, and their tendency is to repeat the forms peculiar to each species; thus we have corals shaped like a hand, like the branches of trees, like mushrooms, like a brain, with its convolutions. They grow and multiply in these societies by budding or gemmation. The side of the animal begins to bulge out, and the protuberance so formed develops into a new mouth, which soon eats and digests for itself, but does not separate from its parent. This process goes on symmetrically, and produces the variety of regular shapes just described.

Some distance below the surface, we no longer find these beautiful shapes, but a dense, solid, coral rock. Take for instance the coral reefs of Florida. Beginning 120 feet below the surface, we first find about 30 feet of massive rock, then the *astrea*, then the *meandrina*, and about ten feet below the surface the palmata or hand-shaped coral. In the shallow mud between the reefs and the continent, there are multitudes of branching corals of the most beautiful forms, colors, and delicacy of structure. The production of coral

rock is explained partly by the mechanical action of the waves, and partly by the destruction of the coral insect by the sea urchin and other animals that feed on it. The waves disintegrate the structure formed by the animal, and then roll back the coral sand thus produced upon it, where it undergoes a process of induration in the course of time.

It is an interesting question how the structure ever rises above the water level, seeing that the animal which makes it cannot live out of the water. The little architects retain enough sea water to last them over until the next tide and are so enabled to work up to the highest watermark. *Acetia* have been observed all closed up on the rock at low water, and then suddenly opened like magnificent flowers, 5 and 6 inches in diameter, when the tide rose.

The ring form of the Pacific islands is due to the shape of the foundation upon which the coral animals built. On the Florida coast the reefs run parallel to the land for the same reason. Now take this, together with the fact that all the high islands are volcanoes, with the regular conical shape, and you will be prepared to understand the explanation, given simultaneously by Darwin and Dana, that the low islands were originally reefs around the high islands or volcanoes, and that the latter, by the gradual subsidence of the ocean bed, sank and left the reefs appear as low islands, with a lagoon where the crater of the volcano was. The reefs, of course, were gradually carried down along with the mountain upon the sides of which they rested, but the coral insects kept on building towards the surface; the mountain appeared as a smaller and smaller cone in the center; what was left a fringing reef now became a barrier reef, and the mountain finally disappeared altogether. This theory is supported by the fact that barrier reefs are found extending 1,700 feet down, while the coral insect cannot live at a depth greater than 120 feet. These facts were illustrated by fine pictures of the island of Bolabola and others, in different stages of the process of subsidence.

The vegetation on the islands is due partly to seeds floating in the sea, and partly to seeds dropped by birds. Hence there are very few species of trees and plants; but being in the tropics, they flourish luxuriantly.

At present, the coral formations are confined to the tropics, because the coral animal cannot exist where the temperature falls below 60°. Dana states that the central axis of the Pacific Ocean is subsiding altogether; it has already gone down more than any other part of the ocean. There are now no islands at all above the water along its line.

In old geological times, the temperature of the earth must have been much more uniform; for we find coral formations very abundantly in nearly all parts of the world. Other limestone formations are formed by a yet lower form of animal, a protozoön, which works at the bottom of the sea and thus covers nearly three quarters of the whole surface of the globe. A diagram was exhibited, showing what the microscope revealed to Ehrenberg in a piece of chalk.

Surely then, concluded the lecturer, if so great a portion of the earth's crust is the product of animal life, we must correct our notions of matter and force, and admire the beauty and simplicity of the economy of God, who makes the most insignificant of creatures subservient to his great works.

C. H. K.

THE NATIONAL ACADEMY OF SCIENCES.

The spring meeting of the National Academy of Sciences opened at the Smithsonian Institute, in Washington, on April 17. There is a strong attendance of the most eminent of our scientists; and judging from the papers which have been read up to the time this issue goes to press, the session is likely to prove an interesting and instructive one. Copious abstracts of the various communications will be found in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 20; and therefore we give in this place but a brief résumé of the more important ones presented. That indefatigable investigator, Professor A. M. Mayer, of the Stevens Institute, opened the proceedings with a paper on tuning forks, which instruments are now largely used for determining short periods of time by means of apparatus involving their vibrations. These researches are vitiated by errors, regarding which little is known; and although instruments have been constructed to indicate the exact measure of time taken by the forks for their vibration, such apparatus has not been accurate. Professor Mayer's new instrument involves a clock pendulum which, at the lowest point of its path, touches a mercury globe, and so completes an electric current to a fork which describes a wave line on a revolving cylinder, covered with smoked paper. When the electric spark passes, it goes through the paper. Thus the length of time between the beats of the pendulum is measured on the waved line, and the number of waves is the number of tuning fork vibrations. Hence, by counting the number of waves between each spark hole, the number of vibrations in a given time may be accurately determined. It is found that the effect of a change of temperature of 1° is $\frac{1}{22000}$ of the length of a vibration; and the effect, therefore, of temperature on any fork may be ascertained by multiplying its number of vibrations per second by the decimal 0.00004545. A difference of 10° in temperature, during the use of a tuning fork to measure the velocity of a projectile, would obviously make a serious difference in the record.

General H. L. Abbott read a paper on the simultaneous ignition of large numbers of fuses, in mining operations. The essay dealt with mathematical points, and involved many formulae, but resulted in a rule which has been reduced to practice, so that 2,500 fuses can be fired at a single instant. The speaker said, incidentally, that more than 8,000 fuses would be simultaneously exploded to blow up the Hell Gate excavations.

President F. A. P. Barnard gave a learned exposition of the theory of magic squares, which are arithmetical puzzles, extremely abstruse and of no immediate practical value.

Professor Henry, President of the Academy, in reviewing scientific progress, said that it was contemplated to conduct a series of new experiments, under the auspices of the Smithsonian Institution, to determine accurately the rate of increase of the earth's temperature at progressive depths—also new investigations on the velocity of light. The work of weighing the earth accurately will also, probably, be undertaken anew.

Professor Mayer also read a second paper, showing how certain sounds would extinguish the sensation of other sounds; and adduced the rule that, while low sounds cannot extinguish high ones, the high sounds may obliterate low ones. This fact is of great importance in the conduct of an orchestra. The conductor regulates the players according to the impression, on his ear, of the different sounds at the place where he stands. But what may be perfect there is necessarily imperfect elsewhere; and therefore, at greater distances the high sounds may be killing the lower ones. To provide the best music, the conductor should locate himself in the middle of the room.

ASTRONOMICAL NOTES.

OBSERVATORY OF VASSAR COLLEGE.

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

M. M.

Position of the Planets for May, 1876.

Mercury.

Mercury rises on May 1 at 5h. 25m. A. M., and sets at 7h. 51m. P. M. On the 31st, Mercury rises at 5h. 47m. A. M., and sets at 8h. 53m. P. M.

Mercury should be looked for after sunset, some degrees north of the point where the sun disappears. On May 21 it will be at its greatest elongation east of the sun, and can easily be found, as it makes very nearly the diurnal path of Venus, and is about 24° nearer the horizon. The new moon is very near Mercury on May 25.

Venus.

On May 1, Venus rises at 7h. 20m. A. M., and sets at 10h. 53m. P. M. On the 31st, Venus rises at 7h. 26m. A. M., and sets at 10h. 35m. P. M.

Venus is at its greatest elongation on May 4. A glass of low power will show that Venus presents phases like the moon. Venus is not at its greatest brilliancy until June, but it can be seen now to cast a shadow when a pencil is held in its light.

Mars.

Mars rises on May 1 at 6h. 38m. A. M., and sets at 9h. 39m. P. M. On the 31st, Mars rises at 6h. 1m. A. M., and sets at 9h. 12m. P. M.

Although Mars is now apparently very small, it is easily found, as it makes nearly the same diurnal path with Venus and shines with a ruddy light. If Mars is seen on the 21st, Mercury can be found nearer the horizon, and nearly in the continuation of the curve which passes through Venus and Mars.

Jupiter.

Jupiter is becoming visible in the evening. It rises on May 1 at 8h. 17m. P. M., and sets at 5h. 55m. the next morning. On May 31, Jupiter rises at 6h. 1m. P. M., and sets at 3h. 46m. A. M. of the next day. Jupiter is still near the star β *Scorpii*, and its daily motions can be watched with reference to this star.

Saturn.

Saturn is seen only in the morning hours. It rises at 2h. 34m. A. M. on the 1st, and on the 31st at 12.40 A. M. It comes to the meridian on the 31st at 6 A. M., and should be looked for in the southeast, before sunrise, at an altitude somewhat less than 31°.

Uranus.

On May 1, Uranus rises at 11h. 31m. A. M., and sets at 1h. 36m. the next morning. On the 31st, Uranus rises at 9h. 36m. A. M., and sets at 11h. 39m. P. M. The position of Uranus is still among the small stars of *Leo*.

Neptune.

Neptune is not only very remote, but at present its path is so nearly that of the sun that it cannot be seen.

Sun Spots.

The report is from March 19 to April 20 inclusive. During this period, photographing has been rendered almost impossible by clouds. In a few cases, very small spots have been seen upon the sun's disk, but at present, with a telescope of 2½ inches aperture, no spot can be found.

The Proposed Aquarium in Central Park.

The subject of an aquarium in Central Park, New York city, is again being agitated, and a bill is before the New State Legislature allowing of the establishment, the same to be under control of the Park Commissioners. We have frequently pointed out the usefulness of such an exhibition, and the benefits which the people would derive from so excellent a means of education and recreation. New York is so situated as to allow of the stocking of a fine aquarium with ocean fishes with but little trouble, and we trust that the appropriation may be granted.

MESSRS. JONES & LAUGHLIN, American Iron Works, Pittsburgh, Pa., employ in one department 62 men, 61 of whom are subscribers to the SCIENTIFIC AMERICAN.

PRACTICAL MECHANISM.

BY JOSHUA ROSE.

SECOND SERIES.—NUMBER II.

PATTERN MAKING.

Of the different kinds of wood serviceable to the pattern maker, pine is, for many reasons, usually employed. It should be of the best quality, straight-grained, and free from knots; it is then easy to work in any direction, possessing at the same time sufficient strength for all but the most delicate kinds of work, and having besides the quality of cheapness to recommend it. Care taken in its selection at the lumberyard will be amply repaid in the workshop. When it is straight-grained, the marks left by the saw will show an even roughness throughout the whole length of the plank; and the rougher the appearance, the softer the plank. That which is sawn comparatively smooth will be found hard and troublesome to work. If the plank has an uneven appearance, that is to say, if it is rough in some parts and smooth in others, the grain is crooked. Such timber is known to the trade as catfaced. In planing it, the grain tears up, and a nice smooth surface cannot be obtained. Before purchasing timber, it is well to note what convenience the yard possesses for storing. Lumber on the pile, though it be out in all weathers, does not deteriorate, but becomes seasoned; nevertheless its value is much increased if it has an extemporised roof to protect it from the sun and rain: but as it is not convenient to visit the pile for every customer, quantities are usually taken down to await sale, and for such a shelter must be provided, otherwise it will be impossible to insure that the lumber is dry, sound, and fit for pattern making, it being obvious that the foregoing remarks on the storage of lumber apply to all woods.

The superiority of pine for pattern making is not, however, maintained when we come to fine delicate patterns or patterns requiring great durability. When patterns for fine work, from which a great many castings are to be made, are required, a fine pattern wherefrom to cast an iron pattern is improvised, because, if pine were employed, it would not only become rapidly worn out, but would soon warp and become useless. It is true that a pine pattern will straighten more easily than one made of a hard wood; but its sphere of usefulness in fine patterns is, for the above reasons, somewhat limited. Iron patterns are very desirable on account of their durability, and because they leave the sand easily and cleanly, and because they not only do not warp but are also less liable than wooden ones to give way to the sand, while the latter is being rammed around them by the molder, a defect that is often experienced with light patterns, especially if they are made of pine. Iron patterns, however, are expensive things to make, and therefore it is that mahogany is extensively employed for fine or durable pattern work. Other woods are sometimes employed, because they stand the rough usage of the molding shop better and retain the sharp corners, which, if pine be used, in time become rounded, impairing the appearance of the casting. Mahogany is not liable to warp, nor subject to decay; and it is exceedingly durable, and is for these reasons the most desirable of all woods employed in pattern making, providing that first cost is not a primary consideration. There are various kinds of this beautiful wood, that known as South American mahogany being chiefly used for patterns.

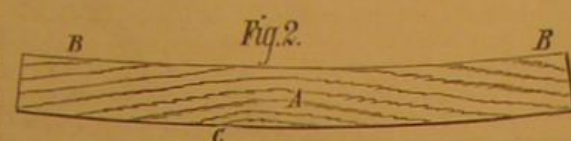
Next to mahogany we may rank cherry, which is a very durable wood, but more liable to twist or warp than is mahogany, and it is a little more harsh to the tool edge. If, however, it is stored in the workshop for a length of time before being used, reliable patterns may be made from it. In addition to these woods, walnut, beech, and teak are sometimes employed in pattern making.

The one property in all timber to be specially guarded against is its tendency to warp, bend, expand, and contract, according to the amount of humidity in the atmosphere. Under ordinary conditions, we shall be right in supposing a moisture to be constantly given off from all the exposed surfaces of timber; therefore planks stored in the shop should be placed in a rack so contrived that they do not touch one another, so that the air may circulate between the planks, and dry all surfaces as nearly alike as possible. If a plank newly planed be laying on the bench on its flat side, the moisture will be given off freely from the upper surface, but will, on the under surface, be confined between the bench and the plank: the result being that a plank, planed straight and left lying as described, will be found, even in an hour, to be curved, from the contraction of the upper surface due to its extra exposure; and therefore it is that lumber newly planed should be stored on end or placed on edge. Lumber expands and contracts with considerable force across the grain; hence if a piece, even of a dry plank, be rigidly held and confined at the edges, it will shrink and rend in twain, often with a loud report. There is no appreciable alteration lengthwise in timber from the above causes; and if two pieces be glued together so that the grain of one crosses that of the other, they can never safely be relied upon to hold. Hence they had better be screwed so that there will be a little liberty for the operation or play of the above forces, while the screws retain their hold. The shrinkage, expansion, and warping of timber may perhaps be better understood by considering as follows: The pores of wood run lengthwise, or with its grain, and hence the moisture contained in these passes off more readily endwise or from any surface on which the pores terminate. Then again the wood shrinks precisely in proportion in which the moisture leaves it; and if we have full knowledge of the direction of the grain, and of the position in which a piece of timber stands or lays, we can (all other things being equal, that is

to say, supposing there to be no artificial heat or other disturbing cause operating on one more than on another side of it) predicate in what direction it will warp. Thus, let A,



Fig. 1, be a piece of timber having the direction of its grain as denoted by the lines; then its surface, B B, which has the grain and pores terminating upon it, would allow free exit of the moisture, and that face would dry first (especially if it lay uppermost) and would contract the most, so that after a time the shape of the piece would be curved, as shown in Fig. 2. Now if it had been placed to lay with the face, C,

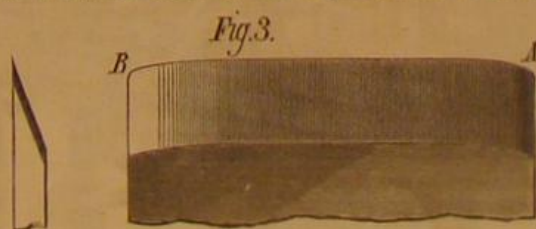


uppermost, the warping would have been much less, because the extra porosity of the face, B B, would have been counteracted by the lack of circulation of air. If, on the other hand, it was placed endwise, the warping, though it would have taken place, would have been appreciably less. It must not be supposed that thoroughly seasoning the timber will remove the tendency to warp, for timber, however long and carefully it has been dried or seasoned, undergoes considerable transformation of shape so soon as much of its outer surface is removed, making it appear that the seasoning or drying process takes place mainly at and near the outer surfaces, and is renewed every time an entirely new surface is presented to the action of the atmosphere. Thus, if we take a thoroughly seasoned piece of wood 3 inches square and 1 foot long, and cut it into strips 1 inch square and 1 foot long, the pieces will warp in a day or so; and if, after a few days, we take those inch strips and cut them into strips $\frac{1}{2}$ inch square and 1 foot long, these latter will again warp; and no matter what pains might be taken with these last strips to season them and let them assume their new shape, were we to cut them into thin veneers the warping process would again set in. It is well, therefore, in particular work, to cut out roughly the various parts of the pattern, so that, while some parts are being operated upon, the others may be assuming their new shape, and thus become not so liable to warp after being worked up in the pattern.

TOOLS, ETC.

One of our first requisites in the way of tools and appliances will be a carpenter's bench, which may be made as follows: Three pieces of stuff, 2x5 inches and 3 feet long, will serve for supports for the top. Two 12 inch boards, 12 feet long and 1 inch thick, will do for the sides. Nail these side boards firmly to the 2x5 inch cross pieces, and put on a top of suitable material, and the bench is ready for the legs. Now take four pieces of stuff, 2x5 inches, and of the requisite height for the legs, and frame a piece 1x3 inches across each pair of legs, about 6 inches from the bottom, placing the legs at the distance apart necessary for the width of the bench. Then cut a fork or slit in the top end of each leg, so as to straddle the cross piece at the end, and put a bolt $3\frac{1}{2}$ inches through each leg and through the side boards, and the bench will be complete; and it will possess the advantage that it can be taken down in a few minutes by removing the bolts from the legs.

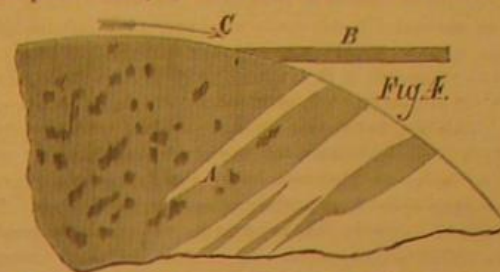
The jack plane is employed for roughing off the surface timber; the stock is made of beech and the blade of cast steel. The blade acts most effectively when it is ground well away toward the corners, thus producing a curved edge, as shown in Fig. 3. When the blade is placed in the stock, and in position to cut off the largest amount of stuff, its



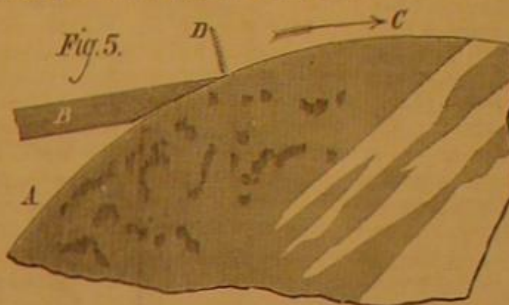
should protrude through the face of the stock about a sixteenth of an inch, while the corners, A B, are about level with the face of the stock. The beveled face should stand at about an angle of 50° to the flat face. In grinding it, care should be taken to grind it as level as possible, rounding off the corners as shown above. The grindstone should be kept true and liberally supplied with water; the straight face should not be ground away, nor indeed touched upon the stone, except to remove the burr which will sometimes turn over. The pressure with which the blade is held against the grindstone should be slight at and toward the finishing part of the grinding process, so as not to leave a long ragged burr on the end of the blade, as is sure to be the case if much pressure is applied, and it will occur to a slight extent even with the greatest care. The blade should not be held still upon the grindstone, no matter how true, flat, or smooth the latter may be; but it should be moved back and forth across the width of the stone, which will not only grind the blade bevel even and level, but will also tend to keep the grindstone in good order.

If a grindstone is in excellent condition (that is, true, flat, and level, or slightly rounding), as it should be, it tempts the workman to grind the plane blade with the stone running toward him, as shown in Fig. 4, for the following

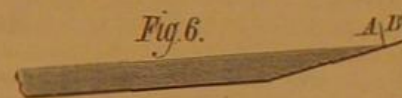
reasons: If the stone, A, travels in the direction of the arrow, C, the plane blade, B, will relieve the abrasion of the stone



at the cutting edge first, thus leaving it clean and with no tendency to leave a long ragged edge; but if the blade were held on the other side of the stone, that is to say, with the stone running from the operator, as shown in Fig. 5, the result will be a long ragged edge on the plane blade, especially if much pressure be placed on the blade.



In Fig. 5, A represents the grindstone, B the plane blade and C the direction in which the grindstone is supposed to revolve: in which case it becomes evident that the plane blade will receive at its edge some pressure in the direction of the arrow, D; and the metal at the cutting edge of the blade, being very thin, gives way to this pressure and bends back instead of abrading off, leaving a long feather edge, as shown in Fig. 6, from A to B. This edge breaks off in many cases further back than it should do, and inevitably breaks off when the blade is applied to the oilstone, leaving upon the face of the oilstone particles of steel which must be removed before a good edge can be secured to the tool. As a rule, however, this feather edge is broken off by lapping the blade on the palm of the hand, or it may be removed by passing the edge lengthways on a piece of wood. It is,



however, better to hold the blade as shown in Fig. 4, but there are other considerations which sometimes render this impracticable. For instance, if the stone is not quite true, the high spots will strike against the cutting edge, and render it impossible to hold the blade steadily, and hence impossible to grind it true. If the stone has soft spots in it, as most stones have, the blade will dig in those soft spots, and will also be thrown off the stone when encountering an unusually hard spot. If, in consequence of digging in a soft spot, the blade catches, the cutting edge will be ground completely off; so that it is only under exceptional and unusual circumstances that the blade can be ground in the position shown in Fig. 4. It is better, therefore, to grind it in the position shown in Fig. 5, which is safer and surer. In oilstoning a plane blade, the straight face should be held quite level with the face of the oilstone, so that the cutting edge may not be beveled off. Not much application to the oilstone is necessary to the straight face, because that face is not ground upon the grindstone, and it only requires to have the wire edge or burr removed, leaving an oilstone polish all along the cutting edge. The oilstoning should be performed alternately on the flat and beveled faces, the blade being pressed very lightly on the oilstone toward the last part of the operation, so as to leave as fine a wire edge as possible. The wire is the edge or burr which bends or turns over at the extreme edge of the tool, in consequence of that extreme edge giving way to the pressure of the abrading tool, be it a grindstone or an oilstone. This wire edge is reduced to a minimum by the oilstone, and is then so fine that it is practically of but little account; to remove it, however, the plane blade or iron may be buffed backwards and forwards on the palm of the hand.

The iron being sharpened, we may screw the cover on, adjusting it so that its edge stands a shade below the corners of the iron, and then screwing it tight; the blade or iron and the cover must now be placed in the mouth of the plane stock, and adjusted in the following manner: The plane iron should be passed through the mouth of the stock until as much in depth of it is seen to protrude from the bottom face of the stock as is equal to the thickness of shaving it is intended to cut: to estimate which, place the back end of the plane upon the bench, holding the stock in the left hand with the thumb in the plane mouth, so as to retain the iron and wedge in position, the wedge being turned toward the workman. A glance down the face of the stock will be sufficient to inform the operator how much or how little the cutting edge of the iron protrudes from the face of the plane stock, and hence how thick his shaving will be. When the distance is adjusted as nearly as possible, the wedge may be tightened by a few light blows of the hammer. If, after tightening the wedge, the blade is found to protrude too much, a light blow on the fore end of the top face of the plane will cause it to retire; while a similar blow upon the back end will cause it to advance. In either case the wedge should be tightened by a light blow after it is finally adjusted.

IMPROVED KEG AND BARREL MACHINERY.

In our issues of March 8, 1874, and February 6, 1875, we published several illustrations, together with detailed descriptions, of new cooping machinery, patented and manufactured by Messrs. E. & B. Holmes, of 59 Chicago street, Buffalo, N. Y. The devices then referred to, which, as we stated, worked a practical revolution in the cooper's trade, related mainly to the manufacture of barrels by machinery, said mechanism in many instances being the first ever invented for performing operations hitherto done by hand labor. To this valuable category of apparatus, the manufacturers have now added a new series of machines designed for the production of kegs and small casks of all kinds and sizes less than barrels, besides a number of novel devices devoted, as before, to improved barrel manufacture.

In Fig. 1 is represented an entirely new machine for leveling and then trussing slack barrels. It is constructed with an iron frame upon which are placed two leveling plates upon slides or guides, which plates are operated by cranks. There are also two other plates placed upon slides, and operated at each end by cranks. Upon these plates are hoop drivers, for driving all the truss hoops upon a barrel at one and the same time. The leveling plates are first moved toward each other and against the ends of the barrel by cranks. The barrel is thus leveled and held in position while the hoop drivers force all the truss hoops to their places. The leveling plates and drivers then recede, and one barrel is discharged from the machine by the introduction of another. The apparatus is so rapid in its operation that, by the help of one man, from 4,000 to 5,000 barrels can be trussed per day.

Fig. 2 is a machine for chamfering, howeling, and crozing kegs and small casks. It is adapted for finishing the ends of kegs or small casks of all sizes, from small kegs to half barrels, ready to receive the heads. It finishes both ends of the keg at the same time with great accuracy. The keg is placed on the machine and forced into chuck rings, which are caused to revolve by teeth, upon their outer edge, engaging with pinions upon a common rotating shaft. Rotary cutters are brought in contact with the ends of the keg, which are finished by a single revolution. The machine is easily altered from one size to another by changing the chuck rings. Its capacity is from 2,000 to 3,000 kegs per day.

In Fig. 3 (see next page) is represented a machine for rounding heads of all sizes for kegs and barrels. This is so constructed that every size of heads for kegs, small casks, and barrels can be made upon it for both tight and slack work, and the change from one size to another is easily and quickly accomplished. The saw and cutters are brought in contact and passed through the wood on such lines as to prevent the tearing, splitting, and shivering of the material used, and to give a smooth finish to the work done. No more set is required in the saw than is necessary in a common circular saw. The machine is made with a strong iron frame, on which is placed a clamp for holding the head. There are, besides, a swing frame, carrying a concave saw and cutters for rounding and chamfering the head, and an automatic apparatus for discharging it when finished.

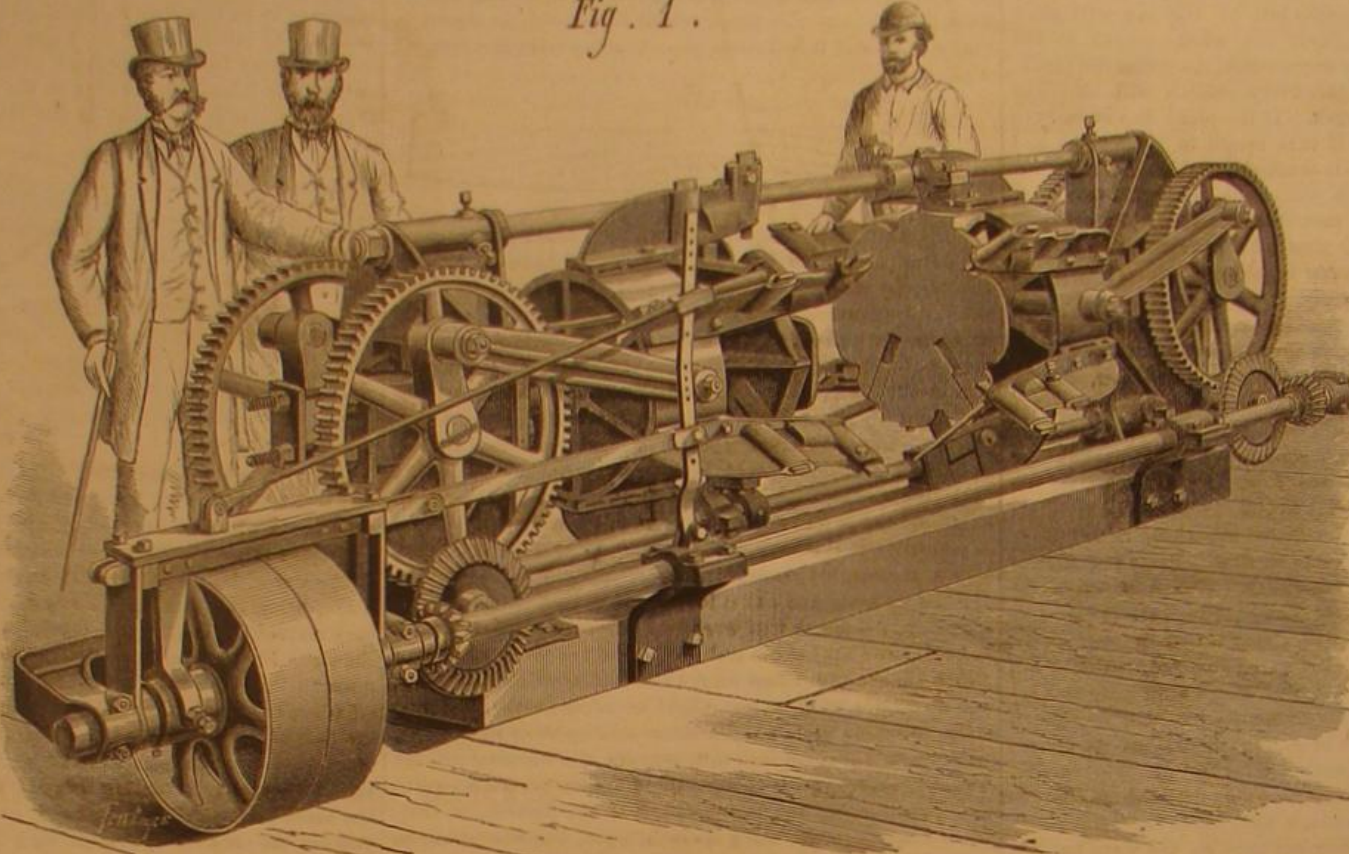
In operating the machine, the blank is placed between the clamps, and at the same time the foot treadle is pressed. This clamps the blanks, and also brings the concave saw and cutters in contact with it, and holds them there until the head is finished, when the latter is released through the automatic action.

In the following engraving, Fig. 4, is exhibited a power windlass for kegs and slack barrels. This is for drawing up

or together the ends of staves of a keg or barrel, ready to receive the head truss hoop, after they have been set up in the setting-up form with their other ends in the other head truss hoop. The machine is constructed with a frame upon which is planted a windlass supplied with a rope, which windlass is operated by friction wheels.

After the barrel or keg has been set up with the ends of the staves in one head truss hoop, it is placed in the machine, and the rope is placed around the flaring ends of the staves. The friction wheels are then brought in contact with each other, when the windlass is set in motion, drawing up the staves, by the aid of the rope, ready to receive the other end

Fig. 1.



MACHINE FOR LEVELING AND TRUSSING SLACK BARRELS.

or head truss hoop. This apparatus is very rapid in its operation, and will windlass from 2,000 to 2,500 kegs or barrels per day.

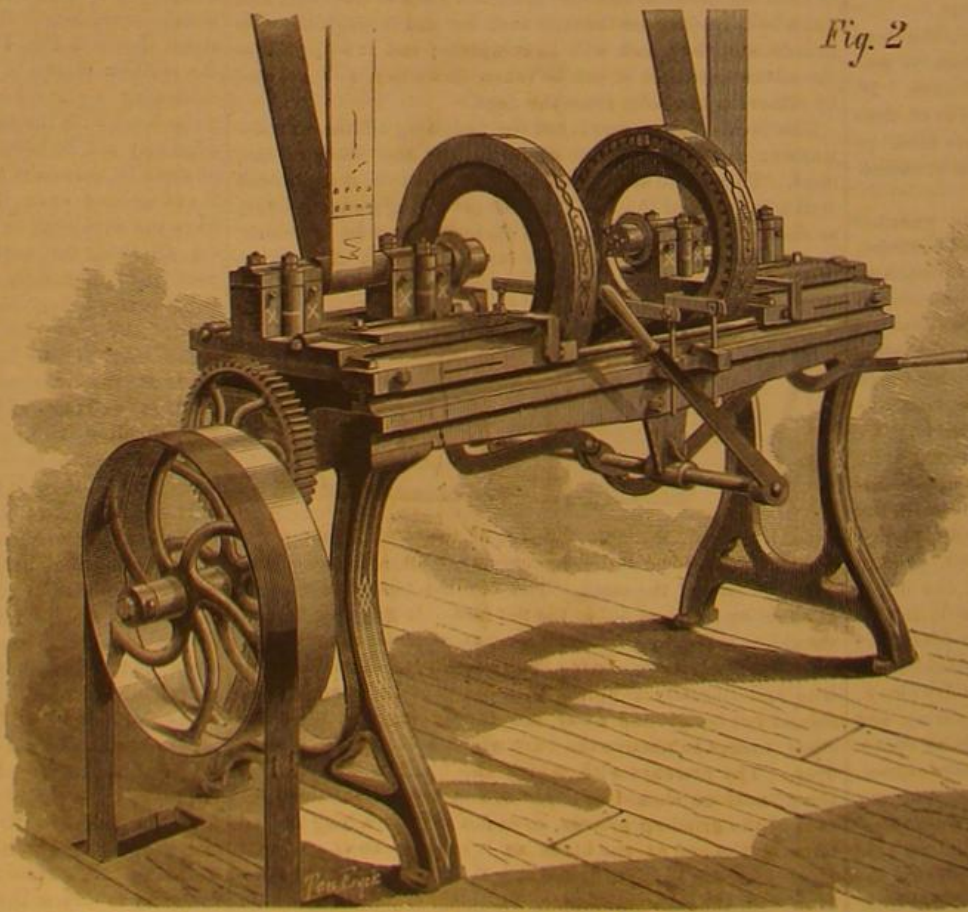
Fig. 5 is a machine for leveling and trussing kegs and small casks, from the smallest kegs to half barrels, and can be easily and quickly adjusted. The truss hoop drivers are attached to two plates, one of which is stationary and adjustable, and the other is moved to and from it perpendicularly by cranks and pitmans. The drivers move automatically in and out, to allow the reception and discharge of the keg into and from the machine. The plates level and the drivers

this car is set at 20 tons. The ordinary platform car weighs about 6 tons, and is considered heavily loaded with 12 tons, a fair burden being from 8 to 10. The ordinary car, capable of carrying but 10 tons, must carry a dead weight of 6 tons; while this new invention will, it is claimed, with absolute safety carry 20 tons, with a dead weight of but 3 tons. The same principle is to be applied in building box cars. Greater safety in case of collision or fire is claimed for these cars. A platform car of this kind has been in use on the Providence and Worcester Railroad since September for transporting stone. Its weight is 3,560 lbs. less than their ordinary platform cars, and in strength and durability it gives great satisfaction.

Condensed Eggs.

It is astonishing, says the British *Trade Journal*, what progress has been made during the past few years in the art of preserving aliments generally, and that a great boon has thereby been conferred all round we have daily evidence. The superfluous herds of Australasia and South America are now potted, or, we should perhaps say, "tinned," for the English and other markets, thus affording comparatively cheap animal food for the less opulent classes. America sends us in large quantities the products of her waters, which but for preservative processes would be lost to the old world; Switzerland is fast ruining the milkman's business in this country; from across the Channel come supplies of vegetables in a form qualified to journey round the world without deterioration; and Denmark exports her delicious butter in ever-increasing quantities, well protected from the effects of keeping and climatic change. In fact, preserved provisions now include a vast variety of substances hailing from all parts of the world. Although more the recipients than the producers of such goods, there are many articles of the kind which we are able to send abroad, and the productions of the Scotch provision factories are especially esteemed in

Fig. 2



BARREL CHAMFERING, HOWELING, AND CROZING MACHINE.

drive the truss hoops at one and the same operation upon the keg, by the movable plate being brought in contact with the upper end of the keg by the action of the cranks and pitmans, the two cranks being on the same shaft. The machine works rapidly, and will level and drive the truss hoops upon from 4,000 to 5,000 kegs per day.

This subject will be resumed in our next issue

certain parts. Only recently a new product has been brought into notice which bids fair to gladden the hearts of our colonists who swear by the virtues of British beer. We see no reason why condensed beer should not be as good in its way, and prove as great a success, as condensed milk. But we have strayed somewhat from our immediate object, which is to call attention to condensed egg, a sample tin of

of which, prepared in Bavaria, has reached us. This article is prepared from fresh raw eggs by a process of desiccation, which, while effectual in removing all traces of moisture, leaves the natural properties of the egg unimpaired. It is only necessary to add a due proportion of water to the egg powder to render it fit for culinary purposes, the active constituents of one egg being contained in about a teaspoonful of the powder. That this is a valuable addition to the line

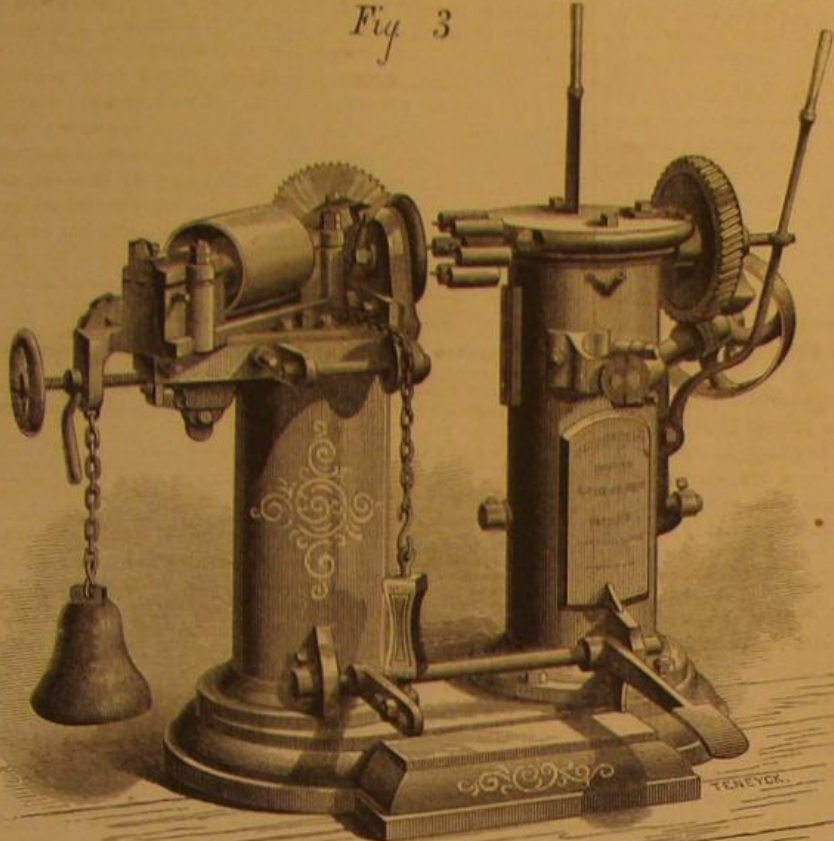
the carbonic acid was absent; namely, copper only about one sixth; lead, only about one half as much; tin and Britannia metal not at all. With access of air, with or without carbonic acid, a considerable quantity of each metal went into solution, with the exception of tin and Britannia metal, of which, in both cases, not a trace was dissolved.

The action of copper, and in a less degree of brass and German silver, towards sal ammoniac solution is worthy of

to 8.1 cubic inches of water, in an open glass covered with paper, lost only 3.68 grains. If copper is boiled in a solution of sal ammoniac, with or without access of air, ammonia is continually liberated, even for hours.

In water containing chloride of magnesium, in the presence of air free from carbonic acid, lead and zinc were most strongly attacked, tin and Britannia were only very slightly. The action upon lead and copper is about the same as that

Fig 3



MACHINE FOR ROUNDING BARREL HEADS.

of concentrated natural aliments will be admitted, we think, by those who, getting the better of a perhaps not altogether inexcusable prejudice, venture on a trial. The contents of a small sized tin are about equal to twelve eggs.

Action of Different Solutions on Metals.

Professor A. Wagner, of Munich, has recently made a series of careful experiments to determine the action of different solutions on copper, zinc, lead, tin, Britannia metal, brass, and German silver, first in air free from carbonic acid, then in the presence of carbonic acid and air. These metals and alloys were in the form of foil, of equal surface, namely two square inches, and of as nearly equal thickness as possible. The copper foil was as good as chemically pure; the zinc was common sheet zinc with 0.68 per cent of lead; the lead was cut from commercial sheet lead; the tin was the pure cast metal. The Britannia metal was a piece of new sheet metal intended for the drums of gas meters, and consisted of 90 per cent tin and 10 per cent antimony. The brass was composed of 64½ per cent copper and 35½ per cent zinc. The German silver was 70.2 per cent copper, and 29.8 zinc and nickel. These pieces of sheet metal were placed vertically in glass vessels, each holding 6.1 cubic inches of the solution to be tested, the metal being completely covered with the solution. In the experiments they were left in the solution for a week. The results of these experiments, as given in the *Bavarian Industrie und Gewerbeblatt*, were as follows:

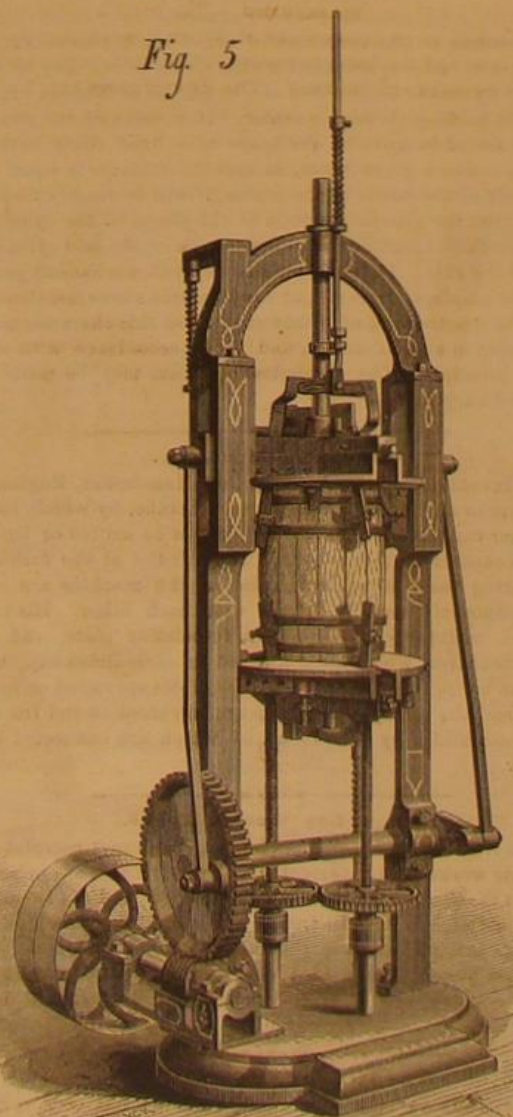
In freshly boiled distilled water, zinc suffered the most change of all the metals tested; tin and Britannia metal suffered no change. With access of air and carbonic acid, the action upon lead, copper, zinc, brass, and German silver was much more energetic than in the presence of air free from carbonic acid. In the latter case only traces of copper, zinc, and lead were dissolved; tin, Britannia metal, brass, and German silver were not attacked at all. In the presence of carbonic acid and air, tin and Britannia metal were the only metals not attacked; all the other metals were perceptibly dissolved.

In chloride of sodium and chloride of potassium solutions, with access of air and carbonic acid, copper, brass, German silver, and zinc were violently attacked, while in the absence of carbonic acid they underwent comparatively little change. The contrary was the case with lead, tin, and Britannia ware, they being attacked more violently when exposed to air free from carbonic acid than in air and carbonic acid. In the latter case, lead was only half as much affected as in former, tin not at all, and Britannia metal very little. With access of air free from carbonic acid, not a trace of any of the metals was dissolved; with access of air and carbonic acid, considerable quantities of copper, brass, German silver, zinc, and lead were converted into soluble compounds, only a trace of Britannia metal went into solution, and no tin was dissolved.

In sal ammoniac solutions, with access of air free from carbonic acid, copper was attacked prodigiously, also brass, German silver, and zinc; Britannia metal, tin, and lead comparatively little. In the presence of both air and carbonic acid, strangely enough, all the metals, with the single exception of German silver, were less attacked than when

attention. Within a week, a large quantity of copper was dissolved, the liquid became dark blue, and contained a perceptible quantity of ammonia. By allowing the sal ammoniac to act upon the copper for a long time, at ordinary temperature, a compound of ammonio-cuprous chloride with ammonio-cupric chloride was formed. The action of sal ammoniac solutions on copper seemed, however, to be essentially dependent upon the unrestricted access of the

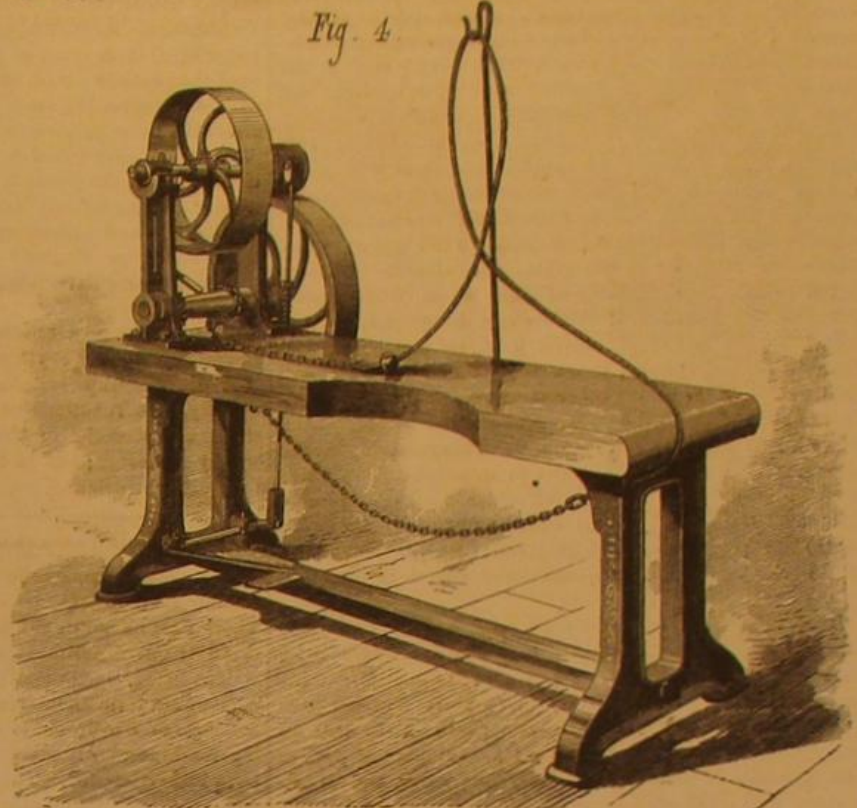
Fig 5



MACHINE FOR LEVELING AND TRUSSING KEGS.

atmospheric oxygen. The loss of weight of one square inch of copper foil, in the experiment, in which air free from carbonic acid was passed through the solution, was 18.56 grains in a week; while one square inch of copper foil, standing vertically in a solution containing 15 grains sal ammoniac

Fig 4



WINDLASS FOR DRAWING BARREL STAVES TOGETHER.

of the alkaline chlorides; zinc, brass, and German silver are more strongly affected. In the presence of carbonic acid and air, chloride of magnesium has about the same effect upon copper and German silver as the alkaline chlorides, and a much stronger one on lead, zinc, and brass. In this case, tin is perfectly protected from corrosion. When carbonic acid is absent, perceptible quantities of zinc alone go into solution, as well from sheet zinc as from brass and German silver. In the presence of air and carbonic acid, considerable quantities of all the metals are dissolved, except tin, of which none is dissolved, and Britannia metal, of which traces only are dissolved.

In solutions of sulphate of potassa, copper, lead, brass, and German silver were perfectly protected from loss of weight in the presence of air free from carbonic acid, the loss of weight of zinc was considerable, of tin and Britannia metal inconsiderable. With access of air and carbonic acid, lead, tin, and Britannia were suffered no loss of weight; copper, brass, and German silver lost equally and slightly in weight, zinc considerably. None of the metals were dissolved in the absence of carbonic acid; but in its presence, copper, zinc, brass, and German silver were dissolved in perceptible quantities; lead, tin, and Britannia metal were not dissolved.

In water containing saltpeter and air free from carbonic acid, lead and zinc were attacked most violently; tin and Britannia were a little; copper, brass, and German silver not at all. With air and carbonic acid present, zinc and lead were attacked most; copper, German silver, and brass were not more acted upon than by distilled water; tin and Britannia metal were acted upon somewhat. None of the metals were dissolved when carbonic acid was absent; when it was present, perceptible quantities were dissolved.

In carbonate of soda, and air free from carbonic acid, lead, copper, brass, and German silver lost nothing in weight, but zinc, tin, and Britannia metal were sensibly affected. Perceptible quantities of tin and Britannia were dissolved; none of the other metals went into solution. It was not possible to pass carbonic acid into the solution, as this would convert the carbonate of soda into bicarbonate of soda.

In water containing caustic soda, and air free from carbonic acid, lead, tin, Britannia metal, and zinc suffered a very considerable loss; brass and German silver an inconsiderable loss; copper, none. A good deal of lead, tin, Britannia metal, and zinc were dissolved; only a little brass and German silver, and no copper. It was impossible to pass carbonic acid and air into the solution, because it would convert the caustic soda into carbonate of soda.

In lime water, with air free from carbonic acid passed into it, lead lost considerably in weight; zinc and brass an inconsiderable quantity; copper, tin, Britannia metal, and German silver, none at all. A perceptible quantity of lead was dissolved, but only traces of zinc and brass. It was, as before, impossible to perform the experiment in the presence of carbonic acid, as this would form carbonate of lime.

Reviewing these results, and classifying them according to the metal, we find that they are affected as follows:

Copper, in the presence of air free from carbonic acid, is very energetically attacked by a solution of sal ammoniac

(loss of weight, 13.56 grains) only slightly by chloride of magnesium (0.075 grain), and alkaline chlorides (0.06 grain), extremely little by distilled water (0.015 grain), not at all by sulphate of potassa, saltpeter, carbonate of soda, caustic soda, or lime water. Quite a considerable amount of copper was dissolved by sal ammoniac, only traces of it by distilled water; none of the other solutions were able to convert any copper into soluble compounds. In the presence of carbonic acid, the copper was attacked by all the solutions, most violently again by sal ammoniac (loss, 2.14 grains), the action being only about one sixth of that without carbonic acid. The alkaline chlorides dissolved 1.76 grains, chloride of magnesium, 1.72 grains, being nearly as strong as sal ammoniac. Sulphate of potassa acted feebly (0.060 grain), and so did saltpeter (0.045 grain) in distilled water (0.045 grain). All these solutions dissolved perceptible quantities of copper.

Zinc, in the absence of carbonic acid, was attacked by every solution, most violently by caustic soda (loss 0.90 grain) and sal ammoniac (0.76 grain), considerably by sulphate of potassa (0.045 grain), less by chloride of magnesium, distilled water, and carbonate of soda (0.195 grain), quite feebly by saltpeter (0.135 grain) and alkaline chlorides (0.105 grain), inconsiderably by lime water (0.045 grain). Perceptible quantities of soluble zinc compounds are produced by the action of caustic soda, sal ammoniac, and chloride of magnesium; traces only by distilled water and lime water. None of the other solutions produced soluble zinc compounds. In the presence of air and carbonic acid, all solutions act upon zinc; chloride of magnesium acts the strongest (loss 0.810 grain); next to it, sulphate of potassa (0.795 grain). The alkaline chlorides act considerably (loss 0.57 grain), and almost equally with saltpeter (0.555 grain) and sal ammoniac (0.54 grain); distilled water less (0.285 grain). Perceptible quantities of zinc were dissolved by each solution.

Lead, in air free from carbonic acid, was very strongly attacked by caustic soda (loss, 6.45 grains); considerably by lime water (2.055 grains); less by alkaline chlorides (0.315 grain); chloride of magnesium (0.3 grain); saltpeter (0.21 grain), and sal ammoniac (0.18 grain); still less by distilled water (0.045 grain); and not at all by sulphate of potassa and carbonate of soda. Caustic soda, lime water, and sal ammoniac converted perceptible quantities of lead into soluble compounds, chloride of magnesium and distilled water only traces of it; while sulphate of potassa, carbonate of soda, saltpeter, and alkaline chlorides dissolved no lead. With access of carbonic acid and air, the chloride of magnesium acted most strongly (loss, 0.525 grain); next saltpeter (0.31 grain) and alkaline chlorides (0.18 grain); still less distilled water (0.12 grain) and sal ammoniac (0.075 grain). Sulphate of potassa was again powerless to affect the lead, and did not dissolve a trace of it, while all the other solutions dissolved perceptible quantities of it.

Tin, in the absence of carbonic acid, was energetically attacked only by carbonic soda (loss, 0.33 grain). Of the other solutions, it lost, in carbonate of soda, 0.105 grain; in alkaline chlorides, 0.90 grain; in sal ammoniac, 0.075 grain; in saltpeter, 0.045 grain; in sulphate of potassa, 0.03 grain; and in chloride of magnesium, 0.015 grain; while it was unaffected by distilled water and lime water. Only caustic soda and carbonate of soda were able to dissolve perceptible quantities of tin. Carbonic acid and air hinder, in a remarkable manner, the action of these solutions upon tin, with the single exception of saltpeter, which acts very faintly (loss, 0.015 grain).

Britannia metal acts quite analogous to tin. In air free from carbonic acid, caustic soda acts most violently (loss of weight, 1.41 grains); the others act inconsiderably. The loss of weight in alkaline chlorides was only 0.135 grain; in carbonate of soda, 0.09 grain; in sal ammoniac, 0.045 grain; in sulphate of potassa, chloride of magnesium, and saltpeter, each only 0.015 grain; and in distilled water and lime water, it was unacted upon. Caustic soda and carbonate of soda alone dissolved perceptible quantities of the metal. In the presence of carbonic acid and air, as in the case of tin, distilled water, sal ammoniac, and sulphate of potassa do not act at all; the alkaline chlorides, chloride of magnesium, and saltpeter act very feebly (loss, 0.015 grain); and saltpeter alone dissolves enough metal to be detected.

Brass acts, on the whole, in a manner analogous to copper. With access of air free from carbonic acid, it is strongly attacked by sal ammoniac (loss of weight, 4.035 grains), only slightly by chloride of magnesium (loss, 0.6 grain), alkaline chlorides, caustic soda, and lime water (each 0.03 grain), and not at all by distilled water, sulphate of potassa, saltpeter, and carbonate of soda. Perceptible quantities of metal are dissolved by sal ammoniac and chloride of magnesium, and traces of it by caustic soda and lime water. In the presence of carbonic acid and air, it is acted on most violently by sal ammoniac (loss, 2.505 grains) very strongly; by chloride of magnesium (loss, 1.38 grains), and alkaline chlorides (loss, 1.2 grains); less by distilled water and carbonate of potassa (each 0.06 grain), and saltpeter (loss, 0.045 grain). All the solutions dissolved perceptible quantities of the metal.

German silver acts like brass, but on the average is less energetically attacked. In air free from carbonic acid, it is less strongly attacked than brass, although quite strongly by sal ammoniac (loss of weight, 0.129 grain), less by chloride of magnesium (loss, 0.045 grain), alkaline chlorides (0.015 grain), and caustic soda (0.15 grain), not at all by distilled water, sulphate of potassa, saltpeter, carbonate of soda, and lime water. Perceptible quantities of metal were dissolved by sal ammoniac and chloride of magnesium; traces only by caustic soda. In carbonic acid and air, the sal ammoniac acts the strongest (loss, 1.74 grains), next to this are chloride of

magnesium (1.005 grains), and alkaline chlorides (0.915 grain), still less distilled water, sulphate of potassa, and saltpeter (each 0.015 grain). Perceptible quantities of metal are dissolved by all these solutions.

Copyrights.

Mr. Rowland Cox, says: In the case of *Lawrence vs. Cupples*, Judge Shepley has announced it as his opinion that, in an action for the infringement of a copyright, where the resemblances are accidental or arise from the nature of the subject treated in the two books, there can be no recovery. To constitute an infringement of a copyright, the learned judge says, there must be piracy; the defendant must have used the plaintiff's book as his model. Although the defendant's work cover the same ground as the plaintiff's, and answers the same purpose *in toto*, it will be no infringement if it is not an appropriation of plaintiff's particular method. Hence, where the plaintiff had compiled a book bearing the title "The Advertiser and Collector's Chart," containing certain lists and names, and defendant issued a book entitled "The New England Mercantile Guide," which contained the same lists, it was held that there was no infringement.

There can be no doubt that a copyright which purports inferentially to cover anything akin to a subject is of no avail. It is idle to attempt to make a copyright effect, directly or indirectly, the functions of a patent or a trademark. The three are possibly of the same genus, but, as species, are widely separated; and to confound them inevitably leads to illogical conclusions.

The Comacho Electric Machine.

The Comacho magnetic machine, with its concentric iron tubular magnets, may be seen at 171 Queen Victoria street. There can be no doubt of the advantage of this form of magnet; but experiment on the resistance of the circuit, weight lifted, electro-motive force, and consumption of zinc, etc., would form an interesting subject. The machine, with five cells of a bichromate battery, works three or four sewing machines. Attempts to work it with the thermopile have hitherto failed. This is very likely, because the elements of the thermopile are coupled up in considerable series, so that, considering the resistance of each element, the whole resistance must be great compared with the resistance of the wire round the magnets. A thermopile should be made of low resistance by coupling a number of elements together in parallel circuit, and then taking some ten or twelve, or more, of such series coupled in succession. It is no doubt worth considerable experiment to attain a successful result from the thermopile, as in that case, by merely turning on the gas, a lathe or sewing machine be made to work.—*Telegraphic Journal*.

Rotary Engines.

According to the invention of Mr. Urbain Chauveau, of Paris, a cylinder is arranged with a piston which may be actuated by steam, compressed air, or gas, so as to move round an axis passing through a center. If a point of the piston rod is forced to move in the space of a fixed circle having for its center a given point, so that the distance is equal to one half of the stroke of the piston, it will be readily understood that the alternate motion of the piston in the cylinder will produce a continuous rotary motion of the said cylinder round the axis. Different arrangements of mechanical parts may be employed to carry out the principle above mentioned, and the construction of rotary engines of this character may be varied to a great extent, and yet in accordance with the same principle. The admission of steam may be made in any ordinary manner.

Drilling and Boring.

An invention by Mr. J. Dodge, of Manchester, England, consists in an improved compound machine, by which four or other convenient number of holes can be drilled or bored at the same time, and by which the spindles of the drilling or boring tools at opposite sides of the machine are set simultaneously, and in unison with each other. His improved machinery consists of a foundation plate, and of four standards, which are connected by cross slides supporting the boring headstocks; the cross slides are raised or lowered, and the boring headstocks are traversed to and fro on the cross slides by screws, all of which are connected together.

Large Lap-Welded Tubes.

The National Tube Works Company have just completed, at their works at McKeesport, Pa., a sample pipe for exhibition at the Centennial. It is 14 feet in length and of 14 inches outside diameter and 10 inches inside, the iron of which it is made being 2 inches in thickness. This is said to be the heaviest piece of lap-welded pipe ever made in this or any other country, and it is stated that such heavy work has never been attempted by any other establishment.

The Hell Gate Obstructions.

The drilling of the chief obstruction at Hell Gate is finished, and the machines have been transferred to Flood Rock. The debris have been cleared away from the shaft, and the caves formed by the deep headings are now in a good condition to be explored. Experiments are being made daily in explosive material, to ascertain the safest. The mine will be sprung next July or August. There are 172 pillars which support the rocky roof; 8,000 borings have been made for inserting explosive matter. Those in charge of the work ap-

prehend more danger from the surging of the water than from the shock at the time the rock is shattered. The work at Flood Rock is carried on day and night.

A New Electric Battery.

M. Cerpaux proposes a battery made of a certain number of plates of copper and of zinc separated by a wooden lath. The plates are plunged in sand or moist earth, and an electric current is at once produced. If on the earth chloride of sodium be poured, a very intense current is generated.

Steam Street Cars in Philadelphia.

Steam street cars are now in operation on one of the railroad lines in Philadelphia. The local papers state that the objection that horses will be frightened by the exhaust has not been realized, as no runaways have occurred, nor do the animals seem at all alarmed by the proximity of the machines.

DECISIONS OF THE COURTS.

United States Circuit Court—District of Massachusetts.

PATENT SHADE FIXTURES.—*STEWART HARTSHORN vs. JOHN SHOREY et al.* [In equity.—Before SHEPLEY, J.—Decided October term, 1875; to wit, February 17, 1876.]

SHEPLEY, J.: This bill is for an alleged infringement of letters patent No. 3,756, dated August 27, 1867, granted to Stewart Hartshorn for improvement in spring fixtures for shades. These are the same letters patent which were the subject matter of litigation in *Hartshorn vs. Almy*, at d. Hartshorn vs. Tripp et al.

Defendants rely upon two grounds of defense: First, that the alleged invention of Hartshorn was not new and patentable at the date of his original letters patent.

Second, that the devices made use of by the defendants are no infringement of the plaintiff's invention.

To sustain the defense of want of novelty, the defendants rely upon evidence of the prior existence of what is well known as the coach fixture, in which a cord is used to lift the pawl and clenchage it from the ratchet when it is desirable to allow the curtain to roll up under the action of the spring. This defense is fully met and answered in the two cases above cited, to which it is only necessary to refer to dispose of this branch of the defense.

The fixture manufactured by the defendants has a spindle which rests in the bracket, and is extended for a short distance into one end of the curtain roller, which end revolves around that portion of the fixed spindle which is projected into the roller, while the other end of the roller is provided with a journal, upon which it revolves freely in the supporting bracket. This spindle is provided with a cam-shaped recess on one side of it, within the roller, and a chamber of sufficient size to receive a small sphere or buckshot in such a position as to be directly over the recess in the spindle when the roller is revolved. The small ball or buckshot is introduced into this chamber. One edge of the recess in the spindle is so constructed that when the ball falls into the recess it will be forced against the side of the chamber, and operate as a detent to stop the revolution of the roller when it is turning one way. The other edge of the recess is so formed that when the roller is turned in the opposite direction the ball is thrown up into the chamber, where, when the roller is rapidly revolved, the ball is held by centrifugal force.

It will be seen, by a comparison of this contrivance with the one described in the Hartshorn patent, that it effects the same result by means of the ball operating as a detent as is effected in the Hartshorn contrivance by the pawl and ratchet. In Hartshorn's, the pawl has a tendency to fall by gravitation into the notches made in the periphery of the hub, or when fixed below the hub, in one of the modes described in the patent, it is actuated by a spring which tends to engage it in the notch. The ball operates as a detent, catch, or pawl, to engage with the notch or ratchet whenever the rotation of the roller, and the upward movement of the curtain under the influence of the spring, are checked by the manipulation of the curtain or shade itself. In Hartshorn's, when the roller is revolved rapidly, the ratchet has not time to fall by gravitation into the notch while the ratchet notch is passing under the toe of the pawl. In Shorey's, while the roller is being rapidly revolved, the ball is kept by centrifugal force from engaging as a detent between the side of the chamber in the roller, and the edge of the recess in the spindle.

The construction of the claim in the Hartshorn patent was fully given in the case of *Hartshorn and Almy*. It was there shown to embrace, in combination with a spring roller, such an arrangement of pawl and ratchet, with the varying speed of the revolution of the roller mutually acting with each other through the manipulation of the roller, that the pawl would engage with the ratchet by checking the rotation of the roller and the upward movement of the curtain by the simple manipulation of the shade, merely varying the speed of the rotation of the roller. It is equally within the scope of this invention, whether the force which determines the fact of engagement or non-engagement of the pawl or detent with the notch or ratchet be that of a spring, or force of gravity, or centrifugal force.

Improvements may be made in the spring or the roller, the shade, or the form of the pawl or detent, and these improvements may be patentable; but so long as the combination embraces, as in the case of the device of the defendants, every element of Hartshorn's invention, operating substantially in the same manner to produce the same result, it must be treated as an infringement.

Decree for complainant, for injunction and account.

[S. D. Lane, for complainant.

A. K. P. Joy, for defendant.]

Inventions Patented in England by Americans.

(Compiled from the Commissioners of Patents' Journal.)

From February 29 to March 27, 1876 inclusive.

- APPLYING MOTIVE POWER.—J. Doubler, Philadelphia, Pa.
- BAKING POWDER.—Dodge et al., New York city.
- BARRED FENCE WIRE.—H. W. Putnam, Bennington, Vt.
- BOILER.—D. L. M. Moore (of New York city), London, England.
- BOILER TUBE APPARATUS.—J. H. Faxon, New York city.
- BOOT-SCREWING MACHINE.—American Cable Screw Wire Co., Boston, Ms.
- BOOT-SEWING MACHINE.—D. Mills (of Brooklyn, N. Y.), Aston, England.
- BRICK KILN, ETC.—G. S. Redfield, Chicago, Ill.
- BRICK MACHINERY.—C. S. Bigler, Harrisburgh, Pa.
- BRICK MACHINE.—W. A. Graham, Carlisle, Pa.
- BURNING LIME, ETC.—A. Smith, Buffalo, N. Y.
- CARDING MACHINE.—J. F. Foss, Lowell, Mass.
- CLEANING WHEAT.—D. M. Richardson, Detroit, Mich.
- COVERING UMBRELLAS.—J. P. Onderdonk, Philadelphia, Pa.
- CUTLERY.—J. Pedder et al., Beaver Falls, Pa.
- ENGINE VALVES, ETC.—H. E. Marchand, Pittsburgh, Pa.
- FABR REGISTER.—J. Sangster et al., Buffalo, N. Y.
- FEEDING CARDING MACHINES.—W. T. Bramwell, Terre Haute, Ind.
- FLUID METER.—J. C. Guertant, Danville, Va., et al.
- GARLIER.—C. Deane, New York city.
- HAY KNIFE, ETC.—H. Holt, East Wilton, Me.
- HEAT RADIATOR.—E. C. Angell, New York city.
- HORSESHOE MACHINE.—J. A. Burden, Troy, N. Y.
- KNITTING MACHINERY.—C. J. Appleton, Elizabeth, N. J.
- LIFE RAFT.—N. H. Borgfeldt, New York city.
- LIGHTING GAS.—H. B. Stockwell et al., Brooklyn, N. Y.
- MACHINE GUN.—W. Gardner, Hartford, Conn.
- MAKING GAS.—M. H. Strong, Brooklyn, N. Y.
- MAKING LEATHER.—C. L. Royer, San Francisco, Cal.
- MAKING PIG IRON.—C. Harrod, Youngstown, Ohio.
- MAKING STEEL.—W. Fields, Wilmington, Del.
- MINER'S PICK.—J. I. Fewkes, Philadelphia, Pa.
- PAPER BOX.—B. Osborn, Newark, N. J.
- PHOTOGRAPH APPARATUS.—W. A. Brice, New York city.
- PIANOFOORTE.—C. E. Rogers, Mass.
- PITH VENEER.—S. H. Penley et al.
- RAILWAY SWITCH, ETC.—J. S. Williams, Niverton, N. J.
- ROLLER SHUTTER.—J. G. Wilson, New York city.
- ROLLER SKATE.—C. H. Green, New York city.
- SCREW WRENCH.—O. T. Bedell, New York city.
- SEWING MACHINE.—G. L. Du Lancy, New York city.
- SOAP.—S. S. Lewis (of Boston, Mass.), London, England.
- SUBMARINE TELEGRAPH STATION.—R. F. Bradley, Mottettsville, S. C.
- TYPE-SETTING MACHINE, ETC.—S. W. Green, New York city.
- VARNISHING METAL CASES.—F. A. Pratt et al., Hartford, Conn.
- VENTILATING MINER.—F. Murphy, Streator, Ill.
- WARNING MACHINERY.—C. W. Littlefield, Boston, Mass.
- WIRE BOOT PEG MACHINERY.—O. L. G. Noble et al., Chicago, Ill.
- WRINGER.—C. W. Littlefield, Boston, Mass.

Recent American and Foreign Patents.

NEW AGRICULTURAL INVENTIONS.

IMPROVED COTTON PLANTER.

Thomas R. Wallis, Egg's Point, Miss.—The novel feature in this consists in the axes of the seed cylinders (which are placed within a diamond-shaped harrow frame), being secured to bars, and these last being attached to two standards on said frame, thus forming a new mode of sustaining said cylinders.

IMPROVED GRAIN DOOR.

Joshua W. Merriman, Wells, Minn., assignor to himself and Benjamin F. Smith, same place.—This consists of a vertical catch bar mounted at its upper end on an eccentric stud of a hand lever. At the lower end there is a slot working on a stud pin, the slot being so inclined that, when the eccentric stud is worked to raise and draw back or lower and push forward the upper end of the catch bar, the lower end will work in the same manner. The bar thus holds one end of the grain door by being pressed into a groove in the door frame, binds the door fast, and prevents it from shaking, and at the same time locks the door against rising.

IMPROVED ROTARY CHURN.

Israel Solt, Lithopolis, O.—This invention consists in using with a square churn a dasher having its blades straight on outer edges, concave on inner edges, and provided with concavo-convex slots, the same being applied to cross bars. This dasher, by its inner concave and outer straight edge, catches all the cream and throws it to the center of the churn, so that the butter globules are forced back and forth through the slots and quickly broken.

IMPROVED COLTER.

Kinyon W. Manwaring, Council Bluffs, Iowa.—It is here proposed to mount the colter, between two right and left nut collars, on a shaft which revolves on end bearings in the yoke which attaches the colter to the plow. The objects are to adjust the colter along the shaft readily for wide or narrow cuts, and to arrange the bearings so as to withstand wet and exclude the dust better than when the colter revolves on a stationary shaft, as commonly arranged.

IMPROVED HORSE HAY RAKE.

Daniel D. Dunn, Greenwich, Conn.—This relates to improvements in horse hay rakes, by which the different operations of the rakehead-governing parts may be accomplished in a simpler manner. The invention consists, first, in applying the swinging rakehead in front of the supporting axle; secondly, in attaching the clearer bar; thirdly, in combining the rakehead-operating lever rod and back piece with a treadle, in such a manner that the horizontal position of the same is secured during its motion; and lastly, in the combination of the rakehead-operating lever rod with a fulcrum foot lever, for securing the rake in raised or lowered position.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED ENVELOPE MACHINE.

Henry D. Swift and Daniel W. Swift, Worcester, Mass., assignors to G. Henry Whitcomb & Co., same place.—This machine includes thirteen new devices, mainly improvements upon an apparatus which was the subject of a previous patent granted to the same inventors. The edges of the blanks rest on a raised form, and the blanks are removed by a gummed lifter. There is new apparatus for applying the gum very smoothly, for keeping the gummed flap separate from other parts during folding, and for adjusting the mechanism to envelopes of varying thickness, beside novel constructive details of much ingenuity, which would require the aid of engravings for their proper elucidation.

IMPROVED TYPE WRITER.

Philander Deming, Albany, N. Y.—This relates to such an improvement in the type writers lately introduced into use that the same may be made available for verbatim reports by a separate marking lever, that prints outside of the printing point of the common type levers, and is operated by an adjustable button attached to the space key. As soon as the marker is joined to the space key, it may be worked by the palm of the hand simultaneously with the striking of the initial key, and thereby verbatim reports made in stenotypic manner by means of the simple and inexpensive marker arrangement.

IMPROVED MAGNETIC MACHINE.

Jerome Kidder, New York city.—This invention consists in hinging the support of an electrical coil in its relation to a galvanic battery in such a manner that, when the coil is turned or swung in one direction, the circuit will be closed with the galvanic battery and when swung in the other direction, the said circuit will be opened.

IMPROVED PAINTERS' SCAFFOLD.

William Hoeft, New York city.—This platform may be carried from place to place and mounted without injury to the stiffening brace rods. The novel feature consists in longitudinal brace rods that are applied by tightening screws by supporting end clips, and to laterally braced arms or stays, which are hinged to the platform to fold with the rods to the under side of the same.

IMPROVED COAL BREAKER.

David Clark, Hazleton, Pa.—The construction of this breaker is such that, should a substance harder than coal or slate get into the breaker and break the safety devices, a roll will be thrown out of gear, and will remain out of gear until the damage is repaired and the said roll again adjusted in place.

IMPROVED WAGON JACK.

Albert E. Van Horn, Sebewaing, Mich.—A ratchet wheel operated by the lifting lever has a slotted projection in which enters a pin on the movable bar of the jack. The pawl falling out, the teeth of the wheel hold the load at any desired position.

IMPROVED JIG SAW.

Peter Hughes, New York city.—This is a novel spring contrivance and an elbow foot treadle for working the saw gate, whereby a simple and efficient mechanism is provided for working a jig saw.

IMPROVED ROCK DRILL.

William H. Wright, Sunbury, Pa., assignor to himself and John Wright, same place.—The object of this invention is to provide for miners a drill for boring coal and rock, that is attached directly to the material to be drilled, without props or supports, and which allows the change of drills to suit the depth of bore hole and material without removing the frame. A frame is provided with stationary or adjustable prongs and a sectional screw nut with link for interchanging the drill.

IMPROVED FRICTION CLUTCH.

Edwin F. Williams, Bald Mountain, Col. Ter.—This invention consists of brakes which are drawn against the face of a disk wheel by wedges, moved by the sliding head on a shaft, which in turn is moved by levers.

IMPROVED GRINDER FOR MOWERS.

Walter B. Grosh, Reading, Pa.—This consists of a supporting frame for the grinding wheel, fixed on pivots so as to shift readily to let the stone run in different angles of the opposite edges of the cutters. The frame has articulations whereby the grinding wheel may be moved forward and backward along the edges of the cutters at the same time that it is rotated for grinding them. There is, besides, a new clamp for holding the cutting bar so as to adapt the face of the grinding wheel to edges of different bevels.

IMPROVED JOINERS' BENCH VISE.

George H. Wheeler, Great Barrington, Mass.—In this invention, a jaw is fitted to slide in a plate attached to the end of the bench, and connected with a foot lever for closing up on the work by foot power. A ratchet bar is arranged in connection with the lever for fastening it to keep the jaw closed. The jaw can be opened and closed much quicker than when worked by a screw, and it is always parallel to the work and the bench. The slide is connected to the lever by a rope passing over a pulley, which will, in practice, be mounted on the plate on which the jaw slides.

IMPROVED PLUG TOBACCO MACHINE.

Thomas F. Morrin, Jersey City, N. J.—This is an improved machine for pressing tobacco leaves to form plug tobacco, splitting it into strips of the required width, and cutting said strips into pieces or plugs of the desired length.

IMPROVED MACHINE FOR MAKING TACKLE BLOCKS.

Frederick S. Burr, Brooklyn, N. Y.—This is a combination of apparatus whereby the sides of wood tackle blocks may be bored and dressed to shape, either for rope or metal hangers, automatically in one machine, so as to economize largely in labor of repeatedly handling them.

IMPROVED MACHINE FOR MAKING TWIST DRILLS.

Edward S. Taber, New Bedford, Mass.—This is a machine for making twist drills with increasing pitch or inclination of the grooves. A spiral groove is made in the mandrel which revolves the blank, and advances it along the cutters which make the spiral or twist grooves. In said groove the key of the wheel which turns the mandrel works, so that, as the mandrel rises along the key, its rotation diminishes proportionately to the advance, and so increases the pitch of the twist.

IMPROVED VALVE COUPLER FOR OIL WELLS.

William Walker, Baldwin, Pa.—By this device, two or more valves may be coupled and worn out before the drawing of the sucker rods is required. A coupling section is screwed to the top of the lower plunger, which is lowered into the barrel and connected by a threaded top stem, with an interior threaded section that is applied to the bottom part of the next plunger to be screwed to the lower section, when the reserve valve is to be brought into operation. A jam nut with notches is placed on the stem of the lower section, and engaged by lugs of the upper coupling section to be screwed down with the same, for connecting the sections.

NEW HOUSEHOLD ARTICLES.

IMPROVED WASHING MACHINE.

Leander Becker, York, Pa.—This invention relates to certain improvements upon the patent granted to the same inventor June 29, 1875, and numbered 165,058; and it consists in the particular construction of the rubber, which is made of corrugated boards fastened in metallic end frames by lugs and screws, and provided with studs by which the rubber is supported in the oscillating frame.

IMPROVED STEP LADDER.

Silas C. Blauvelt, Blauveltville, N. Y.—This device may be readily arranged for use as a step-ladder or as an ordinary ladder, and may be folded together for storage and transportation, and, when adjusted for either purpose, will be held securely in place. In the curved edge of semicircular blocks on one part are formed three notches, in such position as to receive a pin and lock the parts together.

IMPROVED SCRUBBER.

John Deasey, Fall River, Mass.—To a scrubbing brush are attached side pieces that are supported by wheels. The action of a handle on the side pieces produces, in connection with the supporting wheel, considerable lever power on the brush, so as to press the same firmly on the surface to be scrubbed, and clean the same effectively.

IMPROVED WASHING MACHINE.

Benjamin Tarr, Evanswood, Wis.—This consists of an octagonal vessel made of slats into which the clothes are introduced and revolved in the suds box. Inside the vessel are several hard wood blocks. There is a novel arrangement for supporting the cover which constitutes an additional washtub when thrown back.

IMPROVED PRIVY SEAT.

Branch Tanner, Cheneyville, La.—This consists of an oscillating seat with swinging front and rear aprons, of which the front apron is used for watercloset purposes when the seat is swung back below a stationary inclined cover at the rear.

NEW AGRICULTURAL INVENTIONS.

IMPROVED SHADE FOR HOP BOXES.

Hiram Niles Harrington, Wilson Place, N. Y.—This invention consists of the connection of the hop box by upright standards with adjustable shades, supported and braced so that the hops and pickers are protected against sun, rain, and wind.

IMPROVED COTTON PLANTER.

Augustus T. Hatcher, Mansfield, La.—This is an improved cotton planter, the operating mechanism of which may be applied to the stock of an ordinary seeder. It combines improved devices for opening a furrow to receive the seed, dropping the seed, and covering it.

IMPROVED OX YOKE.

Ell A. Farr, Cedar Springs, Mich.—This invention combines with the main beam of a double neck yoke, a central draft staple, and brace rods, vertically adjustable to greater or less depth on the beam, to regulate height of draft.

IMPROVED MILK COOLER OR WARMER.

David D. Whitaker, Carthage, N. Y.—This consists of a milk pan set into a rack with air space all around, which is cooled by zigzag bottom pipes and side pipes, connected to an ice water dish above the pan. The whole is covered by a cloth screen, to keep the cold air confined.

IMPROVED ROOT-CUTTING PLOW.

John S. Swaney, Marengo, Iowa.—This plow is adapted for cutting off the bottom and side roots of hedge, apple, and other seedlings and trees in taking them up.

IMPROVED EXPANSION REEL FOR REAPERS.

Alfred W. Shaw, Chatham Center, Ohio.—This reel is so constructed that it may be conveniently expanded and contracted to work closer to and farther from the cutter bar and ground, without stopping the machine and without changing the tension of the driving belt.

IMPROVED PLOW.

Robert A. J. Armstrong, Knoxville, Tenn.—This consists in a mold board, having oblique sockets for share and point, in combination with a triangular share keyed thereto, and a bifurcated point without fastening, but supported by the share. With this construction, when the lower side of the edge of the share and point become worn, they can be easily detached and reversed, so that they will be self-sharpening, and when worn thick they can be easily sharpened and tempered separately.

IMPROVED HULLING MACHINE.

George H. Peabody, Brooklyn, N. Y.—This invention consists in the combination of disks, provided with alternate concave and flat emery surfaces and wheels provided with alternate convex and flat emery surfaces. The disks and the wheels are revolved in opposite directions and at different velocities, so as to rub off the hulls as the kernels pass through the machine.

IMPROVED INSECT-DESTROYING COMPOUND.

George Thomas Johnson, Pittsylvania Court House, Va.—This invention contemplates the application of a finely divided poison to the leaves of the tobacco plant, in order that it may be taken by the insects and destroy their lives. It consists in mixing kerosene oil, turpentine, and sulphur, in such proportions that it will not be refused by the insects, while its effect will be their certain and inevitable destruction.

IMPROVED PLOW.

Peter G. Johnson, Hoopston, Ill.—This invention is an improvement in the class of riding or sulky plows whose trucks are provided with a bent or cranked axle. The improvement relates particularly to attaching the plow to a ball-shaped lever which is pivoted to the truck and raised and lowered as occasion requires.

NEW CHEMICAL AND MISCELLANEOUS INVENTIONS.

IMPROVED BRONZING MACHINE.

Christian Landolt and Frederick Wichser, Tell City, Ind.—This bronzing machine consists of a flexible stencil combined with a sliding work table, bronze box, and bronzing pads, in such manner that the stencil rolls down and lies on the work at the same time that it is moved under the bronzing pads, and rises off as the table is moved back to take off the work, when the bronze box moves up to the pads and supplies them. It is a simple contrivance whereby cards, bills, etc., may be wholly or partly bronzed.

IMPROVED BOTTLE STOPPER.

Albert Freygang, New York city, assignor to Frederick Knief, same place.—This consists of a swinging ball that carries at its top part a stopper head with slotted vertical top plate and a recessed eccentric cam lever. The latter forces the stopper head down and retains it in the mouth of the bottle by its straight part bearing across the stopper head. The lever is taken hold of by the hand, holding the neck of the bottle when emptying the same, and the stopper is thereby retained easily without any chance of dangling about the mouth of the bottle and interfering with the pouring out of the contents.

IMPROVED BOTTLE STOPPER.

Adolph Luthy, New York city.—This is a stopper applied by the neck band, and made of one piece of rubber, extending from the neck band to and over the mouth of the bottle, so that the swinging yoke with loose sleeve, fitting in a top groove of the stopper, readily closes and opens the same.

IMPROVED BURIAL CASE.

Oscar J. Case and Edwin R. Richardson, Auburn, N. Y.—An improved glass burial case has the lid made in two sections, which are secured by side lugs and pins to guide projections at the outside of the case. The handles or knobs are made in one piece with the sides.

IMPROVED SHIRT.

William H. H. Tracy, Troy, N. Y., assignor to himself and Frederick Spaulding, same place.—This shirt is so constructed that the parts of the bosom will not be drawn out of position and shape by the working of the side parts of the front. The bosom is left free at its side edges, but attached to the body at the top and bottom edges and along the central line.

IMPROVED SHIRT.

Morris Popper, New York city.—This invention proposes to furnish partly made shirts, in which the parts that require skill in putting them together shall be properly sewn, while the long seams of the sides and sleeves, that require no particular skill, shall be left unsewn. The sleeves are to be without cuffs, so that they may be cut to the length required for the arms of the wearer.

IMPROVED MIDDINGS PURIFIER.

Edwin N. Lapham and Joseph Lapham, Peru, N. Y.—A hollow trunk, which stands nearly upright, has stationary beaters extending across and located in groups along the upper portion. The lower side has passages for the escape of the middings into a spout for conducting them away, the passages being regulated by valves. The trunk bends over into a horizontal portion, in which are other stationary beaters, and below them is a hopper for returns. From the inlet the middings are blown up along the trunk against the beaters by a fan, the light particles being separated and carried off to the bran bin, while the heavier portions fall through the valves, and the returns go back to be worked over again.

IMPROVED NECKTIE HOLDER.

Max Rubin, Brooklyn, E. D., N. Y.—To the inner side of the tie is secured a metallic plate, which has a transverse slot formed in it. One end of the slot is made large enough to receive the head of the stud or button of the shirt neck band. The middle part of the slot is made of only sufficient width for the stem of the stud to pass through. The other end of the slot is made wider, but not wide enough for the head of the stud to pass through. A piece of elastic is interposed between the plate and the tie to hold the head of the stud pressed against the inner side of the plate, and keep it from sliding.

STICK FOR DIPPING STAMENS FOR ARTIFICIAL FLOWERS.

Ambrose Giraudat, Neuve (Norwood P. O.), N. J.—The two parts of the sticks are made of the usual size. To the end of the lower part is attached a hook, which enters and fits into a slot in the end of the other part to lock the said ends together. Through transverse holes are passed strips of spring metal, the ends of which are bent upward so as to lock the two parts. To the face of one part, near its side edges, and to the face of the other part, at its center, are attached cords, to hold the threads securely. With this construction, the stick can be readily and quickly applied to the threads, and will hold them securely while being dipped in the paste.

IMPROVED APRON.

Joseph Malonzo, Great Falls, N. H., assignor to himself and Frank Malonzo, same place.—This consists of a sheet of patent leather, constructed in the form of an apron, but contracted in the portion to fit the waist by gore slits cut in it and sewn up. A waist band is attached so as to serve for a holder for the weaver's shears and reed hooks. The device is designed to protect the clothes of the weaver from the wear of the front beam.

Business and Personal.

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

Agricultural Implements and Industrial Machinery for Export & Domestic Use. R. H. Allen & Co., N. Y.

Manufacturers of Circular Saw Mills, please send Description and Price List to Jos. Minchener, Troy, Ala.

Wanted—Small clean iron castings, Makers, send address, Box 2, No. 160 East 48th St., New York.

For Sale—Two Hydraulic Presses, with double power pumps, new; 12 in. ram, 3 ft. lift, clear space 8 ft., plates 4x5 ft. Also three new Power Elevators, Merrick's make, below cost. John Howard, No. 170 Hittenthouse St., Philadelphia, Pa.

For Sale, cheap—The Pneumatic Machinery used in Staking Piers at South St. Bridge: Compressor, Engine, Knowles Pump, Receiver, Gauges, &c., all perfect and complete. Address F. W. Getz, 430 Library St., Phila.

For Sale—Half or whole interest in a manufacturing business (patented), together with the machinery. Address G. P. T., Box 71, Baltimore, Md.

Steam Engines—25 per cent extra power or saving in fuel, guaranteed, by applying the R. S. Condenser. T. Sault, Consulting Eng'r, Gen'l Agt., New Haven, Ct.

Wanted—An exclusive Agency for the sale of a first class patented article or machine of practical utility. Address H. C. Goodrich, 235 State St., Chicago, Ill.

Wanted—To Manufacture on Royalty or Buy a good and cheap Corn Sheller. Address Girdwood & McLeenan, Asheville, N. C.

Leather and Rubber Belting, Packing and Hose. Greene, Tweed & Co., 15 Park Place, New York.

Wanted—A small machine that will, by touch, register, one at a time, the number of articles handled. Address Edwin A. Simonds, Erie, Pa.

For Sale—Engine 20x30, one 16 ft. Engine Lathe, one large Blower, four tank Engines, two Steam Pumps. Ball & Co., Indianapolis, Ind.

The Bastet Magnetic Engine for running Sewing Machines, Lathes, Pumps, Organs, or any light Machinery, 1-32 to 1/2 horse power. Agents wanted. Address, with stamp, 1113 Chestnut St., Philadelphia, Pa.

Wanted—A few good Machinists; must be first class performers on following instruments, viz.: E flat Cornet, E flat Clarionette, E flat Tuba, Snare Drum. Address H. B. Smith, Smithville, Burl. Co., N. J.

Wanted—Manufacturer of Iron Tools or Steam Engines, to take part of Salesroom with a long established firm in this city. Expenses light. Address H. P. O. Box 473, New York City.

Sure Cure for Slipping Belts—Sutton's Patent Pulley Cover is warranted to double the power of any pulley. Circulars free. Agents Wanted. John W. Sutton, 36 Liberty St., New York.

Scroll Saw Blades, best quality, made to order, and Sheet Steel cut to pattern, by A. Coats, 108 Hester St., New York City. Send for List.

Hotchkiss Air Spring Forge Hammer, best in the market. Prices low. D. Frisbie & Co., New Haven, Ct.

For Sale—At a great Bargain, Grain Elevator, Hay Press, and Warehouse, all in excellent repair and good location. Address C. A. Gleckler, Farmington, Iowa.

Machinist's Tools, second hand, which must be sold in order to close up an old partnership. For pamphlet, giving full description of each tool, address Steptoe, McFarlan & Co., 214 West 2nd St., Cincinnati, Ohio.

Baxter Wrenches fit peculiar corners. Prices reduced. Greene, Tweed & Co., 15 Park Place, N. Y.

The French Files of Linnet & Co. have the endorsement of many of the leading machine makers of America. Notice samples in Machinery Hall, Centennial Exposition. Homer Foot & Co., Sole Agents, 22 Platt St., New York.

Vertical Tubular Boilers, all sizes. Send for price list. Lovegrove & Co., Philadelphia, Pa.

Centennial Exhibitors, buy your Belting in Philadelphia, from C. W. Army, 145 North 3d St., and save freight and trouble. Satisfaction guaranteed.

Wanted—Charge of Weaving Department, Cotton or Satin, by a practical, experienced man. Address A. B. C., P. O. Drawer No. 5, Greenville, N. H.

Wanted—Tubular Condenser. Boston P. O., 3396.

Trade Marks in England.—By a recent amendment of the English laws respecting Trade Marks, citizens of the United States may obtain protection in Great Britain as readily as in this country, and at about the same cost. All the necessary papers prepared at this Office. For further information, address Munn & Co., 37 Park Row, New York City.

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

Shingles and Heading Sawing Machine. See advertisement of Trevor & Co., Lockport, N. Y.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel—other kinds imitations and inferior. Caution—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 31 and 33 Park Row, New York.

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

Linon Hose for Factories—1, 1 1/2, 2 & 2 1/2 inch. At lowest rates. Greene, Tweed & Co., 15 Park Place.

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

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

Hotchkiss & Ball, Meriden, Conn., Foundrymen and workers of sheet metal. Fine Gray Iron Castings to order. Job work solicited.

American Metaline Co., 61 Warren St., N. Y. City.

For Solid Emery Wheels and Machinery, send to the Union Stone Co., Boston, Mass., for circular.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon, 470 Grand Street, New York.

Spinning Rings of a Superior Quality—Whitinsville Spinning Ring Co., Whitinsville, Mass.

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

Diamond Tools—J. Dickinson, 64 Nassau St., N. Y. Patent Scroll and Band Saws, best and cheapest. Cordesman, Egan & Co., Cincinnati, Ohio.

The Original Skinner Portable Engine (improved), 2 to 5 H. P. L. G. Skinner, Erie, Pa.

Second hand Iron Working Tools for Sale. For list, apply to New Haven M'F's Co., New Haven, Conn.

Our new catalogue of drawing materials will be sent on receipt of 10c. Add. Keuffel & Esser, New York.

Temples and Offcans. Draper, Hopedale, Mass.

All Fruit-can Tools, Ferracute Wks, Bridgeton, N. J.

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

Wind Mill Rights Cheap—One county in each State to give for introducing the mill. For terms, &c., address E. S. Smith, Good Hope, Ill.

Wanted—Address of Makers of Papier Maché Ceilings. Address J. Parmelee, Des Moines, Iowa.

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

Hamilton Rubber Works, Trenton, N. J. Manufacturers of N° pavement Hose, and any size, also Belting, Packing, Car Springs, and Rubber for Mechanical use. Send for price list.

Notes & Queries

C. S. R. will find that celluloid is a substance suitable for his purpose. See p. 23, vol. 33.—C. H. D. will find a good description of soluble glass on p. 148, vol. 33.—F. H. will find a description of the transfer fluid, for transferring engravings to wood, etc., on p. 138, vol. 30.—M. M. will find directions for preserving natural flowers on p. 204, vol. 28.—F. L. W. will find directions for stuffing birds on p. 250, vol. 30.—B. W. B. will find directions for setting carriage axles in this issue.—N. D. will find a recipe for hydrofluoric acid, for etching glass, on p. 203, vol. 33.—M. G. will find an explanation of the difference between the heights of the tides in different localities on p. 65, vol. 28.—D. W. G. will find a formula for safety valves on p. 107, vol. 31.—A. B. F. will find a description of a Bunsen burner on p. 387, vol. 33.—N. S. will find directions for making a sun dial on p. 409, vol. 29.—F. W. D. will find directions for silverplating without a battery on p. 408, vol. 32. For a similar gold plating, see p. 116, vol. 33. For silverplating with a battery, see p. 133, vol. 30.—G. G. will find a good recipe for black ink on p. 92, vol. 33.—J. F. A. can caseharden his steel cams by the method described on p. 83, vol. 31.—M. S. can prevent an accumulation of rust on his machinery by following the directions on p. 169, vol. 33.—W. E. D. will find a good recipe for gold lacquer on p. 240, vol. 34.—A. S. J. H. T., A. J. W., Jr., J. McC., E. G. P., A. L., W. H., and J. K., 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) P. M. H. A. K. asks: How many horse power will it take to run a 60 inch circular saw through a 2 foot log of hemlock or oak? A. Ordinarily about 10 horse power to every 1 inch of feed in each revolution of the saw. In order to give anything like a correct estimate, the amount of feed to each revolution, the number of teeth, and speed of the saw should be given. Sixty inch saws are run to cut all the way from 5,600 to 40,000 feet of oak and hemlock per day.—J. E. E., of Pa.

(2) A. B. W. asks: 1. Of what size and of what kind of glass should a lens be to take a photograph 2 feet square, the object to be about 15 to 20 feet from the glass, and the focal distance 2 or 3 feet? A. You should have a photographic view camera of 2 feet focal length. The size of the glass may be two or three inches diameter. 2. Could such a photograph be taken easily? A. Not very. 3. Please give me a process for taking negatives on glass. A. Consult some text book on photography.

(3) F. F. says: I see in the SCIENTIFIC AMERICAN SUPPLEMENT mention of a meteor which passed near Boston on February 5. The article says that, "after traversing a path which consumed a second in time," it gradually slackened speed, and finally became motionless. At the speed at which it must have been moving, how could it have become motionless? A. The article says that the meteor moved from east to south, which implies a change in its line of motion, so that, when the direction was in the line of sight, it became motionless to the observer. This was probably caused by the body being deflected by the resistance of our atmosphere.

(4) N. A. E. asks: How can I use crayons on drawing paper without leaving streaks? A. An even tint can be produced by using the tip of the finger, or a small pointed piece of India rubber, or a paper or leather stump, to be bought of a dealer in drawing materials.

(5) X. Y. Z. asks: What are coprolites? A. They are the fossil excrement of extinct animals, and are found in immense beds in some countries. They are valuable as manure.

(6) H. T. asks: Is it possible that a direct-acting steam pump can work with a variable cut-off so that the steam expands down to 15 lbs.? A. We know of no direct acting pump having a variable cut-off.

(7) J. W. asks: 1. Will a cupola 6 inches in diameter be large enough to melt and run into one piece 20 lbs. of cast iron? A. No. 2. What is the largest amount it will run into one piece? A. It might run 10 lbs. 3. The bottom of the coal and iron door is 3 feet 2 inches above the bottom of the cupola; is this height sufficient? A. Yes, for the diameter of the cupola.

(8) G. W. C. asks: 1. Is there such a thing as a drill for drilling square holes? A. No. 2. Is there any probability of one being invented? A. No.

(9) C. S. C. asks: 1. Is tool steel the best for making tuning forks? A. Yes. 2. What temper is required? A. Temper it to a blue.

What grade of soft iron is best for electro-magnets? A. Ulster or Norway iron is best.

(10) B. S. says: I have a portable engine, and the boiler is cracked. The crack is about two inches long; it is situated just above the grates, near the mud valve, and it leaks slightly. Is there

any way of stopping the leak without having the boiler patched? A. Cement may be used. See p. 331, vol. 33. The best plan is to patch the boiler.

(11) F. L. asks: What is the safe working pressure for a boiler made of wrought iron gas pipe, of 2 inches internal diameter? A. You can carry 100 lbs. per square inch.

(12) G. C. W. asks: Will white lead harden under water? A. No.

(13) A. asks: 1. Will copper, when melted, flow as freely as lead? A. No. 2. Will copper give as good an impression of the mold as lead? A. No. 3. Will a black lead crucible stand sufficient heat to melt copper? A. Yes.

(14) W. M. B. asks: Would the wear from friction on a pulley be greater in using a wire band than with a leather belt? A. Yes.

(15) F. D. L. asks: Is there any flux, welding compound, or means whereby a steel face can be united to the jaws of a cast iron vise by putting the steel in the mold, and pouring thereon molten iron? A. Steel faces are welded to cast iron in the way you mention, without the employment of any flux.

(16) W. S. F. asks: Is there any other way of making steel name stamps than with a chisel? A. We know of no way of making them save with chisels and files, but they could no doubt be stamped with suitable dies.

(17) H. D. S. S. asks: Is there a machine shop in the country that has the capacity of building two locomotives a day? A. We know of none.

(18) P. E. L. asks: Can cone friction couplings be used on a shaft running at 140 revolutions per minute, transmitting 30 horse power, one part of the coupling to have a lever attached to throw the same in and out of gear while running? A. Yes. Friction pulleys will answer the purpose well.

(19) W. H. C. asks: By what process may cast steel be annealed so that it can be easily cut with a chisel? A. Heat it slowly to a cherry red, and let it cool off, well covered with slaked lime.

(20) J. S. M. asks: 1. Is the pump on an engine to force the water into the boiler? A. Yes. Where is it generally situated? A. Beside the boiler. 2. By what means is it worked? A. By an eccentric, cam, or crank.

(21) E. G. asks: How can I keep cider sweet for the market? A. If after the first racking the fermentation still continues, it is better that the operation should be repeated as often as any scum rises to the surface. The final racking should be performed in fine weather. When the bottles are filled they should be set by, uncorked, until morning, when the corks must be driven in tightly, and secured by wire and melted rosin or any similar substance.

(22) B. asks: What is the best method of calcining borax? A. Put it in a capacious cast iron pan over a moderate fire.

(23) F. B. M. asks: How can white lead paint be made from old lead pipe? A. Roll the lead out into a thin sheet and place it in an earthen pot with a little vinegar in the bottom. Then bury the pot in fermenting stable dung or spent tan bark. The acetic acid of the vinegar corrodes the metal, forming a superficial coating of acetate of lead. The carbonic acid set free by the decomposing vegetable matter displaces the acetic acid, combining with the lead and forming the carbonate (white lead). The acetic acid thus released attacks more metal, which is again carbonized, and thus, with a small charge of vinegar, the operation is continued a long time, and a large quantity of lead changed into carbonate.

What is the weight of a medium-sized locomotive? A. About 30 tons, with the tender.

(24) J. C. R. asks: How can I mold chalk? A. Ground chalk, if moistened with a little gum water, may be pressed into a mold in a compact mass, by means of hydraulic pressure.

(25) G. M. Jr. asks: What is the process of making deodorized alcohol or cologne spirit from common alcohol? A. Alcohol employed in perfumery should be free from all smell of fusel or other oils. Atwood's (patent) alcohol is deodorized by distillation over permanganate of potassa. Spirit of wine, brandy, and alcohol distilled over soap lose their empyreumatic odor and taste entirely. At about 215° Fahr., the soap retains neither alcohol nor wood spirit. The empyreumatic oil which remains in combination with the soap which forms the residuum of the distillation, is carried off at a higher temperature by the watery vapor, which is formed during a second distillation, the product of which is a soap free from empyreuma, and is fit to be used again for similar purposes. The concentration of the alcohol increases in this operation more than when the soap is not employed, because this compound retains the water, and the alcoholic vapors which pass over are more concentrated. Thirty-three pounds of soap are enough for one hundred gallons of empyreumatic brandy; and direct experiment has shown that, under the most favorable circumstances, the soap can retain 20 per cent of empyreumatic oil. The soap employed should contain no potassa; it should be hard or soda soap, and ought to be completely free from any excess of fatty acids or fluids, otherwise it may render the product rancid or impure. Common soap, made with soda and oleine, has satisfied all the conditions in practice. If this soap is employed, it is better to add a little soda during the first distillation.

(26) C. A. asks: 1. Would a horizontal engine 2x3 inches propel a boat, large enough for 2 persons, up stream? A. You could use this engine in a boat 20 feet long. 2. What size of boiler would she want? A. Make one 2 1/2 feet in diameter and 4 feet high. 3. What speed would she make? A. Probably 5 or 6 miles an hour.

(27) A. L. asks: How can I vulcanize caoutchouc? A. Parkes' method is now generally adopted. The caoutchouc is immersed in a mixture of 30 parts of bisulphide of carbon and 1 part of chloride of sulphur. It is next placed in a room heated to 70° Fahr.; and when all the sulphide of carbon has been volatilized, the process is so far complete that it is only requisite to boil the material in a solution of about 18 ozs. of caustic potassa to 2 gallons of water, the vulcanized caoutchouc being next washed to remove excess of alkali.

(28) C. S. A. asks: Please explain how the jetties at the mouth of the Mississippi river are made. A. See p. 273, vol. 32.

Are they now at work on the tunnel between New York and Jersey City? A. Yes.

We have some glasses that were dipped into water with milk on them; the hot water seemed to set the milk, leaving a milky stain on the glasses, that we cannot wash off. How can we make the glasses look clear again? A. Try a little common washing soda.

How is dry steam made? A. By using a well constructed boiler or a superheater.

(29) D. R. asks: 1. In tinning brass, which is the best method, by cream of tartar boiling or by protoxide of tin solution? A. The cream of tartar method is in more general use. 2. What is the time required to do it? A. It varies from 10 minutes to half an hour, and sometimes longer. 3. In polishing smooth sheet brass to a high finish, how shall I prepare my wooden wheel after the leather is applied to the rim? A. Glue emery to the cutting wheel; and for polishing, use a brush wheel and a rag buff to finish with.

(30) J. M. asks: 1. How much incline per foot should an electro-copper plate have to insure success in arresting very fine gold dust? A. Amalgamated copper plates, set in sluices for obtaining very fine gold, are put at an incline of from 1 to 1 1/2 inches per foot. 2. Do strata of red sand found in aluminum or modified drift generally contain gold dust? A. We believe so.

(31) W. J. G. asks: 1. Does it make any difference in the expansion and contraction of mercury, in a thermometer, whether the tube is sealed or not? A. Yes. 2. How can I regulate automatically the heat in a close box, so that I can secure a certain temperature? A. It can be done by heating the box with steam or water at a fixed temperature.

(32) R. C. asks: At how many revolutions per minute could I run with perfect safety a grindstone 6 feet in diameter and 8 inches wide on the face? A. It would not be well to run the stone faster than 75 or 80 revolutions per minute. This is on the supposition that the stone is as strong as a built-up millstone.

(33) J. G. R. says: I have an engine of 1 inch cylinder and 2 1/2 inches stroke, and want to build for it a boiler which will make steam rapidly and which will stand about 25 to 30 lbs. pressure. Of what size, material, and form should it be? A. Make a cylindrical boiler 10 inches in diameter and 2 feet long. Copper is a good material; it should be about 1/8 of an inch thick, with heads from 3/4 to 5/8 inch thick.

(34) M. E. J. asks: Supposing a ball of immense weight to be rolled around on the surface of the earth, would it affect the center of gravity? If it did, suppose a ball of the same weight could be fired from a cannon around the earth without touching the surface, would that affect the center of gravity in the same way? A. The effect you mention would be produced in both cases.

(35) J. M. Y. asks: At what speed should water move in a draft tube under a water wheel to give the most power to the wheel? A. If you make the draft tube with the same area of supply, and allow it to dip into the water a few inches at the bottom, you will have a satisfactory arrangement, provided the tube is airtight. It is very important to attend to the latter point.

(36) J. F. B. asks: 1. Can water be raised 10 feet high by a wheel 10 inches in diameter, 3 inches wide, the floats being fastened on a square shaft? A. You will have no trouble in raising the water to that height, with 100 to 150 revolutions a minute. 2. What should be the size of the pipe in which it is to be raised? A. A two inch pipe will answer very well.

(37) C. D. B. asks: If I let steam into a vessel of boiler plate, 2 feet in diameter and 6 feet long, to the pressure of 100 lbs. to the square inch, how long will it take for the same to lose its pressure? A. If the air surrounding the boiler is still, the radiation will take place at the rate of between 3 and 4 units of heat per hour for each degree of difference between inside and outside temperatures.

(38) S. P. S. asks: 1. How high may I carry the water in a boiler constructed with an inside case, without danger of filling the inside case? I wish to generate steam at the rate of 1 cubic foot per minute for each linear foot of the boiler, and the water is 6 or 7 inches wide at the water line. Will the water collect in the steam room to any great extent if the water line is kept 4 inches below the top of the case? A. You will have to make some experiments to determine this matter definitely. We imagine, however, that you will find it necessary to carry the water at least 6 inches below the top of the case. 2. We have an engine which runs at 120 revolutions per minute, with a fly wheel 8 feet in diameter, the rim being 11 inches wide and 3/4 thick at edges, and 1 1/4 inches thick in the middle. We need to stop it some times quickly, and as the bottom of the wheel is close to the ground, I propose to use a brake. What pressure is it safe to put upon the wheel? A. You will probably find it safe to apply pressure equal to the tension of a belt on the fly wheel when the engine is doing its greatest amount of work, and this will be more than sufficient for your purpose.

(39) C. S. P. asks: 1. What size of boat, ribbed pattern, will be large enough to carry 12 or 15 persons? A. Make it 30 feet long and 6½ feet wide. 2. What size of boiler is necessary for an engine 4½ inches? A. Make a boiler 3 feet in diameter and 4 feet high. 3. What size and pitch of propeller will be necessary to run the boat as fast as possible? A. Propeller 3¼ feet in diameter and of 3¼ feet pitch.

(40) T. K. G. asks: 1. Will a simple coil of pipe do for a superheater? A. Yes. 2. Can there be any joints in the same, either of malleable or cast iron, without the difference in expansion causing a leakage of steam? A. We think that such joints might be made tight. 3. Is a check valve necessary between the boiler and superheater to prevent the return thereto of the superheated steam, in case the flow of steam at the outlet was checked or retarded? A. Some kind of valve is required. 4. Why is there no economy in fuel in distilling in vacuo? A. There might be some trifling economy if the cost of maintaining the vacuum were not counted; but it would be very slight, as the diminution in the total heat of evaporation would be very little.

(41) W. G. says: I have a steam pump with a 22 inch cylinder, 700 feet underground, and I am obliged to carry the exhaust steam to the surface. Of what size should the exhaust pipe be so as not to have any back action on the engine? A. The exhaust pipe should have an area at least as large as the exhaust port of the engine. 2. What is the cheapest and best material to make it of? A. Make it of galvanized iron.

(42) R. J. M. says: 1. I am about to construct an engine with a 4½ inch cylinder. What should be the size of the ports and exhaust? A. About ⅓ of piston area. 2. How large a fly wheel would I need? A. From 9 to 10 inches in diameter. 3. What should be the size of the boiler, using charcoal for fuel? A. Make it 10 inches in diameter and 2 feet long. 4. Could I use a wood cylinder, allowing the wood to be half an inch thick? A. Not with satisfactory results.

(43) I. Y. asks: Does it make any difference how high a dam is on a stream of water if the wheel uses all the water? For instance, we have a mill running 10,000 spindles, and it holds the water just inside the dam and no more. We want to run 2,000 more spindles; would raising the dam give us any more power? A. Under the circumstances stated by you, raising the dam and doing nothing else would produce no effect on the power.

(44) S. T. M. asks: Why is the letter E placed on the left hand side of an ordinary surveying compass, transit, or similar instrument, and the W is placed upon the right? A. Some instruments are graduated with the E on the right, but the more usual arrangement is as stated in your question. We do not know who first adopted the graduation; but the reason for it is easily explained. Suppose a line to which the compass is directed has an E bearing; then in an instrument graduated like a mariner's compass, the N end of the needle would point to W, because in taking a bearing the needle is stationary and the graduated circle revolves; so that a bearing to the right of N is read off from N towards the left, and vice versa. Hence, if the instrument were graduated as in the mariner's compass, it would be necessary to reverse the readings before entering them in a notebook.

(45) E. R. asks: How can I fix gold on picture frame moldings? A. First give the wooden frame a coating of hot size and whiting; both articles must be of the best quality. Smooth this coat down with a pumice stone and water, and thoroughly dry. Melt some glue size in water, and apply with a soft camel's hair brush. Let dry, and wet a part at a time as required, and press the gold leaf on lightly, and blow on it with the mouth to level it. Burnish with an agate tool.

(46) T. B. C. asks: 1. Does sulphuric acid lose its affinity for watery vapor by use? A. It gradually becomes diluted by absorption of the aqueous vapor, and becomes correspondingly less efficient. The rapidity with which this takes place depends altogether upon the apparatus itself and the method of working it, and it can be determined by experiment. 2. Is the acid decomposed or otherwise rendered worthless after using for a certain length of time? A. The acid is not decomposed, but combines with the water to form a hydrate. The acid may be recovered again with all its original strength by evaporating the liquid in large glass or porcelain lined vessels.

(47) F. C. R. asks: What size of engine is best for a boat 25 feet in length and of 7 feet beam? A. One about 4½ inches would probably answer.

(48) F. H. asks: 1. Do the screw propellers used on ocean steamers have two, three, or four blades? A. They generally have either three or four blades. 2. What is the number of blades on the propeller screws used on the White Star Line? A. We believe that three-bladed Hirsch propellers are used on the steamers of this line.

(49) B. A. J. asks: Why do frozen mercury and red hot iron produce the same sensation? A. They both disorganize the flesh.

(50) T. M. D. asks: What would be a safe pressure to carry in a boiler 12 inches high and 10 inches in diameter, made of ⅝ inch copper, with a 3 inch flue? A. Safe pressure will be about 15 lbs. per square inch. 2. Would the above boiler do for running a sewing machine with an engine 1½ inches bore and 3 inches stroke? A. Yes, if it be well set.

(51) C. F. and others ask for a recipe for a nickel-plating solution. The following is a good one: Digest the nitrate of nickel in ammonia until it will dissolve no more. Then add a cold, saturated solution of Glauber's salt (sulphate of soda)

until a precipitate begins to form. Heat gently for some time, filter, and allow to cool. It is then ready for use.

(52) I. F. F. asks: 1. Which is the deepest well in the world? A. The brine well at Kissingen, in Bavaria, is 2,000 feet deep. We believe there is one in Paris nearly 3,000 feet in depth. Perhaps some of our readers can tell us of deeper ones. 2. Can water be taken out of a well 20 yards deep by any other way than by steam, wind, animal, hand, or other power? A. No. Some kind of power be required.

(53) M. H. K. says: We recently melted some silver, using muriate of ammonia and borax as flux. On taking out the ingot it usually shows a granulated surface, similar to that frequently seen on zinc-coated articles. In this case the surface showed (under a glass) fine cracks following the lines of the granulations. Please explain both granulated appearance and cracks. A. The fissures were probably caused either by some impurities in the fluxes employed or contaminations in the metal. When silver is fused, it absorbs oxygen from the air, which is again liberated on cooling.

(54) C. J. A. asks: How much variation would the sixteenth of an inch at the muzzle of a rifle make in the flight of a ball over 1,000 yards of ground, supposing the gun to shoot correctly, there being no wind to vary the ball in its flight? A. Length of gun from breech to muzzle, in feet: 3,000: 0.0025: variation at target, in inches.

(55) J. P. B. asks: 1. How can I find the specific gravity of a fluid with a specific gravity bottle containing 100 or 1,000 grains? A. The liquid to be examined is brought to the temperature of 60° Fah., and with it the bottle is filled up to the mark. It is then weighed, the counterpoise being on the opposite scale pan. Divide the weight thus obtained by the weight of an equal volume of pure water at the same temperature. The quotient will be greater or less than unity as the liquid experimented upon is heavier or lighter than water. 2. How much ought a fluid to weigh before dividing it by the contents of the bottle, whose specific gravity is 1.2? A. The specific gravity of the bottle itself is not taken. A counterpoise of the exact weight of the empty bottle is made from a bit of brass, an old weight, or something of the kind, and carefully adjusted by filing.

(56) J. P. M. asks: What is the meaning of "area of way in square feet," and "wet perimeter in feet?" A. If water flows in a trough at



the level, AB, then the area of way is the area of the cross section of the water, ABCD; and the wet perimeter is the length of the line of contact, ABCD, of the cross section of the water with the cross section of the trough.

(57) R. S. M. says: 1. I want to run two 60 saw gin stands at the distance of 300 yards. What size of shaft shall I use? A. Use 2½ inch shafting. 2. What distance should the bearings be apart? A. From 7 to 10 feet. 3. Does the length of the shaft tend to weaken it? A. Yes.

(58) E. D. Z. asks: 1. In building a small sloop, what kind of putty shall I use in the nail holes? A. Mix 10 lbs. whiting with 1 lb. white lead, adding enough linseed oil to give the putty the proper consistency. 2. What size of iron wire rope should I use for the jib stay and for the shrouds, one on each side of the mast, for a main sail of 216 square feet and a jib of 106 square feet? A. Probably the smallest size made for ship's rigging will answer very well.

(59) S. A. C. asks: Would a process, by which the surface of wrought iron while being forged to the desired shape, could be made susceptible to being hardened by plunging red hot in cold water, be of any practical value? A. Yes.

(60) W. F. asks: Why will not smoke ascend through the flues and up the chimney of a boiler which has lain still for four or five days? A. Probably because the draft is imperfect and the connections cold.

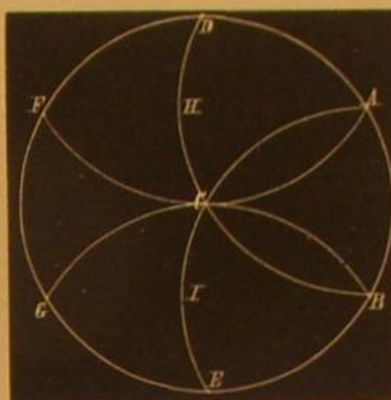
(61) S. D. K. says, in reply to S. H. B., who asked concerning building skiffs: Having decided on the length and width of the boat, take a piece of rough board, as wide as the boat is to be high, and as long as the greatest desired width of the boat. Saw the ends on a bevel of about 4 inches to 1 foot. Then select the boards for the sides, saw the ends to the same bevel as the cross section, and find the center of each. Then nail them by their centers to the beveled ends of the cross section, driving two nails each side half way in so that they can be easily withdrawn. Bring the boards together at both ends, fit stem and stern posts, secure them well, turn the boat bottom up, and true off with drawing knife and plane. Then nail on the bottom, turn over again, true off the top fit knees, knock out the cross section, and the boat is done. This will make a boat as fast as can be made, and of perfect shape. The boat, when finished, should be alike at both ends, and (for speed) about one sixth wide as it is long. The bottom should form a curve of about ¼ of an inch to a foot, both fore and aft and athwartships, as straight lines are not compatible with speed.

(62) J. M. M. says, in answer to J. E. J., who asks if an achromatic spyglass of 50 power would be of any use for astronomical purposes: I have a glass of 35 power, which shows the globular form of the planets, the moons of Jupiter and Saturn, rings of Saturn, sun spots, etc. I have also told the time of day from a clock 10 miles distant. I can discern a man over 20 miles away on a clear day.

(63) C. A. K. says, in answer to R. L. C.'s query as to power for grinding: I have run two pairs of 54 inch burrs with an engine of 25 horse power, grinding 100 bushels per day of 10 hours (50 bushels corn and 40 wheat). The speed of engine was 150 revolutions, that of burrs, 100.

(64) D. J. F. says, in reply to R. T. C., who asks how much wheat should a 4 foot stone grind in a day: A 4 foot stone in good order, properly dressed and furrowed, should only grind from 10 to 12 bushels per hour, and do first class work. You can grind from 18 to 24 bushels per hour if you want to, but you cannot do good work at this pace.

(65) R. A. says, in solution of the problem of constructing a perfect square with compasses, without the aid of any other instrument: This is in the rigid sense, impossible, as a square is a figure bounded by right lines. The solution by W. S. D. (who assumes a line, though he omits it in the diagram) only determines the points through which (or to which) the lines should be drawn, but they cannot be drawn with compasses. But the solution is faulty, for he cannot measure half an arc with compasses alone; he only guesses at it. The following solution is subject only to the



objection first stated: From A and B as centers, describe the arcs, B C D, A C E; with C as a center, describe the circle, A B E G F D; with D and E as centers, describe the arcs, A C F, B C G; then will the points, A, B, G, F, form a rectangle, the portion of which between the points, A and B, and the points, H and I, where the right lines from A to F and from B to G would meet the arcs, C D and C E, is a perfect square. My square is not drawn, neither is W. S. D.'s, but the same process which is necessary to complete his will complete mine.

(66) E. R. H. says, in answer to F. A. R., who asks for a rule for measuring ear corn in a crib: Multiply the length, breadth, and height in inches together, and divide by 3,888. The answer will be the number of bushels of shelled corn.

(67) M. R. says, in reply to a correspondent who asks for a remedy for corns: Bind raw cotton on your corn at night before going to bed, and then saturate the cotton with spirits turpentine. It will remove the most obstinate corn, either hard or soft, in four or five applications. The skin will be apt to peel off the toe, but this is rather an advantage, as it helps to remove the corn.

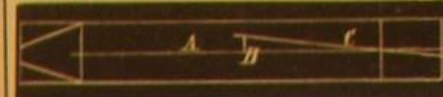
(68) O. P., of Rosloff, Russia, says: In reply to G. W. F., who asks in which position (top or bottom center) of the crank does a locomotive engine exert the most power, you say that there is no difference. I contend that there is a difference; for if the engine is going forwards, and the crank is at the bottom center, it has the full power of the whole area of the piston on it; whereas when the crank is on the top center, the piston rod takes up some of the area of the piston, thus giving less room for steam. When the engine is in back motion, the conditions are reversed. In engines with piston rods running through the whole cylinder, your answer would be correct. Am I right? A. No. When the engine is going forward and the steam is on the rod side of the piston head, the guide bars are relieved of the weight of the connecting rod, guide blocks, cross-head, etc., which quite compensates for the loss of area due to the piston rod.

(69) H. E. W. says, in reply to W. A. S., who asks how he can straighten wire: Put one end, after the wire has been annealed, in the lathe; and fastening the other end so that it cannot turn, start the lathe, and by thus twisting the wire will become perfectly straight and stiff, and not be injured in the least.

(70) C. H. S. says, in reply to M. J. M., who asked for a good rule for setting thimbles: The first thing is to lay out your axes correctly. For the gather, measure off on the bottom of the axle half the diameter of the wheel. Then make a point, at ¼ the amount of gather you want, back of the center of your axle at the point measured off. A line from this point, through the center of the axle at the shoulder, will give the gather. For the pitch: Measure as before ¼ the size of the wheel on the side of the axle. Then measure up, from the bottom of the axle, ¼ the size of your hind boxing at the shoulder and at the point you have measured off. At this point measure off, above the half diameter of your boxing, one fourth the amount of pitch you want. Thus: If you want your wheels to stand 4 inches wider at top than bottom, measure up 1 inch, etc. A line, from this point through the point at the shoulder will give the pitch. Then measure from this line, each way, half the size of your boxes, and your axle is laid out. To set the skeins, it is only necessary to square down on the end of the axle from the lines you have drawn, each way. Then using their point of intersection as a center, strike a circle the size of your skein inside, at the front end, and taper it to that, uniformly from the shoulder. As a cement to fasten them after they

are thus fitted, you will find nothing better than white lead and linseed oil, made as thick as it can be applied nicely.

(71) E. D. P. says, in reply to M. J. M.'s question in regard to setting thimbles: Draw a line, A, through the center of axle; measure back from shoulder one half the height of wheel; then mark the dish of wheel, B; about the center line



from this mark, draw line, C, crossing center line at shoulder, and extend to point of skein, which will give you center of skein. Half the diameter of skein below this line will give side of skein at butt and point.

(72) J. E. T. says, in answer to the query as to the side of the largest cube that can be cut from a ball 12 inches in diameter: It is evident that the longest possible diagonal of the cube is 12 inches. Now the square of the longest diagonal of a cube is equal to three times the square of either side; therefore the square of diagonal = 144, which divided by 3 gives 48. The square root of 48 = 6.9282+ = side of square. [This answer is correct. A. I. F. and J. D. E. have sent similar replies. L. S. W.'s reply, on p. 297, vol. 34, is erroneous.—Eds.]

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

J. W. F.—It consists principally of salt, with some blue dye.—T. L. H.—They are rolled fragments of quartz.—L. R.—The principal constituents are silica, silicate of alumina, and oxide of iron. A complete analysis would show the presence of 5 or 6 other constituents. The cost of the analysis would depend upon its completeness. If you desire a qualitative analysis, with the total amounts of solid mineral and organic constituents, the cost would be \$12, and the amount of water required will be ½ gallon; if a complete quantitative analysis, as well, the cost would be \$35, and the amount of water required 2 gallons.—L. M. N.—It appears to be resin, containing tarry matters, borax, and paraffin.—W. M. S.—Your boiler scale is not dangerous. It is clay, oxide of iron, and carbonate of lime.—N. D. S.—It is decomposed granite. The shining scales are muscovite.—J. F. W.—It is aventurin, and a specimen of it is in every mineral cabinet.—G. B. L.—No. 1 is sulphide of zinc. No. 2 is oxide of iron and clay.—A. W. D.—No. 1 is sand, clay, and quartz, of no value. No. 2 is sulphide of zinc.—J. T.—We find only iron pyrites.—J. S. W.—It is celluloid.—S. L. S.—It is trap rock, containing a small percentage of iron. It is not an iron ore.—R. G. S.—It is sulphuret of iron and copper.—C. A. B.—From its appearance, it would be well to give it a practical trial as fire clay. It should be profitable.—L. W. S.—They are beautiful crystals of selenite, commonly called gypsum or sulphate of lime.—C. W.—It is principally nitrate of soda, with a small percentage of chloride of lime and magnesite.—H. E. B., of Wilson, N. C.—It is hydrated sesquioxide of iron or brown hematite. It is probably worth mining.—A. B. R., of West Burke, Vt. They are sulphides of iron and copper.—We have several letters from which the specimens have escaped in course of transit; and we recommend our correspondents to put each specimen securely in a box and mark it with the name and address of the applicant.

J. L. asks: What is the process employed in making photographic tin types?—A. P. B. asks: How is mica split?—C. A. K. asks: How can I find the area enclosed between the arc and the radius vectors of an ellipse (said radii being drawn from one of the foci), if the semi-axis major, the angle subtended by the radii, and the eccentricity of the ellipse are given?—J. T. asks: Can any one oblige me by describing the photo-engraving process and the photo-lithographic process?

COMMUNICATIONS RECEIVED.

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

On a New Hydrometer. By H. W.
On a Pendulum in a Mine. By J. M. H.
On the Glacial Epochs. By J. H.

Also inquiries and answers from the following: C. J. R.—G. A. P.—J. T. H.—N. R.—E. A. D. P.—J. D. E.—N. M. W.—J. W. S.—C. C. L.

HINTS TO CORRESPONDENTS.

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

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

Hundreds of inquiries analogous to the following are sent: "Who makes lamp chimneys of tempered glass? Who sells drawing instruments? Who sells an engine worked by ignited petroleum? Who makes the best lenses for photographic portraits? Why do not dealers in photographic chemicals advertise in the SCIENTIFIC AMERICAN?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were

Granted in the Week Ending

April 4, 1876.

AND EACH BEARING THAT DATE.

[Those marked (r) are retained patents.]

A complete copy of any patent in the annexed list, including both the specification 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.

Alarm, burglar, W. Boyd.....	175,390
Alarm, burglar, E. Linnard.....	175,412
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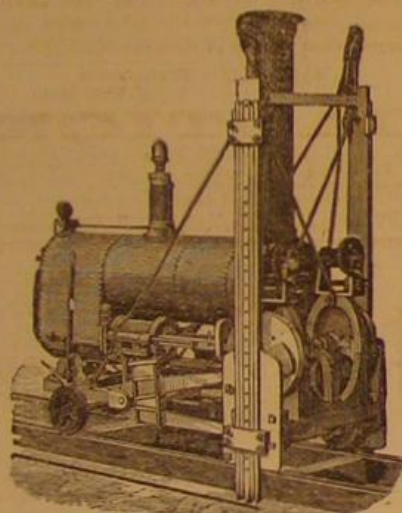
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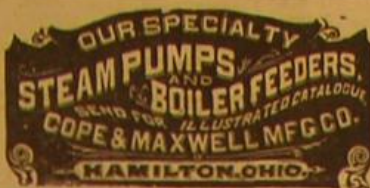
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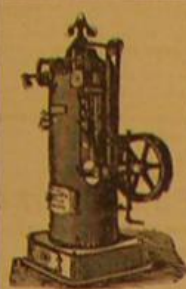
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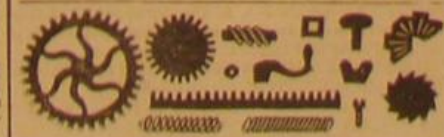
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(NEW SERIES.)

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THE BRAYTON READY MOTOR OR HYDROCARBON ENGINE.

Our engraving represents the Brayton hydrocarbon engine described by us not long ago as being in successful operation in this city. The distinguishing features of this engine are that it can be started in a very short time, that it is economical in its consumption of fuel, and that, owing to the constant maintenance of combustion, it is claimed, the danger of explosion of the hydrocarbon vapor is so greatly reduced as to be practically obviated.

The consumption of the crude petroleum used in this engine is stated to be five gallons per day for a five horse machine, the duty performed by a five horse engine in use being the grinding of 600 bushels of malt per day of ten hours. The ease with which the motor may be handled will be appreciated when we state that those run for our inspection were started, without any previous preparation, in one minute, the proprietors starting the engine themselves, not having an engineer in their employ. Another important feature of the motor is that the consumption of fuel ceases the instant the engine is stopped, the stoppage being effected by simply shutting off the supply of air.

In our engraving, A is the working cylinder of the engine, which is jacketed by a water cylinder. B is an air pump actuated by the working cylinder, and employed to compress air into the two reservoirs, C C, constituting the base of the frame. D is a pump which supplies the petroleum or other suitable fuel, as fast as it is needed for combustion. The action of the engine may be thus briefly stated: The oil pump feeds a few drops of liquid fuel through a small tube into an annular chamber containing felt; here the petroleum encounters a supply of compressed air by which it is vaporized;

the mingled air and vapor are forced in proper proportion into the working cylinder, where the combustion takes place, communication with the annular chamber being cut off and the products of combustion being left to work expansively, driving the working piston downwards or towards the end of the stroke; the compressed air supply to the working cylinder is cut off, thus extinguishing the combustion therein; the opening of the exhaust valve permits egress to the products of combustion, and the stroke is completed. An independent jet of hydrocarbon, burning continuously in a suitably provided chamber, lights the hydrocarbon in the working cylinder at the commencement of each stroke. The supplies of air and oil are, by very simple means, adjustable, thus giving to the engines all the advantages of a variable cut off, and thus effecting an important saving in fuel when the engine is not required to work up to its full capacity. Ordinarily but one of the reservoirs, C C, is employed, the other being kept charged in order to allow of the immediate starting of the engine at any desired time.

The engine is substantially built, the crank and the beam, and the central shaft upon which it works, being made of cast steel. The working or air piston may be removed, when

necessary for repairs, by simply disconnecting the connecting rod from the working beam; and by the removal of the bearing caps, the crank and the beam may be removed, leaving the engine stripped of its main parts, and giving access to any part which may need repair or renewal. The bearing and working surfaces are large in proportion to the amount of duty required of them, thus making the engine substantial and not subject to undue wear.

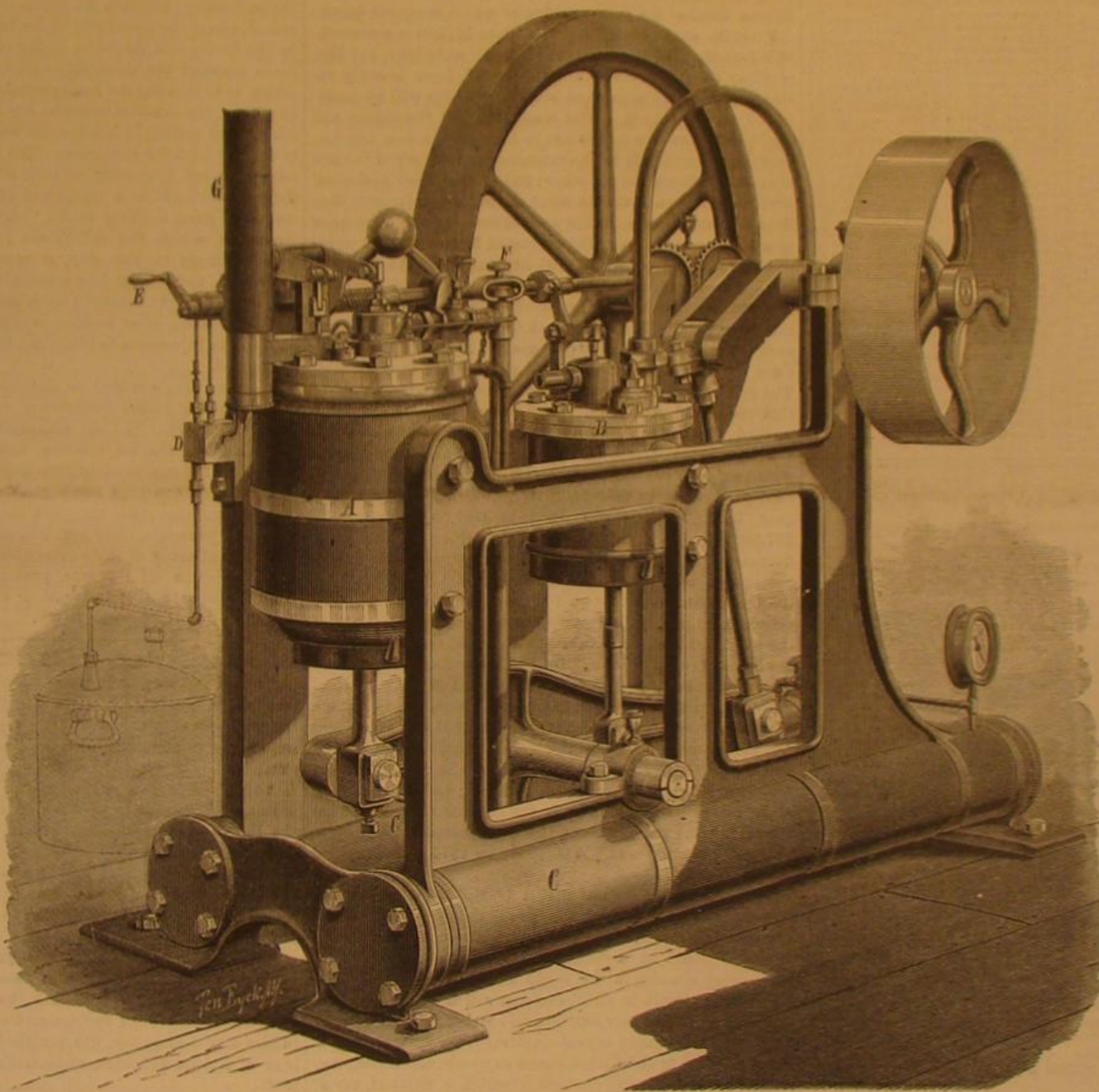
This motor is the invention of Mr. George B. Brayton, who has spent many years in its development and practical application. Sizes of three, five, and ten horse power are now built, and motors suitable for steam yachts and other special purposes are being designed. A one and a ten horse motor

ment is used with it again for a fresh observation. But a number of fresh neutral bars are kept always on hand to be employed in succession.

This instrument is very sensitive. A very slight spark from an artificial electrical machine, or even from an electrophorus, suffices to give magnetism to the core, and to cause deflection on the traversing magnet. Its cost does not exceed \$2, and Professor Melsens is very sanguine that it will prove a useful instrument for an extended investigation of the changes and intensities of atmospheric electricity. The instrument is now used in the telegraphic offices of the Belgian lines, and formal official returns are made of the discharges which are indicated by it. The coil is placed

in continuation with the earth wires, which are provided for the protection of the instruments in the telegraph offices. Professor Melsens states that the magnetic needles in the offices furnished with the apparatus are deflected briskly by a lightning discharge, and that they are not infrequently recalled to zero, either briskly or gradually, by a subsequent discharge. Occasionally the deflection is reversed by the second discharge. Professor Melsens finds that ordinary commercial iron wire serves generally for the construction of the iron bars for the core. He has more difficulty in procuring iron that can be satisfactorily made neutral by heat than in finding iron that gives ready indications of the disturbance. He desires very much that this simple and cheap instrument should have an extended trial among telegraphists as a convenient means for investigating the movement, conditions, and rate of progress of atmospheric disturbances.

The instrument, which was lately shown at the Meteorological Society, will be included in the loan exhibition of scientific instruments



THE BRAYTON HYDROCARBON ENGINE.

will be on exhibition at the Centennial Exposition. For information, address the Pennsylvania Ready Motor Company, 132 North 3d street, Philadelphia, Pa.

New Electrical Instrument.

This instrument is termed Marianani's *rhé électromètre*, and is intended for the investigation of electrical discharges between the atmosphere and earth. It consists essentially of a coil of copper wire turned round a pasteboard tube, and carrying a traversing magnetic needle mounted upon a vertical pivot immediately above the coil. The apparatus is so placed that the magnetic needle is ranged north and south by the earth's magnetism, and that the coil then crosses its axial line at right angles. A small iron bar is inserted as a core within the axis of the coil. Whenever a spark of electrical discharge of high tension passes through the coil, the internal iron bar becomes a magnet, and deflects the magnetic needle traversing above, the deflection of its north point being to the east or to the west, accordingly as the spark passes in one or the other direction through the coil. When the iron bar has been thus magnetized by a spark, it has to be deprived of its magnetism by heating before the instru-

about to be opened at South Kensington, London, England.

A Bi-Centennial Relic.

Professor Edward J. Young, of Harvard College, recently delivered an historical address at Sudbury, Mass., giving many incidents of much interest pertaining to the town, and particularly to King Philip's war and the battle fought at Green Hill. He referred to some relics in that town, one of which was described as follows: "The dwelling now owned by the venerable Mr. Willard Walker, which was built by his great grandfather 200 years ago, and which has been in the possession of the family ever since, is almost entirely unchanged. There is one beam in this house measuring 13 by 14 inches. The building is covered on all sides with 4 inch plank or pitch pine, which is set up endwise and reaches to the roof, and is held on the inside by wooden pins. It is thus made bulletproof. The chimney, likewise, is immense, and has several enormous flues, while the fireplace was large enough to contain logs that were eight feet long. The windows were originally of diamond-shaped glass set in lead, but these have been removed. It is a relic which ought never to be destroyed. No money ought to be able to buy it."

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VII. LESSONS IN MECHANICAL DRAWING, by PROFESSOR MACCORM, 8 figures.

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A CENTENNIAL NUMBER.

In commemoration of the opening of the Centennial Exposition on the 10th of May, the next number of the SCIENTIFIC AMERICAN will appear in a new dress, and its pages will be devoted to illustrations of some of the various buildings, national, state, and those devoted to special industries, which together constitute the miniature city now almost completed in Fairmount Park. In the succeeding number we shall present a full account of the opening ceremonies, together with illustrations thereof, and interesting descriptions of matters and things connected with the event.

At the present time, beyond the brief report of progress which will be found in another column, it is an impossibility to afford any idea of the contents of the Exposition. Two sets of workmen, numbering many thousands, are working continuously, night and day, evolving order out of a chaos which appears to be continually augmented by fresh contributions pouring in at the rate of hundreds of car loads daily. As soon as affairs run smoothly, and the entries are in such condition as to admit of proper examination, our readers may look for complete accounts of all matters likely to prove of utility or interest.

SILVER AND GOLD MONEY.

On February 12, 1873, Congress passed an act by which the gold dollar was made the unit of value, the trade dollar of silver, weighing 420 grains, established, and silver money rendered no longer a legal tender for sums exceeding five dollars. The effect of this measure is, it is claimed, practically to demonetize silver, and a bill to amend it, by making silver a legal tender up to sums of \$20, is now before the Senate. The chief supporter of the amendment is Senator Jones, of Nevada, who represents one of the greatest silver-producing districts in the world, and who has recently made an able speech in behalf of a silver currency. From a review of the mutations and quantities of the precious metals, from the earliest times to the present, it appears that any diminution of the stock of specie, whether resulting from failure of mines or from arbitrary legislation, is fraught with the greatest disasters that can befall society. England, said the Senator, by making gold the only standard of value, in 1816 was brought to serious financial straits, only relieved by the discovery of gold in California, and this, despite the fact that gold was a peculiarly British product. By existing laws, the United States is committed to resumption in specie, combined with a demonetization of silver, and Senator Jones believes this to be an impossibility, and that one or the other course must be abandoned. As no one, save those committed to the inflation heresy, will dispute the necessity of early resumption of specie payments, it follows that silver must be brought to the level of gold; and it is in support of this view that the Senator addresses a valuable array of facts and figures, some of the more striking of which we quote below:

From the discovery of America up to 1873, it is a remarkable fact that the relative values of gold and silver, 15½ lbs. of silver being equivalent to 1 lb. of gold, have scarcely varied, and it is probable that similar stability will be maintained in the future. The reason is that the nature and qualities of the two metals are so nearly alike that any improvement applicable to the extraction or recovery of the one must be applicable to the other; and further, their geological distribution is such that in many of the largest deposits they lie in the same matrix. At the present time, the world's store of specie is one half silver; the estimated figures in 1872 were: Gold, to the value of \$5,800,000,000, and silver, \$5,600,000,000. As a matter of curiosity, we have calculated, roughly, the volume of each metal, supposing each could be melted into a solid mass. The gold would form a cube only 27 feet in each dimension, and the silver, one of 177 feet. A medium-sized room, therefore, would hold all the gold in the world. The gold supply is, however, diminishing; the river beds of California and Australia, the Senator says, “have been washed, the surface gold has been secured, the water line has been worked, and below it are only those sulphurets which as yet have not been successfully treated.” The annual production in gold in 1801 aggregated \$13,000,000 a year, in 1829 \$5,000,000, in 1852 \$182,000,000, in 1875 \$97,500,000. This shows, not only a falling off, but great fluctuation in production; and, moreover, in 1875 British possessions contributed \$60,000,000 against \$26,000,000 for the United States, so that gold is now a British product. The present gold product is insufficient to meet the demands of the world for that metal in use in the arts, and to keep good the loss and wear of coin. On the other hand, in marked contrast to the above, the annual supplies of silver, essentially an American product, have always been steady and are now but little above the average. In 1805 the average of coin *per capita*, throughout the world, was \$2 83; in 1862 it was \$4.75. Between these periods both the production and the *per capita* rate of coin have doubled; and this swelling of the measure of value lies in the increase of gold and not of silver. The production of the latter metal at the beginning of the century was \$35,000,000; in 1875 it had reached but \$73,000,000.

Senator Jones points out that it is the stock of precious metals in the possession of the world that measures prices; and as nearly one half of this stock is silver, to demonetize the latter would be to reduce all prices one half, and convulse every country in the world except those which may refuse to take part in such demonetization. Further more, he insists that we never can resume specie payments by gold alone. By continuing to exclude silver from equal participation with gold in the United States currency, and attempting to resume specie payments, we occasion a demand, say of 350,000,000, to pay off the greenbacks and furnish bank reserves and \$50,000,000 of silver in lieu of fractional notes. The quantity of precious metal needed to maintain prices at their present level in the occidental world is \$4,000,000,000; and of this, if the United States succeeds in resuming specie payments, it must hold \$350,000,000 in gold. It is impossible for the country to obtain this by 1879, with the present production of gold only at \$97,500,000; more than half of this yearly yield is needed in the arts, and 1½ per cent of the occidental stock of gold, \$2,600,000,000, is needed for the maintenance of money, to pay for the abrasion and loss. Deduct these sums, and there is a surplus of \$10,000,000 a year, whence to obtain our \$350,000,000, so that at least thirty-five years will be needed to amass the amount. But the increase of population will make an increased demand for gold exchanges and use in the arts, equal to at least \$6,000,000 annually; and the annual gold product is, besides, diminishing. When these elements of the circulation are all moderately provided for, there will remain perhaps \$500,000 a year surplus, and we shall be 700 years getting our \$350,000,000.

With these difficulties, the Senator contrasts the ease with which specie payments could be resumed on the basis of the double standard of gold and silver. The total coin in the world is \$5,700,000,000, and the annual supply of both metals

to draw upon is \$170,000,000. Instead of having to draw upon the accident alone, we should draw upon the whole world. Three hundred and fifty millions in gold forms one seventh of the entire stock of that metal; the same sum in both metals is less than one sixteenth. If a draft of one seventh would occasion a fall in prices of 15 per cent, a draft of less than one sixteenth would occasion a decline of less than 6 per cent; and while 15 per cent during two and a half years—equal to 6 per cent per annum—would sweep away all and more than all the profits of industry, which on the whole do not net more than 3 or 4 per cent, 6 per cent in two and a half years—equal to 2½ per cent per annum—would enable us to get back to a sound measure of values without the loss of more than a very small portion of our industrial profits.

LA GRANDE CHARTREUSE.

Although modern society has generally concluded that the usefulness of the monastic life has long since passed away, there are many precious legacies in art and literature, which, born and nurtured in the cloisters of the middle ages, have descended to these times. When the outer world was given over to rapine, and the favorite amusement of men of wealth and high birth was highway robbery, it was surely a good thing that men desirous of cultivating the arts and sciences, and of keeping alight the sacred flame of literature, should find retreats which the wildest marauder respected, and which, moreover, were centers whence many streams of charity and benevolence took their course.

The ancient order of Carthusian monks was celebrated through many centuries. St. Bruno and six of his disciples repaired, about the year 1080, to the beautiful country watered by the Rhône and the Isère, in the southeast of France, and there founded the monastery called La Grande Chartreuse which is to this day the headquarters of the order. Another important organization occupied the site of the Charterhouse schools and asylum in London, the name of which is obviously derived from the monastery. The worthy ecclesiastics are now, however, appearing by their attorneys in our courts to defend their right to a trademark affixed to the bottles of a cordial of great delicacy called “chartreuse,” for the manufacture of which the monks are justly celebrated. Some base imitators in this city, it appears, have adopted the trademark, and, by foisting a home-made article on the market, have brought discredit upon the old Carthusians. But Judge Shipman, after hearing argument in the case, at once directed an injunction to issue, and the bogus traffic will now be stopped.

It seems singular that so ancient and venerable a body should appear in the forefront of our modern civilization, claiming its rights like any manufacturer or inventor of our day. Much of the art, learning, and literature, so carefully nursed by the monks of bygone days, has passed away, and their science has long since gone, no one knows whither. Their houses and lands are, even in Italy itself, given over to secular purposes, their numbers are reduced, and there is little left of many of their orders but the names; but there still remains in all its force, protected by the ægis of the United States Patent Office, their capability of producing potent liquids of exquisite flavor.

WORRY AND ITS PHYSICAL EFFECTS.

To so every-day and common a state of mind as worry, ranging, as it may, from a passing “fit of the blues” up to the most poignant mental anxiety regarding life itself, little importance is popularly attached; and especially among so exceptionally nervous and rapid people as the Americans, the fact of a person succumbing under mental strain is of too ordinary occurrence to give rise to extended comment. To the list of the insane immured in asylums and brought thither through heredity or by their own excesses, thousands are added, suffering with broken minds induced by anxiety; but the great majority of people thus affected continue in their places in society, by no means lunatics, nor maniacs, nor idiots, but nevertheless of brain unsound in parts. The world sometimes dubs them “eccentric,” and, if they be distinguished, their odd habits, absence of mind, and like traits furnish rich material for the biographer; in other cases the eccentricities become crimes, and indiscriminating justice may declare the life forfeited because of the workings of hidden faculties, uncontrollable, because disorganized.

Worry, then, is dangerous, more so than the alcohol which kills the drunkard, for the latter involves a taste and a habit which may be put aside; the former is the creature of necessity, and creeps insidiously into every man's life. Its physiological effects, therefore, should be clearly and adequately realized. And the knowledge of the ill may, in some instance, prevent the existence of the cause.

During the early stages of dementia induced by mental anxiety, Dr. Richardson tells us in his “Diseases of Modern Life,” there is nothing more than an increased tension of the minute vessels which supply the brain. In later stages, the substance of the nervous tissue itself undergoes a modification by which its activity is permanently lost. These are the physiological consequences, most briefly summed up. The first symptom is a want of full bodily vigor; then follows craving for more work, disturbed sleep, acute sensitiveness to external impressions, and, finally, strange figures and sounds are seen and heard. This condition may continue for years, and the sufferer in time may begin to accept abnormal creations as natural. Dr. Richardson cites a case of a merchant, who for weeks retained in his vision the spectra of three lights, oval in shape, of the size of an egg, and so clearly defined to the observer that he would watch them half consciously as they floated before him on the wall, the ceiling, or in space. In this stage of the disease lies the

foundation of all hypotheses of ghost-seeing, of ecstatic visions, and even of poetic frenzy. A curious instance directly in point, which came to our notice very recently, is that of a well known writer on the press, who, for some time past, has devoted attention to the subject of morbid mental conditions. This gentleman, in a letter to a daily journal, states himself to be the victim of the horrible spectacle of two men hanging from a gallows, a sight which he once beheld while acting as a city reporter. The suspended corpses are clearly brought before him by the sound of rain (the execution occurred during a rainstorm), and also by the sound of laughter, since, through some uncontrollable impulse during the hanging, he was induced to utter an untimely peal of merriment. That the writer's brain is injured, possibly by the excessive mental strain peculiar to his profession, seems probable; and the lesion is manifested, as already described, by the constant recurrence of the apparition.

It is a well known fact that we have two natures, one purely organic and emotional, the other subject to the reasoning powers. The organic nervous chain exists in the body as a link between emotional mental acts and vascular supply. An impression from without, made through the organs of the senses upon the emotional centers, is reflected directly from them to the vascular expanse. The part flushes or blanches, and the heart hesitates, palpitates, rebounds, or intermits; so that these centers, excited by anxiety, or grief, or joy, or sorrow, influence the waves of blood passing through the system, and the brain promptly feels the imperfect regulation of the supply. Under varying tensions of the vessels, there are flashes, chills, coldness of the extremities, and other oppressive symptoms, while in addition appear the distressing ringing or hammering sounds in the head. These sounds are arterial murmurs, vibrations of the blood which presses with each impulse of the heart on the bony surroundings of the relaxed carotid canal, situated at the base of the skull. The canal is in direct connection, by solid conducting substance, with the organs of hearing, and thus the faintest vibration is detected. The sound produced when it is sudden and unexpected, as in moments of fear, is occasionally mistaken for a sound proceeding from without with no obvious cause.

Thus the sufferer is likely to see visions and hear strange noises, impalpable so to speak, but as purely physical as the most common things in life. In some instances they are actual perceptions of real facts or objects, caught by an extremely susceptible and delicate nervous surface. In others they are an intensified recognition of movements within the body; but in the vast majority of instances they are actual impressions made at some time on the organism and now recalled and rendered more definite by constant recurrence.

At this point, if the mental powers be allowed rest and the fountains of care be closed, recovery may take place; but if the over strain continue, the disease assumes still graver form. There is a maddening desire for work, more work, coupled with the sad sensation that the physical powers are failing; and then there are lapses of memory. The man of business forgets important details, he is irritable, distrusts everybody and himself most, makes mistakes, and yet persists in accumulating more work on himself. The poet and novelist become over sentimental and morbid; the man troubled with remorse for guilt confesses his crime, or commits suicide. The downward course is rapid; in one case epilepsy occurs, in another paralysis, a third develops some hereditary malady like cancer, a fourth dies from nervous failure and local disease of some vital organ. The majority, escaping these special ends, become prematurely old, and sink helplessly into death. The brain becomes disorganized, the balance is broken, and anarchy succeeds to what once was order.

"In every brain, in fact, there is set up primitively a kingly force, to which all other forces bend. The king may be good or bad, he may be an hereditary king or a usurper, but he holds the balance; kill the king, and, in ninety nine cases out of hundred, the kingdom is made chaos and dark night."

THE APPARENT SIZE OF THE MOON AT THE HORIZON.

A correspondent forwards us an article containing the views of Dr. Montucci, of Paris, on the above-named subject. As the learned doctor has expressed a wish that it be published in some widely circulated scientific journal in this country, we accede to his request, making, however, some comments on his theory.

"Everybody must have noticed the enormous size of the full moon when it rises at dusk, just when the sun has set. That it is owing to an illusion is notorious, first, because our satellite cannot undergo any real change in size during its short progress from the horizon to its culminating point, and secondly, because, whether observed at the former or the latter, the micrometric measurement of the visual angle under which it is seen is always the same. This curious circumstance has always been a puzzle to scientific men. La Place says that, since the celestial hemisphere above our heads appears to us depressed, the rays coming from the horizon must seem to us longer than those from the zenith. Other physicists, finding this explanation unsatisfactory, assert that our judgment is led astray at the horizon by the trees and houses bordering on it, and which, having a size known to us by habit, induce us to compare the moon to these objects, and so to think it larger than it is at the culminating point, where it is quite alone, without any type of comparison in the vicinity. To prove this explanation of theirs, they prick a hole through a card, and look through it at the moon on the horizon, thus covering all the terrestrial objects that might lead us astray; and in this way the moon's

disk is indeed reduced to a much smaller size. In an article published in the *Memorial Diplomatique*, Dr. Montucci expresses his astonishment at finding that atmospheric refraction, the only reasonable cause of the phenomenon in his opinion, is not only overlooked in this question, but actually rejected by all school book writers on natural philosophy, as well as by graver men. The demonstration by the pricked card he shows to be worthless: 'for,' says he, 'go about in the evening and look at the gas lamps through the card, and you will find them suddenly dwindle down to pins' heads, because you reduced the radiation of light by narrowing the field of vision. In the same way, if you look at the moon, it becomes less, just like the gas flame; but do not imagine that it is thereby reduced to its culminating size. No, you cannot have two sets of weights and measures; if you look at the moon through the hole when she is at the horizon, you must do exactly the same when she is at the zenith; and then you will see her smaller than you ever saw her.' The card being thus set aside for ever, Dr. Montucci proceeds to examine whether the illusion can be brought about by a type of comparison, and he enumerates several reasons why it cannot, among which is this: When the moon rises close to a large mass of houses or a mountain standing out in high relief above the real horizon, she loses her exaggerated diameter very quickly as she goes higher up; so that, by the time she has reached the top of the prominent object, she has diminished considerably. But that object is still there, it has not changed; then how comes it that, the type of comparison being the same, the object compared has diminished? Illusion from that source cannot therefore be pleaded here. Dr. Montucci next takes up refraction as the sole explanation possible. The misty atmosphere presents itself to the eye of the observer as a concave lens; the moon is outside, and forms with the atmosphere a divergent lens, which enlarges objects on a dark ground. Hence the moon, as well as all terrestrial objects, are increased in size on being projected by refraction through the atmosphere. This view of the case, the author confirms by various experiments with concave lenses."

We must confess that the statements, reasonings, and conclusions of the writer excite our surprise, as the fact is that this curious illusion has never been a puzzle to such scientific men as have taken the trouble to consider it carefully. They all agree with La Place that the celestial hemisphere appears depressed above us, and that objects near the horizon look much further off than those near the zenith; our judgment is not led astray at the horizon by the trees and houses bordering on it, but, on the contrary, these objects give us some faint idea of the great distance of the moon, for in this case alone it becomes perceptible that the moon is so much farther off than the largest distant objects, and the comparison allows some kind of appreciation of the moon's size; while when the moon is at the zenith, there is a total lack of objects of known size with which to compare her, and we are thus led astray by the impression of a smaller distance, and so underestimate her size. The fact is that experience trains us in our judgment of distances in a horizontal direction; but when we look upward, for lack of intervening objects for purposes of comparison, we always underrate the real distances. A six foot man, at 700 feet distance, when on the ground looks to be of natural size, notwithstanding that we see his whole figure under the small angle of less than a third of a degree; but let the man be raised to the top of a tower 300 feet in height, and let us go a little nearer, so as to see him at the same distance (700 feet) as before, and therefore under the same visual angle, or let us even increase the angle, and the man will look very small indeed. Almost every one has experienced the surprise with which we observe that the real size of any object, with which we have become familiar by seeing it always in an elevated position, is so much larger when placed on the ground than it appeared to us while elevated.

Pricking a hole in a card, and looking through it at the moon's disk near the horizon, is a very imperfect and clumsy way of effecting an otherwise good and conclusive experiment. A hole of exactly a quarter of an inch in diameter should be punched in a card, and this card placed at the end of a tube, of cardboard or other material, 28 inches long; then the hole will appear, to the eye placed at the other end of the tube, under an angle of half a degree, which is the angle under which the moon always appears to us, whether she be at the horizon or at the zenith, and when she is at her mean distance from the earth. If we look through the tube at the moon, when she is near the horizon and appears large, and also when she is near the zenith and appears small, we shall see that she is in both cases of exactly the same size, covering the hole nearly perfectly.

The only effect which atmospheric refraction can have is to lift objects, situated outside of our atmosphere, higher above the horizon than they really are, and this action increases as the objects come nearer to the horizon. At the horizon itself, it amounts to only about half a degree, the angle under which we usually see the sun and moon; so that when the sun or moon appears to touch the horizon with its lower edge, it is in fact below the same, and without the atmospheric refraction would show just a trace of the upper edge. As this refraction is greater at the horizon itself than half a degree above the same, the lower edge of the sun or moon is apparently lifted up higher than the upper edge. This has the effect of causing the luminary to appear with a diminished vertical diameter; so that it appears flattened, an appearance which has no doubt been observed by many of our readers; and this takes place to an exaggerated extent when the atmosphere was laden with vapors.

The explanation given by Dr. Montucci is by no means new, and is found in many elementary text books of astron-

omy. It appears in a little treatise for school use, published 40 years ago by Arago, and it has been frequently copied by other authors, as apparently the easiest mode of explaining the phenomenon; it cannot, however, stand the test of scrutiny, as the upper surface of our atmosphere, being parallel to the surface of the ocean, cannot be more curved than the ocean, but is actually less curved, having a somewhat longer radius. As, however, the surface of the ocean can be considered level for all practical purposes, the upper surface of our atmosphere may more reasonably be treated as a flat surface, owing to its larger circumference; but it can in no way be considered to act as a lens. This old theory has been so long since exploded that it is surprising to see it brought forward at the present day.

PROGRESS OF THE CENTENNIAL.

Imagine over a hundred carloads of every conceivable product of art and industry arriving daily, and an immense army of workmen working as if for dear life, early and late, and some idea of the present condition of affairs at the Centennial will be realized. That the American exhibition will be far from complete at the opening day is certain; but fortunately the same is not the case with the foreign contributions, and hence a reasonably good display may be looked for on the 10th of May.

Three new bridges are being built over the tracks of the Pennsylvania Railroad in order to complete the approaches to the Centennial grounds. One is constructed on the rigid suspension principle, another on the stiffened triangular truss system, and the third is an iron truss structure. The last is one of the largest street bridges in the country, and will cost \$300,000.

A new building has been erected near the west end of the main building for a general reception room for all visitors. It contains parlors, baggage rooms, toilet apartments, writing conveniences, and telegraph and mail stations, and is the headquarters of the corps of Centennial guides.

The interior decoration of Horticultural Hall is now nearly completed, and the main hall presents a magnificent display of tropical plants. All of the garden beds have been laid out, and a large quantity of flowers are in full bloom.

The Japanese building is complete, and exquisitely furnished in a style corresponding with the better residences in Japan. The walls are elegantly papered, and the windows are furnished with a peculiar style of paper in lieu of glass.

The Chilean exhibit has arrived by steamer at Aspinwall, and will shortly reach Philadelphia. It includes a magnificent collection of precious ores, and native wines, besides a large quantity of machinery. Some of the small South American republics, not distinct exhibitors, occupy part of the Chilean space. Among these, Guayaquil has sent samples of a straw hat made from the delicate young palm leaf. It takes several months to make one hat, as it can only be worked upon by night in order to escape the action of the sun and heat. No seam or joint is visible, and each hat is valued at several hundred dollars.

The Granger's encampment at Elm Station, on the Pennsylvania Railroad, is now so nearly completed that the buildings will be ready by the opening day of the Centennial. The terms are only \$1 per day for room rent and 50 cents per meal. A branch railroad line will run to the Centennial grounds, and a nominal fare will be charged. The Grangers have the preference in securing quarters, but the general public is accommodated on the above terms. Working men will probably find these accommodations very convenient.

The great 100-ton Krupp cannon has safely arrived. The principal display of war material will be found in the United States section. A very interesting feature in that portion of the exhibition is a small working model of a Hitchcock forge, which will be so arranged that at stated periods miniature guns will be actually constructed, built up from iron sections. The Gatling gun will be shown in all its modifications, and there will be a complete set of small-arm-making machinery in practical operation.

The carriage building is about finished. It is of wood sheathed with corrugated iron, and of very ornamental design. The exhibits consist entirely of pleasure carriages, as all carts, farm wagons, omnibuses, etc., will be displayed in the Agricultural Building. Palace and street cars will, however, be exhibited, together with all improved carriage appliances.

The Art Gallery is rapidly progressing, and in parts of it the hanging committee have already begun arranging the pictures. The judges' pavilion and the Massachusetts building are finished, and present a beautiful appearance. The Pennsylvania building, begun very recently, will not be completed for several days.

The London Artisans' Institution and several French working men's associations are making preparations to send delegations of workmen to the Centennial. We have as yet heard of no similar action on the part of trade associations and large manufacturing concerns in this country. We have already pointed out at some length the advantages to be gained by affording every possible facility for workmen to visit the exhibition, and certainly no other such opportunity for observation and study will be afforded our mechanics during the present generation. This country will never be able to compete with Europe in the matter of artistic workmanship until our workmen have the same advantages, in the shape of galleries and collections of industrial art, that are possessed by their European brethren. In respect to art productions, the Centennial will be especially rich; and with proper opportunity for study, American operatives can gain a fund of information and ideas which will be not only valuable to them, but directly beneficial to all our industries.

IMPROVED AUTOMATIC TANK FILLER.

Mr. Augustus Haerle, of Cincinnati, Ohio, has recently (March 7, 1876) patented an improved device for filling water, beer, oil, and other tanks. It consists of cocks in the filling pipes, and a cock in a relief or signal pipe, attached to the filling pipe and connected with a float in the tank in such manner that the float closes the cocks of the filling pipe and opens the one in the relief pipe when the tank is full; and when the water falls a little, the float opens the filling pipe and closes the other, and thus automatically maintains the required quantity in the tank.

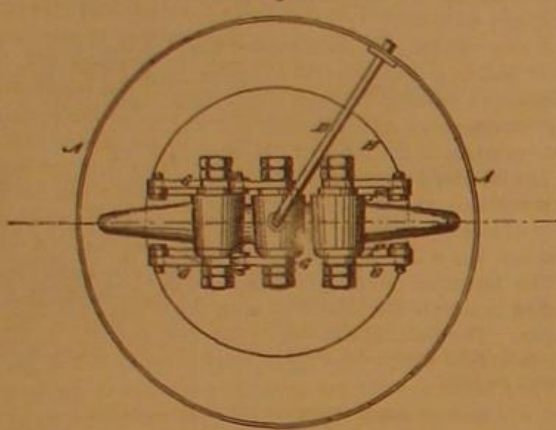
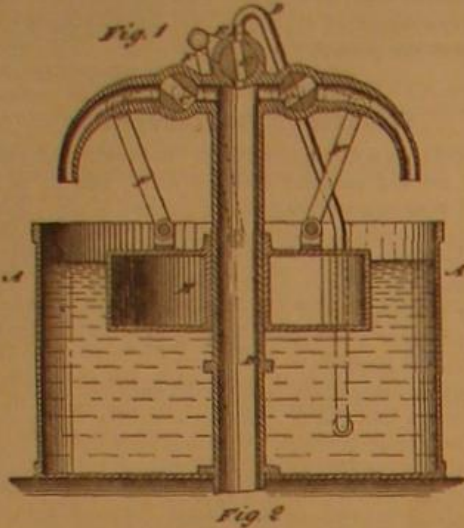


Fig. 1 is a sectional elevation, taken on the line, *x x*, of Fig. 2; and Fig. 2 is a top view. A is the tank, for water, beer, or other liquid. B is the filling tube; C, the cocks in the same for shutting off the supply when the tank is full. D is the relief or signal pipe for the escape of the liquid when cocks, C, are closed, to relieve the feed pipe of the pressure, and to show, by the liquid running through it, that the tank is full. E is the cock in the relief pipe, and H is the float. The cocks are connected to the float by an arm, G, and rod, F, which are so adjusted that cock, E, opens a little before cocks, C, close, so as not to shut off the escape of the liquid, and cause pressure to rise in the filling pipe, and in the reverse operation, the cocks, C, open a little before cock, E, closes, for the same purpose. Besides relieving the pipe, B, from undue pressure, the escape pipe, D, shows, as above explained, when the tank is full.

African Hippopotamus Hunters.

The late Dr. Livingstone, in his "Last Journals," gives the following interesting account:

"At the Loangwa of Zambo we came to a party of hereditary hippopotamus hunters, called *makombé* or *akombé*. They follow no other occupation, but when their game is getting scanty at one spot they remove to some other part of the Loangwa, Zambesi, or Shiré, and build temporary huts on an island, where their women cultivate patches: the flesh of the animals they kill is eagerly exchanged by the more settled people for grain. They are not stingy, and are everywhere welcome guests. I never heard of any fraud in dealing, or that they had been guilty of an outrage on the poorest; their chief characteristic is their courage. Their hunting is the bravest thing I ever saw. Each canoe is manned by two men; they are long light craft, scarcely half an inch in thickness, about eighteen inches beam, and from eighteen to twenty feet long. They are formed for speed, and shaped somewhat like our racing boats. Each man uses a broad short paddle, and as they guide the canoe slowly down the stream to a sleeping hippopotamus not a single ripple is raised on the smooth water; they look as if holding their breath, and communicate by signs only. As they come near the prey, the harpooner in the bow lays down his paddle and rises slowly up, and there he stands erect, motionless, and eager, with the long-handled weapon poised at arm's length above his head, till, coming close to the beast, he plunges it with all his might in towards the heart. During this exciting feat he has to keep his balance exactly. His neighbor in the stern at once backs his paddle, the harpooner sits down, seizes his paddle, and backs too to escape; the animal, surprised and wounded, seldom returns the attack at this stage of the hunt. The next stage, however, is full of danger.

"The barbed blade of the harpoon is secured by a long and very strong rope wound round the handle: it is intended to come out of its socket, and, while the iron head is firmly fixed in the animal's body, the rope unwinds, and the handle floats on the surface. The hunter next goes to the handle and hauls on the rope till he knows that he is right

over the beast: when he feels the line suddenly slacken, he is prepared to deliver another harpoon at the instant when hippo's enormous jaws appear with a terrible grunt above the water. The backing by the paddles is again repeated, but hippo often assaults the canoe, crunches it with his great jaws as easily as a pig would a bunch of asparagus, or shivers it with a kick by his hind foot. Deprived of their canoe, the gallant comrades instantly dive and swim to the shore under the water: they say that the infuriated beast looks for them on the surface, and, being below, they escape his sight. When caught by many harpoons, the crews of several canoes seize the handles and drag him hither and thither, till, weakened by loss of blood, he succumbs.

"This hunting requires the greatest skill, courage, and nerve that can be conceived—double armed and threefold brass, or whatever the *Baaid* says. The *makombé* are certainly a magnificent race of men, hardy and active in their habits, and well fed, as the result of their brave exploits; every muscle is well developed, and, though not so tall as some tribes, their figures are compact and finely proportioned; being a family occupation, it has no doubt helped in the production of fine physical development. Though all the people among whom they sojourn would like the profits they secure by the flesh and curved tusks, and no game is preserved, I have met with no competitors to them except the *wayeye* of Lake Ngami and adjacent rivers.

"I have seen our dragoon officers performing fencing and managing their horses so dexterously that every muscle seemed trained to its fullest power and efficiency, and perhaps had they been brought up as *makombé* they might have equaled their daring and consummate skill; but we have no sport, except, perhaps, Indian tiger shooting, requiring the courage and coolness this enterprise demands. The danger may be appreciated if one remembers that no sooner is blood shed in the water than all the crocodiles below are immediately drawn up stream by the scent, and are ready to act the part of thieves in a London crowd, or worse."

The Solar Protuberances.

For some time past the protuberances on the sun's surface have appeared less numerous. Father Secchi states that the minimum is, however, not yet attained, and this is shown by the sudden changes in the phenomenon. On one day scarcely more than three protuberances can be found, while on the following day they may be counted by dozens, evidencing the fact that the solar activity in course of diminution, suddenly, from some unknown cause, renews itself. Father Secchi also notes the rectilinear form of the hydrogen eruptions, which, with a thickness of several seconds, rise without deviation to a distance of two or three minutes (equal to 60 terrestrial diameters) from the sun's edge. The solar atmosphere is now so calm that the expansion, which takes place at the extremity of the incandescent columns, appears perfectly symmetrical on the two sides of every jet.

A SIMPLE FLOWER VASE.

Everybody is, perhaps, aware that a very tasteful hanging basket for growing plants can be made from a wire or muzzle lined with sod or moss. A variety of wire baskets of

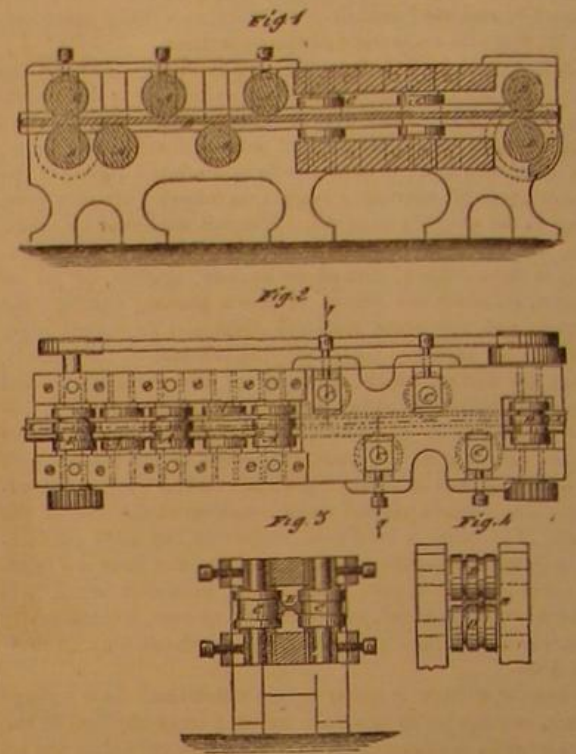


elegant patterns, for the same purpose, are also sold in hardware stores; but these, however, lack the charm which always attaches to an article which is the product of one's own handiwork. About the simplest and most ingenious plan for making flower baskets and pots which has come under our notice is that recently patented by Alfred D. Lee, of Scio, Ohio. A web or plat of sod is first cut of sufficient size to form the vessel when folded in proper shape. A mold of the desired form being previously made of wood, the sod is wrapped about it; and then turns of cord or wire, preferable the latter, are wound spirally about the exterior so as to confine the sod. The ends of the wire are then tightly secured, the mold removed, and the empty space left by the latter, filled with loam, in which the plants are imbedded. The appearance of the finished pot is excellently shown in the an-

nexed engraving. Any desired shape can be made, and the pots themselves may be ornamented with vines and flowers planted on their outer sides. In propagating and transplanting, the pot may be set directly in the bed, when the roots of the plant will find their way through the turf. The latter also holds water and aids in nourishing the plants enclosed.

IMPROVED MACHINE FOR STRAIGHTENING METAL BARS.

In the annexed engraving is represented a new machine for straightening metal bars, which involves a novel arrangement of rollers, which, it is claimed, enables the work to be done with less power and less strain on the machinery than when done simultaneously in both directions by alternate



horizontal and vertical rollers. Fig. 1 is a longitudinal section, Fig. 2 a plan, Fig. 3 a transverse section, and Fig. 4 an end elevation. A represents the series of horizontal rollers for bending or straightening the bars, B, vertically. C represents the series of vertical rollers for bending or straightening the bars horizontally, and D represents the drawing rollers for forcing the bars between the straightening rollers. The upper horizontal rollers are adjusted, and have adjusting boxes and adjusting screws for setting them for bars of different sizes, and the vertical rollers of both sides are adjustable for the same purpose. In this example, the rollers are grooved suitably for bending railroad rails, for which the machine is more especially designed; but it is also applicable for bars of any form, the grooves being shaped accordingly.

Patented through the Scientific American Patent Agency, February 22, 1876, by Messrs. Aquila Howells, John K. Howells, and William Garrett, of Cleveland, Ohio.

Dye Leaves.

We do not remember ever having seen mention in the public prints of the leaves from which a dye is extracted. This quality in certain plants is an interesting one for the botanists who occasionally sojourn with us for awhile, hunting up orchids and other specimens of the vegetation of this locality. A study and analysis of the merits of these may be of vast worth to him who is first in the examination of the subject, and the leader in making their value known to the commercial world.

Of the leaves that are made use of by our country people is one of a class commonly called the china. From it a red tint is extracted, with which the straw hats, from the vicinity of Penonome, are dyed. To all appearances it is a fixed dye, which exposure to rain and sun does not materially alter. We are not acquainted with the secret of the mixture, that is, if there be any mordant employed to give it its fixity. If it be a fixed dye, not needing a mordant to give it a permanency and inalterability, it may prove to be of great value in commerce and the arts; for of all the vegetable dyes thus far known and tested, there is but the single exception of indigo which possesses the quality of durability without the necessity of a base or mordant to make it a lasting dye that does not fade away easily. Should this china turn out to be permanent and not readily deteriorate by the action of temperature and moisture, it may become a valuable acquisition in the manufacture of textile fabrics, and render the making up of cotton cloths something cheaper than what it is at present.

This china is a wild plant that is found in abundance in many of the mountainous districts of the Isthmus. It is a vine (*bejuco*) that attaches itself to tall trees, and the leaves are shed in the dry season. There is no trouble in collecting them, as the time of the year is propitious for such work. It is only left to be seen whether they be a fixed dye; and if that fact be established by a competent analysis, they may be made to take a place as one of the exportable products of the country.—*Panama Star and Herald*.

It is said that eggs may be preserved for six months by dipping them in linseed oil, and so placing them in a layer of sand that they do not touch.

IMPROVED KEG AND BARREL MACHINERY.

In our last issue, we published five engravings of the improved barrel-making machinery introduced by Messrs. E. & B. Holmes, of 59 Chicago street, Buffalo, N. Y. We now resume the subject, continuing it to its close, and illustrating four other machines, which complete the series.

Fig. 6 is a stave equalizer, with reel feed and conveyer. This is adapted to sawing off staves to uniform lengths as required, and will equalize staves of different lengths for making casks of all sizes, from the smallest kegs to barrels. It has a continuous reel feed and conveyer; also two circular saws upon the same mandrel, which can be adjusted and placed at different distances from each other. The stave is placed upon the feeder and is presented to the saws, which cut off both ends. The reel then carries it to, and drops it upon, the conveyer, which delivers it wherever desired.

In Fig. 7 is shown a machine for dressing and jointing headings of all lengths and sizes for casks, from small kegs to hogsheads. One or both sides of the material can be finished as desired. The machine is constructed with a heavy iron frame, upon which is mounted a large iron wheel. On the wheel are placed cutters for dressing and jointing the heading. The inner set of cutters is for dressing the heading, and the outer for jointing. There is also a sliding clamp located upon the frame, in which the piece of heading is placed and clamped, and passed up to the cutters, which dress it and take it out of wind. The piece of heading is then taken from the clamp and placed upon the jointing rest, and brought in contact with the cutters, which give a smooth and perfect surface to its edge.

Fig. 8 is a machine for jointing staves for kegs and small casks. This is so constructed that the operator can instantly change the curve or bilge of the stave, through a foot lever, by which the operator raises or lowers the clamp or rest upon which the stave is placed. The clamp is fastened by an eccentric at any point desired. The stave is placed upon the holder, and is passed up to and against a concave disk, in which are cutters which make a perfect joint upon the edge of the stave. The machine is made with or without the casing, which, in connection with the revolving disk, forms a fan, to remove the shavings and dust to the fuel room or where desired.

In Fig. 9 is represented a machine for bending and rendering flexible wooden hoops. By the operation of this device all the stubborn and unyielding portions of the hoop are rendered flexible. The hoop is put into this greatly improved condition without breakage, thus saving a large amount of valuable stock; and the work of the cooper is greatly expedited. The machine is made with an iron frame in which are placed three iron turned or finished pulleys. A strong belt is so placed upon the pulleys as to drive them all when one is put in motion. The hoop is entered between the belt and the middle pulley, which is carried around the pulley and held close to it by the belt, which prevents its breaking. Hoops are passed through this machine very rapidly.

Lack of space precludes our presenting more than the brief description here given of these valuable machines. We are informed that the manufacturers are the only parties in the United States, or in the world, who make and furnish full and complete apparatus for making all kinds of barrels and kegs. A fine representation of all varieties of their machinery will be found in section 37, columns 50, 51, 52, of the machinery department of the Centennial Exposition.

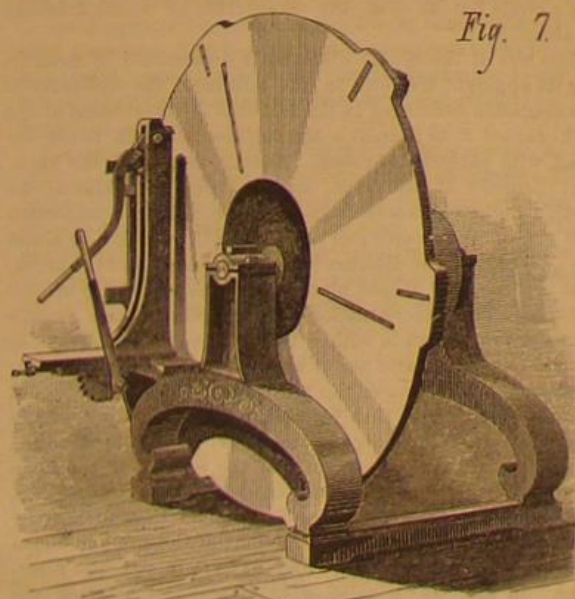


Fig. 7.—BARREL HEAD DRESSING AND JOINTING MACHINE.

For further particulars, address the inventors and manufacturers as above.

NICKEL deposits, from which ore containing 30 per cent of pure nickel has been obtained, have recently been discovered at Ouallou, New Caledonia.

SCIENTIFIC AND PRACTICAL INFORMATION.

HOW WE TAKE COLD.

It is one of the facts best known to Science that, when a part of the outer surface of the body has been exposed long to cold, the greatest risk is run in trying suddenly to re-induce warmth. To become thoroughly chilled and then to pass into a very warm atmosphere, such as is found near a fire, results in a dangerous reaction which, a few hours later, may cause pneumonia or bronchitis, or both diseases. The capillaries of the lungs become engorged, and the circulation becomes static, so that there must be a reaction of heat inflammation before recovery can occur. Common colds, says a contemporary, are taken in the same way: the exposed mucous surfaces of the nose and throat are subjected to a chill,

Fig. 6

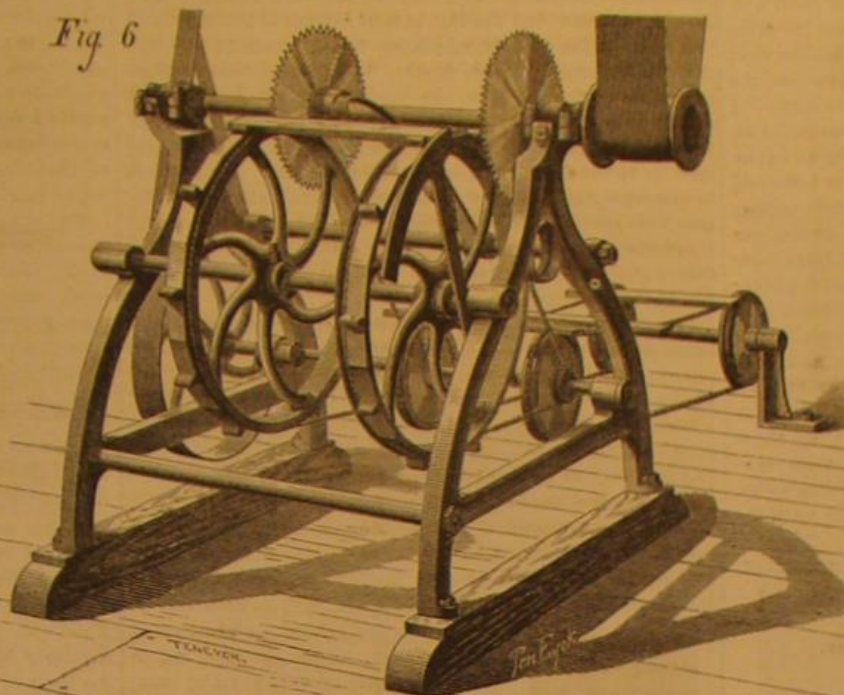


Fig. 6.—BARREL STAVE EQUALIZER AND CONVEYER.

then they are subjected to heat; then there follows congestion, reaction of heat, pouring out of fluid matter, and the other local phenomena of catarrh.

LOISEAU'S PATENT FUEL.

We have already chronicled the excellent success which Mr. E. F. Loiseau has encountered in introducing his patented process for the manufacture of fuel from the hitherto

Fig. 8

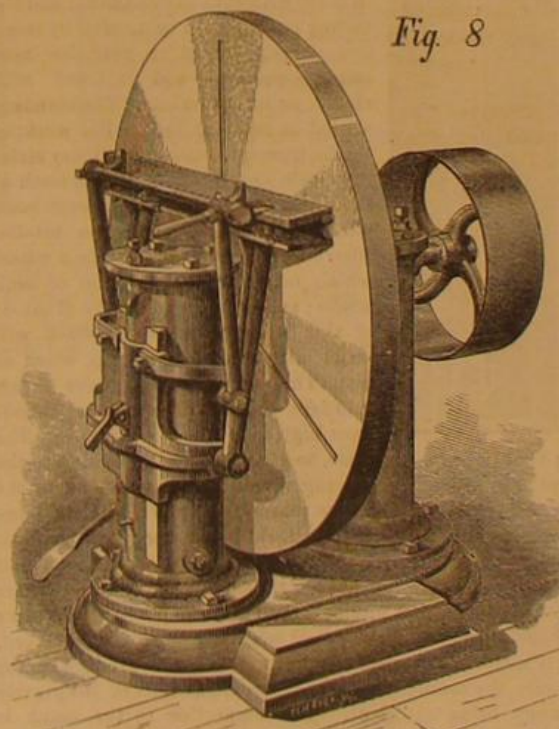


Fig. 8.—KEG STAVE JOINTING MACHINE.

wasted coal slack. Preparations are now in progress for making the fuel on an extended scale, and supplying it for public use. A factory located at Port Richmond, Pa., has a set of Mr. Loiseau's machines capable of making 150 tons per day, and admitting of the sale of the material at one dollar per ton less than the price of stove coal. Contracts have been entered into for immense quantities of coal slack, so that before very long we may expect to see the enormous heaps of that refuse, which now simply encumber the ground in the vicinity of the breakers in the coal districts, disappear. For several months past the Philadelphia and Reading Railroad Company has been experimenting upon the fuel, and it is found to yield more heat and produce more steam than similar quantities of large coal.

We published some time ago complete illustrations, with descriptions, of Mr. Loiseau's very ingenious machinery. The beauty of the process is its continuity: 95 per cent anthracite slack, 5 per cent clay, and some adhesive material enter one end of the series of apparatus, and the compound never

stops moving until it emerges at the other end in the shape of neatly molded hard lumps, covered with a waterproof varnish, and ready for instant use.

A SUBMARINE RAILWAY.

One of the most remarkable and at the same time impracticable plans, which have been suggested for rapid and agreeable transit across the English Channel, has recently been exhibited at the Palais de l'Industrie in Paris, by its inventor, Dr. La Combe. He calls his project "the submarine boat," but the boat is really a portion of a huge carriage which is to run upon a railroad laid on the sea bottom. There is no tunnel, nor anything thereunto resembling. The road bed is of *béton*, which is to be laid by divers, and on this are fastened three galvanized iron rails. The outer ones are for the wheels of the carriage, and the inner one is raised so as to be embraced by rollers, centrally attached to the latter in order to prevent rolling and derailment.

The boat, at all points watertight, is secured to the heavy carriage, and the whole is driven by a screw actuated by compressed air transported in suitable reservoirs. The latter also supply fresh atmosphere for respiration within the boat, and a machine is provided for removing any excess, as well as the vitiated air. The interior is illuminated by the electric light, the current being led to the vessel by a wire from Dover; said wire also serves for telegraphic purposes.

The inventor proposes to arrange guard rails so as to keep the track always clear, and he provides a double-doored chamber in the vessel, so that, in case of necessity, a diver can emerge to examine the line. Should by any possibility the vessel stop, a buoy is immediately sent to the surface of the water, carrying an air tube, so that the supply of air may not fall short; and in case of grave accident, the vessel can be altogether cut loose from the carriage, when it will rise to the surface and float. A series of buoys on the surface will mark the line of the road. Dr. La Combe thinks that his project is practicable, and believes that his vessel could make the journey of twenty-one miles in about half an hour.

PURIFICATION OF SULPHURIC ACID.

The method generally employed, consisting in removing the arsenic by sulphuretted hydrogen, is tedious and costly. Professor Thorn, of Pesth, says the *Moniteur Industriel Belge*, has devised a more simple process. The acid coming from the lead chambers and marking 50° B is carried in a lead vessel at a temperature of from 189° to 213° Fah., and a quantity of sulphate of soda dissolved in water, corresponding to the quantity of arsenic contained in the acid, is added. The sulphide of arsenic is thereby formed in yellow flocculent masses, which aggregate and float upon the surface. On withdrawing the acid, the sulphide remains on the bottom of the vessel, whence it is removed. The operation is easily carried on, and but very little sulphurous acid is produced. The purified acid contains from 3 to 4 per cent of sulphate of soda, which offers, in the majority of applications, no inconvenience. In experiments made at Pesth, acid at 50° B contained 0.098 per cent of arsenic, on leaving the chambers, and 0.004 per cent after purification.

ARTIFICIAL MEERSCHAUM, HORN, AND CORAL.

A new way has been found of making excellent imitations

Fig. 9

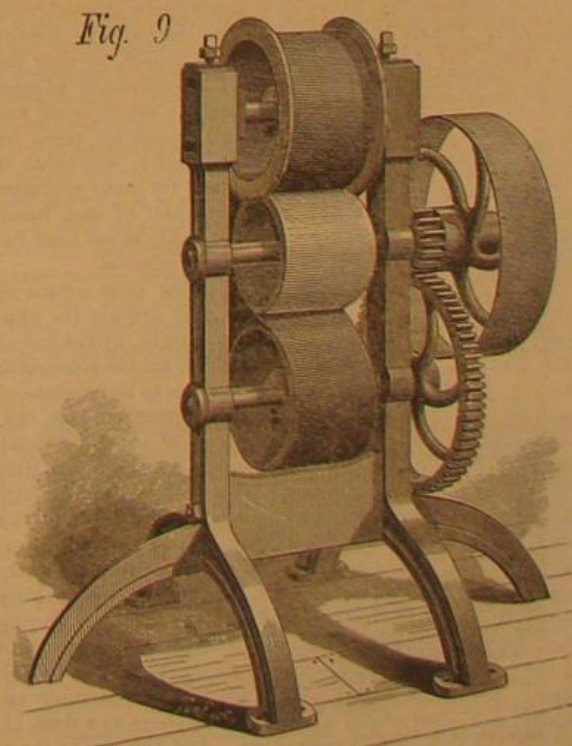


Fig. 9.—MACHINE FOR BENDING WOODEN HOOPS.

of meerschaum, horn, and coral, out of potatoes and carrots. To make the false meerschaum, the potatoes are peeled and macerated for 36 hours in water acidulated with 8 per cent sulphuric acid. They are then dried on blotting paper, and

in hot sand under pressure upon plates of chalk or plaster for several days. The chalk supporting plates must be renewed daily. The resulting material can be readily carved. If greater durability, whiteness, and elasticity be desired, the potatoes are macerated in water containing 3 per cent of soda instead of the acid above mentioned. To produce the horn imitation, the potatoes, after being treated as last stated, are boiled in water containing 19 per cent of soda. By substituting carrots for potatoes, a good imitation coral is produced.

A REMARKABLE ERUPTION.

A curious land slide recently occurred on the line of the Hudson River Railroad near Dutchess Junction, N. Y. At about 200 feet above the Hudson river, there is a level plateau which rises slightly to the foot of a large eminence called the Sugar Loaf, and apparently is a rocky spur of that hill. Suddenly a portion of the plateau was lifted from its place and hurled, with its load of trees and shrubs, into the cove beneath, dashing up the water like a tidal wave over the railroad track and destroying the fences beside the same. A crater about 200 by 150 feet in size was left. Four hours afterward, another slide took place, accompanied by an explosion, and during the succeeding night still another upheaval occurred, which was followed by a torrent of water gushing from the crater. So great was the force of the explosions that trees nearly a foot in thickness were hurled from their places to great distances like straws; and one massive timber was driven into the solid bed of the railroad to a depth of 8 feet. The phenomenon was due to a vast accumulation of water which had formed in the sandy land. This had been fed by the watershed of the Sugar Loaf and by the recent rains, until the huge underground lake found vent with the tremendous force described. The most recent reports at the time of writing (three days after the event) state that the water is still escaping, and the land still crumbling away, a condition of affairs which will probably continue until the water has spent its force.

Correspondence.

The Cause of the Glacial Epochs.

To the Editor of the Scientific American:

It may be said of the earth that she has five distinct motions, which are these: First, a rotary motion, on an axis, say, in herself. Second, an orbital motion, on an axis, say, in the sun. Third, a retrogradatory motion, on an axis centered in the center of the sun's orbit. Fourth, a retrogressive motion round the center of the sun's orbit, and always at the same rate as Sol's motion. Fifth and last, a motion at right angles to the plane of her equator. It is by this motion that the earth's obliquity to the plane of the ecliptic is gradually becoming less and less.

It was held by La Place and several other astronomers that the obliquity of the earth to the plane of the ecliptic would ever be permanent, and that the earth would, as it were, "rock to and fro, never departing more than two or two and a half degrees from her present inclined position." We claim that there is not a power, neither in the earth nor the sun, that will sustain that idea. The earth must (and we claim that the forces in her and in the sun compel her to) revolve round an axis running through her equator, as it were from one side of it to the other: and thus comes first, say the equator, next her pole or poles, if you will; next her equator again, next her pole or poles; and so on for ever, to the sun.

It is by this motion of the earth that she has had all her glacial epochs; and the motion is not at all peculiar to the earth. No doubt all the planets have seen their glacial times, for they all revolve in the manner alluded to. See Uranus at the present hour; he is passing now through such an epoch. Fearfully grand it must be, compared to those of the earth; but it is nothing to what it would be were the plane of his equator in the plane of the ecliptic or of solar motion. No, that is the period when the vastly broad and thick sheets of ice gather over and all around his poles for many thousands of miles. Look at Jupiter, and think of the vast ice sheets which must now and for many centuries to come cover his poles and nearly one half of each hemisphere. How exceedingly thick and vastly broad must Jupiter's glacial ice fields be at this present moment.

Turning to the earth, we find, by quoting from certain of our authors, that at the beginning of this century the obliquity was $23^{\circ} 27' 54''$, and that it shall be, by the end of this century, $23^{\circ} 27' 9''$. That gives, for the nineteenth century, $45^{\circ} 70'$. Now supposing the motion to be regular and uniform, the earth will complete her revolution, and, say, her glacial epoch revolution, in a period of about 2,832,700 years. Therefore, we have four glacial epochs in less time than three millions of years. Five hundred and twenty-three thousand three hundred years ago, the poles of the earth lay in the plane of the ecliptic. Then each pole, during its winter, would be subjected to intense cold and darkness for more than three months, and in summer to thirty days (720 hours) of almost perpendicular sunshine. During such epochs as that, tropical vegetation would grow right at the poles, and animals, accordingly, would feed and dwell there. Broad and thick sheets of ice would accumulate annually, and cover nearly a whole hemisphere at a time, although but thin around their edges. And the speedy thawing of them would cause great floodings and carryings of debris from certain localities to other parts. But now to the coming epoch.

In about 184,800 years from now, the equator of the earth will again lie in the plane of the ecliptic. That will be the middle of one of the greatest glacial epochs which come to

our earth. It comes on and goes off gradually, of course, and therefore it will begin some fifty or sixty thousand years before that, and be gone in another fifty or sixty thousand years.

Then will be the time when the vast circular fields of ice grow in thickness to perhaps several miles, especially at and near the poles. Think of ice accumulating for perhaps 100,000 years, and conceive of its thickness. Think of the attractive force of the sun drawing such huge fields outwardly toward the equator, and causing them to move with an eastward tendency all the time; and see how it becomes possible for the ice mass to tear the crest off one mountain and set it down on the top of another lying in its path. It was, doubtless, during the latest one of the kind (that is, something near 1,231,000 years ago) that the crest of a certain mountain was placed on the top of another. I forget their names just now, but the fact is well known to geologists.

These are the periods which, as it were, turn animal and vegetable creation upside down. The gradual change of inclination of the earth to the sun causes all her climatic changes; and thus creatures and vegetation, foreign to certain localities now, will be found in others than they are now in, in the far future, as has been the case many times in the past; for the earth has seen several glacial cycles, and her animal and vegetable genera may truly be called wandering, restless, and ever shifting things, for neither, individually, has any permanent abiding place on the earth. No, not any one thing!

I humbly recommend the above theory to geologists and other scientists, men whose practical knowledge and superior talent can show the facts up to better advantage than I can do.

JOHN HEPBURN.

Gloucester City, N. J.

New Registering Barometer.

To the Editor of the Scientific American:

I send you a sketch of a registering barometer, which differs from the ordinary barometer in having a longer tube. The cistern is below the end of the tube a distance equal to the greatest difference of the barometer, with sufficient clearance for the mechanical part immersed in the mercury. From the open end of the tube projects upward a small insulated wire, preferably of tempered steel, terminating in a platinum point. This point is amalgamated, and is hook-shaped, the end being bent down so that it is the lowest uninsulated part. This wire is represented at 1 in the engraving; the wire and all of its connections are insulated from *a* to *b*. At 2 is a standard, to guide the working parts. The bearings, *c*, *d*, and *e*, are in holes drilled in the standard; and the sliding parts should be covered by small iron tubes, slipped on over the insulating substance and fastened with shellac or its equivalent. The standard should be made of iron. For working the instrument, I use an ordinary striking clock, and I deepen all the teeth of the count wheel so that the count hook will drop and stop after one stroke. Above this, there is in the train a wheel which makes one revolution to each stroke; and on the end of the arbor of of this wheel is a crank, which will stand with the crank pin up, when at rest. This crank should have throw sufficient to cover all of the variation, from high to low, and a little over. The



fly should be of large size, to give a very slow motion to the crank, to prevent producing waves and fluctuations in the mercury; and for the same reason the tube should be large enough, and the insulation should be as smooth as possible. In connection with the crank motion there should be a pair of feed rolls, carrying a paper ribbon for the record. There should be a ratchet motion to bring the paper to a new place for each record. I use chemical telegraph paper for the record, as it requires a smaller battery, not liable to produce sparks to turn the connections, one or two small cells of the gravity battery being sufficient. The connection to the crank is made with the rod at *f*; the top of the wire, 1, is adjusted so that, when at rest, the end of the wire inside of the tube, at *b*, will always be above the highest point that the mercury reaches. Connection with the battery is made by putting one pole in communication with the mercury in the cup, and the other with a plate which the paper passes over, and lies upon. The record can be taken hourly, half-hourly, or at as short periods as 5 minutes. If it be desired to take it once an hour, the hand arrives at the hour and, instead of striking, the wire inside of the tube begins to descend; when the platinum tip touches the mercury, electric communication is made through the mercury in the cistern to the top of the tube, thence through the steel wire down the tube and outside to the clock movement. This crank movement carries an iron wire, which moves down, pin-like, over the paper; at the instant that the platinum tip touches the mercury, the current passes through the paper and produces a blue mark to the bottom of the stroke; when, or just before, it begins to rise, the iron pen lifts from the paper, to prevent tracing both ways or tearing the paper, also to secure greater accuracy; as the mercury, wetting the platinum point, will lift above the actual level by capillary attraction, and will keep the connection too long, and so will spoil the accuracy of the record.

I put in connection with the iron pen a thermostat, which raises or lowers the pen, making allowance for the expansion of the mercury by heat, so that a thermometrical record could be kept at the same time and on the same paper. On the paper I place points of copper in connection with the battery, and these make lines at right angles with those of the barometer record, which will be perpendicular. These copper points are placed to indicate inches or their fractions. They are adjustable to the exact point, and then are set by screws. They are all in electric communication, but the conductor to them has a greater resistance than the iron pen, to prevent their taking too much force from it. The paper going between the copper points is lined lengthwise in red, and these lines are crossed by blue lines, of greater or less length, according to the state of the barometer, all ending alike at the bottom, each line representing the period of time which the clock registers. I can dispense with all but one of the copper points; and if this represents the 30 inch point, I can measure from this. It is, however, but little trouble to graduate to very small divisions, if necessary. The copper points I make by soldering thin pieces of copper, with the edges toward the paper, to pieces of steel wire. I place two of them very close together for the whole inches, the fine white line between being the inch line.

The advantages I claim for this barometer are cheapness in making and running. There is no work for the mercury to do whatever, as the mechanical part is all done by the clock; and it will do the most accurate work possible, if it is made nicely. I should be pleased to hear, from any one who tries this plan, as to its success.

WM. A. BARNES

Bridgeport, Conn.

THE MOON.

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

If this were a literary instead of a scientific lecture, it could not be more appropriately introduced than by quoting some of the beautiful lines which the poets of all ages have lavished upon the moon, the empress of the night. The moon was perhaps the first of the heavenly bodies that was regularly observed. The ancient observations of eclipses form the basis of many determinations in the chronology of the earth's history. To the mariner at sea, its regular passage across the heavens has always been a means of knowing the time. The modern astronomer is able, without leaving the observatory, to determine the earth's size more accurately by studying the moon than he could by traveling all over the surface. To a person observing the path of the moon from any point of the earth's surface, it will appear less than a semicircle by an amount proportional to the radius of the earth at that point. If the moon could be observed from the center of the earth, we assume, for the sake of simplicity of illustration, that its path would appear a complete semicircle. Hence we have the means of determining the radius of the earth. Even the density of the earth could be determined by a careful observation of the moon's influence upon the tides.

The most convenient way of determining the distance of the moon from the earth is from two distant stations, whose positions on the earth's surface have been accurately ascertained. One of these stations is usually at the Cape of Good Hope, and the other either at Greenwich, Paris, or Berlin, etc. The distance between the two stations, measured on the same meridian, forms the base line, and the observed direction of the moon, when it crosses the meridian, will give us the angles at the base, from which the distance can be calculated. This distance is, in round numbers, 238,000 miles, or about ten times the circumference of the earth. A good pedestrian could travel that distance in 23 or 24 years. The determinations of the moon's distance are so accurate that the probable error does not exceed 15 or 20 miles. This distance is not, however, constant, because the moon's path is not a circle but an oval, the eccentricity of which amounts to about $\frac{1}{8}$.

The size of the moon's diameter is determined by measuring its apparent diameter in the telescope, the difficulty of the operation consisting in the fact that the brightness of the disk causes it to present a circumference which is not defined with perfect sharpness. Having measured the apparent diameter of the moon, and knowing the value of the earth's diameter, as seen from the moon, a simple proportion will give us the moon's real diameter, 2159.6 miles, or about the $\frac{1}{10}$ part of the distance between the earth and the moon, that is to say, 120 moons placed in a line would fill up the distance. The determinations of the value of the moon's diameter are correct to within two or three miles. Then, as the volumes of spheres are to each other as the cubes of their diameters, the volume of the moon is $7930^3 \div 2160^3$, or about $\frac{1}{49}$ that of the earth, that is, 49 moons rolled up together would make a ball as large as the earth. The determination of the density, and consequently of the weight, of the moon is more difficult than that of the most remote of the planets. One method of accomplishing it consists in studying the effect on the tides when the attractions of the sun and moon conspire to raise them, and when they act in opposite directions. In this way a relation is established between the masses of the sun and moon. If the sun and moon were at equal distances from the earth, their attractions would be in direct proportion to their masses, but the sun is about 400 times further off; hence the law that the attraction is inversely as the square of the distance must be also applied. This method, however, is not very accurate. A better one depends on the fact that the earth and the moon revolve about their common center of gravity, and that the position of that center must necessarily depend on the relative masses of the

two bodies. The earth describes a much smaller orbit about that center than the moon, and would be displaced from the position which it would have if it traveled alone around the sun. This displacement will appear in the observed position of the sun, and can be calculated. It has been found to be $6\frac{1}{2}$ seconds of arc; and from this it results that the earth's mass is $81\frac{1}{2}$ times that of the moon. Hence the moon's density is $\frac{3}{8}$ that of the earth.

The force of gravity on the moon is only $\frac{1}{6}$ of that on the earth, that is, a man able to jump up 3 feet on the earth would be able to jump up 18 feet on the moon's surface.



Fig. 1.—THE CRATER OF PLATO.

The moon's path around the earth would always be an oval of exactly the same dimensions if the earth alone acted upon it; but owing to the attraction of the sun, the moon is sometimes in advance and sometimes behind the place she

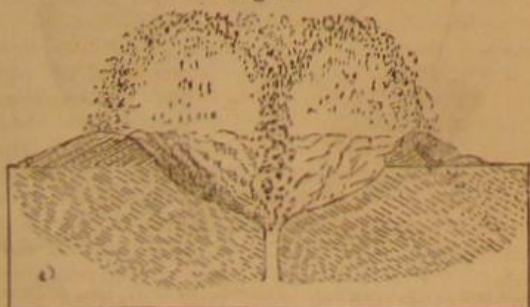


Fig. 2.—THE CRATER WARGENTIN.

ought to occupy according to the laws governing motion in an elliptical orbit. These attractions are called perturbations and necessitate as many as 60 to 75 different corrections in calculating the position which the moon is to occupy at any required moment. Up to about 1870, the calculated position of the moon was only about two miles out of the way; but since that time, some error has crept into the nautical almanac, and the difference is now 5 to 7 miles. Professor Airy thinks some perturbation must have been overlooked. If a mariner had a watch that kept perfectly Greenwich time, he could always ascertain his position by consulting the nautical almanac. The moon is indeed a perfect timekeeper in its passage across the heavens; but its motion is so slow that it would take very accurate observations to obtain the time from its position.

According to Zöllner, the light of the moon is only $\frac{1}{400,000}$ of that of the sun. If the sky were packed full of moons, it would not give us quite as much light as the sun. It has been found that, when the moon is half full, it does not give half as much light as when it is full, because the mountains then cast shadows, while there are no shadows at all on the full moon. From a study of these shadows, Zöll-

Fig. 4.



ner has found that the average slope of the hills and mountains on the moon must be about 52° , without reference to their height.

Zöllner has ascertained, by experiment and calculation, that the moon reflects only about $\frac{1}{4}$ of the light it receives, in other words that its reflective capacity is the same as that of sandstone rock. Snow reflects 78 per cent, granite 10 per

cent, and marble 50 per cent. Sir John Herschel had come to the same conclusion. "I have frequently," he stated, "compared the moon setting behind the gray perpendicular façade of the Table Mountains illuminated by the sun just risen in the opposite quarter of the horizon, when it has been scarcely distinguishable in brightness from the rock in contact with it."

Until quite recently, it was supposed that no heat could be detected in the rays of the moon. They were collected in the focus of a large mirror, and directed upon a very delicate thermopile connected with a galvanometer. The lecturer had this apparatus upon the table, and showed the effect of the heat of a candle placed at a distance. It was discovered by Melloni that the feeble heat coming from the moon was rendered insensible by the earth's atmosphere, and Professor Smyth, on repeating the experiment on the summit of Teneriffe, about 10,000 feet above the level of the sea, discovered that the heat of the full moon was equal to $\frac{1}{4}$ that of a candle placed at a distance of 15 feet from the apparatus. The moon is hottest between the last quarter and the new moon, because it has then been exposed continually to the sun for 14 days. Its temperature must then be from 400° to 500° ;

sults are well known. The lecturer then threw upon the screen a large number of photographic representations of the moon's surface, showing the principal mountains, craters, valleys, and other points of interest. Some of these mountains have a height of 18,000 feet.

Fig. 1 represents the crater of Plato, the bottom of which has been observed to grow darker as the sun rises higher above it, which is by some supposed to be due to its being covered with some sort of vegetation. Notice also the ravine below, looking like a deep railroad cut. Fig. 2 is a view of the crater Wargentia, which presents the peculiarity of being entirely filled up, while the other lunar craters resemble that of Kilauea on one of the Sandwich Islands, a great basin about 1,000 feet deep, out of which numerous cones rise.

Fig. 3 is a representation of a comparison of craters on the moon with the appearance of the volcano Vesuvius and the country in the vicinity of Naples. Both were studied topographically and modeled in plaster of Paris, with the most scrupulous care, by Nasmyth, and the accompanying engraving was made from a photograph of his models.

The only difference between the lunar craters and that of

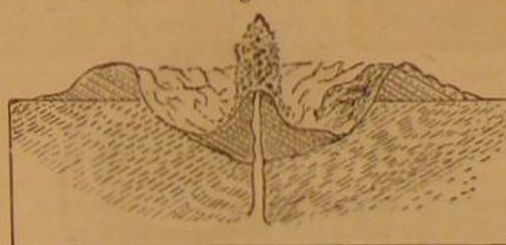


Fig. 3.—SURFACE OF THE MOON.

again, during the long night, 14 days long, it must cool down to something like 100° to 200° below zero.

No atmosphere exists on the moon, as is proved by the absence of refraction, when the moon passes between us and a

Fig. 5.



star. If there were an atmosphere, we would continue to see the star some time after its disappearance behind the disk of the moon; but this is not the case. The star is instantly extinguished. The observations on this point are so accurate that a refraction of 4 seconds of arc could be easily detected. If therefore, there be an atmosphere at all, it must be more rare than that under the receiver of an air pump after we have exhausted all the air we can.

The moon always turns the same face towards the earth, and we only obtain glimpses of the edges of the opposite hemisphere, on account of the irregularities of its motions called librations. Hence we conclude that it turns once around its axis while it performs one revolution about the earth; otherwise we should see the whole of its surface.

If the moon ever had an atmosphere, as is very likely, it may have been absorbed, or it may have entered into combination with the rocks on its surface; but this is mere conjecture. As there is no atmosphere, there is also no moisture, and hence the moon cannot be the abode of beings constituted as we are.

It has been stated that the powerful telescopes of modern times bring the moon down to within 40 miles of us; but that is not sufficient for distinguishing any of the works of inhabitants, if there be any. A city would appear as a mere dot.

The surface of the moon has been carefully studied with the telescope and by means of photography. The first successes by the latter method were obtained by Dr. J. W. Draper, of New York, in 1840, and Rutherford's excellent re-

VESUVIUS AND ADJACENT COUNTRY, ITALY.

Kilauea is that the former are of enormous dimensions. Copernicus, for example, is 56 miles in diameter; its central mountain is 2,400 feet high, and the terraces around it rise to a height of 12,000 or 13,000 feet above the bottom, and are composed of ridges, cliffs, and deep ravines.

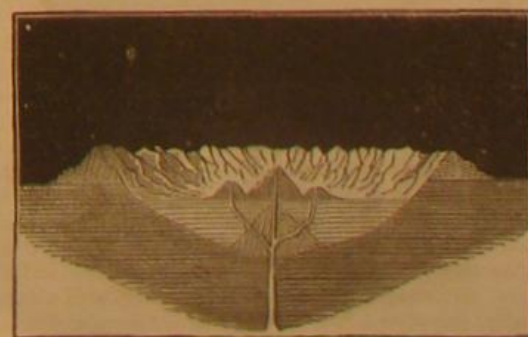
Figs. 4, 5, and 6 illustrate Nasmyth's theory of the formation of these craters. The first eruption, being probably the most violent, projected the stones, lava, etc., to a considerable height, and these, in falling, would accumulate in ridges encircling the crater at some distance. The height to which they would rise would be much greater than on the earth, because the force of gravity is much less.

During the second eruption, which would probably be less violent, the projected matter would not rise so high, and in falling back it would cause the formation of the central cone.

During the subsequent eruption, when the force of the volcano was almost entirely spent, the lava would simply overflow and tend to fill up the basin to a greater or less extent.

There is a gradual change going on in the orbit of the moon, which deserves to be noticed. The ellipticity of the earth's orbit is slowly diminishing, so that it is becoming

Fig. 6.



more and more nearly circular, and its area is becoming greater every year. As a consequence the earth tends to draw the moon nearer and nearer to itself, and causes it to describe a constantly diminishing orbit. The end of this might be to pull the moon down upon the earth. The change is, however, so exceedingly small that we need not entertain any apprehensions for our posterity for many years. C. F. K.

IMPROVED RAILWAY SWITCH SIGNAL.

The invention herewith illustrated is a new apparatus for moving switches, which is so constructed that it is impossible to move the lever without the latter turning the colored light or flag so as to indicate the position of the switch to approaching trains. This is effected by mechanism which causes the lever to turn one quarter of a revolution whenever it is altered, and thereby to rotate the lantern or flag attached to its upper portion.

The lever, as shown in Fig. 1, is made in two parts, the lower one of which is attached below to the rod leading to the switch, and above is forked. The upper part of the lever is pivoted at the fork of the lower part, as shown in Fig. 2, and is supported by a cap at A. Said upper portion carries the red and white lantern and flag as shown, so that, when rotated one quarter revolution on its vertical axis, the change may be made from white to red signal, or vice versa. Formed on the lever is a rounded lug, B, Fig. 2, which, when the lever is perpendicular, enters a curved recess, C, Fig. 1, in the upper edge of the top bar of the switch stand. It will be obvious that, when the lever is moved in either direction, the lug, in leaving the recess, will cause the lever shaft to make a quarter revolution. On the under side of the upper bar of the switch stand, and just beneath the recess, C, is a lug, D. Also on the lever shaft are ears, E. When the lever is moved from an inclined to a vertical position, the ears, E, strike against the lug, D, and turn the lever so that the lug, B, is caused to enter the recess, C. It will be clear also that, when the lever is thrown completely over from end to end of its frame, by the means already described, it will be turned half a revolution.

By this mode of operating the switch, the last displacement, even to one third of an inch, is indicated by the signals being turned, so that it is practically impossible for the switch tender to set the switch wrong without the same being clearly shown. There are no extra movements beyond those ordinarily required, namely, to unlock, throw back, and lock the lever. Patented through the Scientific American Patent Agency. For further particulars relative to rights to manufacture, etc., address the inventor, Mr. Charles W. Spayd, Box 620, Wilkes-barre, Pa.

Hard Paper.

French manufacturers have a method of rendering paper extremely hard and tenacious by subjecting the pulp to the action of chloride of zinc. After it has been treated with the chloride, it is submitted to a strong pressure, thereafter becoming as hard as wood and as tough as leather. The hardness varies according to the strength of the metallic solution. The material thus produced can be easily colored. It may be employed in covering floors with advantage, and may be made to replace leather in the manufacture of coarse shoes; it is also a good material for whip handles, the mounting of saws, buttons, combs, etc. A great deal is used in large sheets for roofing. Paper already manufactured acquires the same consistence when plunged, unsized, in a solution of the chloride.

SHEPARD'S IMPROVED CHURN.

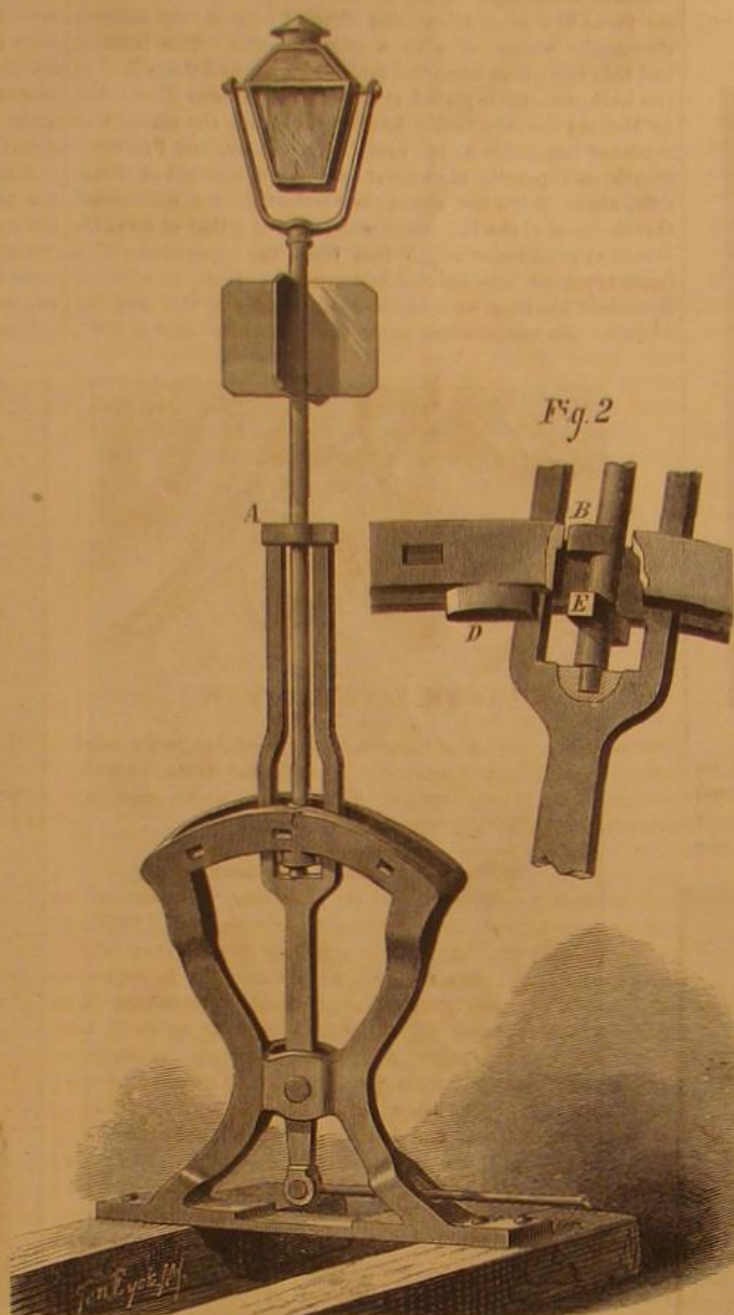
We illustrate herewith a churn of novel construction patented through the Scientific American Patent Agency, March 28, 1876, by Mr. E. W. Shepard, of Wilmington, Ohio. The arrangement of parts is such that the cream is thrown



into violent agitation, while swift currents are set up and instantly broken, so that the butter is brought, it is claimed, with great rapidity.

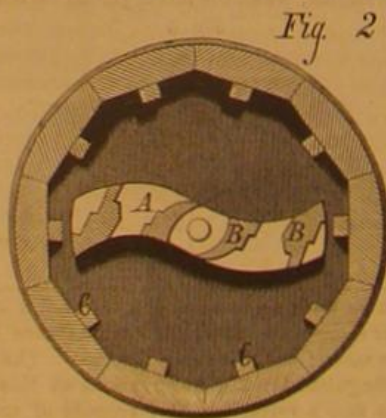
The body of the churn is formed of ten staves, flat on their

inner sides, as shown in the section, Fig. 1, so as to produce a number of interior angles. In the bottom of the vessel is an antifriction socket to receive the dasher shaft, to the lower part of which shaft are attached the S-shaped crossbars, A, Fig. 1. Between said bars are secured four upright paddles, B, placed with their forward edges inclined inward, and rabbeted or concaved on the sides, as shown in section in Fig. 1.



SPAYD'S RAILWAY SWITCH SIGNAL.

By means of the simple arrangement of crank and bevel gearing shown above the churn, the dasher is swiftly rotated, and the currents produced in the cream are broken by the angles in the churn body, and also by the ribs, C, arranged around the interior. The mode of securing one half of the



churn cover is plainly exhibited in the engraving; the other half is loose, so that it can be taken off to allow of the inspection of the progress of the churning.

For further information, the inventor may be addressed as above.

Bleaching Shellac.

Lemming's method for the purification or bleaching of shellac consists in either boiling with, or filtering the hot alcoholic solution through, well burnt and recently heated animal charcoal. When necessary, this operation is repeated until the solution is colorless, when it is filtered through fine silk, and finally through fine filter paper. To insure success, the solution should be in the proportion of about five ounces of shellac to one quart of alcohol (rectified spirits of wine). Dr. Hare published a method for bleaching the lac by means of chlorine. He dissolved one part of shell or seed lac in a boiling solution of one part of pearl ash in about eight parts of water. The solution was then cooled and impregnated with chlorine gas till the lac was all precipitated. The precipitate thus obtained is white, but the color deepens by washing and consolidation; dissolved in

in alcohol, lac bleached by this process yields a varnish which is as free from color as any copal varnish. The application of chlorine must be made by a person acquainted with chemistry. Hence chloride of lime is safer as a bleaching agent, the lime being afterward dissolved out from the precipitate by dilute muriatic acid.

Atmospheric Ammonia.

M. Schloesing has recently studied the exchange of ammonia which takes place between water and the atmosphere. The water which condenses in the clouds and which falls in rain would at first sight appear to despoil the air of all the ammonia contained. Such, however, is far from being the case. Sixteen analyses conducted at different temperatures show that the water never dissolves all the atmospheric ammonia. At 77° Fah., the water takes up but 3 per cent of the total amount of ammonia in the air; at 68°, 4 per cent; at 59°, 6 per cent; at 50°, 11 per cent, and finally, at 41°, 19 per cent. From this it appears that, the lower the temperature, the greater is the amount of ammonia dissolved.

THE BENTON PATENT COPPER FLOAT.

In the annexed engraving is represented a copper float, such as is used in steam boilers, etc., made by a new process. The manufacturers claim that the float is the only one yet invented which will stand the action of steam in a boiler for any length of time, without leaking and becoming filled with water, and consequently useless. The device, it appears from actual test, is extremely strong, and is altogether indifferent to the effects of sudden and wide changes of temperature.

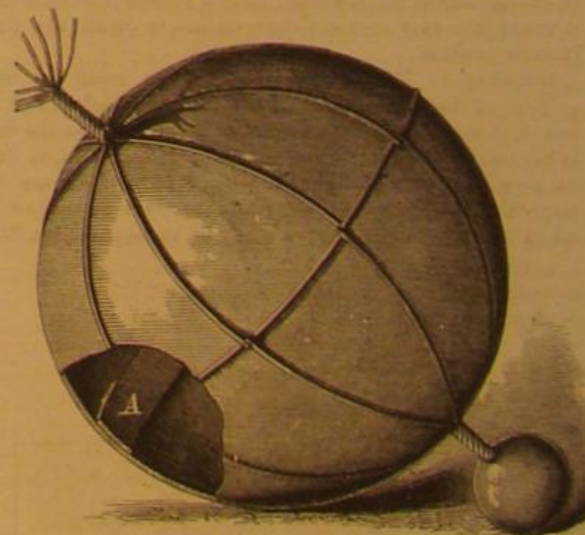
Two hollow hemispheres are spun out of sheet copper of suitable thickness. These are connected at their circumference by being slipped upon a circular ring, A, that is slightly beveled at the edges, to correspond with the curvature of the hemispheres. The latter are also beveled so as to bind intimately on the ring when they are driven thereon.

The float is next suspended in a galvanic copper solution, and a perfect joint is made by the filling up, with copper, of the beveled edges of the hemispheres. The float is then removed, and such of the solution as has entered the interior is blown out through two small holes, bored for the purpose. These holes are then plugged and the plugs, covered with a thin film of copper, by again placing the globe in the solution. A second layer may also be deposited over the joint to secure the strong and perfect connection of the parts.

The test to which these floats are subjected are very severe. They are first placed in a steam-tight tank, into which steam is admitted until they are highly heated, the water of condensation being constantly drawn off. The steam valve is then shut, and cold water is suddenly admitted until the tank is about three fourths filled. The lower half of

each float under test is thus suddenly covered, while the upper half remains hot. Under these conditions, we are informed, no signs of separation at the joint, through contraction or expansion of the metal, appear. The floats are also tested with a cold water pressure of 400 lbs. to the square inch. The manufacturers state that they have experimented with the joint by beating out the copper until it was as thin as tissue paper; and that they will guarantee it to stand until the copper itself is eaten away. Our engraving shows a mode of slinging the float in copper wire, to which a brass is attached to keep the device in proper position.

Patented through the Scientific American Patent Agency, February 1, 1876. For further information address the



manufacturers, Messrs. Benton, Gore & Co., Milwaukee, Wis.

GREASE can be removed from billiard or other cloths by a paste of fuller's earth and turpentine. This should be rubbed upon the fabric until the turpentine has evaporated and a white powder remains. The latter can be brushed off, and the grease will have disappeared.

THE CONE-BERRIED SOLANUM.

Among the plants suitable for indoor cultivation, those which bear berries are generally considered to be the most ornamental. Among the solanums, which are very much sought after for this purpose, the subject of our illustration is likely to become a general favorite. There are several varieties of this species in cultivation, which differ from each other in size and in form of the berries; but the conical berry of the *solanum capsicastrum* is somewhat of a novelty. A correspondent of the *English Garden*, from the pages of which we select our engraving, states that a plant of this variety, about 1 foot high and 1 foot in diameter, was recently seen profusely covered with these berries, which are, when mature, of a bright orange color. It is one of a batch raised from seed sown in March. The seedlings were potted out; and about the last week in May, they were planted out on a western border. Here they received no attention, except occasional waterings until the autumn, when, just before the berries commenced to color, they were carefully lifted, and potted in 32-sized pots. They soon formed new roots, having been kept in a close atmosphere for a few days after lifting; and at Christmas, the plant, from a portion of which the accompanying illustration was prepared, was loaded with berries, handsome both in shape and color. We have no doubt that this variety, when better known, will be generally cultivated.

TWO BEAUTIFUL YUCCAS.

The yucca family of shrubs are all, we believe, indigenous to this country; and they are now being much cultivated in Europe, and are highly valued for the boldness and vigorous growth of their foliage, and their ornamental appearance when in blossom. There are many varieties of them, some of which we have heretofore illustrated; but we believe that the two specimens here presented are little known to the general public.

The *yucca Treculeana* was first brought from Texas in 1850, and is much cultivated in France, whither it was first imported by Mr. Trecul, after whom it is named. It forms a very stout stem, and the fully developed leaves are from



SOLANUM CAPSICASTRUM.

inches broad, the outer ones narrower, and distinctly banded, or more or less tinged, with bright red down the back; or sometimes the flowers are almost a pure white, seedlings varying much in this respect.

Chinese Method of Welding.

The *Ironmonger* says that Mr. Balestier, who went on a mission to the East, describes the Chinese method of welding cracked ironwares by cementing them with cast iron while in a liquid state. In a cast iron pan, which Mr. B. required to be welded, the operator commenced by breaking the edges of the fracture slightly with a hammer, so as to enlarge the fissures, after which the fractured parts were placed, and held in their natural positions by means of wooden braces. The pan being ready, crucibles, made of clay, were laid in charcoal and ignited in a small portable sheet iron furnace, with bellows working horizontally. As soon as the pieces of cast iron with which the crucibles were charged were fixed, it was poured on a layer of partly charred husks of rough rice, or paddy, previously spread on a thickly doubled cloth, the object of which is to prevent the sudden cooling and hardening of the liquid metal. While in the liquid state, it is quickly conveyed to the fractured part under the vessel, and forced up with a jerk into the enlarged fissures, while a paper rubber was passed over the protruding liquid inside of the vessel, making a strong, substantial, and neat operation.

Two Bee Questions Answered.

A couple of vexed questions about bees were recently answered by Professor C. V. Riley, at a bee keepers' council in St. Louis. The first query was: Do bees make or gather honey? The Professor says they make it. Thus does Science proclaim that the venerable Dr. Watts was wrong when he

asserted that the busy bee "gathers honey all the day from every opening flower." The nectar lying in flowers never would become honey, says Professor Riley, no matter how manipulated by the hands and minds of men; but it is taken up by the bees and passed through a state of semi-digestion and excretion, resulting in the manufacture of what is called honey, yet still retaining in part the flavor or perfume of the flowers, by which we determine one kind of honey from another. Professor Riley's views were corroborated by a paper read by a botanist and chemist of Louisiana, describing the process of change undergone by nectar in the stomach of the bee, in order to become honey.

The second question is an interesting one to fruit raisers, as it involves the mooted point of whether bees do or do not injure fruit. Professor Riley, on being appealed to, produced an illustration of the order of hymenoptera, stating that the mouth of the bee is the most complicated structure in insect anatomy. Its construction however, is the same as that of the wasp, and no one denies that the wasp is capable of destroying fruit. The Professor thought beekeepers were prejudiced against the idea of such power in the possession of a bee, but it is true. Still, while being capable of injuring fruit, the bees rarely do so except in seasons of severe drought and when urged by necessity. This fact is no derogation to the usefulness of the insect, for the exercise of its power as a pollinizer is of undoubted value to the orchardist, even with all its depredations upon fruit.

A NEW FORM OF FERNERY.

We publish herewith an engraving showing a cross section of a new form of fern house, recently erected in Scotland by Messrs. Boyd, of Paisley. The arrangement is so well shown in the illustration that but little description is necessary. The building here shown is of large size, 30 feet high in the center, and 60 feet long; but the plan can of course be adapted to circumstances. In this case strong brick walls are carried up both sides and at one end, from which the rockwork slopes irregularly down on either side, forming a miniature ravine with a water all,



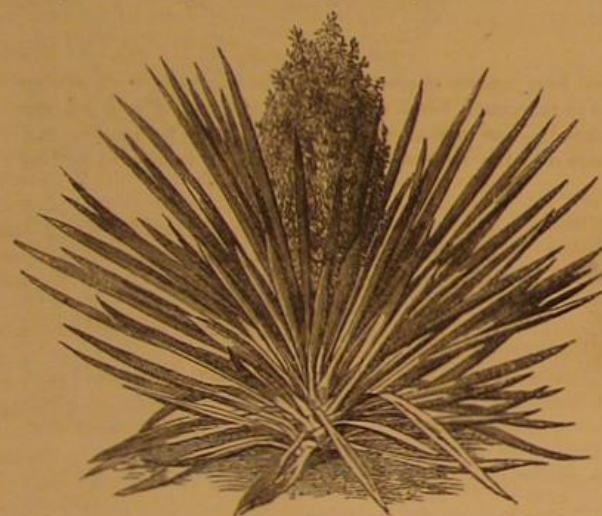
the stream meandering round the crags and among the stately tree ferns. The building is covered by a glass roof, supported by strong iron girders, and the interior is left without a single pillar or tie rod, leaving the space wholly to the ferns and rockwork.

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

A correspondent of the *Ohio Farmer* gives the following method of making a simple corn marker: Take a plank 7 feet long, 16 inches wide, and 1½ inches thick. Pin this on three blocks, 5 by 8 inches thick and 16 inches long, putting one block at each end and one in the middle. With this length the marker is easily turned at the ends. For a tongue, get a smooth tough pole, and fasten it to the center of the plank in such a way that, when the team is hitched up, the marker will stand level. Now take a lath, 1 by 2 inches thick and 10½ feet long. Drive a staple into the plank at each end of the marker and one in the middle. Pass the lath through one outside staple and the end just through the center staple. Fasten a chain to the outer end, and the marker is completed. The chain marks where the middle block or marker must follow the next time across. The lath must be shifted at each end so as to keep the chain on the unmarked land. When using it, stand on the middle of the plank and keep the tongue directly over the chain mark. If the first mark was made straight, all the rest will be so, and equally distant apart. If desired, the lath may be fastened to the middle of the plank with a bolt, so that it can be turned from side to side without lifting. Secure it in position by another bolt, passed through the lath and plank, near the ends of the latter.

It has recently been found by experiment at Cornell University that, as farmers generally know, by sprouting garden seeds before sowing there is a gain of three or four days in the time of ripening.

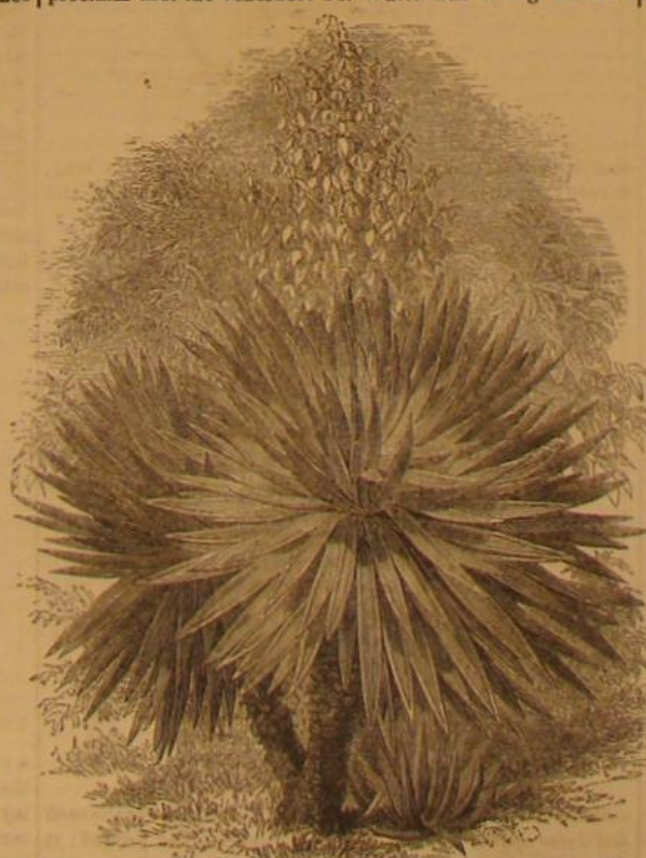
For plating iron, steel, brass, lead, and zinc with tin, the following has recently been proposed. Prepare a solution of perchloride of tin by passing chlorine through a concentrated solution of salt of tin. Dilute the pro



YUCCA TRECULEANA.

3 to 4½ feet long by 2 to 2½ inches broad, dark green on both sides, with a hard, sharp point, and very fine regular teeth. The inflorescence of this species is an exceedingly dense, many branched panicle, not much overtopping the nearly erect upper leaves. A warm sheltered situation should be selected for it. It will be seen that this plant is one of the most remarkable of its kind as regards general appearance and the size to which its leaves attain. The flower stem, which rises up to a height of 3 feet or more, consists of a mass of branchlets about 18 inches in length, bearing multitudes of cream-colored flowers, shining as if glazed.

Our second specimen is the *yucca gloriosa* of Linnaeus; and it has well been styled the most majestic and beautiful of the genus. It has been known in Europe since the end of the sixteenth century; and it was, when first found on our coast (from Florida to North Carolina), about 2 feet or rather more in height. It is now, however, by no means uncommon to see these plants reach as high as 10 or 15 feet, in favorable situations; sometimes, indeed, it stands when in blossom as high as 20 feet, the blossom with its stalk attaining 6 feet. This species flowers freely in sunny situations, after it has reached a certain age; but plants from suckers are usually some years before they flower. The trunk branches after flowering, and it is not unusual to see old specimens many times branched, forming very heavy heads, which should be supported. It is very variable, though, perhaps, not more so than the other species of the genus, but its varieties are better known. The ordinary form or type has upwards of 100 leaves in a dense tuft, 24 to 30 inches long, and 3 inches broad at the middle, narrowed in luxuriant specimens gradually upwards to a brown sharp point, and downwards to 1½ to 1¾ inches above the base; it is green or slightly glaucous when young, very rigid, even the outer older ones remaining erect; face, concave, with longitudinal folds; margin, entire, with a distinct brown line; panicle, 3 to 6 feet long, according to the vigor of the plant, not downy or hairy; flowers, large, among the handsomest of the genus, almost globular or goblet-shaped, when the petals are incurved; petals, oblong, narrowed into a point at the top, from 2½ to 3 inches deep, the inner ones from 1 to 1½



YUCCA GLORIOSA.

duct with 8 or 10 times its volume of water, and filter if necessary. The article, half scoured with sulphuric acid, is to be polished with sand and the scratch brush, then washed with water, and hung by a zinc wire for 10 or 15 minutes in the perchloride of tin solution. Afterwards take it out, rub it with the scratch brush, dry it, and polish it.

If brooms are wet with boiling suds once a week, they will become very tough, will not cut a carpet, and will last much longer. A handful or so of salt sprinkled on a carpet will carry the dust along with it and make the carpet look bright and clean. A very dusty carpet may be cleaned by dipping the broom in cold water, shaking off all the drops, and sweeping a yard or so at a time. Wash the broom and repeat until the entire carpet has been swept.

The following compound is said greatly to facilitate the washing of clothes. Dissolve 2 lbs. of bar soap in about 3 gallons of water as hot as the hand can bear. Add 1 tablespoonful of turpentine, and 3 of liquid ammonia. Stir, and steep the clothes in this for three hours, keeping the vessel tightly covered. Then wash the clothes in the usual way. The soap and water may be used a second time, in which case a teaspoonful of turpentine and the same amount of ammonia must be added. This treatment is calculated to save much labor in cleansing summer clothes stained by fruit, etc.

Very durable and neat mats for floors can be made from old coffee sacks. A piece of the bagging of suitable size is bound with some dark fabric and secured to a frame of four laths. By means of a hook of wood or iron, like an enlarged crochet needle, carpet tags are carried through the material so as to skip every other thread and to leave loops half an inch long, the ends, of course, being fastened. Old red flannel can be used to make tasteful borders.

A new and simple blowpipe consists of two large jars connected near the bottom by a piece of rubber tubing. One is filled with water and put on a shelf above the table on which the other stands. The water passes into the latter, and, in doing so, forces the air out through a stopper and piece of tubing into the blowpipe, which is supported separately. With jars of 1 gallon capacity and a blowpipe with an orifice of 0.016 inch, a steady air current of 10 minutes' duration is obtained; and to keep it up, one has merely to transpose the jars.

A compound of grease and zinc filings is found to be an excellent preventive against rust for iron bolts inserted in wood. It is used to line the bolt hole.

Pulverized anthracite coal, spread on the soil to the depth of half an inch, is said to have a remarkable effect in brightening the colors of flowers of potted plants.

To keep striping pencils in good shape and ready for use, grease them with tallow from a candle and spread the hair straight on a piece of glass; keep them preserved from dust.

A good bronze paint for iron is made of ivory black, 1 oz., chrome yellow, 1 oz., chrome green, 2 lbs. Mix with raw linseed oil, adding a little japan to dry it. This gives a fine bronze green. If desired, gold bronze may be put on the prominent parts of the object when the paint is not quite dry, the powder being rubbed in with a piece of plush.

A weak solution of cyanide of potassium cleans gold lace well.

To prepare skins for fur, mix bran and soft water sufficient to cover the skins. Immerse the latter and keep them covered for 24 hours; then remove, wash clean, and carefully scrape off all flesh. To 1 gallon of water (hot) add 1 lb. of alum and $\frac{1}{2}$ lb. of salt. When dissolved and cool enough to admit entrance of the hand, immerse the skins for 24 hours, dry in the shade, and rub. Stir the liquor again, immerse the skins for 24 hours, dry, and rub as before, immerse for 24 hours in oatmeal and warm water, partially dry in the shade, and finally rub until entirely dry. This leaves the skin like white leather, and fit for immediate use.

Never dilute varnish with turpentine, as it kills the gloss. If too thick, warm it by the stove or place the cup on a warm iron.

To bend amber, drop it into hot beeswax. After it has been immersed for a few minutes, remove it, and, holding it before the fire, bend it to the desired shape.

AGRICULTURAL MACHINERY.

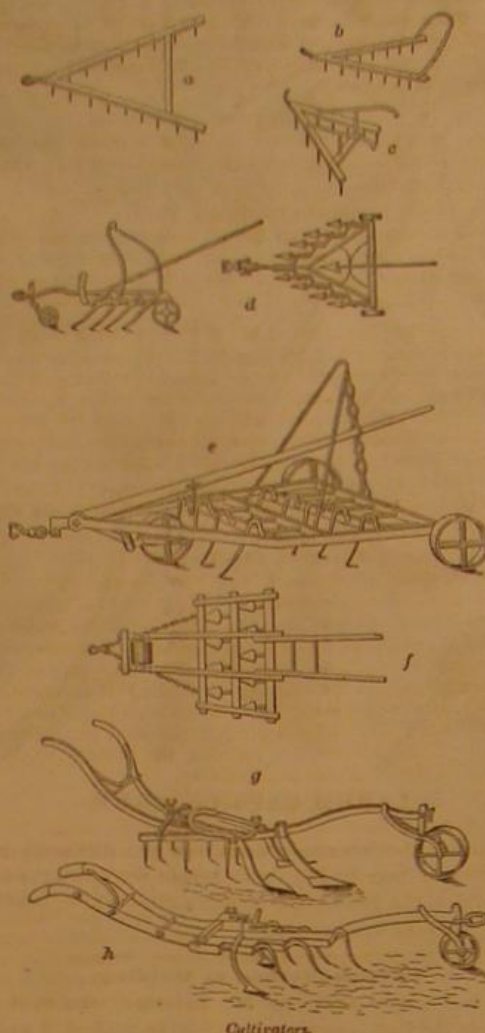
We extract from Knight's "New Mechanical Dictionary," this week, a series of engravings of various agricultural implements, which doubtless will prove of timely interest to farmers. In Fig. 1 are represented several forms of

CULTIVATORS,

under which heading may be included harrows, grubbers, drags, shovel plows, and like implements. The A-shaped harrow, *a*, is well adapted for new ground and in fields where there are occasional obstructions. The rear corners may be readily raised by a hooked stick, so as to allow it to pass a stump without swerving the team. Better still is a bow of hickory, as shown at *b*. Another mode of affixing handles is exhibited at *c*. Wilkie, of Teddington, Scotland, was the inventor of the cultivator proper; he devised the plurality of shares, the expanding frame, and the caster wheel. His cultivator is shown at *d*. The share frame is so suspended from the traction frame as to be raised bodily, by a parallel movement, by means of a single lever at the rear. The teeth are prongs curved to enter the soil obliquely. Finlayson's cultivator, *e, f*, is made of iron, and the prongs are arranged on parallel transverse bars of the frame, which is supported on a caster wheel in front and two wheels at the rear. The depth of tillage is regulated by a lever, which is connected to the carriage of the caster wheel so as to raise the apex of the frame when the lever is depressed, and con-

versely. Wilkie's horse hoe and drill harrow, *g*, has a central fixed share and adjustable side shares, which are expanded or contracted according to the state of the crop or the

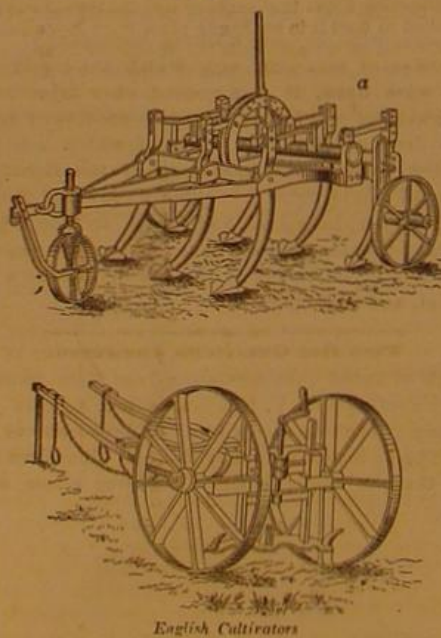
Fig. 1.



Cultivators.

width of the balk. Following the shares is a frame with harrow teeth. Either the share or the harrow teeth may be removed, and the remainder used separately. The depth is adjusted by the caster wheel in front. *A* shows another form, somewhat modified. In Fig. 2, *a* is Colman's cultivator, and

Fig. 2.



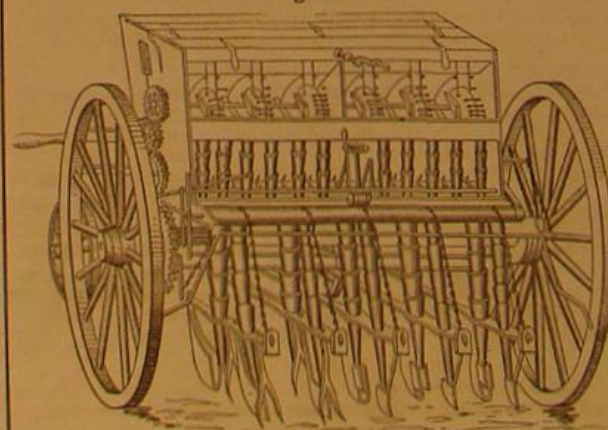
English Cultivators

that below it is known as a skim cultivator with a long, curved, flat share, whose depth is regulated by a crank and screw.

GRAIN DRILLS

were invented by the Chinese, ages ago. Their machine is

Fig. 3.

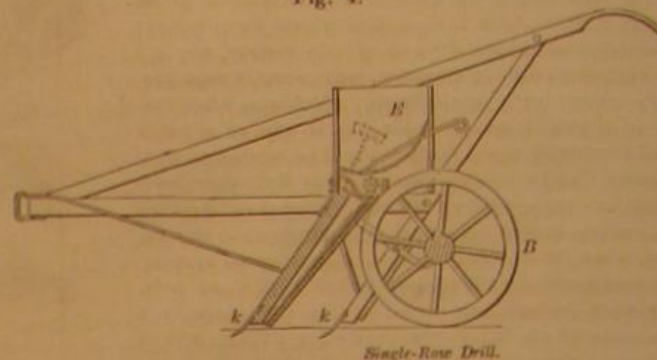


English Grain-Drill.

nothing more than a wheelbarrow with a hopper for the seed and three spouts by which the seed reaches the ground; it thus drills three rows at a time. Fig. 3 is an English grain drill, adapted for performing all the various operations of

seeding and manuring the land. All kinds of grain and seeds may be deposited at any required distances apart and at any depth, either with or without manure. The machines are constructed of various widths and made to deposit the seed in rows from 6 to 15 in number. Fig. 4 is a form of hand drill, mounted upon a stock resembling that of a single shovel plow. Forward is a hollow tube shod with a share and leading the grain from the box. *E*. A share following turns

Fig. 4.



Single-Row Drill.

a furrow upon the sown grain, and the wheel, *B*, following, compacts the soil upon the seed. Fig. 5 is a

LIQUID MANURE CART,

which consists of a tank on wheels for the conveyance of liquid manure, to a field, for distribution. It is made of boiler iron, riveted, and is filled by means of a portable pump

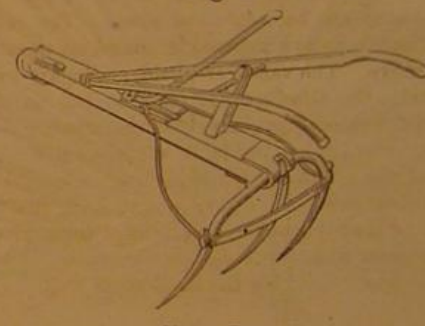
Fig. 5.



Liquid-Manure Cart.

and hose, shown in position. The tank is hung upon centers so as to remain level on inclined ground. Fig. 6 is a manure drag, an implement with hooked tines for hauling manure over the surface of the ground. It is guided by rear

Fig. 6.



Manure-Drag

handles, and a lever is provided, to hold the tines in action or release them at will. *A*

MECHANICAL COW MILKER

is represented in Fig. 7. This is constructed on the principle of the breast pump, with cups for the several teats. The elastic cups communicate with the conical chamber of the diaphragm pump, the piston of which is worked by the handles. The milk is discharged by a spout into a pail beneath. Fig. 8 is a

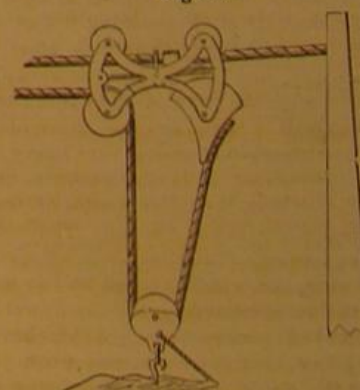
Fig. 7.



Cow-Milker.

HAY ELEVATOR AND CONVEYER by which hay, lifted by the horse fork, is conveyed to distant parts of a barn or mow. It consists of a carriage traveling on a fixed rope and resting on rollers as shown. To one portion of the carriage is affixed the standing part of the hoisting rope, which passes down through

Fig. 8.



Hay Elevator and Conveyor.

a pulley attached to the fork, and then to another pulley on the carriage. A guide line is also attached to the lower pulley. The fork, full of hay, is first hoisted a suitable distance, and then, by slackening the guide line, continued pulling on the hoisting rope draws the carriage along the fixed rope to the desired point of unloading.

Torsion Balance and Experimental Radiometers.

At the *soirée* of the Royal Society, Burlington House, April 5, 1876, Dr. William Crookes, F.R.S., etc., exhibited his new devices for illustrating various phenomena connected with the repulsion resulting from radiation.

1. The torsion balance. A light beam having 2 square inches of pith at one end is cemented to a very fine fiber of glass stretched horizontally in a tube, one end of the fiber being connected with a torsion handle, passing through the tube, and indicating angular movements on a graduated circle. The whole is enclosed in glass and exhausted as perfectly as possible. A weight of 1-100th of a grain is so arranged that it can be placed on the pith or removed from it at pleasure. A ray of light from a lamp, reflected from a mirror in the center of the beam, shows the slightest movement. When the reflected ray points to zero, a turn of the torsion handle in one or the other direction will raise or depress the pith end of the beam, and thus cause the index ray to travel along the scale to the right or to the left. If a small weight is placed on one end so as to depress it, and the torsion handle is then turned, the tendency of the glass fiber to untwist itself will ultimately balance the downward pressure of the weight, and will again bring the index ray to zero. When the weight of the 1-100th of a grain is placed on the pith surface, the torsion handle has to be turned 27 revolutions and 353", or 10,073" altogether, before the beam becomes horizontal. The downward pressure of the 1-100th of a grain is therefore equivalent to the force of torsion of the glass thread when twisted through 10,073". One degree of torsion gives a decided movement of the index ray of light, a torsion of 10,073" balancing the 1-100th of a grain, while 10,074" overbalances it: the balance will therefore turn to the 99-100,000,000th of a grain. Weighed in this balance, the mechanical force of a candle 12 inches distant is found to be 0.000444 of a grain.

2. The turbine radiometer. In this radiometer, the vanes are black on both sides, and are inclined at an angle like the sails of a windmill instead of being in a vertical plane. The instrument is not sensitive to horizontal radiation, but moves readily, in one or other direction, to a candle held above or below.

3. Radiometer with the vanes blackened on both sides, showing rotation in either direction according to the way the light falls on them.

4. Radiometer showing the very small amount of residual air which is present. The vanes of the radiometer move past a piece of pith suspended by a silk fiber. Rotation with great velocity scarcely causes sufficient motion of the residual air to move the suspended pith.

5. Radiometer showing rotation of the glass envelope when the vanes are held in fixed space. The radiometer carries a magnet on its arms, and is floated on water so as to be free to move. The vanes are held stationary by an outside magnet. On allowing radiation to fall on the black surfaces of the vanes, the glass envelope rotates.

6. Radiometer having inside it a platinum spiral. The repulsion of the white and black surfaces is equal when the spiral is below redness. Above a red heat the black is repelled more than the white, and rotation takes place.

7. Radiometer with one vane counterpoised by a mirror, showing method of keeping the steel point from falling off the cup.

8. Radiometer constructed of metal, showing reverse movement on cooling.

9. Bar photometer, showing the method of balancing one light by another.

10. Heat engine. A turbine radiometer, having ice below and hot air above, working by difference of temperature.

Sir John Tyndall.

Professor Tyndall, it is reported, has been offered a baronetcy, and his friends are anxious that he shall accept the honor. It is a graceful act on the part of the British government thus to recognize the labors of the eminent investigator, but we think that it will add nothing to his glory. The aristocracy of scientific discoverers and workers is superior to one involving mere social precedence; and a man who by dint of persevering labor has attained a lofty place in the former stands far higher in the estimation of the world than does any member of nobility, however exalted his rank.

GOLD can be applied to glass by mixing it in a powdered state with mastic and adding a little borax, so that a paste is formed. Having been painted with this compound, the article is heated in an oven. This burns the gum, while the borax vitrifies and so fixes the gold.

Recent American and Foreign Patents.**NEW CHEMICAL AND MISCELLANEOUS INVENTIONS.****IMPROVED SIGNAL LANTERN.**

George J. Cave, Elizabeth, N. J.—This is an arrangement of concentric shells and colored glass tubes, so combined that the mechanism may be readily and quickly adjusted, by a rotary movement, to display a white light, a red light, or a green, or other arrangement of colors, and which shall have no projecting arms, handles, or levers to be in the way.

IMPROVED POCKET BOOK FASTENING.

Daniel M. Read, New York city.—This inventor has devised two ingenious fastenings for pocket books. The first consists of a corrugated base plate, between which and a similarly toothed spring cap plate a double catch hook engages.

IMPROVED METHOD OF JAPANNING BUTTONS, ETC.

Charles M. Rhodes, Taunton, Mass., assignor to M. M. Rhodes & Sons, same place.—This improvement in the art of japanning small articles consists in rotating the painted articles over a fire, and in contact with the products of the combustion thereof, whereby the articles are separated, and their coating is dried, preparatory to baking them.

IMPROVED ELASTIC TRACE JOINT.

Benjamin Franklin Rea, La Fayette, Ala.—This consists of a coiled spring fastened between two sections of the trace by attaching one end to each. Inside the coil are a couple of links, also connected to the trace section, so that, when the spring has been extended as far as is desirable, they come into action and take the strain off the spring. The spring is connected to a ring at each end, and the links connect with the trace sections by a screw passing through the ring and drawing the rings against the trace sections by the links.

IMPROVED SHOE FASTENING.

Conrad Mayrele, Beardstown, Ill.—At each side of the opening a fine wire is longitudinally fastened. Metal clasps then attach the two parts together.

IMPROVED TRUSS PAD.

Charles L. Warner, Homer, Iowa.—This is an improved pad for trusses for the cure of hernia; and it consists of a pad connected to the base plate of a ball-and-socket joint, and suitable detaining devices.

IMPROVED COMBINED TOP AND WHIRLIGIG.

Reuben N. Garrett, Ballston Spa, N. Y.—In using the top as a toy, a top-shaped head is placed loosely upon the end of a pin, and the cord is wound upon the said pin, within the fork of the usual top handle. Then by pulling sharply upon the cord, the pin and the head will receive a rotary motion, and the head will be thrown from the pin, and will spin upon the floor. In using the top as a whirligig, the cord is wound upon the pin, within the fork of the handle, and by pulling upon the cord the pin and the head will receive a rapid rotary motion.

IMPROVED LIQUID COOLER.

John Downing, Binghamton, N. Y.—This consists of an ice chest in which are secured a series of jars. In the case of a water cooler the inlet pipe of the first jar is connected with the water supply pipe, and the outlet pipe of each preceding jar is connected with the inlet pipe of each succeeding jar. The outlet pipe of the last jar is connected with the discharge pipe. By this arrangement the water is drawn from the last jar of the series, which is immediately replaced by partially cooled water from the next jar, and so on, the water from the reservoir entering the first jar, so that cold water can be drawn almost continuously.

IMPROVED CLOTHES LINE.

Elias Stillwell, Rockwell, Mo.—The invention relates to means whereby a clothes line may be gradually run out from a given position convenient to the person engaged in the washing operation. This is done as it receives the garments that are to be dried, so that the washer may not be required to go far from the washroom in order to hang the clothes. It also relates to a mode of tightening the line and protecting it from the weather. Endless lines are carried over two rollers, at a suitable distance, one of which is provided with a crank, by whose aid the lines may be caused to travel back and forth.

IMPROVED PAPER BOX.

Charles A. Whedon and Asbury S. Whedon, Cranford, N. J.—This invention consists of a bandbox, constructed in a simple way of two pieces of paper, and a stand for the hat, which is also contrived so as to be made and attached in a manner to economize the cost of construction, and to facilitate its use in a folding box.

IMPROVED HAT HOLDER.

William H. Hampton, Surry, Va.—The invention relates to a mode of securing a hat in church, so that the owner will no longer be compelled to hold it in his hands, place it on an uncleanly floor, or take up room on the seat with it. It consists in applying to the back of the pew a wire holder that is capable, by a rotary movement, of being carried under the seat, the hat being thus out of the way and not at all liable to become soiled or injured.

IMPROVED SIGN PLATE.

Julius Caesar, New York city.—This is an enameled door or other plate that is secured to a metallic border frame and attached thereby to the door, without requiring the direct passage of the fastening bolts through the plate.

IMPROVED BALE TIE.

William Carson, St. Louis, Mo.—This is an improvement in buckles formed in two parts, one of which is provided with a tongue to fit in a corresponding notch in the other part. They are adapted to be locked together, and also readily disengaged by raising one part vertically off from the other.

IMPROVED LOCKET.

David Untermyer, N. Y.—This locket is composed of pivoted parts, one holding a picture on both sides, and having opposite rims that fit over and enclose the pictures.

IMPROVED PROCESS OF PRESERVING BURIAL CASES, ETC.

Albert T. Heyley, Conception, Mo.—This consists in coating wooden burial cases with a composition of glue, alum, saleratus, saltpetre, common salt, bichromate of potash, and water, applying thereto a second coating of glue and bichromate of potash, and a third coating of shellac, alcohol, and bichromate of potash.

IMPROVED AUTOMATIC HEAT REGULATOR FOR FURNACES.

Alvin C. Norcross, Boston, Mass.—This consists of one expanding and contracting part, and another non-expanding part, so placed in the furnace as to be subject to the heat of the furnace for working the regulator by the expanding and contracting part as the heat rises and falls. The part not required to expand is located within a tubular expanding part, having provision for a current of air to flow through it from outside the furnace to keep the other part from heating. The object is to enable a metal rod of ordinary expanding and contracting qualities to be used where a substance of non-expanding properties has been heretofore required.

IMPROVED HORSESHOE.

Henry Gourlier, New York city.—This horseshoe is so constructed that the calks may be readily replaced with new ones when required, and the calks will be held securely in place when the shoe is in use. The tongues, formed upon the bases of steel heel calks, and having projecting forward ends, are beveled and slotted to receive screws, and are caused to enter slots in the same place with the lower surfaces of the shoe.

MACHINE FOR CUTTING STAMENS FOR ARTIFICIAL FLOWERS.

Ambrose Giraudat, Neuve (Norwood P. O.), N. J.—This is an improved machine, including a series of long, straight knives, for cutting threads into suitable lengths for the stamens of artificial flowers. It cuts the threads evenly and does its work rapidly.

IMPROVED SHOT CARTRIDGE.

Thomas Wilkinson, Brooklyn, E. D., N. Y.—This is formed by placing perforated shot upon sets of wires between two wads.

IMPROVED THILL COUPLING.

Levi Moor, Baraboo, Wis., assignor to himself and Willis B. Rich, of same place.—This is an improved device for connecting thills and poles to the axles of vehicles, so constructed as to enable the thills or pole to be easily and quickly detached without the use of any wrench or tool. A spring bar, provided with a point and a flattened bolt, is combined with a thill iron provided with the hole, and a perforated and slotted lug formed upon the yoke of an axle clip.

IMPROVED HORSE BOOT.

Joseph Fennell, Cynthia, Ky.—This is formed with a padded upward extension, and provided with a strap and rubber tube to buckle around the heel of the hoof. The padded upper part is connected with the lower part by flexible straps made flaring upward and downward, and provided with a padded strap to buckle around the fetlock.

IMPROVED MAIL BAG.

E. Walter Roberts, Troy, N. Y.—This invention is an improvement in the class of mail bag locks, whose distinguishing feature is a chain or flexible strap, provided with a series of bolts or hangers, for engaging with a series of staples or keepers. The improvement consists in providing the bag-locking chain, formed of flat links, having hangers, or bolts, increasing in length *serialim*, with an extension in the form of a leather pull-piece, which projects from the pocket in the flap of the bag. Another part of the invention is the construction of the sliding lock bolt, to which the aforesaid chain is attached, whereby an address card, indicating the destination of the bag and the place from which it was sent, is secured in place.

IMPROVED METALLIC SEAL.

Alphonse Friedrick, Brooklyn, N. Y.—This patent covers certain improvements upon the metallic seal for which letters patent were granted to the same inventor, March 14, 1876. To make these seals more secure, one of the disks is provided with a projecting eye or a perforated ear, through which perforation the ends of a shackle wire are passed before twisting them around the stem. This confines the branches of the shackle wire at the edge of the button, with a continuous ring of metal, and obviates the possible separation of the thin parts of metal forming the flange, and thus prevents the opening of the said flange by pulling apart the branches of the shackle wire.

IMPROVED LIGHTING ATTACHMENT FOR ALARM CLOCKS.

Frank Fischlein, Jersey City, N. J.—This is a device for lighting, simultaneously with the release of the alarm, a candle or lamp; and it consists of the connection of the alarm mechanism of a clock train, by a fulcrum and spring-actuated friction lever, that, on its release, ignites a match secured by suitable supporting and gage devices above the candle or lamp.

IMPROVED COMBINED CALENDAR AND TIME PIECE.

Miner H. Paddock, East Clarkson, N. Y.—This invention relates to the improved construction and arrangement of a calendar in a time piece, so combined therewith as to indicate the day of the week and month and the month of the year. The improvement consists in making the calendar devices independent of the effect of the main spring, so that, instead of being operated thereby, they are actuated by the hand of the operator, through the winding stem in the act of winding, by means of which arrangement the fact of the winding of the watch is indicated upon the dial face, and the question as to whether the watch has been wound or not, is easily ascertained by reference thereto. The improvements also serve to simplify the operating parts of the calendar, and consequently render its construction cheaper and its operation more reliable.

IMPROVED WHIP FERRULE.

Dexter Avery, Westfield, Mass.—This improved whip button is constructed with the braided, woven, or knitted cover of thread turned or folded over the end of the mold into the hold for the stock, so as to make a better finish of the ends than is made when the button is covered after being put on the stocks, and also to make finished buttons independently of the stock.

NEW HOUSEHOLD ARTICLES.**IMPROVED FIREPLACE FENDER.**

Henry C. Wesson, Fulton Station, Ky.—This fender is contrived to disconnect at the middle or thereabouts, and swing open, and also to fold up against the jambs in a compact manner out of the way.

IMPROVED CURTAIN FIXTURE.

Michael Haughey, St. Louis, Mo.—This is a curtain fixture that is made without the use of springs. It consists of a curtain roller to which a weighted band is applied, that raises the curtain, while a weighted pawl, locking into a ratchet of the roller shaft, secures the curtain at any height.

IMPROVED ROCKING CHAIR.

Wm. E. Buser, Chillicothe, Ohio.—This improvement relates to the application of an improved fastening or means of connection between a rocking chair and the base platform upon which it is supported and vibrated. The fastening consists of a slotted plate attached to the platform, a hook or arm attached to the rocker and working in the slot of said plate, and a spring arranged to bear upon the said hook or arm. The slotted plate attaches the chair to the platform, and also holds it in proper position thereon. The spring tends to hold the chair seat level in that it counterbalances the weight of the back, which would otherwise cause the chair to assume an inclined position. It also assists in giving the chair an easy rocking motion.

IMPROVED VEGETABLE STEAMER.

Elias Stangeland, Rock Dell, Minn.—This invention relates to a furnace and steaming apparatus for cooking grain, roots, etc., for cattle, also for heating water. It is designed for the use of farmers, livery stable proprietors, and others having the care of stock. It is portable, the several parts may be easily detached and put together, and the consumption of fuel is very economical, while the steam is so applied as to speedily produce the desired effect.

IMPROVED TACK HAMMER.

Willis C. Avery, Wallingford, Conn.—This consists of a tack hammer with a wedge-shaped pene end, having a dovetailed groove diminishing in width and depth from the body of the hammer toward the sharp edge of the pene. This offers a ready means of sticking the tack in, previous to driving it, without using the fingers.

IMPROVED TILTING CHAIR.

Alanson S. Cushing, Buffalo, N. Y.—This is mainly a novel arrangement of flanged hinged plates, rubber blocks, and springs, the whole forming a convenient and desirable device for pivot or screw chairs.

IMPROVED FIREPLACE HEATER.

Samuel Musser, Beaver Falls, Pa.—This invention relates to certain improvements in that class of fireplace heaters which have a hot air chamber in the rear, which is employed in connection with a flue and registers for heating the upper rooms of a building. The invention consists in the particular construction and arrangements of the parts whereby the construction is simplified and a more economical use of fuel obtained.

NEW TEXTILE MACHINERY.**IMPROVED WEFT FORK.**

Caleb H. Warfield, Whitinsville, Mass.—This is a novel construction, whereby the fingers are readily soldered to the arms in holes connected with a groove, so that a cheap method of securing them is obtained. They can be readily be taken out by the application of a hot iron, and others put in.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED REVERSIBLE LOCK.

Edwin A. Kimball, Danville, Ill.—In this device the latch serves also as a lock bolt. The invention consists in combining with a key-holed case and shouldered bolt a double-acting guard, pivoted centrally in a recess of the bolt, having portions thereof curved and provided with projecting teeth, so as to enable the same key to lock the bolt, no matter in which direction it may be turned.

IMPROVED MOUNTING HOOK.

Nels E. Johnsen, Chelsea, Mass., assignor to himself and George W. Gannaway, of same place.—The invention consists in tongued notches formed in the parts of the hook at their shoulders, and the grooved shoulders or projections formed upon said parts at their points, to adapt the parts of the hook to interlock with each other. To open the hook a spring key is withdrawn, and the eyes slipped around upon one of the arms of a pear-shaped thimble, which allows the parts of the hook to be drawn apart.

IMPROVED VEHICLE SPRING.

Thomas Alsop, Elkhart City, Ill.—This consists in combining a ratchet and pawl with springs arranged on shafts and attached at their inner ends to loose sockets. The pressure of the wagon body upon the lever arm is transmitted to the spiral spring and throughout the full length of the same to the fixed socket, the spring being called gradually but entirely into action, avoiding thereby any violent shocks and producing the easy and elastic play of the springs.

IMPROVED VENTILATING CARRIAGE AND CARRIAGE TOP.

Ezra Marsh, Newark, N. J.—This invention proposes to make close carriages in such a way that fresh air, in any desired quantity, may be admitted, and the foul air allowed to escape. The invention consists in a carriage body, having its front top bar and posts made hollow or tubular, and provided with the opening to admit fresh air to the carriage body. The latter is also provided with an air space, made by interposing a sheet of straw board between the upholstery and the walls, through which they are formed. The second invention includes a shield made in two parts, in which are glass panes connected to the dash board by swiveled eyes, so that it may be adjusted to any angle, according to the relative position of dash and top. Another new feature is a frame arranged in connection with the dashboard to hold a rug which is adapted to serve as a foot warmer.

IMPROVED DRAFT EQUALIZER.

Alexander Meharry, Pleasant Hill, Ind., assignor to himself and William Brown, of same place.—A bar is pivoted to the tongue, and to its ends are attached small chains which are secured to hook bars. From one hook bar a chain passes to a pulley on the axle, along the axle to another pulley on the tongue, thence to another pulley on the axle, and then to the other hook bar. To each hook bar a whiffletree is attached. By this construction the points of draft attachment are close to and upon a level with the forward ends of the plow beams; and by adjusting the position of the pulley on the tongue with respect to the axle, the weight of the tongue may be wholly or partly taken from the horses' necks, as may be desired.

IMPROVED WAGON BRAKE.

Jacob Hamelback, Hopewell, Ohio.—This invention relates to certain improvements in that class of wagon brakes in which the back lash of the neck yoke and the forward movement of the vehicle when the team is stopped serve to apply the brakes. The invention consists in the particular construction of devices connecting the brakes with a sliding collar, to which the neck yoke is connected; in the use of a ratchet and pawl, arranged to automatically hold the brakes applied, and to automatically release the same upon the starting of the team. It also consists in the peculiar construction of devices for preventing the application of the brakes while backing.

IMPROVED BARREL HEAD.

John W. Sasser, Jr., Horse Head, Md.—This invention contemplates the manufacture of barrels with heads that may be readily removed without taking off or loosening a hoop, or impairing the strength of barrel. The invention consists in making an expandable barrel head in four pieces, of which two are pivoted to and over a third, while the fourth piece is employed to serve as an expanding key that retains the head tightly in its proper position.

IMPROVED DUMPING WAGON.

Jared Wells, Grand Rapids, Mich.—The bottom of the body is made in three transversely pivoted sections, each of which is connected by a chain to a pulley, and said chains pass to a shaft operated by a lever. By turning the lever the sections are tilted sufficiently to cause the load to slide from the rear ends.

IMPROVED FIFTH WHEEL.

David G. Wyeth, New Way, Ohio.—The object of this invention is to provide an improved swivel coupling for connecting the front spring and axle of carriages, wagons, and other vehicles. It consists in the construction of a sectional socket containing a bearing with two bevels which form a swivel connection between the spring and axle, and in the means of connecting and securing the parts together, the whole being designed to take the place of the fifth wheel and king bolt as ordinarily employed.

IMPROVED AUTOMATIC GATE.

William A. Baker, Morenci, Mich.—This gate is so constructed that it may be opened and closed without its being necessary for the driver to get out of the vehicle. It occupies no space outside of the line of the fence, and its operating mechanism is raised from the ground so as not to be affected by snow and frozen ground, and it closes directly behind the vehicle.

IMPROVED DUMPING CAR.

George A. Gregg, Quarry, Iowa.—The car is mounted on two grooved middle wheels running on the rails, and a single wheel on each side running on plank, by which contrivance the car may be dumped either sidewise or endwise. The middle wheels are the support when dumping sidewise, and the side wheels when dumping endwise. The sides and end of the box are so pivoted to an overhead support that they keep closed when the car is upright, and open self-actingly when the car dumps.

IMPROVED VEHICLE SEAT LOCK.

George E. Robison, Locke, N. Y.—This is an ingenious lever and clamp for fastening a seat to the body of a vehicle, in such a way that the seat can be readily moved forward or back upon or detached from the body.

IMPROVED DUMPING WAGON.

Montgomery C. and Henry L. Meigs, Romney, Ind.—This invention relates to certain improvements upon the dumping wagon for which letters patent, No. 166,125, were granted to the same inventors, July 27, 1875. It consists in a detachable skid adapted to be attached to the end of the wagon and used as an inclined way, up which the loading scoop is drawn, by means of a doubletree of greater length than the width of the wagon, the horses being attached to the ends thereof, and walking upon opposite sides of the wagon. The invention also consists in guard rails, placed upon the sides of the wagon to prevent the doubletree from deranging the devices for lifting the bottom sections of the wagon. It also further con-

sists in a support, pivoted to the bottom of the front end of the wagon and provided with a notch which, when the end of the wagon is raised, falls upon the reach, from the action of gravity, and supports the wagon in an elevated position so as to accommodate the front wheels in short turning.

IMPROVED SAWING MACHINE.

William S. Saunders, Atlanta, Mo.—This invention consists of a portable sawing machine, containing a crank and band wheel contrivance for working the saw by a crank and pitman. The essential features are a ground hook, for holding and fastening the log, a helper for holding small sticks, and a shaft and truck wheel contrivance to facilitate the moving of the machine from place to place.

IMPROVED CAR MAT.

John W. Groat, N. Y.—The object of this invention is to furnish an improved mat for the floors of cars, saloons, and other places, which shall be simple in construction, strong, firm, and durable, and at the same time capable of being made very ornamental. This mat is formed of strips of wood which, by screw bolts carried diagonally between corner pieces and a flanged center piece, are securely fastened in place.

IMPROVED HAND CART.

Joseph M. Jones, Paris, Ky.—This inventor combines the body of a hand cart, a cranked axle, and an elliptic spring, the latter resting on the sliding frame, while the cranked axle supports it. He is thus enabled to apply the spring to take up the shock of jars and jolts without lifting up the body too high above the wheels.

IMPROVED AUGER.

William H. C. Smith, Pawtucket, R. I.—This is an improved hollow auger for boring wooden conductors, being so constructed that the wood is chipped up to allow it to fall down through the auger without clogging. Bits of different size and height are used, and there is a new way of attaching the bit to the auger by side projections, grooves, and a fastening screw.

IMPROVED CIRCULAR SAWING MACHINES.

James T. Baggs, Bridgeport, O.—This invention consists of an improved arrangement of contrivances for automatically adjusting the tilting table laterally at the same time and by the same operation that it is tilted, the lateral adjustment being to shift the saw slit so as to compensate for the misplacement of it relatively to the saws, caused by the tilting. The invention also consists of a novel contrivance of the apparatus for adjusting a couple of saws on an A-shaped frame, whereby both saws may be adjusted simultaneously, or either independently of the other.

IMPROVED DUMPING WAGON.

Samuel B. Steward, Urbana, O.—By operating a lever or pinion, a shaft secured in the frame meshes into a curved rack attached to the forward part of the body. This raises said portion of the body, when, by suitable devices, the end board may be released and the contents discharged.

IMPROVED SHUTTER AND DOOR FASTENER.

Thomas B. Rogers, Jr., Brooklyn, assignor to Max Hallheimer, of same place.—A couple of bars, of unequal length, are joined together at one end. One is joined to the window and the other to the window sill, so that they swing with the blind. At the joint of the bars is a clamp by which the joint can be readily made rigid to fasten them and hold the blind in any position; and besides the clamp, there is a stud which drops into a socket in the sill to fasten the blind shut.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED NAIL EXTRACTOR.

Lorenzo D. Browne, Shawnee, Ohio.—This consists of an auxiliary claw mounted on the top of the ordinary claw bar in such a manner that it can be used when the spike is too high for the main claw, and can be swung out of the way readily when not required for use.

IMPROVED FRICTION CLUTCH.

Edwin F. Williams, Bald Mountain, Col. Ter.—This invention consists of brakes which are drawn against the face of a disk wheel by wedges moved by a sliding head on the shaft, in turn operated by the levers.

IMPROVED LEATHER-SKIVING MACHINE.

Edwin B. Stimpson, Brooklyn, N. Y.—This is a machine by which thin, light, and soft leather can be readily skived in pieces of any form. It consists of a table, which can be revolved and turned in any direction, and also raised and lowered at will, over the central portion of which is a rotary skiving cutter, a rotary presser, and a rotary guide for the leather. The leather is placed on the table, and the latter turned or moved about so as to pass the margin to be skived under the cutter. The work is effectually and rapidly performed on leather of any thickness, quality, or condition.

IMPROVED MAGNETO-ELECTRIC MACHINE.

Thomas W. Livingston, Ainsworth, Iowa.—This invention consists of straight magnets with alternating polarities, and wire coils wound in one direction, combined with a revolving shaft having at both ends as many radial arms as there are magnets. The shaft is provided with a commutator in connection with conducting springs, attached to a pivoted lateral block set by a lever into a notched plate for producing currents of uniform or reversed polarities.

IMPROVED CAR COUPLING.

John H. Lands, Reigelsville, Pa.—This consists of a pivoted link that is raised from the top side or platform of the car by a laterally swinging link frame. The latter is retained in position by a sliding guard piece with front plate until pushed back on the approach of the car to be coupled, so as to drop the link over a coupling hook.

IMPROVED CAR COUPLING.

James B. Smith, Hepworth, Ontario, Can.—This invention relates to certain improvements upon the car coupling for which letters patent were granted to the same inventor on October 26, 1875; and it consists in the improved attachment of the drawbar to the car. The rear end of the drawbar is recessed, and in the recess is arranged a box over which the drawbar slides, which box swings on a vertical pivot and constitutes the connection with the car. Upon each side of this sliding box and arranged in the recessed drawbar are disposed independent springs, which arrangement enables the buffer spring to be made stronger or lighter than the draw spring, as may be desired.

IMPROVED NUT LOCK.

George E. Jordan, Angola, Ind.—This inventor proposes a continuous strap or plate with slots or recesses for several nuts, said plate being secured by washers and keys at the ends.

IMPROVED GOVERNOR FOR STEAM ENGINES.

Christ Ackermann, Young America, Minn.—This improvement consists in the peculiar construction of parts whereby the connection between the valve and the balls of the governor is broken whenever the belt breaks and the balls drop, so that the valve automatically closes as soon as the accident occurs, and the speeding of the machinery is prevented by cutting off the steam.

IMPROVED BOAT-DETACHING HOOK.

Robert McMaugh and Archibald McMaugh, St. Catharines, Canada.—This consists of a pair of hooks, surrounded at the middle by a pivoted loop which ordinarily holds them closed. The loop is held in place by a pin entering one part of the hook and being held there by a spring. A cam arrangement is added, so formed that, when it is turned to bring its lever upward, it may force outward the spring, withdrawing the pin from the hook and allowing the loop to be raised.

IMPROVED COKE OVEN.

Sebastian Stutz, Pittsburgh, Pa.—This improvement consists in the arrangement of zigzag passages below the bottom of the coking chamber and upon the sides between the inner and outer walls whereby a more uniform heat may be maintained, and also in the employment of a reservoir for the collection and utilization of the waste gases.

IMPROVED MACHINE FOR CUTTING BOOT STRAPS.

John E. Plummer, Hornellsville, N. Y.—This invention is designed for cutting boot straps, but is applicable also for cutting straps used in harness, trunk, and saddle making. It consists in a framework carrying a revolving shaft having a leather holder provided with a set of automatically operated clamping fingers or springs, which clasp the leather to a holder, in combination with a stationary knife which, as the leather holder revolves, cuts off the length of the strap, and a series of stationary knives which sever the cut section of leather into a series of straps.

IMPROVED PACKING FOR CAR AXLE BOXES.

I. Benedict, Richmond, Va.—This invention relates to means for packing the axle boxes of cars and other vehicles so as to furnish a gradual supply of lubricating material to the journals, and consists in the application of cork or analogous substance, so that oils of a liquid character only at ordinary temperatures may be as readily employed as those that assume a more solid form, and so that the boxes may be safely manipulated even by unskilled persons.

IMPROVED GUARD FOR RAILROAD CROSSINGS.

Lyman L. McCrea and Robert V. Coon, Troy, N. Y.—This is a device for preventing horses' feet from getting caught upon the spike heads, or between the rail and planking, at railroad crossings. It consists in a guard having one edge formed to fit upon the flange and into the neck of the rail, and its other edge formed to fit against the edge of the planking. It is concaved upon its upper side, and provided with a flange and lugs to underlap the planking and the flange of the rail between the ties.

IMPROVED DIE FOR MAKING HAMMERS.

Henry W. Kip, Buffalo, N. Y.—This invention consists of dies contrived in a novel way for shaping, riveting, and other like hammers, and punching the eyes in a drop press at one blow, and also partly separating them from the rod.

IMPROVED BELTING.

John Neumann, Brooklyn, N. Y.—This consists of broad metal links with notches in the ends, forming loop-shaped projections for interlocking. The projections of one are arranged in the notches of the other, and a couple of pins are inserted and so arranged that they roll one on the other when the chain bends around the pulleys. Sliding friction in the connection of the links is thus avoided. The invention also consists of plates attached to the sides of the link to adapt the belt for grooved pulleys. Said plates are so arranged as to fit the sides of a tapered groove, and have a little flexure in the connection with the links, so that they accommodate themselves to the sides. These plates are connected to the links in a simple and inexpensive manner, which also constitutes a part of the invention.

BUTTON-SEWING ATTACHMENT FOR SEWING MACHINES.

John W. Fries, Salem, N. C.—This consists of a clamp for holding the buttons under the needle arranged on a shifting plate, which is worked to right and left alternately with the operation of the needle by a little vibrating cam on an elbow lever worked by the needle bar, and which is itself vibrated by the plate which carries the clamp.

IMPROVED PUMP.

John K. J. Foster, Horbury, near Wakefield, England.—This consists in constructing the displacer in the form of a hollow cylindrical sheet metal vessel, with a tube running through the same longitudinally, so that several of the displacers may be placed upon the same pump spear, if desired.

IMPROVED BURNISHING MACHINE FOR BOOTS AND SHOES.

George E. Burgess, Hudson, Mass., assignor to himself and Waldo B. Brigham, same place.—This consists of a rotary burnishing tool, constructed in conical form to fit the beveled shape of the edges of shoe shanks, and having a head which fits the upper edge. The head at the same time constitutes a guide, by which to aid the operator in applying the shoe to the tool. A friction pad is combined with the tool, to afford the heat necessary to the efficient action of the tool.

NEW AGRICULTURAL INVENTIONS.

IMPROVED MILK COOLER AND STRAINER.

Charles Weineis, Bloomingdale, Ill.—This is an improved milk cooler and strainer, by which any quantity of milk may be cooled in quick and effective manner for transportation, the cooler allowing also the ready detaching and cleaning of the parts. The invention consists of an outer water receptacle, a milk receiver, with bottom strainer and threaded tube screwing into the bottom tube of the outer receptacle, and of an interior cooling can, with spiral winding rib, forming the channel for the milk to pass through to the outlet tube.

IMPROVED BEE HIVE.

Caleb E. Bost, Davidson College, N. C.—This invention relates to an improved construction of bee hive designed to give greater security to the bees from the attacks of moths and millers, and which shall be more convenient in handling and better adapted to promote the health and prosperity of the bees in all seasons. It consists in the construction and arrangement of the entrance to the hive for keeping out moths and millers, and in a supplemental upper section for the hive, which can be taken off or placed on according to the requirements of the season.

IMPROVED RAKE.

Glover Hawley, Hawleyville, Conn.—The object here is to make rakes that have become loose upon the handle as firm and strong as new ones. A plate of wood or metal, made wider at its forward end, and with two holes to receive the middle teeth, is secured to the handle and head.

IMPROVED WEANING BIT FOR CALVES.

John H. Bailey and Louis Loupee, Toledo, Iowa.—This is an improvement on the anti-sucking bits for calves for which letters patent have been granted to John H. Bailey, under date of November 9, 1875, so that the animal has a better chance to eat and drink without covering up the ends. The invention consists of a tubular suction bit, which is made of two centrally hinged sections, open at the ends, which rings are attached to stationary staples projecting toward the rear of the bit sections.

Business and Personal.

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Agricultural Implements and Industrial Machinery for Export & Domestic Use. R. H. Allen & Co., N. Y.

The Patent Lubricating Compound of Chard & Howe, 134 Maiden Lane, is reported by Prof. Thurston, of Stevens Institute, Hoboken, to the American Institute, as first in order of merit. Silver medal awarded.

25 per cent extra power in steam engines, or an equal saving in fuel, guaranteed by applying the R. S. Condenser. T. Bault, Con. Eng'r, Gen'l Agt., N. Hav., Ct. For Sale—42 vols. Sci. Amer., Sept. 1850, to Jan. '76, compl. \$43. Address C. L. L. P. O. Box 399, Allentown, Pa.

To Mfrs and Machinists—Parties desiring Self-Feeders attached to Machines formerly fed by hand, or Improvements otherwise, address Inventor, Box 773, N. Y.

Trip Hammer for Sale Cheap—100 lb. Head. Has never been used. Also Watt Steam Hammer, 1500 lb. Head. Used about two years. Address Edgar L. Kinney, Cambridgeport, Mass.

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

Patented Invention of real merit wanted—No notice taken unless particulars specified. Address A. E. H., Station G, New York City.

The Photo-Engraving Co. have been obliged to remove from 62 Courtland St. to a larger building at 67 Park Place. Their Relief Plates for Newspaper, Book, and Catalogue Illustrations are rapidly taking the place of Wood Cuts and are unsurpassed. See advertisement in another column of this paper.

Wanted—A Marine Engineer, with some capital for partnership to a valuable invention. A great fortune is offered to a speculative man. Address to J. Ch., P. O. Box 202, Bristol, Conn.

See Boult's Paneling, Moulding, and Dovetailing Machine at Centennial, B. 3-55. Send for pamphlet and sample of work. B. C. Mach'y Co., Battle Creek, Mich.

Use Blake's Belt Studs for Leather or Rubber Belts. Greene, Tweed & Co., 18 Park Place, New York. New 4 H.P. (link) Engine, \$75. Look 6, Taunton, Ma.

For Sale—35 in. x 16 1/2 ft. Lathe, \$400; 31 in. x 10 ft. do., \$250; 15 in. x 3 1/2 ft. do., \$125; 15 in. x 3 ft. do., \$100; 9 ft. Planer, \$400; 6 ft. do., \$325; Prof'g Machine, \$300; Lincoln Miller, \$200. Shearman, 45 Courtland St., N. Y.

The Bastet Magnetic Engine for running Sewing Machines, Lathes, Pumps, Organs, or any light Machinery, 1-32 to 1/2 horse power. Agents wanted. Address, with stamp, 1113 Chestnut St., Philadelphia, Pa.

Parties manuf'g Door Knobs to Order, send address to W. H. Gonne, Architect, Chatham, Ont., Can.

Scroll Saw Blades, best quality, made to order, and Sheet Steel cut to pattern, by A. Coats, 108 Hester St., New York City. Send for List.

For Sale—At a great Bargain, Grain Elevator, Hay Press, and Warehouse, all in excellent repair and good location. Address C. A. Gieckler, Farmington, Iowa.

Machinist's Tools, second hand, which must be sold in order to close up an old partnership. For pamphlet, giving full description of each tool, address Steptoe, McFarlan & Co., 214 West 2nd St., Cincinnati, Ohio.

Baxter Wrenches fit peculiar corners. Prices reduced. Greene, Tweed & Co., 18 Park Place, N. Y.

The French Files of Limet & Co. have the endorsement of many of the leading machine makers of America. Notice samples in Machinery Hall, Centennial Exposition. Homer Foot & Co., Sole Agents, 22 Platt St., New York.

Yacht & Stationary Engines, Sizes 2, 4, 6 & 8 H.P. Best for Price. N. W. Twiss, New Haven, Conn.

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

Corrugated Iron—Iron Buildings, Roofs, Shutters, Doors, etc. Moseley Iron Bridge and Roof Company, Office, 5 Day St., New York. Send for circulars.

For 2nd Hand Portable and Stationary Boilers and Engines, address Junius Harris, Titusville, Pa.

\$1,000 for any Churn equal to the "Prize." A. B. Cohn, 197 Water St., New York.

Centennial Exhibitors, buy your Belting in Philadelphia, from C. W. Army, 148 North 3d St., and save freight and trouble. Satisfaction guaranteed.

Wanted—Charge of Weaving Department, Cotton or Satin, by a practical, experienced man. Address A. B. C., P. O. Drawer No. 5, Greenville, N. H.

Trade Marks in England.—By a recent amendment of the English laws respecting Trade Marks, citizens of the United States may obtain protection in Great Britain as readily as in this country, and at about the same cost. All the necessary papers prepared at this Office. For further information, address Munn & Co., 37 Park Row, New York City.

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

Shingles and Heading Sawing Machine. See advertisement of Trevor & Co., Lockport, N. Y.

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

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

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

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

Hotchkiss & Ball, Meriden, Conn., Foundrymen and workers of sheet metal. Fine Gray Iron Castings to order. Job work solicited.

American Metaline Co., 61 Warren St., N. Y. City.

For Solid Emery Wheels and Machinery, send to the Union Stone Co., Boston, Mass., for circular.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon, 470 Grand Street, New York.

Spinning Rings of a Superior Quality—Whitinsville Spinning Ring Co., Whitinsville, Mass.

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

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

Temples and Oilcans. Draper, Hopedale, Mass.

All Fruit-can Tools, Ferracute Wks, Bridgeton, N. J.

Wind Mill Rights Cheap—One county in each State to give for introducing the mill. For terms, &c., address E. S. Smith, Good Hope Ill.

Notes & Queries.

A. K. will find, on reference, that the perpetual motion absurdity in most of its forms is discussed in vols. 23 and 24.—R. J. will find formulae for calculating the strength of boilers on pp. 116, 165, vol. 23.—F. W. can nickel plate iron castings by following the directions on p. 235, vol. 33. J. S. can clean marble by the method detailed on p. 333, vol. 32.—J. W. H., J. C. W., C. S., F. J. M., J. D., R. M., 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) R. M. C. says: We have an engine 7 1/2 inches diameter by 20 inches stroke. The steam ports are 4 x 3/4 inches, with a 1 1/4 inch steam pipe. We use 60 lbs. steam boiler pressure, cut off at 1/2 stroke, and run at 150 revolutions per minute, using 3/4 to 1 cord hard wood per day. We have written to a firm in regard to a governor for the same, and have received a reply that the steam pipe should be not less than 2 1/2 to 3 inches, as the steam now has to travel through 1 1/4 inches pipe at the rate of 15,000 feet per minute, to keep up with the piston. Is this so? A. The steam pipe is too small if you wish to get full power out of the engine. Under the circumstances, it seems to be large enough, and you could probably carry a lower boiler pressure, and open the throttle a little more.

(2) C. C. E. asks: What time of the year is best for cutting oak timber for fence posts? A. There is some difference of opinion on the subject, but we think the weight of authority is in favor of cutting the timber in spring or autumn.

(3) C. L. M. asks: 1. What proportion has the focus of field lens of a Huyghenian negative eyepiece to the eyeglass, as used in compound microscopes? A. The field lens has about double the focal length of the eye lens, and their distance apart is one half the sum of their focal lengths. 2. What proportion has the aperture to the focus? A. The aperture of each is one half the focal length.

(4) W. O. asks: During the first quarter revolution of the driving wheel of a locomotive (the wheel pressing upon the rail), does the point in the circumference marking the exact top thereof move a greater distance forward than the exact bottom of the same? A. Yes.

(5) W. G. says: I have tried zinc in my boilers for preventing incrustation, and find it very good. I wind strips of copper around it. I put in a 3 feet by 10 feet boiler about 20 lbs. in 3 to 4 lbs. ingots. I put some on the bottom, and some on top of the flues, near the heads.

(6) M. B. M. asks: 1. How much water would Montgolfier's hydraulic ram discharge at the spindle valve in raising 100 gallons 25 feet above the supplying fountain? A. It would depend on the head and the efficiency of the ram. 2. Would it discharge any more at the spindle valve to raise the same amount 50 feet high? A. Yes, other things being equal.

(7) J. H. H. says: Our town is situated on a limestone rock bed, with a river running through it; and when the water runs over the dam, the windows and doors of the houses within a quarter of a mile of it shake. Is the shaking caused by the water falling on the same strata of rock that the foundations of the houses stand on, or by concussion of the air caused by waves, etc.? The fall of the water is about 12 feet. A. We incline to the first hypothesis.

(8) C. G. B. asks: How much water is evaporated from a pond of given area (say 100 by 300 yards) in the course of a year, and how much daily in warm weather? A. In general practice, the average evaporation per 24 hours is taken at 1/8 of an inch in depth. This only gives an approximation for estimates. Of course, for any particular locality, it must be determined by experiment.

(9) H. F. S. asks: Would two half circles of round iron, 1 inch in diameter, placed in curved slots made to receive them, bear a sudden and great force, tending to separate two blocks connected by them, without straightening? A. Thus arranged, they would form a very strong connection.

(10) I. L. B. asks: 1. What effect is produced on the temperature of air by its being compressed? A. It is increased. 2. Is this effect intensified by the extent of compression? If so, what is the law? A. See p. 123, vol. 33. 3. How much can air be compressed? A. It is only limited by the strength and durability of the machinery. 4. What would be the effect of heating or cooling air, when compressed, after it is permitted to expand? A. Heating increases, and cooling decreases, the volume or the pressure. 5. Has any automatic device been contrived by which air can be compressed, so as to give it an expansive power of two or more atmospheres, and where can a description of such device be found? A. There are numerous machines of this kind. You can obtain descriptions from nearly any dealer in machinery.

(11) D. C. S. asks: 1. Is zinc paint as good as oil paint for the outside of a boat where it will come in contact with the water? A. Our experience, which is, however, quite limited, is rather against the use of zinc paint under such circumstances. 2. What is the best composition to use in cleaning the brasswork on a boat? A. Bath brick with oil answers very well. 3. What composition is the best to put on ironwork of a boat to give it a smooth black surface that will last? A. Black varnish made from petroleum is very good.

(12) H. M. W. says: 1. I am making a small engine, with a cylinder 1 1/4 x 3 inches. What should be the size and weight of fly wheel? A. Make it 10 inches in diameter, to weigh 12 or 15 lbs. 2. I wish to make a horizontal boiler 14 inches in diameter and 2 feet long, with a flue 8 inches in diameter, using the flue for a fireplace. Would this leave sufficient water space? A. Yes. 3. Would cast iron heads do? A. We do not recommend their use.

(13) J. J. says: 1. You state that some kinds of cast iron become casehardened to a high degree by friction and wear. Is there any particular mixture of cast iron that will become thus casehardened? A. All cast iron casehardens by friction. The harder the metal is, the more it casehardens. 2. Is there any known method of casehardening either wrought iron or cast iron by the application of any substance while in motion? A. No.

(14) H. P. M. asks: I am making a pair of engines with live steam jackets on cylinders. Is there any better mode of effecting economy by preventing radiation? A. Steam jackets are advantageous in some cases, and in others it is doubtful whether their use is beneficial. Much depends upon the conditions under which the engine is operated, and more, probably, upon the design and management of the jacket.

(15) L. H. F. says: 1. We often see, in the morning and evening, when the sky is partly clear, streaks running to or from the sun. What causes them? A. They are caused by a portion of the sun's rays passing through openings in the clouds, while the adjacent portions are obstructed by the clouds. 2. Why does more snow fall after sunset than during the day? A. The heat of the sun retards its forming. 3. Some say that a noon mark for the summer season will not do for winter, that the sun is farther west. Is this true? A. There are but four times in a year in which the sun will be on the noon mark at noon. These are April 15, June 14, August 31, and December 24. The sun is either fast or slow the rest of the time. 4. What causes a circle around the sun? A. These are called parhelia, and are caused by the sun's light being refracted by moisture or frost in the higher portions of the atmosphere.

(16) H. J. W. asks: Is there any acid that will burn iron plating as deep as 1/2 an inch or more? A. You may try a hot mixture of muriatic and nitric acids with water. We do not, however, think that any method of this kind will prove very successful.

(17) J. H. H. asks: Does the virtue of gypsum for fertilizing land consist in the amount of sulphuric acid combined with the lime? If so, how can I determine the relative amount of acid in two different parcels? A. It is generally believed that the favorable action of gypsum upon vegetation is due to the absorbed ammonia which is yielded up. Putridity gives rise to the formation of carbonic acid, which combines with the lime of the gypsum, leaving carbonate of lime and sulphate of ammonia. This explanation of the efficacy of gypsum-dumping, as it is termed, is however insufficient. The investigations of Mayer have shown that in clayey soils the oxide of iron, etc., affords larger and better combinations with ammonia than gypsum. The quantity of gypsum used is about 5 cwt. to the acre, containing and realizing at the most 2 1/2 cwt. of carbonate of ammonia. Mayer's researches, however, show that in an acre of field land there are 272, and in chalky soil 158, cwt. of carbonate of ammonia contained. According to Liebig's late researches (1863) it appears that the gypsum gives up to the earth a portion of its lime in exchange for magnesia and potassa. But it must be borne in mind that pulverized gypsum, as well as unburnt gypsum, when brought into contact with a solution of potassa, sets into a difficultly soluble mass. We must, then, wait for an adequate theory until the several reactions have been more closely studied.

(18) C. R. C. says: I wish to convert waste silk into its raw state. How can it be done? Being twisted, it is almost useless. Is there any chemical process by which the twist may be disengaged and the substances converted into floss? A. We know of none.

(19) C. A. B. & B. ask: How can we make a waterproof glue, solid and tough at ordinary temperatures, but which can be softened by heat? A. Melt together in an iron pot equal parts of pitch and gutta percha; apply while hot.

How can we make artificial camphor, described by Dr. Ure? A. Transmit the dried hydrochloric acid gas into the artificially cooled essence of turpentine so long as it is absorbed. As soon as this absorption ceases, the compound must be submitted to the action of a freezing mixture of snow and salt, by which it is separated into two portions, one of which crystallizes while the other remains liquid even at 0° Fah. The production of the liquid compound is favored by elevation of temperature. If the temperature of the essence be raised to 215° Fah. during the absorption of the hydrochloric acid, the liquid compound only is formed. Both the solid and the liquid are found, on analysis, to possess the same composition. The solid body has been termed hydrochlorate of camphene or of dadyl. It crystallizes in white prisms, which have an aromatic smell and taste resembling those of ordinary camphor. It is insoluble in water; alcohol dissolves one third of its weight of it. This artificial camphor melts at 230° Fah., and boils at 320°, at the same time undergoing partial decomposition.

(20) H. L. asks: How can I make gasoline, for burning in a stove which I am constructing? A. Gasoline is obtained as a product of the distillation of petroleum. It is among the lightest oils that come over on the first application of heat, its volatility and inflammable nature rendering it a dangerous substance in inexperienced hands. It would be cheaper and safer for you to purchase one of the stores in question, and with it

explicit directions for its manipulation, rather than attempt the construction of one from any directions that we could give you. This answers soveral other correspondents.

(21) A. B. says: We are using inkstands made of zinc plate, but the ink will not keep in them, as the logwood falls to the bottom, and above is clear water. How can I remedy this? A. The common metals are not suitable for the construction of inkstands, no matter what variety of ink is employed. Glass vessels are the best and most economical.

(22) S. P. says: I desire to get a light (from an oil lamp or a coal gas flame) that has no chemical activity or actinism whatever. I understand that a yellow light has no such activity, and that photographers use a yellow light in their dark rooms without its exerting any apparent effect on the negative. How can I do this? A. The actinism of lamp or gas flame is almost imperceptible. Such light is of itself of a yellowish cast, and does not require the colored glass you mention.

(23) J. P. O. asks: What chemical will destroy tinfoil without soiling paper or eating it up? A. Try mercury.

(24) W. J. F. says: Please give me a formula for protoxide of iron. Can it be made by any other method than passing dry hydrogen over the red oxide? A. Yes. The monoxide is thrown down from its solution as a bulky, whitish hydrate, by the addition of a little solution of potassa; it soon becomes brown, however, if allowed to remain in contact with the air, by the absorption of oxygen.

(25) C. D. M. asks: Can dynamite be diluted to a degree that it will lessen its explosive properties, so that it can be experimented on by inexperienced persons without danger of serious results, and at the same time retain its characteristics so that its actions may be understood? A. Such experiments could not possibly be made free from danger. The dilution you suggest is not practicable.

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

D. F. M.—It contains no silver.—J. C. H.—The inorganic constituents of the sample are alumina (considerable), potassa, soda, lime, and traces of iron and strontia. It would require a complete analysis to determine the organic constituents, which form a very considerable portion of the substance.—W. R. F.—No. 1 is gum of *artocarpus incisa*. We cannot say whether this contains any injurious matter or not; but many of the gums of the same species have acid and intensely poisonous properties. We cannot classify No. 2 without an analysis. Nos. 3 and 4 are Florida beans.

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

On a Telescopic Eye. By J. H. H.
On the American Flag. By C. E. N.
On a Boat Protector. By A. M. G.
On the Confederate Banner. By S. D.
On Canine Sagacity. By S. S. M.
On the Flow of Liquids. By C.
On the Erie Canal. By W. J. A.
On a Pico-Hydrometer. By H. W.
On the Wear of Railway Rails. By J. L.
On a Torpedo Experiment. By A. B. R.
On a Remarkable Egg. By J. McM.

Also inquiries and answers from the following:
B. B.—E. L. L.—A. M. S.—G. B. R.—P. B.—J. K.—T. B.—N. W.—J. W.—O. A.—T. R. V.—G. W. S.—C. S. C.—H. S. R.—D. S.

HINTS TO CORRESPONDENTS.

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

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

Hundreds of inquiries analogous to the following are sent: "Who makes air pumps? Where can steam engine indicators be bought? Whose is the best pressure gage? Who sells detonating railway signals? Who sells plate friction electrical machines?" All such personal inquiries are printed, as will be observed in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH
Letters Patent of the United States were
Granted in the Week Ending

April 11, 1876.

AND EACH BEARING THAT DATE.

(Those marked (r) are reissued patents.)

A complete copy of any patent in the annexed list, including both the specification 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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