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A STRONG ROOM FOR VALUABLES.

It has been said that, no matter how much ingenuity is exercised by honest men in devising means for the protection of their valuables, there is an equal amount of inventive genius to be found among rogues, devoted to discovering ways for overcoming apparently the safest of safeguards. We have seen some burglars' implements, which have been captured by the police of this city, which show not merely skilled but highly skilled workmanship, certainly indicating that the maker might have gained large wages had he seen fit to earn his livelihood honestly. Besides manual ability, burglars, in many instances, have been proved to possess thorough scientific knowledge in the use of explosives and of the electric current; so that, all things being considered, safe makers of the present day find themselves met by weapons of offense, which compel them constantly to search for new ways of strengthening their defensive structures.

One of the largest safes that has ever been constructed, and one than which probably no stronger exists, is a banker's security room recently built by Messrs. Hobbs, Hart, & Co., the celebrated lock makers of London, the head of the firm being Mr. A. C. Hobbs, of Hartford, Conn. We give an engraving of it, extracted from the *Engineer*.

The dimensions of the room are 12 feet in hight, 14 feet wide, and 7½ feet deep, embodying 476 feet of planed surface. It is constructed of sixty-two divisions, all of which are most accurately fitted, upwards of 32,000 holes having been used. The engraving shows the door open. The exterior decorations of the room are very effective, the design being a modification of that made for the jewel room constructed by the firm for Her Majesty's special use at Windsor Castle. There are 456 feet of molding, forming the panels and supporting the turreted cornice overhanging the top. It will be seen from our illustration that there are no external indications of any of the sixty-two divisions.

The construction of this room is briefly as follows: First, there is an elaborate base or false bottom formed of plates five eighths of an thickness, on which are placed girders to support the room, forming thereby a chamber underneath the safe, designed to prevent the room from being tunneled into. The recent robberies in Baltimore in 1872, and in Russia in 1874, make such means absolutely in dispensable for perfect security. The whole of this chamber is inclosed by doors, etc., and steps are formed leading to the bottom of the strong room, providing easy access into the interior. As the floor of the room stands some distance above its base, there is an arrangement of steps running on wheels, which can be drawn out opposite the door, rendering the entrance to the room perfectly easy and convenient. Standing in front of the door we find a series of locks, each having different keys to be retained by independent officers, thus providing against the risk of any single individual having access to the room without the presence of the others. Robberies having been effected abroad by drilling the outer plates of safes and strong room doors for the purpose of screwing in steel plugs, after filling the locks with gunpowder, to meet such mode of attack the locks are filled with solid interior packing and with a movable disk, which entirely precludes all access to the interior of the lock. Hence these locks cannot be affected by any explosive, except such as would blow the entire structure to pieces, and bury the experimenter among the ruins. These locks differ from all others in having a series of holding points, all of which must be destroyed before the safe can be broken into, instead of one point only, as is usually the case. As no strong room, safe, or lock can be regarded as continuously secure, unless the possessor of the key has the means, independently of its manufacturers, of making such alterations in it as will virtually make an entirely new combination of the lock, the firm have invented a lock and key which render the possessor independent of any workman, as he can at any moment change the combination of this key on every change of servants, or on any suspicion that a duplicate key has been made, from the original or from a wax impression.

The door as well as the body of the room is formed of iron and steel welded together. The weight of the door alone is nearly two tuns. By means of equivalents for hinges—namely, 2½ inches pin centers—the working of the door, notwithstanding its weight, is perfectly under control. It is held to the room by a series of clutch bolts, passing through interlacing projections into corresponding recesses in the frame, maintained in position by wedge bolts, thus rendering it mechanically impossible to wrench the door by means of levers, wedges, or screw jacks. The exterior plates forming the body of the room are made of ⅝ of an inch wrought iron Staffordshire plates, attached to which are defences of high and low carbonized welded steel and iron, to prevent drilling without previously softening the plates and maintaining them in a softened condition. Steel and iron in such a combination cannot be easily broken in pieces, as would be the case with slabs of steel only. The various means that have hitherto been adopted against such violence in this and other countries have been slabs of cast iron, interlaced with a network of iron bars to strengthen the cast metal, first patented by Newton in 1853, by Lilly in 1856, and improved on by the introduction of spiegleisen by Herring in 1864. The plan of security adopted in the strong room of Messrs. Hobbs, Hart & Co., first employed by them in 1857, unquestionably surpasses all hitherto devised means of defence against skilled violence. The sixty-two sections of the room are connected by outside and inside angle iron 5 x 5 x ¾ of an inch thick, and 6 x 6 x 1 inch thick; while that forming the door is made of angle iron 9 x 6 x 1 inch thick, attached to the plates by means of rivets and screws of the thickness of the iron, varying from 1½ inches to 2 inches apart. Beyond the outer body there is an inner chamber 1½ inches between it and the fireproofing, the object of which is to cut off the heat-transmitting power of the metals. By a system peculiar to the firm, the various materials forming the fireproofing are kept separate, thereby preventing any chemical action, either on the metal or on each other, while the outer body plates are arranged vertically, the burglar-resisting appliances are placed horizontally, and the fire-resisting chambers in opposite directions; thus all the joints are overlapped and crosswebbed. In this room a series of safes of great strength will be placed, thus providing against any possible attacks of skilled burglars or dishonest workmen. Viewing the strong room as a whole, it is a marvel of ingenuity and mechanical skill. The weight is nearly 35 tuns, and the price $12,500, delivered on board ship.

BANKER'S STRONG ROOM.

Power of Gunpowder.

M. De Saint Robert, in an article from his pen in *La Revue Scientifique*, gives the following calculation of the efficiency of a rifled cannon, the diameter of the bore of which is 3 inches, the shell of which weighs about 8·3 lbs., and the firing charge of which is 1¼ lbs. It may thus be estimated: Experiment has shown that the velocity of the shell when it leaves the mouth of the cannon is about 1,300 feet per second. The hight from which the projectile would have to fall to acquire this velocity is 26,800 feet. Consequently the work actually done by the powder is equal to 219,000 foot pounds. On the other hand, Bunson and Schischkoff have found by direct experiment that the heat evolved by the combustion of 2·2 lbs. of gunpowder is equal to 619·5 calories. Hence the heat evolved by the above charge of 1¼ lbs. of powder is equal to 340·7 calories. The mechanical work corresponding to this amount of heat is 1,050,000 foot pounds. Comparing this, which is the possible mechanical work, with the actual work done on the projectile as given above, the ratio is 0 208 for the effectiveness of the cannon, that is to say, about 21 per cent

The Induced Current.—"It appeared as if the current, on its first rush through the primary wire, sought a purchase in the secondary one, and, by a kind of kick, impelled backward through the latter an electric wave, which subsided as soon as the primary current was fully established."—*Tyndall.*

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(Illustrated articles are marked with an asterisk.)

SURFACE ADHESION.

The adhesion of surfaces is of much greater importance and of more general application, in the economy of Nature and in the production of a multitude of phenomena, than appears at first sight. It produces not only the friction between solids in contact (without which it would be very difficult, if not impossible, to attain any stability) but also the retention of liquids against the surface of solids, without which we would be unable to moisten or lubricate effectively any solid surface. This surface adhesion between a liquid and a solid of course increases with the increase of the surface of the solid, and the most direct illustration of this is the fact that, while, for instance, solid stones sink rapidly in water, when crushed they sink much more slowly, and this exactly in proportion as they are more finely divided: thus, while the stones in a river will sink even when the current is swift, the coarse sand will be carried along, and not sink unless the current is slow; while the very finest sand, notwithstanding it consists of the very same material as the stones, will not be deposited at all except where the water is at perfect rest. Hence the coarseness or fineness of the gravel in a river bottom depends on the speed of the current. The most striking illustration of this property is found in the process of elutriation, practised by chemists. It consists in grinding insoluble products with a little water to a thin paste, and then suddenly diffusing the paste through a large quantity of water in a deep vessel, from which, after the subsidence of the coarser portion, which at once takes place, the supernatant liquid is poured into another vessel and allowed to deposit the next fine parts held in suspension. After a time, say 15 or 20 minutes, it is again decanted, and the apparently clear water left to settle for several days, when a small quantity of the very finest impalpable powder is obtained. In the preparation of emery and other polish ing powders of numerous grades of fineness, several vessels are employed; and the muddy liquid, first left to settle a short time, is poured in the second, left to settle a little longer, then poured in the third, and so on. The powder of this hard substance, last deposited, is in so minute a state of division as to possess very great value as a polishing agent.

Adhesion also exists between gases and the surfaces of liquids or solids, and is the origin of many phenomena, the sole cause of which must be looked for in this adhesion. If, for instance, there were no adhesion between the air and the surface of water, there would be no friction between them; and the wind would move freely over the surface of the ocean, and would be unable to raise waves. The proof of this is that, if we cover the surface of water with a film of a lighter liquid, like oil, having less adhesion to air, thus having friction less than that of water with air, the winds will glide over it without raising waves: hence the well known quieting influence of oil on the surface of water agitated by the boisterous winds; and use of this property has occasionally been made with good effect when oil was on hand. It is the same adhesion of air to solids which causes the dust to be raised by wind, notwithstanding that the particles of dust are much heavier than the air.

But the most important example of this force of surface adhesion is the power of the air to hold up fine particles of water in the form of clouds. To explain this apparently wonderful support of water in the atmosphere, so great a man as De Saussure had recourse to the absurd hypothesis that the water particles of which clouds and fogs consist were small hollow, vesicular spheres, like microscopic soap bubbles, with a vacuum inside, and therefore specifically lighter than the air. And microcopists even went so far as to investigate the vapor of hot water, to see if the ascending globular particles were hollow inside. Some of them even asserted that they found this to be so; but every one experienced in microscopic observations knows that it is next to impossible to decide if a very transparent globular object is hollow or solid, especially if it moves in the field of the instrument, as is the case with the particles of ascending vapors. In the light of our knowledge of adhesion, such an hypothesis is utterly unnecessary and uncalled for. We know that the dust of heavy solids, even of the metals, is carried by the air, as is proved by the microscopic observations of the dust collected from the roofs of the houses in any large city; why, then, cannot dust of water be carried upward, and remain suspended? If any one doubt the existence of such water dust, let him observe the spray of the Falls of Niagara, or other large falls, and see how it ascends. It is nothing but water ground to dust by the tremendous fall; and when the atmosphere is not dry enough to absorb it and make it disappear, it will rise to elevations of hundreds and thousands of feet, and form real clouds, which will float away with the others. The size of these particles determines the hight to which they will ascend; the finer will form the upper clouds, the coarser the low, floating fogs. Dr. Angus Smith recently recorded a fog which he observed in Iceland, of which the particles were larger than he ever saw before. It rolled low over the ground like a dust, and microscopic observation convinced him that the particles were not hollow but solid, and he found the diameter to be $\frac{1}{400}$ part of an inch. He also refers in his account to the absurdity of the vacuum hollow sphere theory, which only shows that the greatest inventor is liable to invent erroneous theories.

HOW SOME MOUNTAIN GAPS HAVE BEEN FORMED.

Every one who has visited the Delaware Water Gap, or ascended the Susquehanna from Harrisburg, or passed through the cut where the Potomac has pierced the Blue Ridge at Harper's Ferry, or has seen indeed any one of the numerous gaps made by seaward-flowing rivers through the long mountain ridges which flank the Alleghanies, must have been struck by the question how a comparatively small stream could overcome so formidable an obstruction.

Evidently the river could not have taken advantage of a natural cleft or fissure through the mountain dam, for the strata correspond on the opposing sides of the gap, and the river flows over an unbroken stratum under-running the broken strata of the banks. The gap as plainly denotes a section cut out of the mountain as a notch in a stick does the removal of the wood. The disconnected edges of the strata tell precisely the same story as the severed lines of annual growth on the sides of a wood chopper's cut: the connecting portions of wood and stone have been removed. The question is: How?

The first and most natural supposition would be that the valley, back of the dam, had originally been filled, forming a lake whose outlet was over the ridge above the present river channel: and that, as the outlet was lowered by the wearing down of the obstruction, the lake was drained until the entire valley was laid bare.

This supposition is negatived by the plain fact that it would be impossible to fill the valley to the hight of the ridge at the point of the gap. Before the water could reach that level it would find an outlet elsewhere, where the natural elevation of the dam was less. An excellent illustration occurs a few miles above Harrisburg, where the Susquehanna crosses a flexure of the mountain ridge, cutting twice through the mountains within a few miles, when apparently it might easily have avoided the obstruction by going a few miles around.

Another supposition is that originally the river ran at a level corresponding with the top of the ridge, and that the present valley through which it runs is the result of erosion: while the river was slowly wearing through the hard mountain strata, the softer earth of the surrounding country was washed away through its sinking channel, leaving the more unyielding rocks in mountain ridges. From this point of view, the river is to be regarded not merely as the cleaver of the mountain barrier but as the creator of it, by reducing the level of the adjacent land.

Hitherto this supposition has been the most plausible and the most generally accepted. But another and perhaps truer explanation is suggested in Professor Powell's "Exploration of the Cañons of the Colorado."

As our Atlantic rivers cut through the Alleghany ridges, so the Green River, the chief head stream of the Colorado, pierces the Uinta Mountains, flowing through a series of cañons compared with which our eastern water gaps are in significant. As in the case of the Susquehanna, above noted, the river bursts through the opposing mountains when apparently it might have found an easier passage by going round them. Why did it choose the harder course?

Professor Powell's answer is that it had the right of way. It was running there before the mountains were formed and simply removed the obstruction as fast as it rose in the way.

The contraction of the earth causes the strata near the surface to wrinkle or fold, and such a fold was started athwart the course of the stream now known as Green River. "Had the fold been suddenly formed, it would have been an obstruction sufficient to turn the water into a new course, to the east, beyond the extension of the wrinkle: but the emergence of the fold above the general surface of the country was little if any faster than the progress of the corrosion of the channel. We may say, then, that the river did not cut its way down through the mountains, from a hight of many thousand feet above its present site; but having an elevation, differing but little perhaps from what it now has, as the fold was lifted, it cleared away the obstruction by cutting a cañon, and the walls were thus elevated on either side. The river preserved its level, but the mountains were lifted up, as the saw revolves on a fixed point as the log through which it cuts is moved along. The river was the saw which cut the mountains in two."

The gigantic nature of this aqueous saw cut can be faintly estimated from the circumstance that the mountain log or fold had a diameter of fifty miles, while the depth of the cut, that is, the elevation of the fold above the present level of the river, was over twenty-four thousand feet. But a fraction of this enormous uplift of rock remains. As the rocks were lifted, rains fell upon them and gathered into streams, and the wash of the rains and the corrosion of the rivers cut the fold down almost as fast as it rose, so that the present altitude of the Uintas marks only the difference between the elevation and the denudation. The mountains were not thrust up as peaks, but a great block was slowly lifted, and from this the mountains were carved by the clouds—patient artists, who take what time may be necessary for their work."

THE WOODBURY PLANER WAR.

The manufacturers and users of the woodworking machinery on which the Woodbury Planer Patent Company are endeavoring to collect royalties, on the ground of an alleged infringement, will doubtless learn with gratification that at length the claims of the Woodbury people have been fairly brought before a United States Court. It will be remembered that a motion was granted some time ago in Washington, requiring the claimants to show cause why their patent should not be set aside on the ground of fraud. The time to appear was fixed for June 23, but an extension was granted until the middle of October; and from that period, it appears, still further time has been obtained, so that there is no immediate prospect of the matter being judicially determined from these proceedings. A suit has, however, been commenced by the Woodbury Company against Messrs. Stearns & Sons, large lumber dealers in Boston; and as this firm is resolute in refusing any compromise whatever, the cause at issue will in due process be reached.

Meanwhile the Woodbury Company seem to be resorting to all kinds of efforts to secure their tax. They have compromised with several users by giving licenses of a face value of $100 for $20 per machine; and one of their agents (or rather an individual named Allen, who claims to be such, and who has been endeavoring to frighten royalties out of small manufacturers in Massachusetts by representing himself as a United States Marshal, and acting otherwise fraudulently) has been locked up on criminal charges.

From 1,000 to 1,200 manufacturers and users of machines are now allied against the Woodbury monopoly, and the intention is to devote all possible energy to the breaking down of the claims of the latter by vigorously contesting the matter in the United States Court. The whole affair from beginning to end needs the searching scrutiny of a judicial examination. It began with Woodbury attempting to get a patent for a device which the courts had long previously decided to be an infringement on a prior patented invention. The Patent Office rejected his application in 1852, and thereupon woodworking people throughout the country adopted the pressure bar (intrinsically a most useful attachment) and used it, undisturbed, for eighteen years. In July, 1870, an act of Congress was passed, containing the following clause:

> "That when an application for a patent has been rejected or withdrawn prior to the passage of this act, the applicant shall have six months from the date of such passage to renew his application or to file a new one; and if he omit to do either, his application shall be held to have been abandoned."

As a necessary consequence hundreds of old cases were revamped, including Woodbury's; but his application was again rejected. In January, 1873, another application met another rejection, and then, on April 26 of the same year, the Patent Office turned a complete somersault and declared all its previous decisions to be untenable and a tissue of blunders, and allowed the patent. The Commissioner, although the case was not in legitimate course before him, previously ordered that it be decided on its merits, without reference to abandonment, and gave instructions that no interference should be declared under the rule; and thereupon the patent was issued three days after its allowance, and two weeks ahead of the usual time.

When the act of Congress, containing the above quoted clause, was passed, we questioned its wisdom, and expressed the belief that it was framed more with a view to benefit some special case than to meet public exigencies. Certainly the facts relating to this Woodbury job point to the affirmation of that belief. The unusual action of the Commissioner we also stated at the time to be well calculated to create a suspicion of partiality, and not at all likely to impress inventors with the idea that the Patent Office was perfectly fair in its dealings. Mr. Leggett, however, in a recent letter to the *Northwestern Lumberman*, gives explanation of his course in the matter, and states that he felt bound to order the grant of the patent from the fact that the courts had decided that the public use of an invention, between the time of first application and that of the grant of a patent, if without the consent or allowance of the applicant, could not be construed as a public use in such sense as to prevent the grant of a patent. Regarding the merits of the present controversy, and especially in relation to the validity of the patent, the ex-Commissioner unreservedly speaks his mind as follows:

"I knew that the doctrine as laid down by the Court would grant the patent; yet I just as well knew that the patent ought not to be granted, and I believed that it would not be valid if granted. I have never believed from that time to this that the patent could stand a thorough litigation. I believe, if properly placed before any court of competent jurisdiction, they will declare it to be invalid. I so expressed myself upon it openly and frequently before the patent issued, upon its issue, and on every occasion I have had to do so ever since. I believe the whole thing to be a fraud upon the public."

To review the long array of arguments bearing upon the validity of the patent would require more space than is at our present command. It is enough to hope that everything relating to the case will be thoroughly ventilated during the approaching trial. If a broad flood of light can be shed into the inner history of the circumstances attending the passage of the act of Congress, and of the descents made by the Woodbury people upon the manufacturers who, for a score and over of years, have undisturbedly used the pressure bar, we have little doubt but that the public will be treated to a most interesting record of jobbing and rapacity.

EXPANSION AND CONTRACTION BY MOISTURE.

The effect of water or moisture on certain porous materials varies, under slightly different circumstances, so as to be apparently inconsistent. The general effect is to cause an increase in size, as the water is absorbed in the pores by capillarity, which causes them to enlarge, the watery atoms acting as so many wedges, forcibly driven in, causing a general expansion of the body: a sponge is the type of this kind of expansion, as, its structure being similar in all directions, the effects are also alike all round.

A piece of wood presents other conditions. The fibers are directly connected, and this connection is longitudinal, while the pores are between the fibers transversely. When, therefore, the pores absorb water, its particles do not enter between the longitudinal connections, but between the transverse ones, and the result is a transverse expansion or swelling, while the length will not perceptibly increase. This swelling by moisture and the subsequent shrinkage by drying are always in a transverse direction, and are familiar and well understood.

Paper, whether made from wood or any other fiber, will, by the influence of moisture, expand in all its dimensions, if the fibers lay in all directions. Such is the case with the hand-made paper, once in universal use, but now only known in the form of some drawing and writing papers; but in the machine-made paper, especially if made from long fibers, such as those of jute, the fibers lay more or less in the direction in which the paper moved on the machine by which it was made. This fact is easily ascertained by trying to tear it, as it will tear much more easily longitudinally with the fibers than transversely across them. Such paper will expand by moisture less longitudinally than transversely; and if a paper hygrometer be made, for estimating the amount of atmospheric moisture by the elongation of a strip, the little instrument will be much more sensitive if the strip be cut transversely to the direction of the fibers than if it is cut longitudinally, or parallel to this direction. These conditions are still more obvious with wood, and hygrometers have been made of long strips of very porous wood, glued together end to end, but all cut transversely to the board. Very sensitive instruments have been constructed in this way. A long human hair has been used for the same purpose. It elongates by moisture; and when one end is fixed, and the other end wound around the axis of a hand moving over a dial, the slight elongation may be magnified, and a tolerably reliable instrument obtained, the credit of the invention of which belongs to De Saussure. If a hemp or flax rope, in which the fibers are not twisted, but lay all parallel and longitudinally, could be made, it would increase by moisture in thickness, and not at all or very little in length. All ropes, however, are held together by twisting the fibers, giving the whole the form of a long screw; and then the effect of expansion in thickness by moisture influences in a peculiar way the length, it thickens the strands, and, although it has the effect of tightening the twists, as if the rope were more tightly twisted, it shortens the length; and the shortening by moisture or water varies directly with the degree to which the rope was twisted in making. This effect is very perceptible in clothes lines, which will become quite taut when wet, so much so, indeed, as often to extract the hooks to which they are attached, or pull the poles out of plumb. One of the most striking instances of this kind which we ever witnessed was with a bell rope in a lighthouse on the coast of France, nearly 300 feet high, with a first class revolving Fresnel light on top. The attendants were signaled by means of a bell at the top, pulled by a twisted hempen cord suspended inside the tower; and this cord became a perfect hygrometer. On dry days it hung down to about three or four feet from the ground; while on moist days the end was six feet from the earth, and on very wet days even more, so that it had to be elongated in order to be always within reach.

The practical applications of these properties are, besides the use of hygroscopic substances for hygrometers, the insertion of dry wooden wedges in grooves made in stone in quarries, by wetting which they swell and detach the stones; this is largely employed in the millstone quarries in France. The swelling, untwisting, and shortening of ropes by water is often made use of to produce a strong traction for a short distance. As a most remarkable example of this kind, it is recorded that, in the reign of Pope Sixtus the Fifth, a colossal obelisk, which had been brought from Egypt, was being erected in Rome; it was ordered that, during the difficult and critical operation of raising it, a profound silence should be observed by the spectators, so as not to interfere with the commands of Zapaglia, the engineer and architect, who had made all the calculations for the machinery required, so as to secure the success of the enterprise. When the obelisk was raised, however, he found that he had not sufficiently taken into consideration the stretching of the ropes by the enormous weight; he saw that the obelisk was lifted about half an inch less than the hight of the pedestal on which it had to stand. Fortunately, at this critical moment, he remembered the effect of water on ropes, and his voice was heard, in the universal silence, ordering the ropes to be wetted. This was at once done, and in a minute the obelisk was raised, by the contraction of the ropes, to the right hight, and successfully placed on the pedestal.

MAN AS AN AUTOMATON.

A little more than a year ago Professor Huxley startled the world with his famous paper on "Animals as Automata." In that paper, this lucid writer and bold thinker used the word automaton in much the same sense as we use the adjective automatic, namely, to describe something which acts involuntarily, and not, as Webster defines it, "a self-moving machine, or one which has its driving power within itself." Professor Huxley meant to say that the movements of animals were directly caused by external impressions, independently of any exercise of will power; in other words, they were machines, upon which certain causes produced certain effects. We are not yet ready to acknowledge ourselves as automata or machines (and really the two words mean the same thing), even if so great a philosopher as Huxley should tell us we were.

The differences between a man and a machine are numerous. In the variety of work performed, man surpasses any engine that he has yet devised, although many of his machines surpass in perfection their builder. Where great accuracy, great delicacy, or great strength are requisite, the machine outstrips the man; and yet so simple a motion as that of walking has been but poorly imitated by machinery.

The superiority of a man to a machine is shown by his ability to devise and construct machines; it is, in fact, the superiority of mind to matter. But between the machine which can do nothing but what it was expressly built for and the intelligent thinker and inventor who planned the machine, there are all the intermediate stages represented by different members of the human family. There are men of little brains and much muscle, men of big brains and less muscle; men who plod along, year after year, in the paths which their fathers trod, and men who put all their heavy work on muscles of steel and of leather. The proportion of wide-awake, thinking men to dull routine plodders in different countries or sections of country is easily determined by the relative number of patents taken out in that country; and measured by this standard, the United States contains the least proportion of automata.

But there is a word to be said in favor of automata or man machines. Even now, toward the close of this nineteenth century, there remain many kinds of labor which cannot be done by machinery. There is also a large number of men, and women too (for the fair sex are not to be excluded in this classification), required to tend the machines, feed them, prepare work for them, and fill up the gaps in their work. For some of these positions there are required skill, thoughtful care, presence of mind, nerve, and ingenuity. Yet the more nearly all our motions resemble those of a machine, the greater is the amount of work we can do in a given time, and the less the fatigue. As the movements become automatic and regular, removed apparently from the control of the will, they become more rapid and easier. Why has division of labor accomplished so much? Chiefly because a man whose sole work it is to do one particular thing not only comes to do it better, but learns to do it with the least expenditure of time and the least exertion of brain and muscle; in fact he works very much like a machine. The compositor's hand travels the same road every time as it goes from the case to the stick; the bricklayer always seizes his brick with the same hand, and makes no unnecessary motions in conveying to its place, in preparing its mortar-lined couch, or tapping it home; the shoemaker whose sole labor is nailing on heels goes through the few simple motions automatically, no more stopping to think which tool is next required or where he is to look for his nails than an old woman when knitting thinks about the stitch, or an ordinary person thinks what muscles he is to call into play when he is walking. Does a rapid penman ever stop to recal the shape of a letter, or do his words and thoughts flow automatically from his finger ends? The fingers of an experienced player find the keys of his piano as a compositor finds his type boxes, or the hand knitter her needles and yarn, automatically.

Habit is another term often employed to designate what we do automatically, but habit applies alike to mind and muscle. A man accustomed to smoke or drink does not do these things without thinking about them; habit only causes and strengthens the desire. On the other hand a man who habitually swears, like a woman who bites her finger nails, does it unconsciously, and hence automatically. It is acknowledged to be a good thing to possess good habits, and not merely be free from bad ones: so it is equally desirable for a man employed in any specialty to acquire the simplest and best way of doing his work; this way selected, let him adhere to it perseveringly until it becomes automatic. Let the habit become fixed, and he will find his speed increase and the exertion diminish. To accomplish this desirable end, it is, however, absolutely necessary that no superfluous movement be made. In feeding a small hand printing press, where each card must be laid on separately, if the cards be piled in such a manner as to involve turning each one over or around, the speed is reduced at least 10 per cent. Every motion, however slight, which must be repeated 50 to 100 times per minute is time-robbing. The writer who crosses his t's and dots his i's cannot write so fast as he who does not. The man who spells bought, through, received, etc., in their simpler forms bo't, thro', and rec'd, saves a large percentage of time; and if all the silent and useless letters were omitted, the most hasty scribblers could find time to write distinctly. As that system of shorthand which has the fewest strokes consistent with legibility receives the preference, so that language which uses the fewest and shortest words to express an idea perspicuously deserves to become the universal language of the commercial world.

"Practice makes perfect" is a good old proverb and a true one; but what is the use of perfection in bad methods? The man who always carried a stone in one end of the bag to balance his grist may have arrived at perfection in the selection of a suitable stone; but what gain was that? First use your brains in devising the shortest and quickest methods, then by practice learn to do them automatically, and you have a maximum of speed with a minimum of labor.

AMERICAN INVENTIONS RE-DISCOVERED IN EUROPE.

It is no unfrequent thing for us to meet, in the columns of European papers, notices published with all the flourish peculiar to the first announcements of strikingly novel ideas, concerning old American inventions, long known and used here. Here are two examples in point: "A French blacksmith has devised a perforated plate, put in rotation by clockwork, and intended to be placed behind the lock of a safe. The consequence is that the safe cannot be opened except at certain times during business hours, when there is no danger of any robber intruding into the offices." This is from a late number of *Nature*, one of the keenest of English scientific weeklies. A chronometer lock was patented in this country by John Y. Savage in 1847, and has for years been in use here upon safes in banks, government treasuries, and business houses. The French blacksmith and *Nature's* item are twenty-eight years behind the age.

The second paragraph begins as follows: "Of all the extraordinary discoveries which have been announced of late, Germany sends us the most surprising." After which, the English *Textile Manufacturer* proceeds to describe wool made from liquid furnace slag by blowing through it a steam or air jet. This is not a German discovery. It was invented by Mr. John Player, deceased, and patented here by Amelia Player, of Philadelphia, Pa, his administrator, May 31, 1870. Descriptions of beautiful examples of this curious product have heretofore been published in our paper.

SCIENTIFIC AND PRACTICAL INFORMATION.

TO FIX PAPER ON DRAWING BOARDS.

Take a sheet of drawing paper and damp it on the back side with a wet sponge and clean water. While the paper is expanding, take a spoonful of wheat flour, mix with a little cold water, and make it a moderately thick paste; spread the paste round the edge of the drawing paper one inch wide with a feather, then turn the drawing paper over and press the edges down on the board. After this take four straight pieces of deal wood, $\frac{3}{8}$ inch by $2\frac{1}{4}$ inches wide; place them on the edge of the drawing paper, and put a large book or heavy weight on each corner to make the paper adhere firmly to the board. In about an hour's time the paper will be straight and even, and quite ready for executing a drawing. When the drawing is finished, take a sharp knife and raise one corner of the paper, then take a scale, run it round the edges, and the paper will come off easily. Turn it over and take the dry paste off with a knife, and all will be perfectly clean, and no paper will be wasted.

A MICROSCOPIC BI-CENTENNIAL.

The city of Delft, Holland, has recently celebrated the bi-centennial anniversary of the discovery of microscopic infusoria by Antony Van Leeuwenhoek. Public memorial services were held, a monument unveiled, a banquet partaken of, and the discoverer's instruments displayed. It is something new to witness people of all classes in a city taking part in an enthusiastic celebration of a discovery made two hundred years ago, and regarding which the average individual knows so little.

FAST HORSEBACK RIDING.—At a fair at Waco, Texas, lately, a horseman rode for a wager sixty miles in two hours and fifty-five minutes, using relays of ordinary Texas horses to the number of forty-two. His last mile was made in two minutes and seven seconds, and his time for the sixty miles was five minutes better than the best time ever recorded in this method of racing.

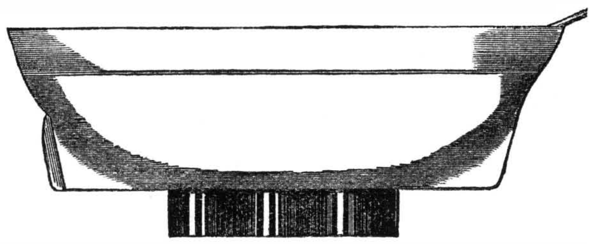
FARADAY established the fact that gases are but the vapors of liquids possessing a very low boiling point.

A NEW PROPELLER.

The peculiar mechanism of the dorsal fin of the pipe fish (*syngnathus*) and sea horse (*hippocampus*), which is also known to be present in the electric eel (*gymnotus*), has been referred to by more than one naturalist. The action is a kind of wave, commencing at the front end and continued through its whole length, continually repeated, so as to form a kind of screw propeller.

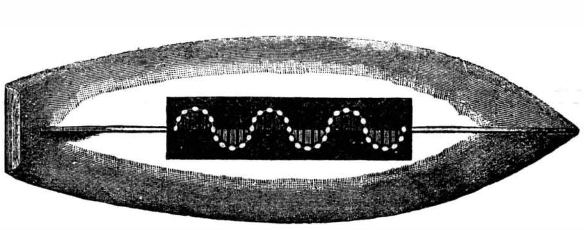
It is not difficult to imitate artificially this undulatory fin of the abovementioned fish. A series of rods hinged near their middle on a single axis will evidently represent at one end any movements given to them at the other. Therefore,

Fig. 1.



if they are made to come in contact at one extremity with the side of a screw which is placed perpendicularly to their direction, and at the same time is provided with projecting disks at right angles to its axis, one between every two rods, to keep them in place, the opposite tips will form an undulating curve, just in the same way that the ivory balls, in the eccentric apparatus so frequently employed by lecturers on experimental physics, are made to represent the undulations of the atoms of the luminiferous ether in the production of

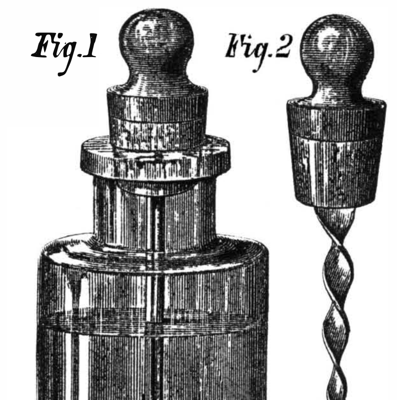
Fig. 2.



light. Like this apparatus, also, if the screw be made to rotate, an undulation will travel along the rods, which is exactly similar to that observed in the fin of the sea horse. Such a piece of machinery, driven by clockwork, ought, theoretically, to propel a boat if properly placed. Mr. C. Becker, says *Nature*, of the firm of Messrs. Elliott & Co., has constructed such a boat, (seen sideways in Fig. 1, and from below in Fig. 2). Its speed is slow, as is that of the fish; in the former case this is accounted for by the fact that the machinery is, in this particular instance, perhaps a little too heavy, at the same time that the friction developed in its action is very considerable. In the artificial fin there are just three complete undulations with eight rods in each semi-undulation, forty-eight in all. Between the rods the membranous portion of the fish's fin is represented by oiled silk. The rods and the other portions of the driving gear are so arranged that the former project, with their undulating ends and the oiled silk, in the middle of the boat, along the line of the keel. They form what may be termed a median ventral fin. The undulations are very complete, the curves being true semicircles.

LUBRICATING DEVICE FOR SEWING AND OTHER LIGHT MACHINES.

The article in ordinary use for applying oil to machinery is the pressure or spurt oil can. For the machine shop, where dirt and oil seem to be matters of no moment, this apparatus serves an excellent purpose; but for sewing machines, and light machinery in general, the use of it is open to many objections



Besides the trouble of pouring oil from a bottle into the can, the delivery of oil from the spurt cans is very uncertain. You put the point of the tube against the part of the machinery requiring oil, and give a gentle pressure with your thumb on the bottom, and nothing comes. You press again a little harder, with the same result. Then, if you are only an average specimen of humanity, you get provoked and give a squeeze which nearly collapses the cup, and a small deluge of oil flows out and over not only the bearing, but it gently trickles down on the work or one's clothes, and it takes a woman with an angelic temper not to say something a trifle hasty. Then, when you put your oil can down, the surplus oil flows down the outside of the tube over the cup, and slowly meanders around the table, ready to soil the next thing it comes in contact with; and you can set it down as a rule that, when one introduces a spurt oil can into the house, he ought also to bring a gallon of benzine with which to antidote it.

With the little device illustrated herewith, it is claimed that all this is avoided. The cork, or stopper, and rod are made to fit the oil bottle, just as it is received from the dealer, and it is always ready for use. To operate it, remove the rod by means of the little knob attached to the stopper. The latter comes out with its groove full of oil. Touch the point of the rod to the parts requiring lubrication, and the oil flows as long as necessary. Remove the point at just the right moment to leave the exact quantity needed. The rod is returned to the bottle, the cork pressed in, and the bottle is safe from spilling from a chance overturn; and the hands, work, and table are clean, and no oil is lost or wasted.

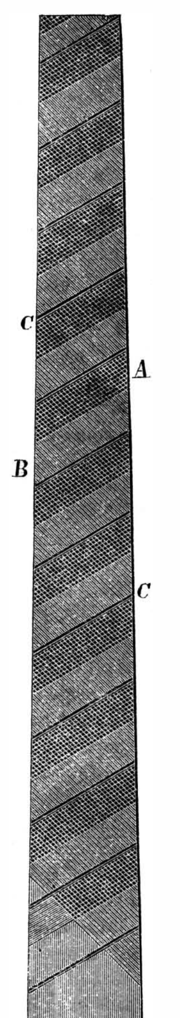
As evidence of the value of this little invention, the inventor estimates that a sewing machine company, using 100,000 oil cans, would save $4,000 or more per annum by adopting this device. Few persons, he thinks, after trying the invention on their sewing machine, jig saw, lathe, or other light machinery, would willingly go back to the old can.

Patented September 28, 1875. For further information address the inventor, Mr. G. A. Sawyer, care Trump Brothers, Wilmington, Del.

A NEW PATENT FILE.

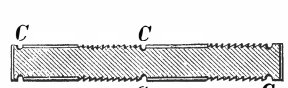
We illustrate in the annexed engravings a new method of cutting files, through which, it is claimed, the tool is caused to partake of the advantages of both the single cut and the cross-cut file. The invention, which will be readily understood from the illustrations, consists in forming, on the surface of a file of the usual shape, a number of sections, A, Fig. 1, of cross-cut teeth alternated with a similar number of sections, B, of single-cut teeth. Also, at the point of intersection between each cross-cut and single-cut division, and for the purpose of meeting the requirements of coarse filing, a groove, C, is made, shown in section in Fig. 2, which is parallel with the edges of the various divisions and has a depth and width greater than those of any of the other cuts. The object of these diagonal grooves is to collect the particles of metal abraded and to prevent the same from being wedged into the teeth, in this way obviating the scratching, by these minute fragments, of the material worked upon.

Fig. 1.



The inventor submits to us several excellent testimonials from machinists and others who have practically tested the tool with satisfactory results. He informs us that it allows of the surface of either metal or wood being cut away with greater rapidity than is possible with a single-cut file, and at the same time it produces a smoother surface than the cross-cut file, in this manner, as stated in the beginning, combining the advantages of both kinds of tool. It appears to be an efficient and useful invention, and to possess qualities of durability superior to those of files of the ordinary pattern.

Fig. 2.



Patented September 7, 1875, by Messrs. C. F. Carr and S. S. Wilcox. For further information relative to sale of rights, etc., address the last mentioned inventor at Lisle, Broome county, N. Y.

THE PROPOSED REFRIGERATOR STEAMER.

It may be safely predicted that the time is not very far distant when vessels carrying perishable cargoes, of fruit, meat, and other articles of food, will make constant and regular voyages between the tropics and the colder temperate regions. The use of refrigerator cars in transporting the fruit and vegetable productions of California to the Atlantic seaboard, and more recently the export of a quantity of American peaches to England, by steamer, during the latter part of last summer, may be considered in the light of successful experiments leading to the more important results of a steady commerce, and this more especially in view of the rapidly advancing progress in refrigerating machinery.

We lately alluded to the Tellier refrigerating apparatus, in which a low degree of temperature is transmitted to an air blast which passes around large plates cooled by the expanded vapor of methylated spirit. By the aid of this invention, it is believed that cargoes of fruit, etc., may be carried over very long voyages even in the warmest weather, and it is now proposed practically to test this assumption. From late French journals we learn that the inventor has chartered a steamer of 900 tuns, which he has named the Frigorific, and which he intends to load with perishable material in France, and dispatch to La Plata, in South America. The first part of the test will consist, of course, in determining whether the outward cargo will keep over the voyage. If so, the contents of the ship will be disposed of and her hold filled with fresh beef, which will be transported to France. This transportation of beef has been the object of projectors of schemes for cooling vessels for a long time past, for the reason that, if success can be obtained, an immense trade is at once possible. In Texas, on the pampas of South America, and in Australia, thousands of cattle are slaughtered simply for their hides, the bodies being left totally unutilized. It has of course occurred to many that to carry this enormous quantity of meat, to be bought for almost nothing, to European markets where butchers' rates are high, and especially to great cities where to the poor fresh meat is a luxury sparingly to be indulged in, would be both profitable to a high degree, and at the same time a measure of philanthropy. Hence the repeated attempts, thus far failures, which have been made to use ice as a means of preserving cargoes of dead cattle.

Fig. 1.

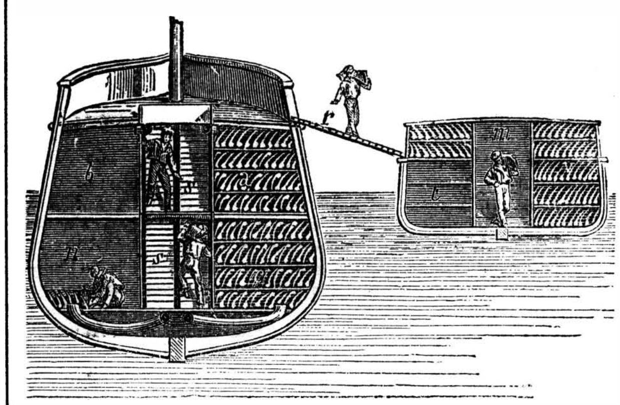


Fig. 2.

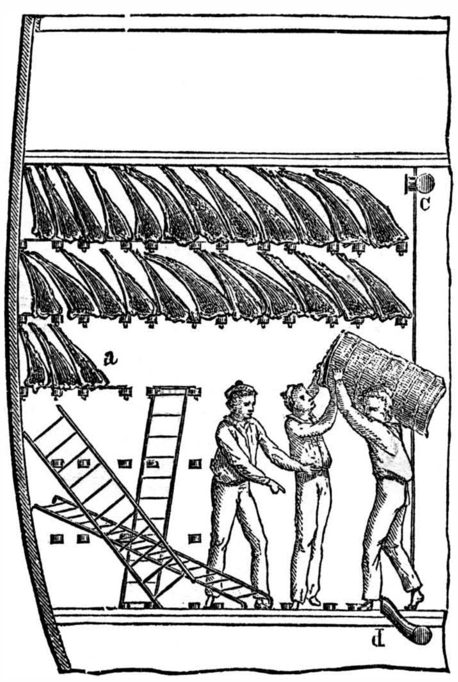
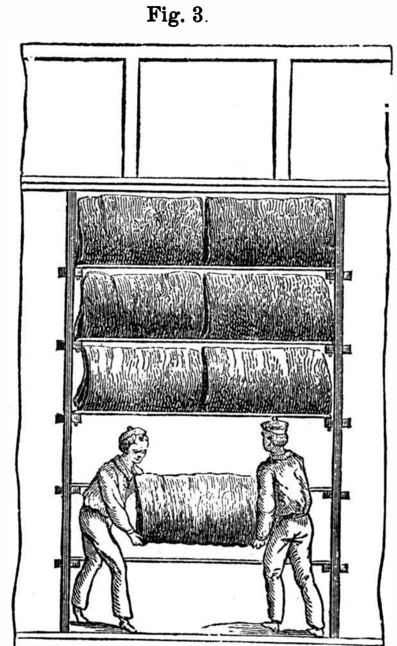


Fig. 3.

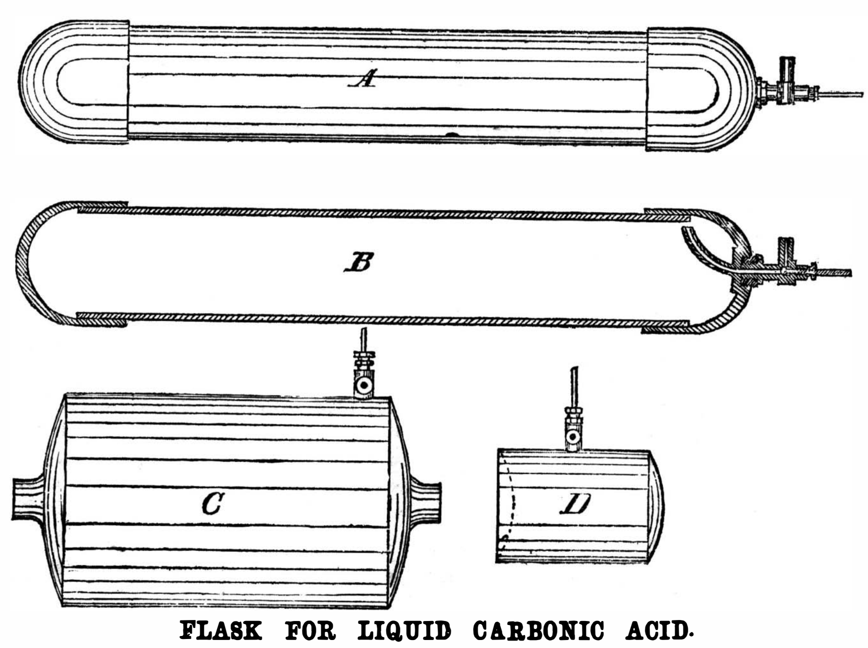


If, as appeared to be the case when we examined the Tellier apparatus, it is possible to maintain a temperature of 32° Fah. at so small an expense as was indicated, there is nothing now apparent, either in point of efficiency or in cost to prevent the success of the inventor's experiment. His mode of stowing the meat is illustrated in the annexed engravings, the object sought being of course to give a free circulation of the icy draft about every piece. For loading and unloading, it is proposed to use a scow, as shown in Fig. 1, in which the meat is packed after being taken from the ship, and so transported by canal, inland or to the wharves. The scow is fitted with a refrigerating machine and arranged somewhat similarly to the ship, as will be seen by comparing the two sections given. The mode of stowing the quarters will be understood from Figs. 2 and 3, of which Fig. 2 is a thwartship, and Fig. 3 a fore-and-aft, view of the hold. The meat is laid in regular lines upon a light framework in such a manner as to be securely held, and at the same time to take up but little room. The pipes, C and *b*, in Fig. 2, are respectively the inlet and outlet pipes for the cold blast.

The Frigorific, we learn, will shortly sail from France; and as the inventor has invited several members of the French Academy of Sciences to make the voyage in her, carrying with them any articles the possibilities of the preservation of which it is especially desired to test, it is probable that the experiment will be conducted under very close scientific investigation, and that a valuable report will be made.

FLASKS FOR LIQUID CARBONIC ACID.

In our article on carbonic acid gas as a motor, published recently, we neglected to state specifically that the apparatus described was the invention of Mr. W. N. Hill, chemist of the U. S. Torpedo Station, at Newport, R. I., although the fact was clear from the context. We hasten to rectify this inadvertence, and at the same time take occasion to add an engraving of the flasks referred to in our article as those in which the liquid carbonic acid is stored, after it is produced by the machinery at the rate, as we are informed, of 55 pounds per hour (continuous working).



FLASK FOR LIQUID CARBONIC ACID.

The Highest Signal in the World.

A new surveying signal has lately been erected on the summit of Mount Shasta, Cal., by the Coast Survey Department. The signal is a hollow cylinder of galvanized iron, twelve feet high and two and a half feet in diameter, surrounded by a cone of nickel plated copper, with concave sides, three feet high and three feet in diameter at the base; and its altitude is, according to the observations taken by the members of the Coast Survey, 14,402 feet. The nickel plating of the signal is a brilliant reflector, and will, from 6 to 9 A. M., and from 3 to 7 P. M., reflect the sunlight in such a manner that the reflection can be seen from the valleys and the mountains from which the summit of the mountain is visible. It is believed that it can be used for observations at a distance of one hundred miles, and possibly further.

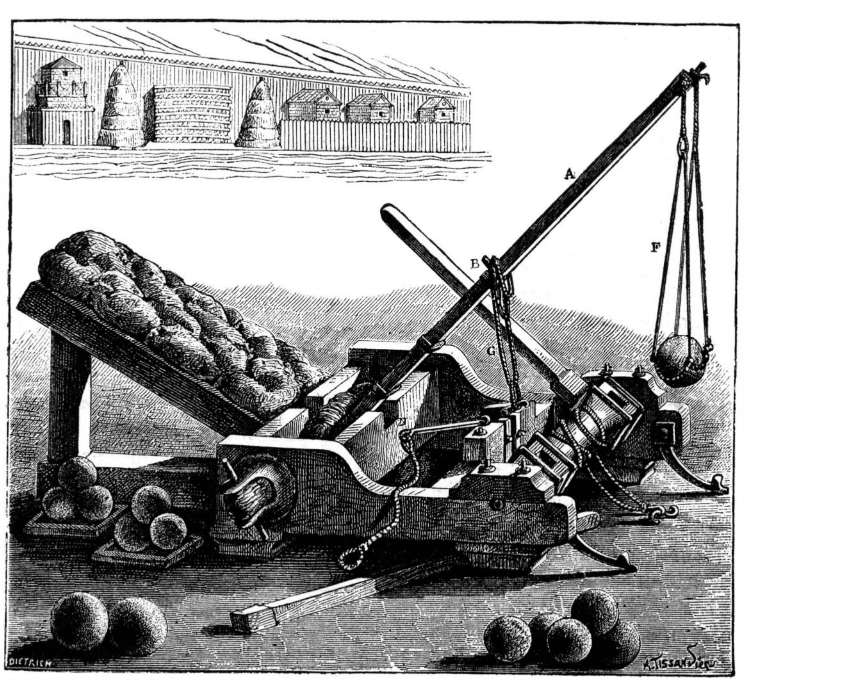
ANCIENT WAR ENGINES.

At the time when Napoleon III. was writing his life of Julius Cæsar, he caused to be constructed, at the Museum of St. Germain in Paris, a set of models of the weapons of war employed by the ancient Romans. These models (which were built, with the greatest care, according to the descriptions of Latin authors and after the representations in bas-relief on Trajan's Column), having served the purpose of the Emperor, remained objects of little interest until recently, when, under the direction of M. Maitre, Director of the Museum, a series of experiments were conducted upon them in order to determine their power. The results obtained are of historical importance, since they enable us to form a good idea of the means of attack on which the armies, which dominated Europe eighteen hundred years ago, relied.

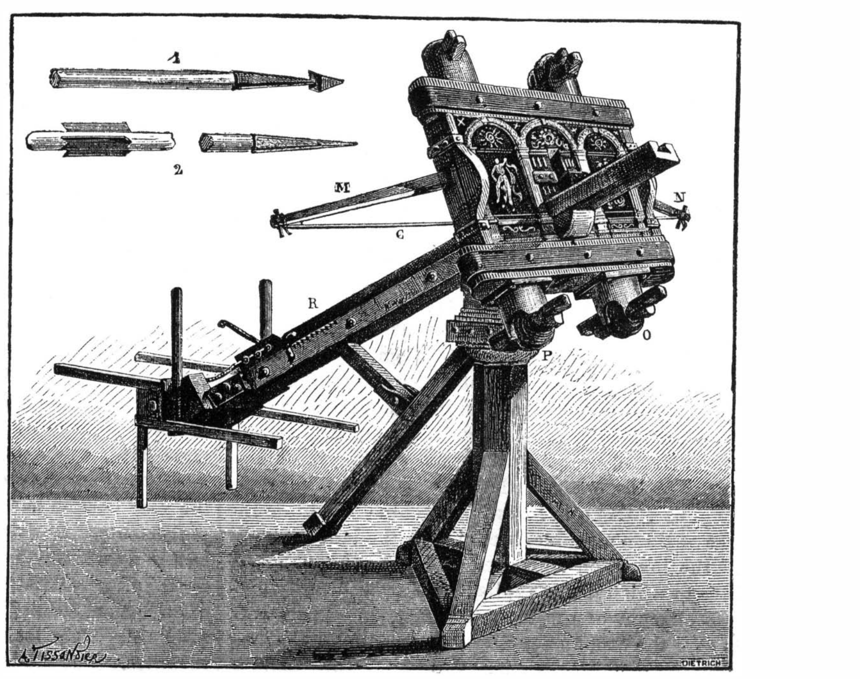
Two of the largest war engines are represented in the annexed engraving, for which we are indebted to *La Nature*. The onager, Fig. 1, consists of a wooden lever, A, which at its lowest end is inserted in a bundle of tightly twisted cords. These last are fixed on a massive frame, and there submitted to extreme torsion, so as to store up in them a powerful reacting force. By the aid of a windlass, the lever, A, is drawn back, thus still further twisting the cords, and the lever is secured in this position by the rope, C, passing over a hook, B. A sling, F, is suspended from the extremity of the lever, and carries the stone bullet. By means of a stop, the catch, B, is freed, when the lever flies forward with great force, bringing up against the cushion placed to receive its impact. The movement is so rapid that the eye cannot follow it, and the projectile is hurled to a distance, varying from 415 to 515 feet, according to weight. The velocity of the ball is low and its flight can easily be seen. The diameter varies from 3·1 to 5·8 inches. It is supposed that these missiles were thrown from the onager at very near range, and that they were also used to drop or roll down upon attacking parties from the summits of fortresses or palisades.

The balista, represented in Fig. 2, is a much more formidable weapon, since it is a huge crossbow mounted on a frame, which often was supported on wheels so as to be conveniently moved from place to place. For the bow is substituted two short arms, M and N, passed through bundles of twisted cords, O and P, similar to the arrangement in the onager. As the string of the balista cannot be pulled back by hand, this is done by catching it over the wooden piece, R, which last is then drawn back by the windlass. When a sufficient tension is obtained, the cord is fastened on a catch, and an arrow is placed in front of it in a suitable groove. By freeing the catch, the string flies forward, throwing out the projectile, which is of the form marked 1 and 2 in the engraving, and made of tough wood and iron The length of the missile is 4·1 feet and weight from $2\frac{1}{4}$ ozs. to $1\frac{1}{2}$ lbs. The range varied, with the weight, from 690 to 480 feet.

At the upper portion of Fig. 1 are sketched the various types of defensive fortification used during the period when the above described weapons were in vogue. These consisted in walls flanked by salient towers. The Romans knew of but three varieties of fortress: the *castrum*, which included not only regular camps but any walled place; the *castellum*, which is analogous to the baronial castle of the middle ages; and the *burgi*, which were similar to but less important than the *castella*.



THE ONAGER.



THE BALISTA

ROMAN WAR ENGINES.

TO FILL holes in burrstones, use melted alum mixed with burrstone pulverized to the size of grains of sand.

A New Reagent for Gold.

Sergius Kern says: "Studying the action of sulphocyanates on some double salts of gold, I have found a remarkably delicate test for gold; experiments prove that even less than $\frac{1}{15000}$ of a grain of gold may be easily detected by using my reagent.

The gold is first separated from foreign metals, and next converted by means of sodium chloride into sodio-gold chloride; the solution is then concentrated by evaporation. In order to detect gold, an aqueous solution of potassium sulphocyanide is used, containing for one part of the salts about 15 to 20 parts of water. About 92 grains of this solution are poured into a test tube, and some drops of the concentrated solution, obtained by treating the sample as described above, are added. If gold is present, a red orange turbidity is immediately obtained, which soon falls in the form of a precipitate; on gently heating the contents of the test tube, the precipitate dissolves and the solution turns colorless.

The reagent is so delicate that one drop of a solution of sodio-gold chloride (15 grains of the salt dissolved in 600 grains water) gives a very clear reaction.

This reaction showed the existence of very interesting double sulpho-cyanides of gold."—*Chemical News.*

A New Electric Machine.

The apparatus, by S. C. Tisley, consists essentially of an electro-magnet with shoes, forming a groove in which a Siemens armature is made to revolve: this is much the same as the original machines made by Siemens and Wheatstone, but the difference occurs in the break or commutator; here there are two springs or rubbers employed in taking the current off from the commutator. The commutator consists of three rings; one of these rings is complete for three quarters of the circle, the other quarter being cut away; another ring is cut away three quarters, leaving the one quarter; and in between these two rings is a third ring, insulated and connected with the insulated end of the wire wound round the armature; on this center ring are projecting pieces, one a quarter of a circle and the other three quarters, so arranged as to complete the two outer circles. The rubber spring which comes into contact with the quarter of the middle circle is connected with the electro-magnet of the machine, and the arma ture is so arranged that at the time of contact the best magnetizing current is displayed. The other spring rubber is in connection with the wire on the armature during the other three quarters of its revolution; and this is connected with any external piece of apparatus required to be worked

By this arrangement, the alternate currents being utilized, they are all in the same direction; and by the length of contact the whole of the current is obtained in the best condition for heating wires, decomposing water, giving an electric light, and other usual experiments.

At present a model machine has been constructed on this principle, the armature of which measures 5 inches long by 2 inches in diameter, on which is wound about 50 feet of cotton-covered copper wire, No. 16 B. W. G. The magnet has about 300 feet of covered copper wire, No. 14 B. W. G.: the whole instrument, without the driving gear, weighs 26 lbs.: with this apparatus 8 inches of platinum wire, of 0·005 inch diameter, can be made red hot, water is rapidly decomposed, etc.

The armature is constructed specially to prevent the accumulation of heat to which every class of dynamo-magneto-electric machine is liable. It is made in two halves, a groove of zigzag form being cast in each half; so that, when the two are screwed together, a continuous channel is maintained through the bearings for a current of cold water to pass during the whole time the machine is at work.

The Relation of Patents to the Various Industries.

We gave recently a *resumé* of a portion of Mr. J. A. Whitney's excellent address on the above topic. We continue our extracts below, commending them to the reader as of especial interest as showing the rise, progress, and profits of several of the most important American inventions:

" One of the most beneficent effects of the patent law is that, after it has caused a great invention to be made, it does not stop there, but leads to the production of many improvements upon it, the scope and value of the original invention being thus continually enlarged. It was so in a remarkable degree with the sewing machine; for this great invention owes nine tenths of its usefulness to scores of supplementary inventions that would never have been made if the patent laws had ceased with the fabrication of the first machines. Among these is the tuck creaser, a simple device patented fifteen years ago by Henry W. Fuller. The invention consisted in creasing or marking the cloth in lines parallel with the line of sewing, simultaneously with the operation of the needle, so that the making of one seam provided a guide, perfectly parallel with it, either for folding the fabric or for making the next seam. During the life of the patent fifty thousand of these creasers went into use in manufacturing establishments alone. The creasers were found on an average to last a year, or, to keep on the safe side, two hundred days of actual use. Each creaser would do three hundred yards of tucking per day, and this quantity was often doubled. A fair day's work without the creaser was one hundred yards; making the entire work done by one creaser in a year sixty thousand yards, worth three cents per yard, or a total of eighteen hundred dollars. The cost of the labor, including use of the sewing machine in which it was used, did not exceed four hundred dollars, leaving a net profit of fourteen hundred dollars. But as one third of this amount would be obtained by the same expense of labor, we must deduct this proportion, leaving a net profit from each creaser of $933.33, and showing that, in manufacturing establishments alone, in the short period of fourteen years, there was a saving of human labor—a saving in the work of tired fingers and weary eyes—of forty-six million, six hundred and fifty thousand dollars. But this was not all. One million, two hundred of the creasers were sold to families during the same time, and whatever economy resulted from this greater number must be added to the public benefit conferred by the invention. While the cost of materials, etc., remained the same, this invention reduced the price of the finished article from four cents a yard to two cents. And there was the ruffle, patented by George B. Arnold, and known in the market as the 'magic ruffle.' This was a new article, and the patentee devised a new way of producing it. His invention shortened the labor of making such articles twenty fold, and provided a ruffle more uniform and better in quality than had previously been made by hand. In its manufacture only three operators were required to do the work of fifty, so that, with twenty dollars' worth of material, ruffles could be made, ready for market, at a cost of twenty-three dollars that otherwise would cost seventy. These inventions were worth to the public two millions of dollars a year. The patents during fourteen years brought in to the owners $49,976.93, as proved from their accounts, to which must be added $15,000 received from their foreign patents.

"The gimlet-pointed screw invented by Thomas J. Sloan has made the old variety as obsolete as the hammers of the neolithic age. This inventor secured a number of patents for machinery for making the screws, and the value of these adjunctive patents is illustrated by one of them, granted in 1851. This particular apparatus was simply for taking off the slight burr left by the saw used in cutting the nick or groove in the head of the screw. The production of wood screws at that date was ten thousand gross per day. Two hundred and eighty-eight of these machines were in use in the works of the Eagle Screw Company in Providence, R. I., and in fourteen years—the term of patents at that time—the invention effected a saving of ninety-seven thousand dollars. The double hand stamps for canceling stamps and post-marking letters by the same stroke of one hand, patented sixteen years ago, saved the government in 1866 the salaries of two hundred and fifty-four clerks at from $700 to $900 each, or more than two hundred thousand dollars per annum. A slight modification in the manner of joining wrought and cast iron in the manufacture of railings, patented the same year, saved one fourth of the usual expense of repairs, and during the term of the patent saved seventy thousand dollars to the public by the comparative freedom from corrosion and breakage. The subject matter of Aiken and Felthousen's patent of twenty-four years ago was the first machine to sew tubular goods, such as shirt sleeves, boot legs, etc., and in 1865 it was estimated that fifty thousand sewing machines, embracing one or the other of the features of this improvement were in use. No other sewing machine would do the work. One of these machines would save the labor of eight hands, and the invention added ten dollars to the value of any machine to which it was applied. The curved rest which formed one element of the invention was stated by sworn experts to save the community fifty thousand dollars a year in the manufacture of boots alone. But let me turn again to patents, the results of which have reached all over the world.

" We can all recall the time, not many years ago, when metallic or fixed ammunition was used in fire arms to only a limited extent; whereas, not only for army but for all other fire arms, it is now universally used. It was impossible to manufacture such cartridges, either of good quality or cheap enough to permit their use, until Ethan Allen's patent of 1860 disclosed a method which produced a revolution in fire arms throughout the civilized world. And how much did Allen receive during the term of fourteen years? He made, in royalties and from the sale of a machine, thirteen thousand one hundred dollars. He also made a manufacturer's profit of forty cents a thousand on sixty seven millions of the cartridges sold, not to the Government, but to the general trade, which was little enough in all conscience when we consider the importance of the invention.

" Perhaps a greater benefit was conferred upon the country and upon mankind through the patents upon which the manufacture of American Brussels and pile carpeting has been founded. Erastus Bigelow secured his first patent in 1837, and subsequently obtained many others, that of 1847 embracing the features that made the machine an absolute success in weaving carpet by the power loom. Bigelow had made, up to the year 1861, $136,912.74 from these inventions. The history of Eli Whitney's cotton gin or Jethro Wood's iron plow show that it was the promise held out by the patent laws that led these men, through manifold trials, the one to open the way of this country to supremacy in the growth of the staple fiber of the world, the other to realize in sober fact the fairy tale of Scandinavian mythology, which told how a metal share added tenfold to the produce of the earth. Agriculture owes more than any other industry to the fostering spirit of the patent laws. And as the yield of the harvest begins with the turning of the furrow, perhaps the steel plow is the best illustration I can use in this connection. It was patented in 1864 by Francis F. Smith.

"Smith commenced business in Ohio, thirty-three years ago, as a blacksmith, and started his own shop in 1843. He sought to make improvements as early as 1850, and made two steel plows of sheet steel, by hand, in 1856. In 1859 he made numerous experiments in tempering sheet steel plows, but could not save more than one in three. In 1859 he was laid up by sickness, and learned by reading that steel could be cast to shape, but could get no satisfaction by enquiry until brought, by correspondence, into relations with the Collins Steel Company of Connecticut.

"The first cast steel plow was made and tried at Collinsville in July, 1860. Smith "gave all his time, energies, and thought to the development of this plow" up to the seventeenth day of April, 1874. The number made and sold by the Collins Company was eighty thousand five hundred and sixty-nine. Smith, up to January 1, 1874, over and above money expended, but without allowing anything for his labor during these years, received about $55,000. The Collins Company invested not less than two hundred and fifty thousand dollars in the manufacture and introduction of these plows; and the plows could not have been made at a price low enough to come within the reach of the farmer, neither could they have been introduced when made, without this large capital to pave the way. Cast iron plows are too soft to wear well in sand and grit; they will not scour in soft prairie or bottom lands. Plows made of sheet steel had been tried and been practically abandoned. Sheet steel plows are of flat plates; they do not have the greatest thickness at points of greatest wear; the plates tend to constantly renew their former flat form. The parts cannot be made uniform, cannot be readily duplicated or repaired, and will not admit of high temper and hardness; for tempering and hardening warp, and twist or crack, and spoil the sheet. All these defects are obviated in the cast steel plow. The worth to the farmer in increased durability, aside from scouring, estimated by sworn experts at five dollars per plow over and above common plows, after making allowance for difference in the prices at which they were sold—80,500 plows, with an increased value of five dollars each—is upwards of four hundred thousand dollars gained by the farmers of the West, while the inventor made less than one seventh of this amount.

"But a greater than the steel plow was McCormick's reaper; for his reel and divider made grain-harvesting a success. In the extension of these patents it was shown by sworn evidence that, in those districts of the West where reapers were introduced, the increase in the production of grain was one hundred per cent; for the labor of those regions could not harvest by the old methods more than one half of what the soil was capable of yielding. The work of sewing is one half easier than that of reaping; so that, if all was sown that could be, one half of the crop would have had to rot on the ground. On an average each machine cut, during each year of its lifetime of ten years, two hundred acres, or a total of two thousand acres. Hence it was that each machine saved to the user, in labor alone, at least five hundred dollars, besides paying its original cost; and in this way, up to 1859, the saving of labor to the public amounted to thirty-six millions six hundred thousand dollars. The gain to the public in the increase of the grain crop, due to the invention, to the same date, was one hundred millions of dollars. McCormick's patents were dated 1834, 1845, and 1847; but up to the year 1859 he had devoted twenty-seven years to his improvements. During this time he paid out one million, eight hundred and sixty-five thousand, two hundred and seventy-eight dollars. His receipts, exclusive of bad debts and costs of collection, were $2,527,698, leaving him a clear profit of $662,414. This included both manufacturer's profits and royalties. But the devices that would cut the upright hollow stalks of grain were unsatisfactory when applied to cutting the more slender and fibrous stems and the yielding leaves of grass; and the sickle bar, playing through slots in the guard fingers closed at both ends, clogged so that no successful machine for cutting grass was made before Eliakim R. Forbush, in 1849, patented his guard finger with the open slot. This enabled the knives to clean themselves, and effectually avoided clogging. This was applied to various machines that needed nothing more to fit them for cutting grass. The inventor was modest enough to estimate the value of this improvement at two dollars for each machine, although no machine that would successfully cut fine grass had ever been used before. Twelve years ago the number of mowing machines sold in one season was twenty-five thousand, or a gain to the farming community from this device of fifty thousand dollars annually. Forbush was unfortunate; and while the public was making this, he delived, during the original term of his patent, just twenty-five dollars and ninety cents per annum.

"After machines had been made to reap, and other machines had been made to mow, it still remained to provide a machine that would do both. There were numerous attempts to do this before John H. Manny's patent of 1851, but none had succeeded. Before this two distinct machines were required for the two kinds of work, at a cost of from $235 to $270, or an average of $250 for the two. Manny sold a machine, equally efficient for both kinds of work, for $135, saving $115 to the purchaser of each of his machines. There were made and sold under this patent of 1851 sixty thousand machines, saving to the farmers in fourteen years, in this matter of first cost alone, six million nine hundred thousand dollars. But this is not all. Manny made the cutter bars of his machine so readily adjustable that they could be raised or lowered to cut lodged grain the lodged grain being picked up by the bar, cut, and saved. The loss from lodging has been frequently estimated at several bushels per acre; but at only half a bushel per acre, at eighty cents to the bushel, a machine cutting ten acres a day, the saving amounts to four dollars a day for every day a machine is used. Assuming each machine to be used only twelve days each year, the saving amounts to forty-eight dollars for each machine per annum. These machines, with usual wear and tear, were found to last eight years—a shorter time than McCormick's, because they mowed as well as reaped. Eight times forty-eight dollars is $384, and the sixty thousand machines saved in lodged grain alone $23,040,000. Add to this the saving in first cost of machines, and Manny's inventions saved to the agricultural community in fourteen years within a fraction of thirty millions of dollars. Manny secured no less than thirteen patents, from which he made altogether a trifle more than $283,000, including his profits as a manufacturer, or less than one per cent of what the farmers had gained from them during the same time. But Manny's profits, like those of every other inventor, ceased when his patents expired. But the public, with these, as with all other inventions, has their benefits for all time; and the same rule holds good for small inventions. In 1861 Nathan Brand patented a machine for making hoes by rolling instead of forging the plates. This reduced the cost from twelve to nine dollars a dozen; and there are one hundred thousand dozen hoes made and sold annually in the United States. Brand made from it, over and above the expense of his experiments, three thousand six hundred dollars."

A Silver Bath from Ditch Water.

" All our formulæ tell us to use pure water in making up our silver solutions. I was led into a discussion, a short time since, with a brother photographer on this one point of our manipulation, and it finally led to a small wager that I could not make a bath with such water as he might furnish, the first plate exposed in the bath to give a good negative.

" The water came; it was evidently such as he had dipped up from some hog puddle—muddy, greasy, and in every way filthy; and from this stuff I was to make a half gallon of silver bath which would work from the start. I commenced my labors, and had one week to finish the undertaking. First, I let the mud settle in the bucket in which I received the water, skimming off the green mass and the grease which floated on the surface. After leaving it a few hours to settle, I carefully decanted the liquid into a tall glass candy jar, and found I had about one gallon of stagnant water, anything but inviting for the purposes intended. I let it stand over night, and, for a result, had about half an inch of settlings in the bottom of the jar. I again decanted into another clean jar the liquid from the mud, and I had a little less than three quarts of water. I now added half an ounce of nitrate of silver, which turned the liquid brown before it was half dissolved. I placed the jar in the sun for one day, and in an hour it was black as ink; by next morning it showed signs of clearing up, and I again decanted the clear solution. I filtered it carefully, and made my bath by adding nitrate of silver sufficient to bring it up to forty grains strength, adding one and a half grains of iodide potassium for each ounce of silver used, shaking thoroughly. I put the bath in the sun, and left it for two days, when the solution was perfectly clear. I filtered through prepared cotton, and finally added chemically pure nitric acid until blue litmus paper turned slightly red. Placing the solution in my bath tub, I coated a plate with collodion, and left it in the bath over night. The result was that the first plate dipped in the bath and exposed in the camera gave a fine negative."—*F. J. K., in Western Photographic News.*

A Captive Gorilla.

The rather curious discovery has been made of a living gorilla among the apes in the Zoölogical Gardens of Dresden. The animal was purchased while quite young as a chimpanzee and an unhealthy one at that. As it became older, its development attracted general attention, and finally Dr. Schweinfurth, the African traveler, after examination, pronounced it a genuine gorilla. It is the first of the species that has been kept alive in captivity; and as it now appears to be doing well, there is a probability that it will reach maturity, and thus enable zoölogists to make important studies regarding its now little known habits and characteristics

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

The grindstone is a self-sharpening tool; and after having been turned in one direction for some time (if a hard stone), the motion should be reversed. Sand of the right grit applied occasionally to a hard stone will improve it.

To remove rust from small hollow castings, dip in dilute sulphuric acid (1 part commercial acid to 10 of water). Wash in hot lime water and dry in a tumbler in dry sawdust.

To remove chuck cement from lathe work, warm the object over a spirit lamp and tap lightly with a stiff brush: the wax will adhere to the latter. If in a hurry, a few seconds' boiling in alcohol will remove the remainder of the wax.

Exhaust steam should never be discharged into a brick chimney. It is liable to disintegrate the mortar and thus to render the entire structure unstable.

A mortar celebrated for its durability is composed of well slaked lime mingled with finely sifted sand. To this is added one quarter as much fine unslaked lime as there has been sand used. While it is being mixed, the mass heats, and the mortar should then be immediately used. The substance is waterproof and becomes excessively hard.

Salmon skin makes a leather of about the thickness of dogskin and as tough as wash leather. The scale marks leave a neat pattern.

The finest glass enamels are generally prepared by fusing (at a high temperature) silica, oxide of tin, and oxide of lead, and spreading the mixture over a sheet of copper, of gold, or of platinum. A much more economical and as efficient a compound consists of arsenic 30 parts by weight; saltpeter 30 parts; silica 90 parts; litharge 250 parts. This is spread on plates of glass of the required shape and size, care being taken, however, that the kind of glass employed be not less fusible than the enamel. Enameled gears thus prepared may be drawn or written upon as readily as paper, and in less than one minute the writing may be rendered indelible by simply heating the plate in a small open furnace or muffle.

Hydraulic cement mixed with oil is recommended as a paint for concrete brick walls. The same is a good waterproof paint for roofs and walls of cisterns.

The French (St. Gobain) glass, used for lighthouses, is composed of silicic acid 72·1 parts: soda, 12·2 parts: lime, 15·7 parts; alumina and oxide of iron, traces. Birmingham glass is made of French sand 5 cwts.: carbonate of soda, 1 cwt., 3 quarters, 7 lbs.: lime 2 quarters, 7 lbs.: nitrate of soda, 1 quarter: arsenious acid, 3 lbs. The best qualities of this glass are at present produced in the Siemens furnace.

The following are good colored glazings for potter's use; White. Massicot 4 parts: tin ashes 2 parts: fragments of crystal glass 3 parts: sea salt ½ part. Melt in earthenware vessels, when the liquid flux may be used. Yellow: Equal parts of massicot, red lead, and sulphuret of antimony. Calcine the mixture and reduce it again to powder; add then pure sand 2 parts and salt ½ part. Melt the whole. Green: Sand, 2 parts: massicot, 3 parts: salt 1 part, and copper scales according to the shade to be produced. The mixture is melted as directed above. Violet: Massicot 1 part; sand, 3 parts: smalt 1 part: black oxide of manganese ⅛ part. Blue: white sand and massicot, equal parts: blue smalt ⅛ part. Black: Black oxide of manganese, 2 parts: smalt 1 part: burned quartz 1½ parts: massicot 2½ parts. Brown: Fragments of green bottle glass, 1 part: manganese 1 part: lead glass 2 parts.

It has been observed that old charcoal burns more energetically than recent, because the former has absorbed oxygen from the air, a circumstance which has been practically utilized with advantage in refining crude iron.

New linen may be embroidered more easily by rubbing it over with fine white soap. It prevents the threads from cracking.

The Southern States Agricultural and Industrial Exposition.

The attention of the reader is directed to the announcement of the Southern States Agricultural and Industrial Exposition, which appears on our advertising pages. This fair opens in New Orleans on February 26, 1876, and continues for ten days. Competition for very attractive premiums is asked from all parts of the United States, Mexico, and Central America, and special prizes are to be awarded for strictly southern products.

The industries of the south are now rapidly advancing, and that section of the country now offers a valuable field for the sale of improved machines and inventions of every description. To manufacturers of agricultural implements, cotton presses, machinery and apparatus for making cotton seed oil, and improved devices for tobacco and sugar culture and preparation, we have no doubt but that the above exposition will prove very profitable. The same may be said as regards builders of steam engines, and particularly small motors, portable and otherwise, for plantation and factory use. It will be observed that the display is to take place during a period when no similar exhibitions are in progress, and between the closing of the fall fairs and the opening of the Centennial, so that those who have contributed to the former, and who intend exhibiting at the latter, might easily send their articles to New Orleans during the intervening time.

Poisoning by Arsenical Wall Paper.

Cases of arsenical poisoning occasioned by living in rooms, the walls of which are covered with paper colored green by arsenite of copper, have frequently been recorded. Lately, a case of arsenical poisoning has come under my notice," writes Professor Cameron, "caused by inhaling the dust from paper not colored green. The family of a gentleman, Mr. Jones, residing at New Ross, suffered so severely from symptoms usually produced by arsenic that he was induced to get the wall paper of his house examined. Out of seven kinds of paper six were found to contain arsenic. No. 1, an olive green paper, with deep green flowers and gold-like lines, contained an immense amount of arsenic in the two green colors and the gold. No. 2, a faint lavender watered paper, contained arsenic in large amount. No. 3, a white paper with gray flowers, contained a very large amount of arsenic. No. 4, a paper with red and green flowers on a gray ground, was highly arsenical. No. 5, a dark olive-colored paper, with gilding, did not contain much arsenic. No. 6, a pale green and white paper, also contained only a small amount of arsenic, much less than was put on the lavender paper. Mr. Jones's family had not suffered from the symptoms of arsenical poisoning until shortly after the house was papered with the above, and the symptoms disappeared shortly after they left the house preparatory to the removal of the paper."—*Medical Press and Circular.*

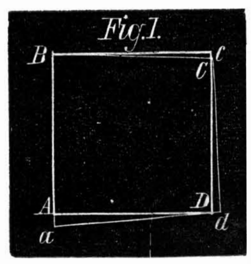
LAYING OFF A SQUARE.

In a letter recently received, a correspondent asks an explanation of the following difficulty:

He wants to get out a square board, 6 inches on a side. He first dresses one edge of the stuff true; and having proved his try square, he applies it to this edge, lays off one corner, and works it to the line; then he makes the new edge 6 inches long, applies his try square, and lays off a second right angle, and so proceeds. When he reaches the starting point, he finds that the last angle is not a right angle, and he wishes to be told the reason of this.

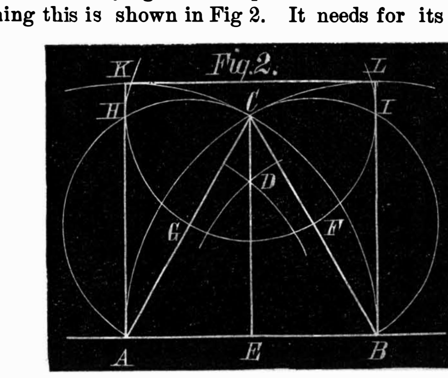
Many a young mechanic, on his promotion to the vise bench, is confronted with this difficulty, on trying to square up a nut with the aid of a try square; but not many, it is probable, know the reason, so perhaps a few remarks on the subject may not be out of place.

It must be evident to any one that, if the first three corners of a piece of stuff are square with absolute precision, the last corner must necessarily be square also, but it may not be so obvious that a slight error in each of the first three corners will be greatly magnified in the fourth. This can be made plain, however, by a little study of Fig. 1.



Suppose the workman starts on a straight edge, A B, and applies his square at B, laying off what he thinks to be a right angle; but partly from the error in the line, and partly from want of accuracy in working to the line, he actually makes the angle at the corner, B, A B *c*, which exceeds a right angle by the angle, *c* B C. Proceeding to the corner, *c*, he works out a second angle, B *c* which is as much in excess of a right angle as the first, but about twice as much in excess of the true angle of the corner, B C D. At the third corner, the angle, *c d a*, is worked out, only exceeding a right angle by the angle C *b c*, as in the first case, but having about three times this excess over the true angle of the third corner, C D A. This shows where the difficulty lies: the three corners, B, *c*, *d*, are each only a little out of square but the corner, *a*, has three times the error, and any error, however small, if multiplied considerably, becomes very noticeable. In the figure the error is purposely made quite large for the sake of clearly illustrating the point; but even in this aggravated case, the errors in the corners, B, *c*, *d*, seem trifling in comparison with that of the corner, *a*.

Having shown the error that is likely to arise from the use of the try square for cases of this kind, it is perhaps only fair to point out a more excellent way. Since the trouble is caused by the multiplication of errors from corner to corner, and since experience shows that work of absolute precision is rarely accomplished with ordinary tools, it will be better to divide the errors equally among all the corners, if possible, in laying out the square. One method of accomplishing this is shown in Fig 2. It needs for its execution



a straight edge, a pair of dividers with well sharpened points, and a fine scriber. Having worked one edge true or drawn a straight line, lay off on it a distance, A B, equal to one side of the proposed square. With A and B as centers, and with A B as a radius, describe two arcs, intersecting at the point, C. With the same points, A and B, as centers and with a radius less than A B, describe two arcs, intersecting at the point, D. Draw a straight line through the points, C and D, cutting the line, A B, at the point, E. E is the center point of the line, A B. Join the points, A and C, by the straight line, A C, and the points, B and C, by the straight line, B C. With C as a center, and with a radius equal to A E or E B, describe an arc, cutting the lines, A C and B C, in the points, G and F, respectively. With F as a center, and A E or E B as a radius, draw an arc, cutting the former circle in the point, I; and with G as a center, and the same radius, describe an arc, cutting this circle in the point, H. Draw a straight line through the points, B and I, cutting the arc drawn from B, in the point, L; draw also a straight line through the points, A and H, cutting the arc drawn from A, in the point K. Join the points, K and L, by a straight line, and the square will be complete; and any errors of construction will probably be evenly divided among the four corners, if care is used in drawing the lines. It is possible, also, to check the accuracy of the construction at different stages. Thus, the straight line drawn through the points, C and D, should bisect the line, A B, and this can readily be tested with the dividers. Also the circle drawn with C, as a center, and with a radius, A E or E B, should cut the lines, A C and B C, at their middle points.

Specific Heat.

Suppose we take two vessels, the one containing 1 lb. of water and the other 10 lbs. of water, and expose them to such a source of heat that equal amounts of heat will enter each vessel at equal intervals of time, we shall find that, when the temperature of the 1 lb. of water has risen to 10°, that of the 10 lb. will have risen only 1°. Now as ten units of heat have entered each vessel, it follows that it requires ten times as much heat to raise 10 lbs. of water 1°, as it does to raise 1 lb. of water the same amount; and as similar results are obtained with other substances, we may conclude that the amount of heat, required to raise different weights of the same substance 1°, must be proportional to these weights. Now suppose we take four vessels, containing respectively 1 lb. of water, 1 lb. of mercury, 1 lb. of silver, and 1 lb. of iron, and, as before, expose them to such a source of heat that each substance in the same intervals of time will receive the same amount of heat. Having placed a thermometer in each vessel, upon observation we shall find that, when the water has risen 1°, or, in other words, when it has received one unit of heat, the other substances will indicate a much higher temperature, as shown in the following table. We there find that one unit of heat will raise a pound of mercury 30°; consequently, it will only require $\frac{1}{30}$ or 0·033 of a unit to raise it 1°. In this manner, by taking water as unity, we can determine the fractional part of this unit required to raise equal weights of any other substances 1°. This fractional part, which is shown in the third column, is called the specific heat of the substance.

Name of Substance.	Temperature, with Application of one Unit of Heat.	Specific Heat.
Water............	1·0°	$1{\cdot}000=\frac{1}{1}$
Iron............	8·8°	$0{\cdot}114=\frac{1}{8{\cdot}8}$
Silver............	17·5°	$0{\cdot}057=\frac{1}{17{\cdot}5}$
Mercury.........	30·0°	$0{\cdot}033=\frac{1}{30}$

From the above table we also learn that, at the same temperature, water contains 8·8 times as much heat as the same weight of iron; 17·5 times as much as the same weight of silver; or 30 times as much as the same weight of mercury. If we were to examine a more extended table of specific heats, we should find that water, at the same temperature and at equal weights, contains more heat than any other known substance; and for this reason, the specific heat of different substances is always expressed by the fraction obtained by comparing the amount of heat required to raise 1 lb. of the substance 1° to that required to raise 1 lb. of water 1°.—*Engineering.*

Long Rails.

During the recent celebration at Darlington of the fiftieth anniversary of the opening of the first passenger railway, the Britannia Iron Works Company, at their works at the neighboring town of Middlesborough, rolled for the inspection of visitors some rails of unprecedented length, and it is proposed to place one of them, 130 feet long, near the first locomotive engine, opposite the Darlington station, as a memorial of the jubilee. During the same week this company rolled in one mill, 1,350 tuns of rails 40 lbs. per yard, a quantity which it is believed has never been even approached in any other mill in the same space of time. The rails were for the New Zealand Government Railways.

Substitute for the Liquid Prism.

A new method of determining rapidly the index of refraction of liquids is given by MM. Terquem and Tannin in a recent number of the *Journal de Physique*. It is based on the fact that when a sheet of air, enclosed between two plates of glass, is placed in a liquid, parallel luminous rays striking this sheet obliquely are totally reflected at the limited angle of the liquid with reference to the air. It is sufficient then measure this angle, and one has all the necessary data for calculation of the index. The authors describe two different arrangements of the apparatus, and compare some of their results obtained by it with those of Fraunhofer and of Messrs. Dale and Gladstone, showing close correspondence. The method is quicker than that of the liquid prism; the cleaning of the small vessel is very easy; one has not to be preoccupied with the angle of a prism and the exact verticality of its surfaces; and lastly, the temperature of the liquid is more easily determined.

WE understand that Mr. Hughes, of Cincinnati, O., formerly of the firm of Hughes & Foster, is now making for use of the Defence Association a model of a planing machine with yielding pressure bars, such as were used in 1843, three years before the Woodbury Company date their claim to the invention.

IMPROVED ODORLESS WATER CLOSET.

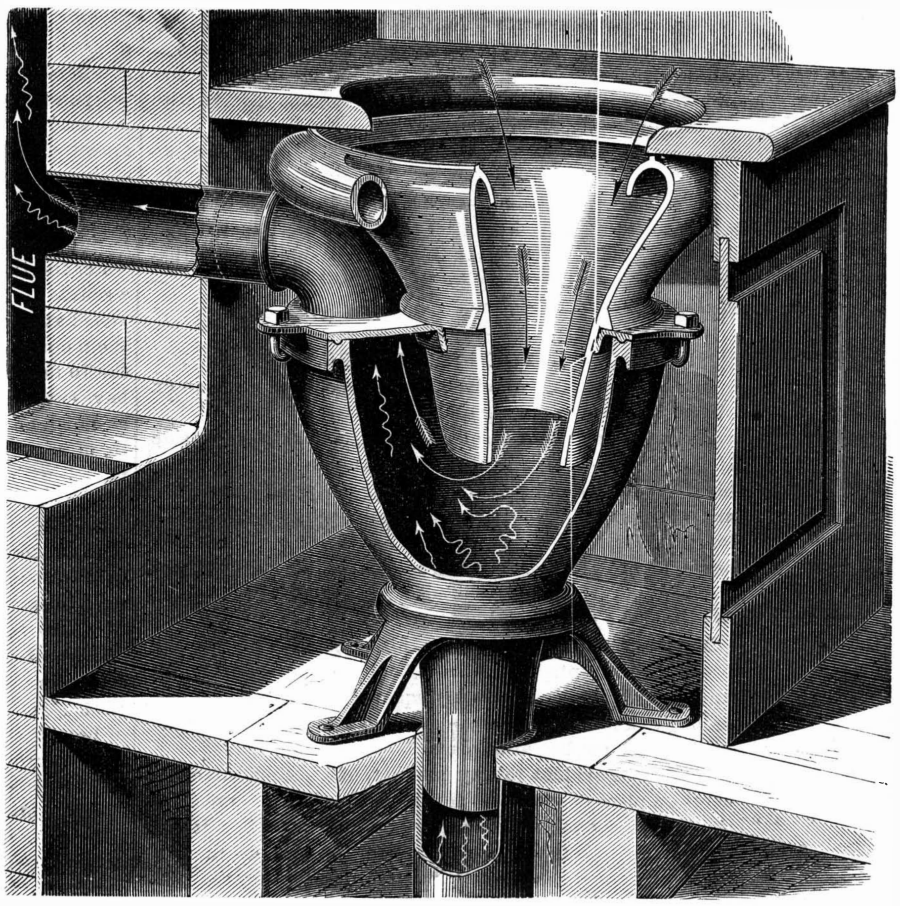
It is just now beginning to be understood that the results of defective drainage are pestilence and death, and, moreover, that many of the safeguards, hitherto relied upon as protections, are in fact no defense whatever. Into the public sewers all kinds of excrementitious matters, waste, and offal, are deposited, along with abundance of water, and the whole is exposed to a temperature favorable to fermentation. The offensive sewer gas is the product, which seeks to escape from its confinement in the sewer by every practicable outlet. The only protection against this escape, commonly employed, is the water-sealed trap, usually in the form of an ɷ, the lower bend of which is supposed to be constantly filled with water, and to prevent the passage of sewer gas. It is known, however, that a pressure of two ounces or less per square inch is sufficient to displace the water in any trap, and this small pressure is frequently exceeded by the gases confined in the pipes. Such augmented pressure may be produced by the influx of a stream of water, by the variation of temperature caused by the entrance of hot water, by wind blowing into the open mouth of the sewer, or by the backing in of tide water, by flushing, etc. In addition to these are other causes capable of unsealing traps, as the disturbances of pneumatic pressure in flushing some distant part of the pipe, siphoning by portions of some textile fabric, as a cord, string, or rag washed partly out of the trap, evaporation, etc. The presence of the characteristic smell in the vicinity of a water-closet denotes that some one of these causes is at work, forcing or aiding the escape of the gas from the opening of the waste pipes.

Traps are designed to suppress and keep in confinement the gaseous products of sewer decomposition. We have repeatedly pointed out, however, the defects of the trap system, and have also expressed the opinion that the best precaution is found in properly directed ventilation, by which the noxious exhalations will be harmlessly carried away. We are therefore able to pronounce favorably upon the invention herewith illustrated, which is based upon the ventilating principle, and in which the bowl of the water closet is directly connected with a chimney or other flue, through which a draft of air will be caused to flow upward and be discharged above the house top. It will be perceived that this arrangement merely constitutes a siphon, the long leg of which is the flue and the short leg the bowl of the water-closet, and that the well known siphon action must ensue. The effect, we are informed, is a complete and perfect prevention of the escape into the apartment of any gas or odor from the soil pipe or interior of the container. This effect is well represented by the arrows in the engraving, the regular ones denoting the flow of pure air, and the crooked ones denoting sewer gas or foul smells. With these closets traps may be advantageously dispensed with, because whatever sewer gas comes to the container will go up the chimney instead of into the apartment, and its presence is immaterial. Besides, with a free outlet of escape at every closet, there could be no accumulation of such gas, and the work of disposing of it would be constantly going on.

These closets are in successful use in the cities of Washington, Baltimore, Cincinnati, Chicago, and elsewhere, and in no instance have they failed to give entire satisfaction. The inventor guarantees them to be perfectly odorless in every instance, if properly set.

With reference to the liability of a down draft in the chimney to cause an overflow of gas, the inventor says that he has not yet encountered any such effect in a well constructed chimney into which air could enter anywhere below the top, and that if the chimney does not draw properly it is simply a case for correction, and must be made to draw. There are also several minor points of improvement worth noticing. The container is placed upon legs, which gives the plumber access to the soil pipe joint, and enables him to caulk it tightly without trouble. The cover is fitted with a rib entering a groove in the rim, so as to insure a tight joint there, with but little material. The bowl is bedded in putty or cement under the flange and down beside the neck for an inch or more, which insures for it a very firm seat.

Patents for this invention have been granted to R. D. O. Smith, 613 Seventh street, Washington, D. C., to whom inquiries for further information should be addressed.



SMITH'S ODORLESS WATER CLOSET.

HALE'S DUPLEX WATER ELEVATOR.

We represent in the annexed engraving a new elevator, the motive power for which is obtained, first from the weight of a column of water, and, second, from the normal pressure of the atmosphere. These forces are applied to raise the carriage through the medium of a piston traveling in a vertical tube, and in connection with suitable hoisting apparatus.

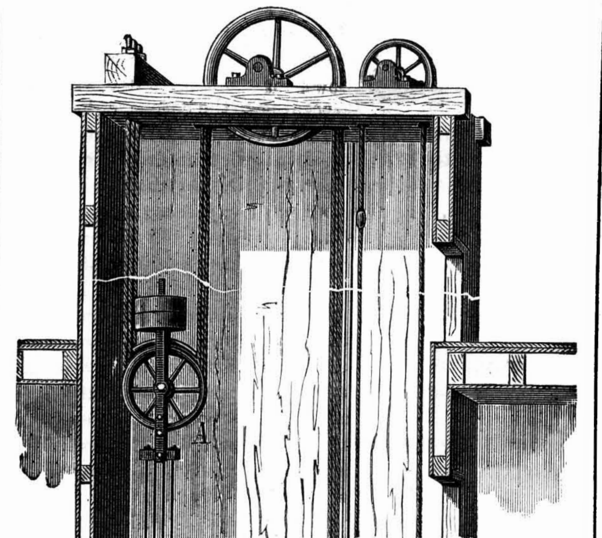
By these means a machine, simple in construction, is produced, and at the same time one claimed to possess the important advantages of cheapness, safety, certainty, and smoothness of action. There are various ways of applying the power above named, different from the plan here illustrated, and of which the manufacturers have likewise availed themselves; but to these it is not deemed necessary to make other than this passing reference, since the reader will obtain a good idea of the principle upon which all are based from the present engraving and description.

The carriage is secured by several ropes which pass up over a fixed pulley wheel, thence to a weighted gin block, A, and their standing parts are secured above, as shown. The weight on the block, A, together with the piston, B, constitute a counterpoise for the carriage. The piston, B, is attached to the gin block and traverses the tube, C. When the carriage is at the lowest point of its course, the piston is at the upper end of the tube. To cause the carriage to rise, the rope, passing through it and shown in the hands of the figure, is pulled, thus opening a valve at D, which admits water through the pipe, E, on top of the piston, and at the same time opens an exit pipe, F, for the water already in the tube below the piston. Since the weight of the carriage itself is compensated for by the counterpoise already mentioned, the resistance to be overcome reduces itself to the load added *plus* the inertia of the various parts. Against this we have, first, the weight of the air, 15 lbs. per square inch above the piston. This is obviously gained through the escape of the water below, the tube giving a column of the latter about thirty-three feet in hight. Second, the absolute weight of the water itself acting on said piston; and, third, as a variable force dependent upon outside circumstances, the pressure of water which may exist in city mains or may be due to difference of level between the top of the tube and a tank located in the upper story of the building. The result of this condition is necessarily the descent of the piston and the elevation of the carriage, the water below the piston meanwhile escaping into the sewers or being led into a tank, from which it may be raised by any suitable means to the tank in the upper story, and so be used over again.

To lower the carriage, no outside power is called into use, a point of advantage of this system over steam elevators, which require a large expenditure of steam to hold the load in descending. The valve rope is pulled so as to set the valve, at D, in the opposite direction, so that the water now enters beneath the piston, passes again through F, and escapes through E. The carriage then sinks slowly and noiselessly, without jar or shake.

That this invention is economical, as compared with steam elevators, will be generally obvious. There is no engine or boiler, requiring care, fuel, and repairs, and in fact there is no reason why, after the apparatus is once constructed of good durable material, it should not last until worn out, at no further expense save that of the water used, as determined per meter, or at that involved in the pumping of the water from the lower to the upper story. It is easy to operate, it stops automatically at the top and bottom of its course, it includes devices (not here represented) for graduating the power employed in proportion to the load, and safety appliances for preventing its fall in case of accident to the hoisting gear.

The invention is covered by six patents, the latest dated April 20, 1875. For further information address the manufacturers, Messrs. W. E. Hale & Co., 56 and 58 Park Place, New York city, or 107 and 109 Lake street, Chicago, Ill.



HALE'S DUPLEX WATER ELEVATOR.

A Collodion Polarizer.

In the *Archiv* Dr. Schnauss says that for some years he has used small bags prepared from thick collodion in his dialytic and endosmotic researches, and that, latterly, Herr Grippon has employed collodion film peeled off clean glass plates in his experiments with polarized light and the radiation of heat. The collodion film polarizes reflected as well as transmitted light, provided the thickness of the skin be, by exact microscopic measurements, between 0·000333 inch, in which case the angle of the greatest polarization would be = 38° 55, and its reckoning index = 1·5108. The skin allows 0·91 of the heat radiating from a luminous source of heat to be transmitted, while a darkened vessel with boiling water only allows 0·70 to pass through; but if the heat radiating from the water be but 50°, then only 0·50 passes through.

From this it will be seen that the radiation from a vessel producing 100° of heat, when transmitted through two superposed collodion skins, still retains 0·583° of heat. Further, the greater transparency of collodion renders it a suitable substitute for mica in producing polarization, and the ease with which it can be prepared counterbalances the greater durability of the mica; and its great dia-thermometric powers recommend it as a vehicle for experimenting upon the radiation of heat.

The War Kite.

Mr. Simmons, the aeronaut, who is the inventor and patentee of a machine named the parakite, lately made a somewhat successful experiment with this invention at the Alexandra Palace, London. The machine used on this occasion was 30 feet high and 30 feet wide. As soon as the sail was fixed over the framework, and the front or windward point of the parakite was raised so as to allow the wind to touch the machine on its under surface, it was instantly converted into a concave form and showed symptoms of rising. The wind was blowing at the rate of not more than two miles an hour; but with this slight breeze Mr. Simmons was carried into the air. We understand that these experiments will be repeated a few times previously to public demonstrations; and should they continue to be successful, the invention can be put to practical utility for war purposes, engineering, and signaling, where it is necessary to attain lofty elevations. The machine above referred to covers an area of 700 superficial feet, and its entire weight is 100 lbs. The inventor asserts that it can be used successfully in any wind ranging between 4 and 40 miles an hour, and an altitude of from 600 to 1,000 feet can be attained.

PRODUCTION OF HEAT AND LIGHT.

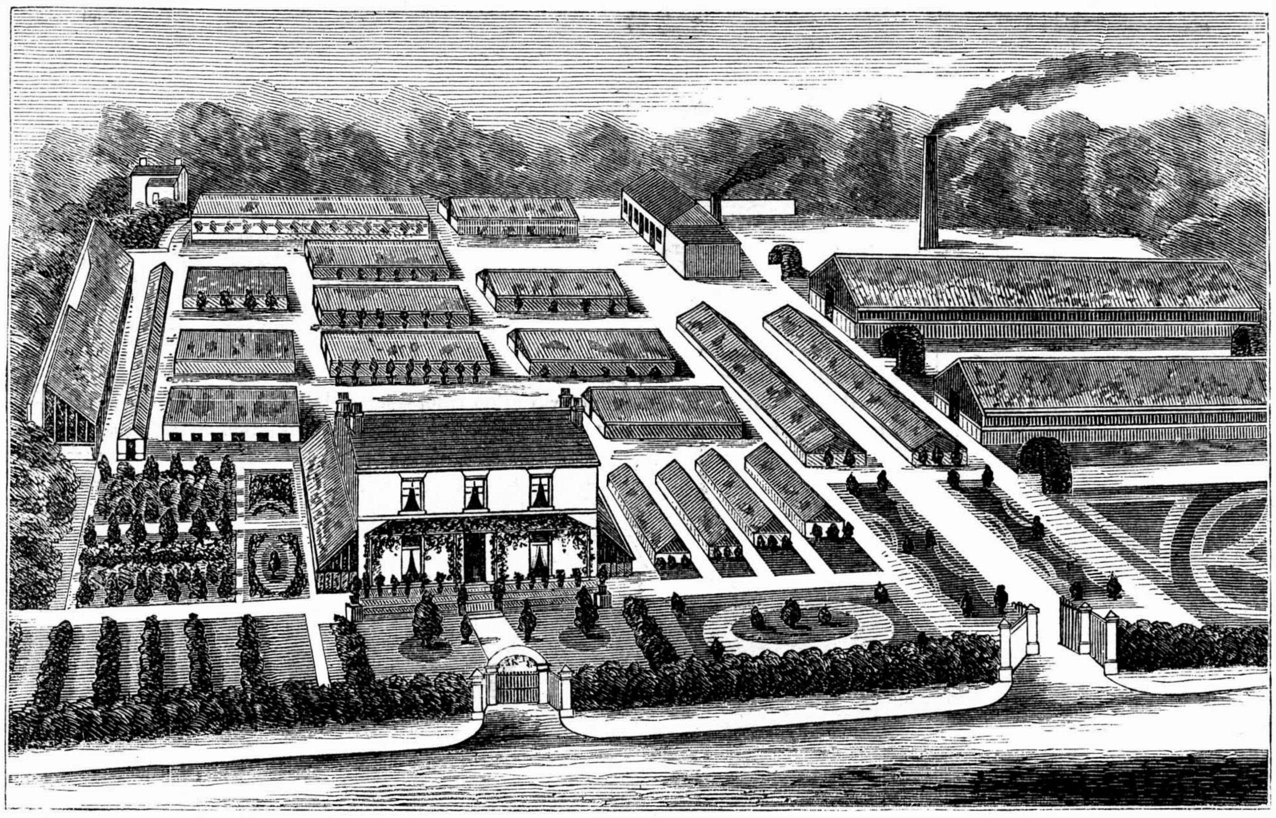
On page 290 of our volume XXXII., we illustrated and described an invention of Mr. Cowan, a Scotch gentleman, combining a hot water heating apparatus with a limekiln or small gas works. The system seems to be likely to come into extensive use in Europe, a company being already formed for bringing it into operation; and they have recently purchased a vineyard at Garston, near Liverpool, containing six acres of ground, which is nearly all covered with glass, and in which four miles of iron piping is employed for heating purposes. We publish an engraving of this establishment, which is now heated entirely by surplus heat from limekilns, although till recently 16 hot water boilers were employed, at a considerable expense for fuel. A correspondent of the *Agricultural Gazette*, from the pages of which we select the engraving, recently visited the place; and he states that, although the limestone has to come by rail, and costs about $2 a tun, the vineyard is heated nearly free of cost, the lime sold paying the expenses. Lime burning is as suitable a process for combining with the heating as the making of gas; for lime is as necessary to the farmer as to the builder. Moreover, if a large area of hothouses could be used, gas to supply the adjoining villages, lime for the whole neighborhood, and warmth for the cattle sheds in winter could all be furnished.

A writer in the English *Farmer* states that "a large party met and spent a day or two, and some of them a night or two, in the Garston vineyard. After the most careful inspection, it is a satisfaction to be able to add that the heating was most satisfactory. The limekilns gave out a powerful steady heat, warming the pipes easily to temperatures ranging from 100° to 140°, according to the distance from the kilns. These temperatures are absolutely sufficient for all horticultural purposes. The new system entirely abolishes the anxieties of night or day stocking. It is only needful to charge the kiln once in 12 or 24 hours, and the joint combustion of the limestone and fuel will maintain the temperature steadily, without varying hardly 5°.

"Neither can there be a doubt about the economy of the limekiln heating. Several gentlemen who have had it in operation for two years declared that the entire cost of the fuel was defrayed by the lime sold.

"The company have also added cheap lighting to the heating of horticultural and all other buildings. The vineyard is already lighted with gas made by placing a retort over the limekiln. This adds to the heating power of the kiln, as the conversion of the coal in the retort into coke and gas gives off additional heat, which is at once absorbed by the boiler astride of both.

"It may not be possible for many or any of our readers to erect a kiln for themselves to light and warm their villa premises, hothouses, or gardens. But villas are often built in blocks, and large numbers of them are not seldom placed within easy reach of each other. Surely in such cases it might be possible to have a common kiln erected, and heat and gas conveyed to all who wanted them, at a remunerative rate. There need be very little more difficulty in conveying hot water to hothouses or mansions than there is in taking coal or gas. Of course there must needs be a double line of pipes, a flow and a return, and some means would have to be used to keep the water warm on its passage. But all these are matters of detail that would be more than compensated by the simplicity of merely turning a tap on when heat was wanted, and turning it off when it was not."



THE GARSTON VINEYARD, NEAR LIVERPOOL ENGLAND.

THE YUCCA STRICTA.

Nearly all the hardy species of yucca inhabit the shifting sands of the seashores of northeast America, from Virginia southward to Florida, and, therefore, they are admirably adapted for planting in similar situations; but they will flourish in any thoroughly drained, free soil, open sunny places suiting them best. They grow rapidly and flower freely in gravelly soil, and we have also seen them doing well on various sand formations, and on the chalk; but they thrive best of all on a deep alluvial soil.

For the rock garden, for massing on knolls, for planting singly, for association with other plants with ornamental foliage, for planting in formal gardens, and for a variety of other purposes, the yuccas stand unrivaled. Although loving a deep free soil, especially where there is moisture below, they will succeed in a stiff loam; but in a heavy soil, slightly raised mounds should be selected, or they are liable to suffer in winter, and rarely flower. In very dry seasons they should be liberally watered; this promotes growth and the production of flowers; but yuccas will bear a long drought without actual injury. This may be verified where small garden plots are drained completely dry, and where rain runs off the ground unless the precaution is taken of keeping the surface moved. Nevertheless, yuccas should be extensively planted in towns, not only in small gardens, but also in the public squares and parks, for water is not altogether so scarce in towns that a little cannot be spared for the garden, and the labor of applying it is far less, as a rule, in town than in the country. For defying dust, and general hardiness of constitution, few plants equal, and none surpass, the hardier species of this genus; but give them the sunny side of the house.

The *yucca stricta* species has long narrow leaves, and a proportionately short stalk to the panicle, the lower part of which does not rise quite clear of the leaves. The marginal threads are very slender and few in number. The lower branches of the panicles are long, and bear as many as dozen flowers, and the latter are comparatively large. Yucca stricta is described in *La Revue Horticole* as a short stemmed plant which, at the surface of the soil, presents a spherical mass of leaves, which are very numerous, and measure some 16 or 17 inches in length, and about half an inch in breadth. They taper off to a point, are straight or sometimes a little bent, slightly canaliculated, and bear upon their edges whitish gray filaments; the youngest leaves are somewhat shorter and broader than the others, and are glaucescent on the interior surface. The flower spike is green, pubescent, and strong, attaining a hight of 3 or 4 feet. The twin flowers, which are often solitary on weak stems, are at first greenish, then yellow, and subsequently nearly white. The external divisions are about 1½ inches long, and three quarters of an inch wide; the interior ones are oval and somewhat larger This plant, which commences to flower toward the end of June, sends out but few suckers. It seems to be intermediate between *y. flaccida* and *y. filamentosa.*

THE YUCCA STRICTA.

Gas Explosion.

At Hamilton, Ontario, one evening recently, a quantity of gas escaped from the street pipes into a sewer. Some workmen were sent to discover the leak, and the sparks caused by striking stones with their boring tools set fire to the gas, and the flame followed the sewer, causing an explosion about one hundred feet distant. The building under which the explosion took place received a severe shock, all the glass in the windows being broken, the walls and floors badly cracked, and a man thrown out of his chair.

A New Telegraph System.

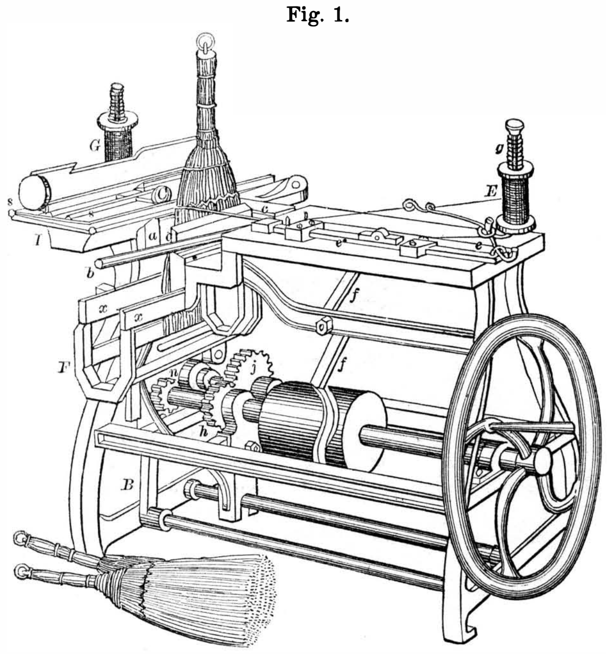
A new telegraph system invented by Paul La Cour, Vice-President of the Royal Meteorological Institute at Copenhagen, obtained considerable attention lately at the International Telegraphic Congress at St. Petersburg, where the inventor exhibited it. The invention is thus described by the inventor: "The system does not consist in a new form of receiving and transmitting apparatus, which, by the talented combinations of Hughes, Wheatstone, Siemens, and others, has attained such a state of perfection that great improvements seem improbable. La Cour's system, however, opens up a new scope for telegraphy, in that he has constructed some simple instrument, whereby the electric current, by being passed through a different instrument, obtains different qualities, whereby it can act upon corresponding instruments at the receiving station. Supposing twenty conducting wires be led from one of the poles of a battery through twenty such instruments; then, by connecting each or some of these with a single telegraphic wire, the following result is obtained, namely, that an electric local current is produced in the twenty corresponding conducting wires on the receiving station, exactly as if the twenty conducting wires on the transmitting station were connected with the twenty conducting wires on the receiving station by means of twenty separate telegraphic wires. Each of these instruments contains a tuning fork connected with an electro-magnet and two wire coils, so that the electric current becomes isochronously vibrating in the measures which correspond with the notes of the tuning forks; and thus those tuning forks in them which have the same note as those in the transmitting instruments are set vibrating, and a current is caused in their local wires."

The above system appears to be identical with that of Mr. Elisha Gray, of Chicago, an account of which we published in the SCIENTIFIC AMERICAN, August 1, 1874. It was there stated that the invention had been tried with success over a circuit of 2,400 miles on the Western Union Telegraph lines. Details of the *modus operandi* were given, sufficient to enable any skillful electrician to construct an apparatus on the same plan. Now it may be that the Vice-President of the Royal Meteorological Society of Copenhagen did not see the SCIENTIFIC AMERICAN, although we have subscribers there, and we believe our paper is on file in some of the libraries of that city; it may be also that he is an independent inventor of the improvement. But unless he can produce proofs of an earlier date of invention than Mr. Gray, M. La Cour should in justice publicly accord to the latter the honors of priority. Electricians will look with interest for M. La Cour's response in this matter.

MISCELLANEOUS USEFUL INVENTIONS.

Continuing our extracts from Knight's "New Mechanical

Fig. 1.



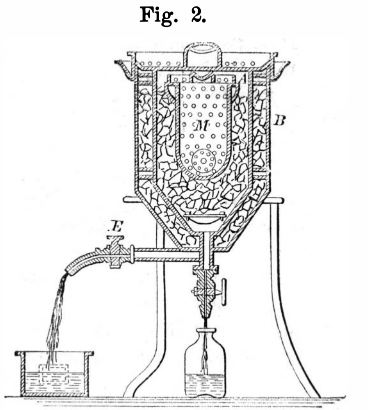
Broom-Sewing Machine.

Dictionary,"* we give below a variety of engravings, with the necessary descriptions, of several useful and ingenious inventions. Fig. 1 represents a

BROOM-SEWING MACHINE,

used for pressing a bunch of broom corn into shape for a broom, and then sewing it in its flattened form. The broom is placed between jaws, *a a*, closed by an eccentric, *c*, and operated by lever, *b*. The machine being set in motion by the rotation of the shaft of the cam wheel, A, the cam groove

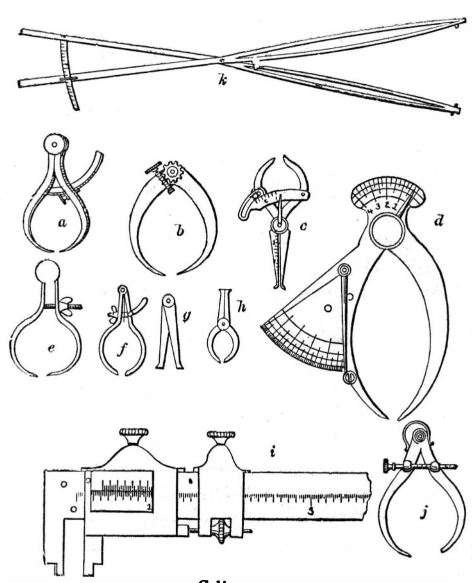
Fig. 2.



Calorimeter.

of the latter, actuating the lever, *f*, forces forward the needle bar, *e*, thus driving the needle with its thread through the broom and above the twine around the latter. The shuttle, *c*, operated by lever, B, acting on the opposite side of the

Fig. 3.



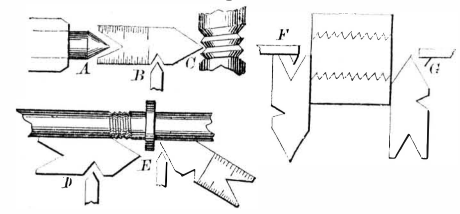
Calipers.

broom in conjunction with the needle, forms the stitch. A reverse movement of the needle bar then withdraws the needle, the eccentric, *n*, lifts the jaws, *a*, so that the next stroke of the needle carries the stitch below the binding twine. The next outward movement of the needle, the jaws being again lowered, carries the stitch above the twine. In this manner the stitches are formed alternately above and below the twine, their distance apart corresponding to the intermittent feed given to the jaws upon their supporting guides, *x*.

THE CALORIMETER,

shown in Fig. 2, is an instrument for measuring the quantity of heat given out by bodies in passing from one temperature to another. The body is weighed, then heated, and finally placed in the compartment, M. The lid is placed over it and covered pounded with ice which already fills the surrounding vessel, A. Over this another lid is placed and covered with ice, which the outer vessel, B, also contains. Finally, a double lid covers the whole. The ice in A is quickly melted, and, flowing out by the stopcock, the water is collected and weighed. The latent heat of water being known, the specific heat of the substance

Fig. 4.



Center-Gages.

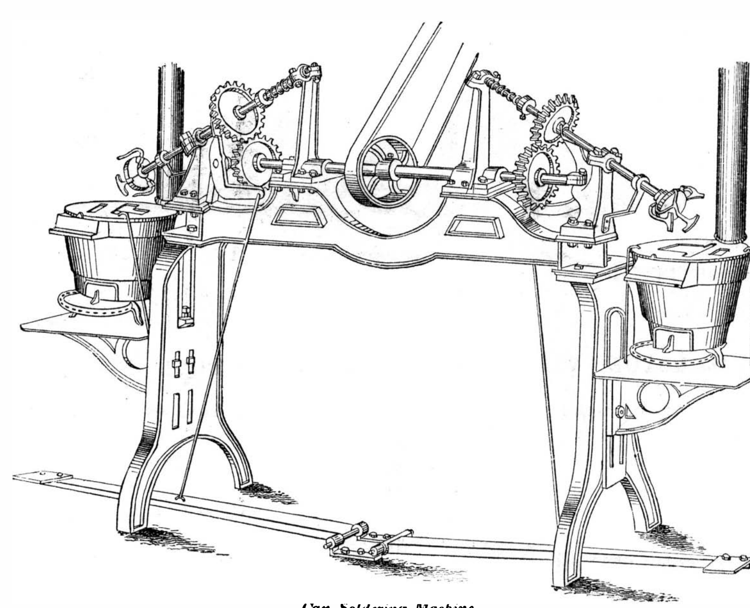
may be readily calculated from the quantity of water obtained.

In Fig. 3 are given several different forms of

CALIPERS

adapted for measuring the diameter of concave or convex bodies. *a* is a bow calipers, with arc and tangent screw; *b* a calipers whose legs are operated by a worm wheel and pinion; *c* is an inside and outside calipers having a graduated arc and index; *d* is a calipers which shows, by the index and arc at the joint, the distension of the points. One leg has a spring, and expands as the calipers is passed over the work, the index on the leg showing the amount of variation from the true size to which the joints have been set; *e* is a spring calipers;

Fig. 5.



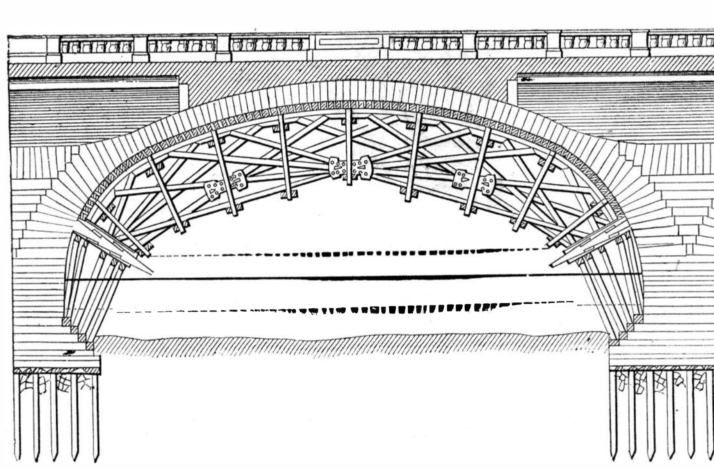
Can-Soldering Machine.

f, a common form of calipers with arc; *g*, inside calipers; *h*, inside and outside calipers; *i* is a vernier instrument for inside or outside measurements, which reads to thousands of inches. On the other side are sixty-fourths or fiftieths of inches, to read without a vernier. *j* is a spring calipers with pivoted operating screw and nut, and *k* is a calipers for measuring standing or cut timber, having arms thirteen feet long, and a brass arc on which are figures showing the quarter girth in feet and inches. Several adaptations of the

CENTER GAGE

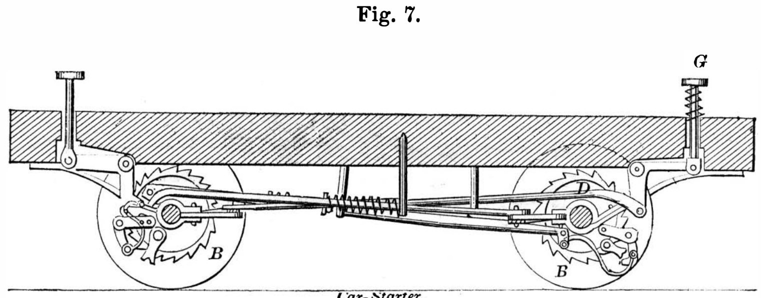
are shown in Fig. 4. The tool is used for showing the angle

Fig. 6.



Center Waterloo Bridge.

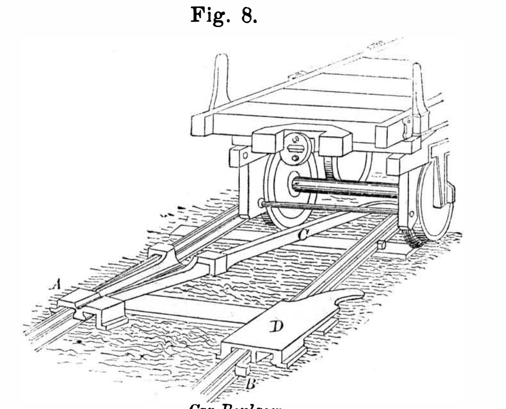
Fig. 7.



Car-Starter.

to which a lathe center should be turned, and also for accurately grinding and setting screw-cutting tools. At A is shown the manner of gaging the angle to which a lathe center should be turned, at B the angle to which a screw cutting thread should be ground, and at C the correctness of the angle of a screw thread already cut. In the lower figure the shaft, with a screw thread, is supposed to be held on the center of a lathe. By applying the gage as shown at D or E the thread tool can be set at right angles to the shaft, and then fastened in place by the screw in the tool post, thereby avoiding imperfect or leaning threads. In the right hand figure, the manner of setting the tool for cutting inside threads is shown. The angles used in this gage are of 60°

Fig. 8.



Car-Replacer.

The four divisions upon the gage of 14, 20, 24, and 32 parts to the inch, are useful in measuring the number of threads to the inch of taps and screws. Fig. 5 is a

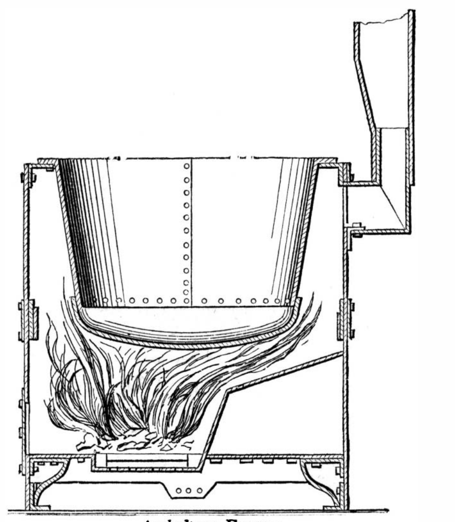
CAN-SOLDERING MACHINE.

In this, a clutch on the end of a shaft, having a bevel wheel gearing with the bevel wheels turned by the central pulley, is placed at each end of a frame, enabling two workmen to operate at once. Beneath each clutch is a bracket for receiving a soldering furnace. A can, with its bottom or top inserted, is fixed upon the clutch, the treadle being previously depressed to throw the bevels out of gear and to withdraw the clutch from the surface of the metal in the soldering furnaces. On releasing the treadle the bevels are thrown into gear, and a spring forces the rod bearing the clutch downward, until the lower edge of the can is slightly immersed in the molten solder, and caused to rotate against the surface of a soldering iron held thereon. After this the treadle is again depressed, and the can removed.

THE CENTERS FOR THE ARCHES OF THE WATERLOO BRIDGE,

in England, have been often cited as admirably arranged structures of their kind. Inclined piles, which carried the weight of the ribs of the center, had their bearings on the offsets of the stone piers, which afforded an excellent abutment. The ribs were laid upon whole timbers capping the piles, and under each set of ribs, wedges were introduced, which were made to extend across the whole width; when it was required to ease the center, the wedges were driven along each other and slid down the inclined plane into larger spaces than they had formerly occupied. The whole center, by this means, was made to descend very gently, and was retained at any required position during the progress of the

Fig. 9.



Asphaltum Furnace.

work. An elevation of the framing is shown in Fig. 6. This center has remarkable strength, and, when struck, the arch settled but a very few inches. The

CAR STARTER,

represented in Fig. 7, is a device intended to assist in starting a street car from a dead stop, so relieving the horses. Pressure on the brake treadle, G, causes a frictional contact between the driving wheels, B, and the friction wheels, D, on the same axle, which retards the motion of the drivers and condenses the spiral spring. When the pressure is removed, the spring actuates a ratchet on the wheel, B, thus assisting to gain the initial impulse.

A number of devices have been patented for the purpose of enabling a car to ascend to its position on the rails when drawn or driven by the locomotive. The general feature, in which all varieties of

CAR REPLACERS

agree, is shown in Fig. 8; it consists in two inclined planes, one

* Published in numbers by J. B. Ford & Co., New York city.

forming a bridge, with a plate, D, to let the lower wheel cross the rail and drop into place. The grooved plate, A' forms a bridge up to the other rail. C is a bar to lead the wheel toward the bridge piece.

Asphaltum, or native bitumen, is largely used for pavements, roads, roofs, and as a waterproof cement. For pavements it is mixed with sand or gravel, and laid while hot upon a foundation of broken stones. The

ASPHALTUM FURNACE,

in Fig. 9, is adapted for heating the material which, when melted, is ladled from the boiler and spread upon the surface to be treated. The construction of the apparatus is quite simple, and will be readily understood from the engraving.

Hints in Hygiene.

From the November number of that most excellent journal the *Herald of Health*, we compile the following practical hints for the preservation of health:

CARBONIC OXIDE

is a colorless and almost inodorous gas, containing one part of oxygen less than carbonic acid. It may be seen burning with a beautiful blue flame on the top of a newly fed coal fire. It is much more poisonous than carbonic acid, and must be guarded against with care. It forms abundantly in our coal stoves, and presses through their cracks and joints into our rooms. It escapes from the gas flame when the pressure is so great that more gas flows than can be burned; it forms and escapes from charcoal burning in the open air or in fireplaces, and may escape into sleeping rooms through open stove pipes or broken flues in chimneys, or half burning wood behind the ceiling, in this way greatly injuring those sleeping therein. Even the ordinary smoke that escapes from smoky stoves and fireplaces may contain it, and persons thus breathing it be injured thereby. One of the effects of carbonic oxide on the blood is that its power to take in oxygen is greatly lessened, and the separation of carbonic acid from the blood retarded.

CANDLE-WICK GAS.

The composition of this smoke is carburetted hydrogen, carbonic oxide, burnt olein, etc. When putting out a candle light before going to bed, always do it so that there shall be no burning wick left to poison the air of the room.

BAKED AIR.

When the air is passed through a hot furnace and heated to a high degree, and then passed into a room, such air should be called baked air, and it is about as bad a form of lung food as can be taken. Nothing but headache, faintness, drowsiness, and dullness can come from its use.

HOW HOUSE AIR IS SPOILED.

The following facts will show how the air in houses becomes contaminated:

1. An adult person consumes 34 grammes of oxygen per hour, a gramme being equal to 15 grains.

2. A stearin candle consumes about one half as much.

3. An adult gives off 40 grammes per hour of carbonic acid. A child of 50 lbs. weight gives off as much as an adult of 100 lbs. weight.

4. A schoolroom filled with children will, if not well ventilated at the beginning of the hour, contain 25 parts in 1,000 of carbonic acid, at the end of the first hour 41, and end of the second hour 81.

5. The air is also spoiled by the perspiration of the body, and by the volatile oils given out through the skin. An adult gives off through the skin in 24 hours from 500 to 800 grammes of water mixed with various excrements, poisonous if breathed.

6. A stearin candle gives off per hour 0·4 cubic feet of carbonic acid, and 0·03 lb. of water.

7. Carbonic oxide is a much more dangerous gas than carbonic acid, and this obtains entrance to our rooms in many ways, through the cracks in stoves and defective stove pipes, or when the carbonic acid of the air comes in contact with a very hot stove and is converted into carbonic oxide. The dust of the air may, on a hot stove, be burnt to produce it; or it may flow out from our gas pipes when the gas is not perfectly consumed.

8. Another form of air injury is the dust of a fungus growth which fills the air in damp and warm places. We call it miasm from a want of a true knowledge of its character.

9. Accidental vapors are the crowning source of air poisoning. These are tobacco smoke, kitchen vapors, wash room vapors, and the like.

10. When we heat our houses and close them from outside air, the heat turns the mixture into a vile mess unfit for breathing. The only remedy is ventilation. Now that it is cold weather and our rooms are closed from free currents of outside air, let us look after the matter thoroughly and do our best to prevent injury to ourselves from polluted air.

CURE FOR LOVE OF LIQUOR.

At a festival at a reformatory institution, recently, a gentleman said, of the cure of the use of intoxicating drinks: "I overcame the appetite by a recipe given to me by old Dr. Hatfield, one of those good old physicians who do not have a percentage from a neighboring druggist. The prescription is simply an orange every morning a half hour before breakfast. 'Take that,' said the doctor, 'and you will neither want liquor nor medicine.' I have done so regularly, and find that liquor has become repulsive. The taste of the orange is in the saliva of my tongue, and it would be as well to mix water and oil as rum with my taste."

SMALL SLEEPING ROOMS.

A large sleeping room is but little better than a small one, unless there is a supply of fresh air for it, and egress for spoiled air; and on the other hand, a small room where there is a constant change of air is nearly as good as a large one.

The supply of air without draft is more important than the size of the room; still a large sleeping room, well ventilated, is most desirable, and children should never be tucked away in small unventilated rooms.

A DRAFT OF AIR.

When the air moves at the rate of two feet in a second, most people will be sensible of a draft, and if the air is cold it will be felt at a less rapid rate. Now a draft is where a current is felt, and in ventilating our rooms in cold weather the air should move through the rooms so as not to be much more rapid than this. In hot weather it may move more rapidly.

SIZE OF SCHOOL ROOM.

For a school room for 20 pupils, 36 feet square and 12 feet high is about the right size. The entire air of such a room should be warmed and changed five times an hour to keep the carbonic acid down to the proper amount; nothing short of this will keep the air sufficiently sweet. At the end of every hour the room should be flushed from every direction to still further purify it.

COUNTERFEIT GRAHAM FLOUR.

Nearly all the Graham flour sold in New York, and perhaps in other large cities, is bogus. It is made by mixing the coarsest of the bran with either spoiled flour or with white flour which may not be spoiled. This flour is made into bread by bakers and sold to dyspeptics who think it wholesome, but it is a poor substitute for the genuine article. Those who want a genuine article must either make it with a home mill, or have it made to order by an honest miller.

TREATMENT OF SORE THROAT.

In cases or ordinary sore throat, the simplest and best treatment is the wet pack, using a linen cloth wrung from cold water, and over this a knit or crocheted yard band, four feet long and four inches wide. Apply this two or three nights in succession, unless it is a very serious case, when the pack should be kept on during the day. If taken off in the morning, wash the throat in very cold water, and rub dry with a coarse towel and with the hand. This will prevent taking more cold. The more friction used the better; let it be a sort of squeezing of the parts so as to affect the deep-seated tissues. Sore throats may be prevented by these means from becoming chronic.

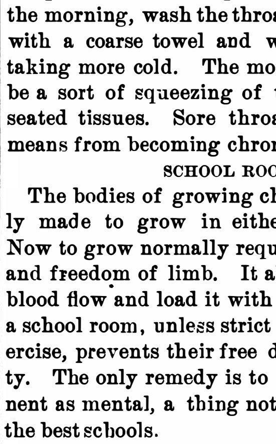
SCHOOL ROOM DEFORMITIES.

The bodies of growing children are soft and tender, easily made to grow in either a normal or abnormal shape. Now to grow normally requires constant change of position and freedom of limb. It also requires exercise to make the blood flow and load it with fresh air. Now confinement in a school room, unless strict attention is given to air and exercise, prevents their free development and causes deformity. The only remedy is to make physical culture as prominent as mental, a thing not yet done by any means in even the best schools.

PROFESSOR BUNSEN'S NEW APPARATUS AND BATTERY FOR SPARK SPECTRA.

Only for a small number of elements and their compounds is the relatively low temperature of the non-luminous gas flame sufficient to produce spectra which can be of use in analytical researches; by far the larger number turn into vapor at such degrees of temperature as can be obtained only by the electric spark. There are difficulties, however, in the way of employing spark spectra, which consist in, first, the necessity of a simple method by which such spectra can at any time be produced; and second, the absence of spectrum tables useful for all practical purposes.

Professor Bunsen has recently devised means for the overcoming of these drawbacks; and in a very important treatise, the first portion of which, relating to the first requirement above noted, has just been published, he fully describes the results of his investigations. An abstract of the treatise we find in *Nature*, from which the following facts and the annexed illustration are taken. Professor Bunsen has invented a new battery and a new spark apparatus, by which the spark spectra can at any time be obtained with the same ease and facility as ordinary flame spectra. The battery is a charcoal-zinc battery without clay cells. The exciting liquid is a mixture of bichromate of potash and sulphuric acid. To prepare the liquid, 1·6 lbs. of powdered bichromate are mixed with 0·881 quart of sulphuric acid in a stone jar, while the mass is constantly stirred; when the salt is changed to sulphate of potash and chromic acid, 9·75 quarts of water are added, the stirring being kept up and the water allowed to flow from a spout about $\frac{1}{2}$ inch wide; the crystal meal, which already is very warm, eventually dissolves completely. The exciters of the liquid are a rod of the densest gas coal, 1·56 inches broad, 5 inches thick, and immersed 4·6 inches into the liquid, and a rolled plate of zinc of the same breadth, of a thickness of 0·19 inch, and immersed to a like depth. The zinc is coated with a layer of wax applied hot, except on the side turned toward the coal, which is amalgamated. The distance between coal and zinc is optional. The best shape for the cells is that of narrow high cylinders. This battery possesses an electromotive force which is about 13 per cent larger than the ordinary charcoal-zinc or Grove battery. Its essential conduction resistance is about 12 per cent smaller than that of Grove's battery with clay cells.



Four of the pairs above described are used for the production of spark spectra. The pole wires conduct the primary current, of which a branch puts the current interrupter into action, to a Rhumkorff apparatus, the induction coil of which has a diameter of nearly 7·8 inches and a length of 19·5 inches. The induced current is carried to the spark apparatus represented in the illustration, which is placed in front of the slit of the spectroscope. The bottle with three necks, *a*, serves merely as a stand. The current passes from the mercury cup, *b*, through the fine wire, *c*, to the carbon point, *d*, which is fastened on a pointed platinum wire; thence, it passes as a spark to the other carbon point, *e*, and from this it reaches the second mercury cup, *f*, which is connected with the other end of the induction coil. The platinum wires, which are surrounded by glass tubes sealed firmly upon them, can be moved upwards or downwards by the corks, *h*, and this allows of a quick and exact fixing of the carbon points before the slit of the spectroscope.

The method given of preparing the charcoal for the points consists in heating sticks of the coal to an intense white heat in a covered porcelain crucible, contained in a large clay crucible and surrounded on all sides by powdered charcoal. The slides are afterwards cut into cones, and then, in order to eliminate the potash, soda, silica, etc., contained in them, they are boiled in a platinum dish, first with hydrofluoric acid, then with concentrated sulphuric acid, then with concentrated nitric acid, and finally with hydrochloric acid, repeating each process several times, while between each manipulation each of the acids is removed by washing and boiling in water. The carbon cones, after this treatment, weigh about 0·2 grain each, and can absorb more than their own weight of liquid. They give a spark spectrum of very long duration.

Scouring Liquid.

For a considerable time Panama wood and Panama extract have been in great use in France. The following is the recipe given by M. Leclerc for what he calls the *esprit de Panama*, for scouring and removing grease from tissues of all kinds and worn clothes. To take out spots the liquid is used pure, but for general scouring it is mixed with four or five time its own quantity of water.

In 22 gallons of hot water dissolve white Marseilles soap 15$\frac{1}{2}$ lbs., and carbonate of potash 1·3 lbs. or 15 or 18 lbs. of soft soap. To the solution add extract of Panama 1·1 lbs.; then in another vessel mix ox or sheep gall 15 quarts, and ammonia at 22°, 3 pints. Heat this mixture, skim it, let it cool, and then add alcohol at 90°, 3·3 gallons; decant and filter.

Take one third part of the soap mixture and two third parts of the gall mixture, and add some aromatic essence.

Method of Increasing the Brilliancy and Silkiness of Dyed Goods.

MM. Gillet et Fils, of Belgium, have adopted, and apparently patented, a simple process for this purpose. In addition to the beating by hand or by mechanical power of the dyed silk when in a wet state, they beat it again when dyed and dry, and say that the effect is surprising. They use the same means as in the former case, hand power, the Dashwell machine, beaters, or even fulling mills. The method is said to be equally effective for silk and any other textile material whatever.

New Vehicle for Colors.

A new method of preparing colors for printing on tissues, paper, leather, or any other substance which will take color, is the invention of M. J. P. Daguzan, a Belgian. It consists of a base of natural caoutchouc or, in certain cases, of gutta percha or other gums. The gum is reduced in benzine or other solvent to the consistence of thin paste, and organic colors are added as desired. In practice, down or the shearings of wool or silk, previously dyed of the desired tint, are used, but they may be replaced by any other analogous substances.

Instantaneous Bleaching Fluid.

In 5$\frac{1}{4}$ pints of water, heated to 190 or 212° Fah. are introduced successively: Mother of pearl, 3$\frac{1}{2}$ ozs.; indigo, 0·75 grain; cochineal, 0·75 grain; chloride of lime, 150 grains; soda crystals, 150 grains; potash, 150 grains. Boil for half an hour, and the preparation is ready for use. The inventor, M. Boiselier, says: "The mother of pearl gives softness, luster, suppleness, etc., and gives to hemp the feel of cashmere; the indigo gives a slight azure tint, the cochineal adds brightness, the chloride effects the bleaching, the soda washes and brushes, and the potash removes all grease."

PROFESSOR F. E. NIPHER suggests the following optical experiment: Observe a white cloud through a plate of red glass with one, and through green glass with the other eye. After some moments transfer both eyes to the red glass, opening and closing each eye alternately. The strengthening of the red color in the eye, fatigued by its complementary green, is very striking.

THOUGH Howe is no more, the Howe Sewing Machine Company is still prospering. A few years ago it established a branch in Scotland, with Glasgow as its headquarters, and it may surprise our readers to learn that in the company's works in the city named 800 persons are employed, and 1,500 machines manufactured weekly.

Freezing Mixtures.

One of the most familiar is the common freezing mixture, which generally consists of equal parts of pounded ice or snow and salt, which produces a reduction of temperature to about —16° C. (3·2° Fah.), and is often used for making ice creams, etc. If, instead of the salt, we used three parts of crystallized chloride of calcium at 0° (32° Fah.), and two parts of snow, we obtain a far more powerful freezing mixture, the temperature falling to about —45° (—49° Fah), and quite sufficient to freeze mercury. The salt in the first instance melts the ice, the water thus formed in its turn melts the salt: so we have both the solids changing to the liquid state simultaneously, consequently absorbing a large amount of heat. For a similar reason, the solution of most salts in water is accompanied by the absorption of a large amount of heat; nitrate of potash and chloride of potassium both cool the water in which they are dissolved.

A useful machine is now made for freezing water without the use of ice, which cannot always be obtained, by mixing together powdered sulphate of soda and common hydrochloric acid. The apparatus consists of an upper and lower thin metal chamber, the upper one having two inner casings and an interior revolving inner cylinder, capable of being turned by a handle at the top. The freezing mixture is placed in the inner casing, and the water to be frozen in the outer casing and in the revolving cylinder. Several vanes are fixed on the outside of the cylinder, so that, when it is turned by the handle, the acid and sulphate are kept constantly mixed. After sufficient ice has been made, the water is drawn off into the lower chamber, which is prepared for holding a number of bottles of wine to be cooled by this liquid.

Detection of Arsenic in the Air of Rooms.

H. Fleck has shown in a series of interesting and important experiments that there is arseniuretted hydrogen in the air of rooms, the walls or the carpets of which are colored with Schweinfurth green. The dust of arsenic mechanically diffused in the air is therefore not the only cause of chronic arsenical poisoning. We must add the arseniuretted hydrogen gas evolved from the decomposition of the free arsenious acid existing in the green. The experiments of Fleck prove that this gas is liberated under the joint action of organic matter and moist air, and its presence is therefore possible wherever free arsenious acid comes in contact with organic matter.—*Zeitschrift für Biologie.*

THE angular velocity of clouds is determined by M. Hursan de Villeneuve in the following way: He takes a ball of silvered glass, on which he draws with ink an equator and equidistant meridians. He places the sphere so that, the axis being horizontal, the cloud may be seen, by reflection, displaced along the equator traced, and then the time which it takes to go from one meridian to the next gives the angular velocity.

Recent American and Foreign Patents.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED HATCHWAY BRACE.

James Fleming, Buffalo, N. Y.—This invention consists of adjustable braces which strengthen the sheave timbers, through which the rope attached to the grain shovels pass. The braces also serve to hold the elevator in position, and to protect the shovel ropes against chafing.

IMPROVED HANGER FOR SLIDING DOORS.

Leeds A. Cook, Dansville, N. Y.—This is an improvement on the invention patented to same inventor November 1, 1870. The object is to simplify that device, and the arrangement is so modified as to consist of a sliding door hung to a swinging lever sliding in a slot of the main post, and supported centrally by a radius bar pivoted to said post, so as to be opened and closed by a parallel motion.

IMPROVED SLEIGH.

Benjamin F. Sweet, Fond du Lac, Wis.—The knee of the sleigh is so constructed that it has considerable play or movement in the socket formed by the parts by which it is secured to the runner. The runners are hence adapted to yield somewhat to uneven surfaces, so that the bob will sustain heavy loads, and will glide over the snow with less friction than those whose frame is rigid.

NEW HOUSEHOLD ARTICLES.

IMPROVED WOOD SPLITTER.

William Latus, Brooklyn, assignor to T. Karutz, Brooklyn, E. D., N. Y.—This is a portable contrivance for splitting wood for lighting fires without damaging the hearth, or using a hatchet. There is a bed piece supporting a horizontal blade, which is caused to reciprocate by means of a handle connected to it by rack and pinion. The wood, being placed between the blade and stationary bed, is quickly split.

IMPROVED CLOTHES DRYER.

Lorin A. Wait, Riceford, Minn.—The arms on which the clothes are hung are attached to a collar which slides on a vertical post. They pass through slots in a revolving cap on top of the post, so that, when the collar is pushed up toward said cap, the arms extend radially, and when the collar is lowered they fold in compactly. By this arrangement, the device can be stowed away in a small space when not in use.

IMPROVED KEY FASTENER.

William W. White, New York city.—This is a useful little invention for travelers, inasmuch as it prevents the key of a door being turned by nippers or other instrument inserted in the keyhole from the outside. A bow of metal in form of a staple hangs on the knob shaft, and passes through the key loop; and its ends are secured in a small block by means of a set screw.

IMPROVED NON-EXPLOSIVE LAMP.

George W. Vernon, Bonsacks, Va.—The invention consists in a wick tube enlarged toward its upper end and provided with a divided neck, to form a channel discharging at the top of the tube. This is applied to a lamp having an oil reservoir below and a water chamber above, the wick tube passing down through the latter to the former. By this construction, the wick tube is kept cool while, in case of an overturn, the flame is instantly extinguished.

IMPROVED BEEF STEAK TENDERER.

Theophilus Billington, Weatherford, Tex.—This inventor proposes to pass the steak through studded rollers, mounted one above another on a stand. Said rollers may be adjusted for different thicknesses of meat, and may be pressed together by power easily regulated by the operator.

NEW AGRICULTURAL INVENTIONS.

IMPROVED GRAIN SEPARATOR.

Hermann Mielke, Watertown, Wis.—This machine is so constructed that the current created by the fan acts on the grain in its passage from the hopper, and separates the light grain from the heavier. The lighter falls on a laterally inclined plane, between partitions, and is conveyed to the side of the mill, the chaff and other impurities being conveyed over an outer inclined plane, extending downward from the second partition wall. The machine may be worked for any kind of grain by a simple regulation of the feed opening and current.

IMPROVED HARVESTER.

Christopher Lidren, La Fayette, Ind, assignor to himself and R. Jackson, of same place.—In this invention, the novel features include a rake pivoted to the rake standard to swing backward and forward to discharge the gavels, together with devices which turn the rake or scraper up edgewise preparatory to going back to scrape off the gavel, and turn it down flatwise preparatory to going forward again. Arrangements are provided to pass the scraper forward below the platform and up through it and the grain which falls while a gavel is being discharged. There is also a means of returning the rake to the front without interfering with the grain lying on the platform, and a novel mode of supporting and adjusting levers for the reel, whereby it can be readily raised and lowered by the driver without moving from his seat, and without altering the tension of the belt.

IMPROVED MOWING MACHINE.

David Wolf, Avon, Pa.—This inventor proposes ingenious mechanism for locking the cutter bar of a reaper or mower in different positions to adapt it for various kinds of work, and to enable it to be fastened upright for passing from place to place.

NEW CHEMICAL AND MISCELLANEOUS INVENTIONS.

IMPROVED SAFETY OIL RESERVOIR.

Thomas Scantlin, Evansville, Ind.—This consists of a can or reservoir provided with a pump and with measuring compartments and a filling compartment and tube. The measuring vessels may be of different size, so as to hold the quantities usually called for, as one quart, two quarts, or a gallon. The oil is drawn, as it may be ordered, directly into the customers' vessels, and is not exposed to the air, or to danger from fire.

IMPROVED VARIABLE MEASURE.

Charles P. Sullivan, Jr., Line Creek, S. C.—This inventor has devised an ingenious method of combining several measuring vessels in one. The box has a movable bottom which is shifted up or down in the interior and sustained by pivoted pieces from below, and by pins inserted through perforated hollow vertical tubes on the sides.

IMPROVED BUTTON FASTENING

James H. Harrington, Providence, R. I.—This is a new way of fastening buttons to garments so that they may be attached or detached without sewing. The button has a spring hook eye pivoted its back in which is inserted a ring.

IMPROVED MEDICAL COMPOUND.

John W. Harvey, Memphis, Mo.—This invention relates to a new medical compound for the cure of catarrh. It is composed of nitrate of potash, chlorate of potash, powdered golden seal, table salt, and gum camphor, to be dissolved in water and used as a bath to the head and nose, or snuffed up the nose and inhaled in the form of a powder.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED COMPRESSION COCK.

James McLaughlin, New York city.—This compression cock is so constructed that it may be fully opened and closed by a half turn of the handle. The inventor states that it is entirely free from leakage, durable when used with both hot and cold water, and not liable to get out of order.

IMPROVED LUBRICATOR.

Joseph Warren Reed, Kalamazoo, Mich —This is a hollow plug charged from the holder and discharged into the engine, at the same time cutting off the supply from the holder. The new features include, first, an improved contrivance of venting the hollow plug, by which there is no waste; second, of a valve to shut off steam from the holder to prevent the mixing of water with the oil by the condensation of steam; third, of a vent or waste pipe connecting with the space above the valve, to carry off the condensed steam in case the valve is not perfectly tight, and insure its closing; and, fourth, of a contrivance to regulate the amount of oil delivered.

IMPROVED ROAD ENGINE.

John Henry Bange, Edwardsville, Ill.—This is a new and ingenious form of road engine, to which the name of the "Mountain Runner" has been given by its inventor. Many of the improvements are of a mechanical nature and cannot be clearly described without the aid of drawings. The principal feature, however, consists in the novel construction by which the water in each compartment, when the engine is passing up and down hill, finds its level independent of the water in the other compartments of the boiler, so that it cannot collect at the end of the boiler, but will be distributed through it.

IMPROVED DEVICE FOR TRANSMITTING POWER.

John Wesley Woodruff, Jollytown, Pa.—This invention consists of the connection of a fly wheel by a long crank lever, of which one end is fixed to a point near the circumference of the fly wheel, while the other crank-shaped end turns a large spur wheel that intermeshes with a pinion of a shorter shaft with a transmitting pulley. The transmitting lever turns by a ball journal in socket bearings near the crank end. This enables the power of an engine to be transmitted for some distance and then applied directly to machinery.

IMPROVED CAR WHEEL CHILL.

William Wilmington, Toledo, Ohio.—This invention relates to certain improvements in chills for casting car wheels, and it consists in constructing the metallic annular chill with annular air chambers at the points of the interior surface of the chill where the outer periphery of the flange of the wheel is formed, and also at the points where the outer horizontal surface of the tread is formed, by means of which the central portion of the tread which receives the greatest wear is allowed to harden: but the outer periphery of the flange and the outer surface of the tread are prevented from rapid cooling by the new conducting air chamber, and the metal at these points is molded and preserved in its full strength and tenacity, a result to be greatly desired in view of the fact that, while the process of chilling hardens the iron, it greatly impairs its tenacity and strength.

IMPROVED ELEVATED RAILWAY.

John Westcott, Tocoi, Fla.—The object of this invention is to provide a cheaper construction of railroads and cars than that now in use, and it consists in a single iron rail laid upon and fastened to a continuous beam of wood, which is supported upon the ends of a series of piles driven into the earth so as to constitute an elevated railway. The cars have a single set of wheels, which have two flanges and run upon the rail, the bottom of the car being close to the rail, and the sides of the same extending down by the sides of the piles and engaging with friction rollers upon the same to steady and hold the car in position.

IMPROVED CAR COUPLING.

Hugh F. McKervey, Cheboygan, Mich.—This invention is an improvement in car couplings of the harpoon variety, and it relates, first, to the combination and arrangement whereby the coupling bar is connected with a pivoted counterweight, and by it maintained in such position that lateral arms or shoulders formed on its middle portion will remain engaged with hooks or shoulders formed on the front end of the same drawhead which contains the counterweight. The invention consists, secondly, in the arrangement of a sliding bar in such relation to the counterweight, pivoted within the chamber of the drawhead, that the latter may be thereby raised, or turned on its pivots, and locked, or held in its elevated position by the slide bar projection under it.

IMPROVED DRIVE-WELL PACKING.

Vincent F. Thomacich, Mobile, Ala.—This invention relates to the packing of the drive well or other pumps, and contemplates a prevention of the curling of the hard leather packing. It consists in a metallic ring support, concaved on the inside and bracing the leather packing of the piston.

IMPROVED SPINDLE BOLSTER.

Welcome Jenckes, Manchester, N. H.—This invention relates to what is known as the spindle bolster of spinning frames, and consists of a longitudinal slot in the bolster, in which slot is placed a packing, which is saturated with oil for lubricating the spindle. By this arrangement, the spindle is kept lubricated for weeks continuously, and the trouble of oiling every day, as is usually the case, is obviated.

IMPROVED COTTON PRESS.

Benjamin F. Platt, Vienna, La.—This is a very simple and inexpensive plan for applying hand or horse power to work the press. The press case is arranged on stationary pivots. Each pivot is screw-threaded, and has for its head one of the press followers. The screws are right and left handed, so that they move the followers in opposite directions at the same time, when the power is suitably applied.

IMPROVED LIFTING JACK.

Samuel E. Mosher, Chillicothe, Ohio.—In this device the lifting bar has downwardly-inclined teeth on one side in which teeth on the lifting dog engage. The dog is pivoted to a lever, which in turn is pivoted to swinging bars on top of the stand, so that the dog is drawn into the teeth on the bar when force is applied to the lever.

IMPROVED ADJUSTING FEED ROLLS FOR PLANING MACHINES.

Charles D. Lawrence and Charles E. Ward, Fairfield, Me.—The feed rolls are mounted on a rod by bearings which can slide or be fixed in position as may be preferred. The bearings are moved by a shaft having pinions gearing with station racks. An arm connecting the lower sliding bearing turns it to shift a pinion along the feed roll to keep it in gear.

IMPROVED ADJUSTABLE BUMPER OR FENDER PLATE FOR PILES OF ELEVATED RAILWAYS.

John Westcott, Tocoi, Fla.—The object of this invention is to provide a bumper or fender plate for protecting the piles of elevated railways, in which the track consists of a single rail mounted upon a series of piles, and the car is provided with pendent extensions upon each side of the rail which extend down beside the piles. The invention consists in two symmetrically shaped curved plates faced upon the inside with elastic cushions and provided with flanges which are fastened together by means of screw bolts, so as to cause the said plates to tightly clamp the piles, and having lugs to keep them from turning.

NEW BOOKS AND PUBLICATIONS.

THE HUMAN VOICE, ITS ANATOMY, PHYSIOLOGY, PATHOLOGY, THERAPEUTICS, AND TRAINING. By R. T. Trall, M.D., Principal of the Hygeio-Therapeutic College, etc. New York city: S. R. Wells & Co., 737 Broadway.

This work is intended to be a manual for the use of students of elocution, and to it are appended rules for the management of debating societies, and some selections from popular authors for practice in reading aloud with correct and appropriate expression.

MANUAL FOR THE USE OF THE GLOBES. Illustrated. By Joseph Schedler. New York city: E. Steiger, 22 and 24 Frankfort street.

This is a very readable little pamphlet, containing some excellent remarks on the value and importance of the science of geography. The astronomica information is very concisely and well expressed.

HANDBOOK FOR CHARCOAL BURNERS. By G. Svedlius. Translated from the Swedish by R. B. Anderson, A.M. Edited, with notes, by W. J. L. Nicodemus, A.M., C.E. Illustrated. Price $1.50. New York: John Wiley & Son, 15 Astor Place.

This little manual was originally prepared for the Government of Sweden, chiefly from two meritorious but unsuccessful papers offered in response to an official call for a popular treatise on charcoal burning. It no doubt fairly represents the best practice of Sweden in the matter of charcoal making, and may be found useful to those engaged in pit burning on a small scale. Professor Nicodemus has added a few notes from Percy's "Metallurgy," and from Crookes & Röhrig's treatise on "Fuel," the latter describing briefly some of the older methods of kiln-burning practised in this country. To answer for American charcoal makers, this portion of the work would need to be very much extended.

A TREATISE ON THE RICHARDS STEAM ENGINE INDICATOR, and the Development and Application of Force in the Steam Engine. By Charles T. Porter. New York city: D. Van Nostrand, 23 Murray and 27 Warren streets.

This work is written in a clear, lucid style, showing its author to be a thorough master of his subject. The reader is led, from a clear understanding of the requirements of an indicator and the manner in which the well known Richards indicator fulfils them, to carefully written instructions, first as to how to use the instrument, and then how to compute the results of any given diagram. The laws governing the development and application of force in a steam engine are laid down in a concise manner, giving a complete understanding of their principles. The book contains many excellent and carefully compiled tables, showing an immense amount of work by the author, and will be found useful to the professional engineer as well as the student.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From October 8 to October 12, 1875, inclusive.

CONDENSER.—Ransome Siphon Condenser Co., Buffalo, N. Y.
DOUBLING MACHINE, ETC.—J. F. Wicks, Providence. R. I.
EXCAVATING MACHINE.—P. J. Stryker, New Brunswick, N. J.
LIGHTING GAS, ETC.—M. E. Jones, Pittsfield, Mass.
STILT.—F. Beaumont, Jr., *et al.*, Dallas, Texas.

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.

Dry steam dries green lumber in 2 days, and is the only Cheap House Furnace. H G. Bulkley, Cleveland,O.

For Sale—Machine Tools, 2d Hand, good order: Planer, 12 ft.x36 in.x32 in., $800; Crank Planer, 2 ft. bed, 14 in. stroke, $345; Upright Spliner, 5 in. stroke, $90; New Milling Machine, platen 15x8, $387; Putnam 24 in. Gear Cutter, $500; Upright Drill, 52 in. swing, $325; ditto, 56 in. swing, $250; Engine Lathes, as follows: 1—new 25½ ft. bed, 36 in. swing, $1,550; 16 ft.x31 in. swing, $660; 15½ ft.x30 in. swing, $630; 12½ ft.x30 in. swing, $500; 16 ft.x24 in., $240; 12 ft.x24 in., $425; 9 ft.x15 in., $210; 6 ft.x15 in., $230; 8 ft.x17 in., $215; Double-headed 15 ft x 20 in., 11 ft.x12 in., and 16 ft.x20 in., $350, $155, and $250, respectively; 8 ft.x20 in., $290; 5 ft.x14 in., $195; 5 ft.x15 in., $210; 8 ft.x17 in., $240; 6 ft.x17 in., $225; 4 ft.x 9 in., $140. Also speed or drill Lathes, as follows, viz: 5 new 6 ft.x12 in., each $75; 6 ft.x13 in., $50; 2 ft.x9 in., $55; 3 ft.x8 in., $35, 5 ft.x18 in., $75; 6 ft.x14 in., $50. Also new "Oneida" make of Chucks, 24 in., $105; 15 in., $50, and 12 in., $42; No.4 Wiley & Russell Power Bolt Cutter, $170; 7 ft. helve Iron Frame Trip Hammer, $150; Japanning Oven, $20. For full printed lists, address Forsaith & Co., Manchester, N. H.

For Sale—Miscellaneous Machinery, 2d Hand Horse Power, with wood sawing rig, $165; Hydraulic Presses and Pumps, weighing 13,000 lbs., $650; No. 4 Blake Pump, $220; No. 1 Seldon Pump, $80; No. 2 Knowles Pump, $85; 5 ft. Whitney Water Wheel, complete, $400; 5 ft. Blake Wheel, complete, $375; 3 ft. Whitney Wheel, $275; Lot ⅝ in. iron chain, 4½c. per lb.; No. 7 Sturtevant Blower, 4 ft. diam., with Steam Boiler for drying wool by heated air, almost new, cost $1,100, price $450. Iron Pulleys as follows, finished: 12 ft x25 in., 4c. lb.; 9 ft.x20 in., 5c. lb.; 6½ ft.x20 in., 4½c. per lb.; 5 ft.x25 in., 3½c. lb.; 5 ft.x12 in., 5c. lb.; 4 ft.x10½ in., 5c. lb.; 4 ft.x10 in., 4½c. lb.; 42 in.x22½ in., 5c. lb.; 3 Binder Rolls with shafts and boxes, 26x28 in., $18; 25x21 in., $10; 22x19 in., $8. For printed lists, address Forsaith & Co., Manchester, N. H.

The largest newspaper mail which goes to any one firm in this country, is received by Geo. P Rowell & Co., the New York Advertising Agents. Their place of business is at No. 41 Park Row.—[Exchange.]

25 per cent extra power or saving in fuel, guaranteed to steam engines, by applying the R. S. Condenser. T. Sault, Consulting Eng'r, Gen. Agt., New Haven, Ct.

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

Wanted—A First Class Tinner. One accustomed to small work, such as Saddlery Hardware, preferred. Address Factor, Philadelphia P. O.

Parties wanting articles made, wholesale, on wood-working machinery, call on or address C. E. Phillips, Vandalia, Ill.

Capitalists or Manufacturers Wanted—To take interest in the manufacturing of Toepperwein's new Repeating Guns. Address E.A.F.Toepperwein, Boerne, Kendall Co., Texas.

Gothic Furnace, for coal and wood, heats houses churches. Send for book. A.M.Lesley.226 W.23d st.,N.Y.

Traction Engines, good order, for Sale cheap—International Chemical Works,10th St., Hunter'sPoint,N.Y.

Double-Entry Book-Keeping Simplified. The most successful Book on the subject ever published. Cloth, $1. Boards, 75 cts. Sent post paid. Catalogue free. D. B. Waggener & Co., 424 Walnut St. Philadelphia, Pa.

Bolt Headers, both power and foot, and Power Hammers, a specialty. S. C. Forsaith & Co., Manchester, N. H.

Main Driving Belts—Pat'd improvement. Address for circular, Alexander Bro's, 412 N. 3d, Philadelphia, Pa.

Boult's Paneling, Moulding and Dovetailing Machine is a complete success. Send for pamphlet and sample of work. B. C. Mach'y Co., Battle Creek, Mich.

For best and cheapest Surface Planers and Universal Wood Workers, address Bentel. Margedant & Co., Hamilton. Ohio.

Patent Scroll and Band Saws, best and cheapest in use. Cordesman, Egan & Co., Cincinnati, Ohio.

Small Engines. N. Twiss, New Haven, Conn.

The Original Skinner Portable Engine (Improved), 2 to 8 H.P. L. G. Skinner, Erie, Pa.

Camp Lounge, $5. C. L. Co., Troy, N.Y., and Norwalk, Ct. N. Y. City Salesroom, 177 Broadway.

Hotchkiss Air Spring Forge Hammer, best in the market. Prices low. D. Frisbie & Co. New Haven. Ct.

Saw Teeth Indicator—Showing improved form for filing teeth on Saws for use in different kinds of wood, &c. Sent free for 50c. E. Roth, New Oxford, Pa.

For reduced prices of Surface Planers and Mitre Dovetailer's Machines, send to A. Davis, Lowell, Mass.

"Pantect," or Universal Worker—Best combination of Lathe, Drill, Circular, and Scroll Saw. E. O. Chase, 7 Alling Street, Newark, N. J.

To Manufacturers—Pure Lubricating Oil, Sample Package (24 gals.), $7. Send to Geo. Allen, Franklin.Pa.

Educational Lantern Slides—Send for Catalogue to Prof.W.A.Anthony, Cornell University, Ithaca, N.Y.

Hotchkiss & Ball, Meriden, Conn., Foundrymen and workers of sheet metal. Fine Gray Iron Castings to order. Job work solicited.

For Sale—Second Hand Wood Working Machinery. D. J. Lattimore, 31st & Chestnut St., Phila., Pa.

Price only $3.50.—The Tom Thumb Electric Telegraph. A compact working Telegraph Apparatus, for sending messages, making magnets, the electric light, giving alarms, and various other purposes. Can be put in operation by any lad. Includes battery, key, and wires. Neatly packed and sent to all parts of the world on receipt of price. F.C.Beach & Co., 246 Canal St., New York

Small Tools and Gear Wheels for Models. List free. Goodnow & Wightman, 23 Cornhill, Boston, Mass.

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

For Solid Emery Wheels and Machinery, send to the Union Stone Co., Boston, Mass., for circular.

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

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 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.

Brass Gear Wheels, for Models, &c., on hand and made to order, by D. Gilbert & Son, 212 Chester St., Philadelphia, Pa. (List free.) Light manufacturing solicited

American Metaline Co., 61 Warren St., N.Y. City.

Genuine Concord Axles—Brown, Fisherville, N.H.

Faught's Patent Round Braided Belting—The Best thing out—Manufactured only by C. W. Arny, 148 North 3d St., Philadelphia, Pa. Send for Circular.

For 13, 15, 16 and 18 inch Swing Engine Lathes, address Star Tool Co., Providence, R. I.

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

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Temples and Oilcans. Draper, Hopedale, Mass.

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The "Scientific American" Office, New York, is fitted with the Miniature Electric Telegraph. By touching little buttons on the desks of the managers, signals are sent to persons in the various departments of the establishment. Cheap and effective. Splendid for shops, offices, dwellings. Works for any distance. Price $6, with good Battery. F. C. Beach & Co., 246 Canal St., New York, Makers. Send for free illustrated Catalogue.

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

The Baxter Engine—A 48 Page Pamphlet, containing detail drawings of all parts and full particulars, now ready, and will be mailed gratis. W. D. Russell, 18 Park Place, New York.

Notes & Queries

N. G.'s directions for placing an engine on the center originally appeared in the SCIENTIFIC AMERICAN.—P. T. will find an article on glue on p. 8, vol. 32, which will probably answer his purpose.—T. S. can copper his malleable iron castings by following the instructions on p. 90, vol. 31.—D. J. W. and others are informed that we have so frequently recommended courses of study to young engineers that we cannot repeat them.—F. B. L. can make a waterproof varnish for cloth by following the instructions on p. 74, vol. 31.—G. M. can solder brass to iron by following the directions on p. 251, vol. 28.—F. D. will find directions for drying raisins on p. 409, vol. 31.—S. C. D. will find directions for making fulminate of silver on p. 90, vol. 31.—S. E. S. can produce a dead black on brass work by the process given on p. 362, vol. 25.—W. H. L. can transfer pictures to glass by using the process detailed on p. 123, vol. 30.—C. E. F. will find an answer to the question as to the ball falling through the earth on pp. 158, 250, vol. 31.—C. J. will find directions for obtaining albumen from blood on p. 344, vol. 31.—C. R. can use up his coal dust by following the directions given on p. 371, vol. 24.—G. can temper turning and boring tools by following the process described on p. 21, vol. 31. As to horse power of an engine, see p. 33, vol. 33.—S. H. D. will find a recipe for an alloy for making models, etc., on p. 91, vol. 30.—W. S. will find directions for making matches on p. 75, vol. 29.—L. E. O. will find that the gyroscope is lucidly described on p. 91, vol. 31.—W. B. T. can preserve leaves and flowers by the process given on p. 266, vol. 31.—F. S. will find a description of a wooden railroad on p. 358, vol. 31.—J. M. McC. can detect cotton in linen goods by the method described on p. 102, vol. 28.—T. K. G. will find a recipe for a composition for explosive bullets on p. 300, vol. 33.—L. J. F. will find directions for refining cotton seed oil on p. 19, vol. 30.—C. S. can glue his rubber rollers to the wooden spindles. For a recipe for utilizing old rubber, see p. 33, vol. 27.—D. A. R. can clean ivory by the process described on p. 10, vol. 32.—M. R. W. will find rules for calculating the proper cut-off of an engine on pp. 37, 69, vol. 32.

(1) C. R. M says: I am going to cover a boiler with staves one inch thick, tongued and grooved; the staves do not fit close to the surface on account of rivet heads. Would charcoal dust mixed with clay be a good thing to put between the boiler and the staves? A. Clayalone will probably answer as well.

(2) G. C. H. and others desirous of entering government service as engineers should apply to the Secretary of the Treasury; and if there are any vacancies in the engineer corps, they will receive full information.

(3) T. B. J. asks: 1. What power should be obtained from steam issuing from a quarter inch round pipe at 80 lbs. pressure by a good non-condensing engine? A. We would like some further particulars. 2. Has any rotary engine hitherto constructed given as much power from the same steam as a plain reciprocating engine? A. There is not much information in print about the performance of rotary engines; but as far as the records go, the advantage is with the reciprocating engines.

(4) A. H. asks: If the smoke stack on a locomotive be cut off about one foot above the boiler, will that reduce the power? If so, in what proportion may grate area and heating surface be increased to remedy the loss? A. If the blast continues effective, there would be little difference.

(5) B. L. G. says: 1. I have a vertical stationary 4x8 engine, with a vertical boiler 6 feet high, 30 inches outside diameter, with 40 two inch tubes 4 feet long in it. How much power will I get with 50 lbs. steam? A. Probably between 3 and 4 horse power. 2. The heat as now arranged passes through the tubes and up the chimney. To economize fuel, I propose to put a sheet iron jacket over the boiler, to within 6 or 8 inches of the bottom, with another outside of that, reaching from the bottom and made tight, the pipe to the chimney leading from near the top of this. The heat would then pass up the tubes, down between the shell of the boiler and the inner jacket, and up between the jackets to the chimney. Would this be advisable? If so, how much space would be necessary between boiler and jacket? The draft is good. 2. It might be better to leave off the second jacket. Make space about the same as the cross section of tubes. 3. I would like to use the exhaust for heating; would it be advisable to run it through 150 feet of pipe with 8 elbows? Should I use a back pressure valve? A. It would be advisable to have a back pressure valve in this case. 4. What size of pipe would be best? A. The larger the pipe you use, the better.

(6) H. M. says: 1. Please give me the dimensions of a boat for an engine 3x3 inches. A. Make a boat 20 feet long by 5 feet wide. 2. How large a wheel should I use? A. Use a propeller from 20 to 24 inches in diameter, and 2½ to 2¾ feet pitch. 3. The boiler is 23 inches long and 14 inches in diameter, and has nineteen 1¾ inch flues, with firebox 13 inches high and 14 inches in diameter. It is made of ¼ inch plates. Heads are $\frac{5}{16}$ inch thick. How much steam can I carry? A. About 130 lbs. per square inch, if your boiler is well made.

(7) N. Y. says: 1. I wish to supply 90 gallons of water per hour at 160° Fah. through a 1 inch pipe. The temperature of the space about the pipe is 325°, and the incoming water 36°; what must be the length of pipe? A. You will have to determine the matter by experiment. 2. As it would take a different length to raise the temperature to 200°, or a different length still of 2 inch pipe to raise the same to 160° or 200°, by what formula can a solution be obtained? A. Possibly some of our readers may have information on the subject. If so, we would be glad to hear from them, as the subject is one of great interest. We could give you approximate formulas, but they would not be very safe guides.

(8) E. H. K. asks: I have an upright boiler, 12 inches in diameter by 2 feet high, with nineteen 1¼ inch tubes, 6 inches water space above tube sheet, and 8 inches space below crown sheet. She lifts her water a great deal, and I think of carrying the water 6 inches above crown sheet. Is there any danger in having water below the tube sheet? Will the dampness of steam keep the tubes not surrounded with water or above the water safe from burning? A. It is very common to run vertical boilers with the water a few inches below the upper tube sheet.

(9) C. and B. say: We are building a boat, 18 feet in length by 4 feet beam and 6 inches draft forward and 8 inches aft, to run on very still water. What size of screw propeller will it require to run it at ten miles an hour? A. The boat will not carry the machinery necessary for that speed.

(10) W. H. asks: How can I make a compound of metal, such as is used for plugs in low water whistles for steam boilers? A. Mix bismuth, lead, and tin, changing the relative proportions of the different metals for different melting points.

(11) M. M. says: I have an upright tubular boiler, 6½ feet high by 34 inches diameter. The tubes are 4½ feet by 2¾ inches. The steam pressure never exceeds 70 lbs. Is it dangerous to use steam at that degree of heat? A. From your account, we do not think that you are carrying a dangerous pressure. 2. An ½ inch pipe, from near top of boiler, leading to a steam box, had a crack about 2 feet from boiler soldered over with common solder, and the steam melted the solder off. A. The solder was probably too soft, or had too low a melting point.

(12) A. B. C asks: In finishing my house, can the plaster be made to resemble porcelain? A. An extra hard surface and superior polish is given to plastering by the use of Keene's cement or the Parian cement, which is furnished by dealers in this city, being imported from Europe. These cements are used, either of them, in place of plaster of Paris, and probably will give the surface you require.

(13) R. S. N.—Much obliged to you for calling our attention to that curious exhibit.

(14) F. B. M. asks: 1. How can I solder silver with a blowpipe? A. Make silver solder as follows Hard solder: Silver 4 parts, copper 1 part. Soft solder: Silver 2 parts, brass wire 1 part. 2. How can I make a good solution for cleaning silver? A. Clean silver with hot water, followed by a mixture of equal parts of spirits of ammonia and turpentine; after this, if necessary, use prepared chalk, whiting, magnesia, or rouge. 3. How can I test gold with acid? A. See p. 283, vol. 33.

(15) E. T. M. asks: What solvents are more powerful than muriatic acid? A. This depends upon the nature of the substance. Some substances insoluble in muriatic acid dissolve readily in nitric acid. And again bodies, such as gold and platinum, insoluble in nitric or hydrochloric acid alone, are dissolved by a mixture of the two. Mineral substances, containing silicates, are dissolved by hydrofluoric acid, or in a mixture of hydrofluoric and sulphuric acids.

(16) A. H. asks: 1. Has the United States government offered any reward for an indelible ink or liquid for obliterating stamps with? A. We do not know. 2. Will a preparation answer which no chemical can remove? A. The ink must, to be effective, be irremovable by chemicals or any other means.

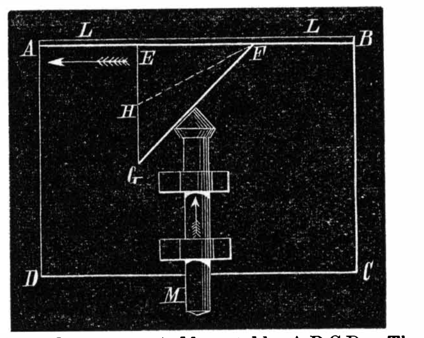
(17) J. G. asks: What is lucern, and how is it prepared for fodder for cattle? A. Lucern is a forage plant, one of the *leguminosæ*; it is known in Spain, and in California and elsewhere, as *alfalfa*. Hay can be made from it, as is done with clover; but eaten green, it is an excellent food for cows. It is in full bearing in the third year, and may afterwards yield from three to five crops per season.

(18) S. C. asks: How can I dissolve india rubber, to saturate thin linen cloth with, to make it waterproof? A. Make a solution of the gum rubber in bisulphide of carbon, steep the material in this for a short time, and allow to dry in the air.

(19) W. M. B. asks: 1. Is there such an article as linoleum, made from flax seed? A. Yes it is now largely manufactured in this country. and used as a substitute for oilcloth. 2. Can it be used as a substitute for india rubber? A. We do not know that it has yet been used for this purpose.

(20) Referring to query No. 23 in our paper for October 30, an asbestos cement, recommended for verandah roofs, is manufactured by the inventor and patentee, H. W. Johns, 87 Maiden Lane, N. Y.

(21) W. F. C. says, in reply to S. P. and others who doubted the superior velocity of iceboats to the wind that drives them: It is clear that L. P. is no sailor, or he would know that a boat's best point of sailing is very often not before the wind, that is to say that some boats can sail faster with the wind abeam than with it behind them. Carrying this principle to iceboats, and assuming (not taking friction of ice and wind into account) that before the wind an iceboat can sail as fast as that wind, with the latter abeam it can sail much faster. Example: Suppose a field



of ice to be represented by a table, A B C D. The wedge, G E F, is an ice boat traveling from B to A. The sliding rod, M, represents the force and direction of the wind, and the raised ledge, L L, will answer for the grooves or edges of the runners that keep the boat on her course. We will further suppose all these parts to be lubricated so as to create a minimum of friction. The G F side of the wedge represents the sail of the boat, fixed at an angle of 45° to the line of direction. If the bolt is pressed forward one inch upon the side, G F, of the wedge, the latter will be moved forward in the direction from B to A just one inch, and at equal speed. Therefore, if this one inch of motion of the boat represents the wind at 30 miles an hour, the corresponding motion of the wedge, E F G, will also be 30 miles per hour. If, however, the sail of the boat or the side of the wedge be not at an angle of 45° to the line of its direction, as at G F, but only at an angle of 22½°, as at H F, one inch of forward motion of the boat, M N, will produce two inches of motion on the wedge, H E F, so that, if the inch of motion of M N represents, as before, the wind at 30 miles an hour, the resultant motion of the wedge will represent progress of the boat at the rate of 60 miles an hour, being, of course, two to one. These figures are necessarily purely theoretical, as friction is not at all taken into account. They will, nevertheless, serve to demonstrate that which is apparently impossible—a boat traveling faster than the wind which drives it.

(22) H. A. says, in reply to L. P. S.'s query as to the running of fans: An old foundery foreman was in charge of a foundery, the proprietors of which had just put up a new fan, with wooden trough connection with the cupola. The fan was so geared that the blast could not be varied by varying the speed of the fan, as had been the practice. So our foreman proceeded to make a long slot in the side of the air trough, and over the slot he carefully fitted a sliding cover. "Now," said he, "go ahead with your blast. I'm ready for you!" Finding very soon that the blast was too strong, he slightly opened the slide in the trough to let the blast escape outwardly. But, to use his own language, "the more he opened the more she blew," and his expedient was a total failure. The next day he put in a gate as the only means of reducing the blast.

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

E. W. P.—It is decomposed mica, and consists of silex, alumina, magnesia, lime, potash, and soda.—W. K.—We found no gold in your specimen.—D. T. M.—We cannot say how they were made. They do not contain injurious substances.—H. M.— It is an artificial stone, and has been made apparently by cementing clay, of which it is mostly composed, together with graphite, by means of some lime cement.—H. N. P.—It is composed of zinc and tin.—R. J. B.—Your specimen did not come to hand.—W. J.—It is hydrated oxide of iron, but the percentage of iron is too small to permit of its being worked profitably.

D A. R. says: I have a bar of iron 10½ x½x4 inches, supported at one end. I wish to know how to calculate the weight which, applied to the end, will break it?—J. D. asks: How can I best weigh flax before it is fed through the cards for manufacturing into bagging?—W. L. T. asks: How can I make papers with a black surface to be drawn on so that the lines will show the white ground through the surfacing composition?—J. A. R. asks: How do you calculate the number of gallons of oil in an oil car tank of cylindrical form with hemispherical ends, at different depths?—M. asks: How can I prepare autumn leaves for preservation?

COMMUNICATIONS RECEIVED.

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

On the Relation between Spectral Lines and Atomic Weights. By E. V.
On the Resistance of Fluids. By T. C. M.
On the Wagner Free Institute. By W. W.
On Mental Phenomena. By R. O. D.
On Mensuration. By C. H.
On Banks. By J. M.

Also inquiries and answers from the following:
A. F.—J. C. P.—A.—W. A. B.—G. E. K. Jr.—N. W. —E. B. W.—F. L. K.—J. B. S.—J. C. N.—F. R. J.— S. S. T.—E. T. H.—S. H. W.—W. B. W.—E. T. J. Jr.

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 hard rubber plates for electrical machines? Who sells microscopes? Whose is the best carriage varnish? Who sells the best telegraph wire? Who makes the best pianoforte wire? Why do not makers of firearms 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

October 19, 1875.

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

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Apple-paring machine, A. Rippien 169,040
Bars, drawing and polishing, D. I. Farmer 168,975
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Windmill, A. Willson 168,950
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Yarn printing machine, J. Short 168,932

DESIGNS PATENTED.

8,718.—COOK STOVE.—J. Brownback *et al.*, Limerick Station, Pa.
8,719.—CANDLESTICKS.—W. Roby, East Cambridge, Mass.
8,720.—STATUARY.—J. Rogers, New York city.
8,721 to 8,739.—EMBROIDERY.—W. Steinhaus, New York city.
8,740.—CALENDAR.—J. E. Blythe, St. Louis, Mo.
8,741.—BOOK CASES.—H. S. Kerr, Philadelphia, Pa.
8,742.—CLOCK CASE.—H. J. Miller, New York city.
8,743, 8,744.—HOBBY HORSES.—A. Shoeninger, Chicago, Ill.
8,745.—KNITTED SKIRTS.—S. Wallis, Newton, Mass.
8,746.—TOY MONEY BOX.—J. Murray *et al.*, Philadelphia, Pa.

SCHEDULE OF PATENT FEES.

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CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA,

October 20 to 23, 1875.

5,278.—A. O. Kittridge *et al.*, Salem, Ohio, U. S. Oil can. Oct. 20, 1875.
5,279.—F. C. Tapley, Clarkson, N. Y., U. S. Knitting machine. Oct. 20, 1875.
5,280.—L. Bastet, New York city, U. S. Electro-magnetic engines. Oct. 23, 1875.
5,281.—W. M. Adams, Toronto, Ont. Chimney cowl. Oct. 23, 1875.
5,282.—L. O. Root, Minneapolis, Minn., U. S. Safety runners for railroad cars. Oct. 23, 1875.
5,283.—G. B. Durkee, Alden, New York city, U. S. Snap hook. Oct. 23, 1875.
5,284.—I. N. Richardson, Malden, Mass., U. S. Playing cards. Oct. 23, 1875.
5,285.—S. W. Steele *et al.*, Northfield, Vt., U. S. Process of marbleizing surfaces. Oct. 23, 1875.
5,286.—G. C. Eastman, Lewiston, Me., U. S. Flour sifter. Oct. 23, 1875.
5,287.—S. Landon, Iroquois, Ont. Oil tank. Oct. 23, 1875.
5,288.—G. F. Simonds, Fitchburg, Mass., U. S. Process of forming and tempering saws. Oct. 23, 1875.
5,289.—G. Leverick, Brooklyn, N. Y., U. S. Elastic hub for vehicles. Oct. 23, 1875.
5,290.—W. P. Widdifield, Siloam, Ont. Wheeled vehicle brake. Oct. 23, 1875.
5,291.—W. E. Andrew, New York city, U. S. Making butter from the oils of animal fat. Oct. 23, 1875.
5,292.—C. Martin, Toronto, Ont. Construction of ventilators. Oct. 23, 1875.
5,293.—S. B. Strong, Albion, N. Y., U. S. Pump. Oct. 23, 1875.
5,294.—N. Kimball, London, Ont. Portable and stationary fence. Oct. 23, 1875.
5,295.—G. W. Cottingham, Rockport, Tex., U. S. Sad iron. Oct. 23, 1875.
5,296.—G. W. Cottingham, Rockport, Tex., U. S. Machine for ironing clothes. Oct. 23, 1875.

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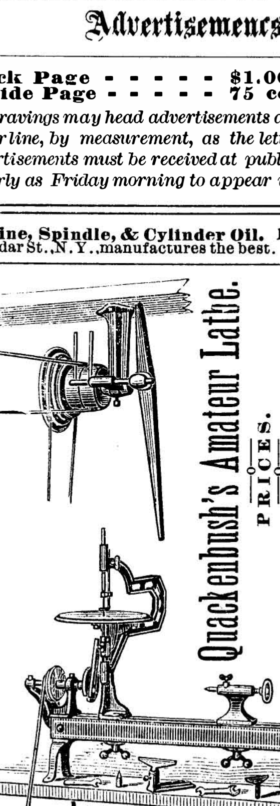

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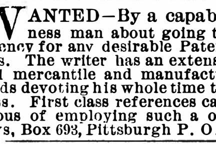

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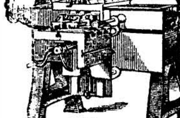

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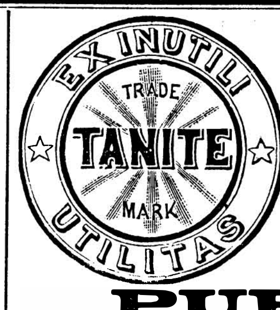

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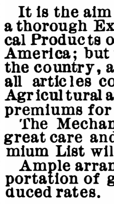

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