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NOVEL HYDRAULIC RAILWAY LOCOMOTIVE.

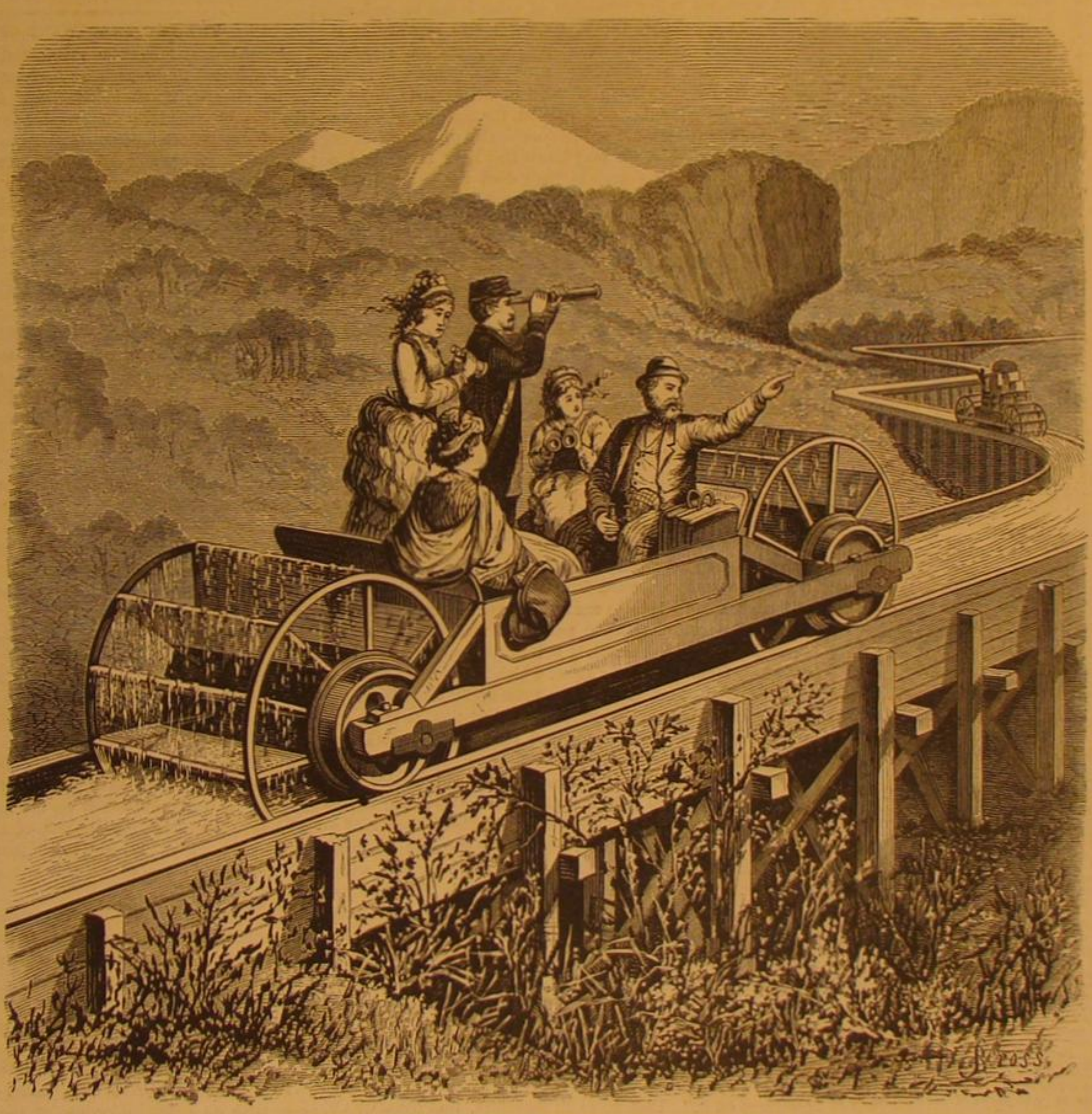
A new mode of traveling has lately been invented, which the inventors claim to be applicable to any mining country where flumes exist, or which may be used wherever a stream of water of sufficient velocity of current can be inclosed for suitable distance. The device involves a carriage driven entirely by outside power; and paradoxical as it may appear, it is caused to travel either in the same direction as the force, or diametrically opposite thereto, while the direction of application of the power remains unchanged. In short, it is a carriage which travels up stream, impelled by no other force than that of the current. The invention is claimed to be practicable; it has already been used in California for transportation on a small scale; and judging from experiments, the inventors state that a car for the transportation of passengers, as shown in our engraving, may thus be driven at considerable speed, depending of course upon the head of water.

The carriage rests on ordinary flanged wheels which traverse rails laid on the edges of the flume. On the axles are attached paddle wheels, which correspond in shape to the section of the flume, and are acted upon by the current therein. It is clear that the current turning the paddles will so rotate the wheels of the vehicle, which will consequently move in a direction opposite to that of the current. When it is desired to move in the same direction as the current, the paddles are stayed stationary, and the water impels the car down stream.

A test trial with a working model, we learn, has demonstrated the capacity of the carriage to carry about 8 lbs. of load (exclusive of its own weight) for every inch (miner's measure) of water in the flume. A flume of 600 inches of water will therefore furnish power to transport a load of about 5,000 lbs. up stream, on any grade from 4 to 20 inches to the rod, at a speed of from 4 to 8 miles per hour; a less grade causes a slower run. The strength of flume and car is the only measure of capacity of the device in going down stream, and the velocity may extend to any speed desired, being governed only by the grade and the speed of the flow of water. The rate of travel is regulated by brakes; and the paddle wheels are attached to the shafts with clutch gear, to be unshipped at pleasure.

The frame is built in two sections, and the platform rests on anti-friction balls, for the purpose of turning curves with but little friction. By double gearing, the speed may be greatly increased for passenger transportation, of course at the expense of power.

This invention was patented through the Scientific American Patent Agency, November 7, 1876, by Messrs. C. A. Leaman and John A. Heckart, of Pentz Ranch, Cal.



NOVEL HYDRAULIC RAILWAY LOCOMOTIVE.

In some localities, damp-proof courses in walls are formed of slates set in cement: these are liable to crack, and thin impervious stones are better. Sheet lead has been used for the same purpose, and is most efficacious; but it is expensive.

A New Method of Making Glass Signs.

Mr. Henry A. Goetz, of New Albany, Ind., has patented through the Scientific American Patent Agency (January 2, 1877) a new method of making gilt signs, etc., on glass. The usual mode of procedure consists in roughly painting the letters on one side of the glass; then on the opposite side the letters are carefully painted in gold size. On this the gold leaf is laid, and when the whole is dry the superfluous gilding is removed. The letters are then shaded by hand. Mr. Goetz' process is much more simple and expeditious. He begins by covering the glass where it is to be lettered with gold or silver leaf, having previously applied a coating of isinglass size. Then a yellow, hard-drying ink is applied to the gilded surface with elastic type, in such places as are to retain the leaf. When this ink becomes thoroughly hard and dry, the surplus leaf is removed with whiting, applied with a damp pledget of cotton, while the lettering or ornamentation is retained by the ink. The shading, or the outline of the shading, is now printed on the glass with elastic type in any required color. When this becomes dry, hand work may be added, if desired, and the whole backed up in the usual way.

Number One, 1877.

We would remind those of our Western subscribers who have failed to receive our first of the present year that the mails, carrying that number of the SCIENTIFIC AMERICAN, were burned at the recent destruction of the Ashtabula, O., railway bridge. We will supply the missing number gratis, to those subscribers who have not received it, on receipt of postal card request.

At Pomeroy, O., at a depth of 104 feet, a petroleum well, supplying nine or ten barrels of oil a day, has lately been opened

Treating Lubricating Oils.

Heretofore it has been necessary to mix hydrocarbon, or mineral lubricating oil with a considerable proportion of fatty oils, to give it the necessary body or viscidity, but these fatty oils (both animal and vegetable) are all more or less oxidizable in the air, producing gummy matter becoming very acid; and if left in warm places on cotton, wool, clothes, sawdust, or similar material, are exceedingly liable to spontaneous combustion. For lubricating the pistons of high pressure compound surface-condensing engines, both marine and stationary, the fatty oils are particularly objectionable, for, in addition to the before mentioned faults, the high pressure steam decomposes them into fatty acids and glycerin, which are, of course, carried into the boilers, where the fatty acids corrode most powerfully, and with the glycerin make a kind of soapsuds, producing excessive priming.

But Mr. Humfrey, of Chester, England, claims that he is able to produce mineral or hydrocarbon lubricating oil of such a body that no mixture of fatty oils whatever is required, the viscidity being equal to the best olive, and considerably superior to sperm; while being perfectly neutral, it cannot act on or corrode the condensers nor boilers, nor form concretions in the cavities of the pistons and steam passages; nor does it act on the india rubber valves of the air pumps to any injurious extent when used for internal lubricating of steam engines. For ordinary lubricating it is perfect, as it forms no gum or acid, and it is absolutely safe from spontaneous combustion, with a lubricating power equal to sperm. The oil treated by his invention is also specially suited for lubricating fast running machinery, and for all kinds of fast running mechanism. He first submits the oil to careful fractional distillation, and collects the heavy portion of the product. In the refining or chemical treatment, instead of agitating the chemicals with the oil by means of paddles, screws, or other mechanical means as have heretofore been used, he forces a large stream of compressed air through a pipe at or near the bottom of the vessel, by which very important advantages are obtained. As well as a most thorough and complete agitation, a considerable effect is produced, powerfully aiding the action of the chemicals used; at the same time, the great volume of air passing through carries off all traces of oils of low gravity and boiling points, the result being lubricating oil possessing more body and higher specific gravity and flash point than any mineral lubricating oils heretofore produced, making it specially adapted for lubricating the pistons, slide valves, and other parts of the marine, locomotive, and other steam engines, steam hammers, and other apparatus. The oil may be produced from coal, shale, peat, bitumen, asphaltum, petroleum, and other oil producers as is found most economical and convenient.

The bark of slippery elm has been recommended as a preventive of boiler incrustation.

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FORCE ANALYZED.

We have repeatedly taken occasion to point out the exceedingly loose apprehension which prevails regarding the meaning of the word "force." We doubt if there be another word in the language which is more constantly wrongly used, or which is dragged in to express a greater variety of more wholly different and entirely indefensible significations. We are told of "accelerating force," "moving force," "centrifugal force," "living force," "projectile force," "centripetal force," in mechanics; imaginative biologists wander into such expressions as "psychic force," "odic force," and "vital force." We say a force "may be generated," and that a moving body has such a "force;" and in brief so generally used is the word, anywhere and everywhere, that we carry its wrong meaning into idioms and colloquialisms, and talk of the "force of habit," "force of circumstances," etc.

It will be observed that all these erroneous notions of the term are based on the conception that force is a thing, something tangible and existent; whereas it is nothing of the sort, as a brief consideration will show. The various arguments on this topic are admirably summed up in Professor Tait's latest addition to his excellent work on "Recent Advances in Physical Science;" and we can do no better than to follow the same course of reasoning and adopt the very clear and concise definition of the term "force," to which his views of the subject lead him.

At the outset, we may recall the fact that absolutely nothing can be learned as to the physical world save by observation or experiment, or by mathematical deductions from data so obtained. The exercise of reason is an unavoidable necessity, for it shows us that our senses are merely subjective, that what we call a sensation of color is but an influence upon the eye due to the extent, form, and rapidity of the vibrations of the luminiferous medium; that our classification of sounds, as to loudness, pitch, and quality, is merely the subjective correlative of what in the air particles is objectively the amount of compression, the rapidity of its alternations, and the greater or less complexity of the alternating motion. And thus we may know that light and sound no more exist outside ourselves than does the pain, which a swiftly moving stick is capable of producing on our bodies, reside in the stick itself. Heat, though not material, has objective existence in as complete a sense as matter has. It is merely a form of energy, which, in all its constant mutations, satisfies the test which we adopt as conclusive of the reality of matter, that we cannot in the slightest degree alter its quantity. This test fails altogether when applied to force.

In his endeavor to reach an idea of the meaning of force, Professor Tait first brings forward Newton's laws of motion. Of these the first is: Every body continues in its state of rest or of uniform motion in a straight line, except in so far as it is compelled by forces to change that state. That is, any change whatever in the direction or the rate of motion of a body is attributed to force. This carries with it the upsetting of the old notion that, in bodies moving in a circle, a centripetal force was necessary to balance a so-called centrifugal force, it being imagined that a body moving in a circle had a tendency to fly outward from the center. "If," says our author, "a body is to be made to move in a curved line instead of its natural straight path, you must apply force to compel it to do so; certainly not to prevent it from flying outwards from the center about which it is for the moment revolving. In fact, just as you must apply force *in* the direction of motion to change the *rate* of motion, so must you apply force *perpendicular* to the direction of motion to change that *direction*."

Newton's second law is: Change of motion is proportional to the moving force and takes place in the direction of the straight line in which the force acts. Motion is here used as a technical scientific term for what we now call momentum, the product of the moving mass into the velocity with which it moves. "Change of motion," therefore, is change of momentum, or the product of the mass of the moving body into its change of velocity. "Of course," says Professor Tait, "the longer a given force acts, the greater will be the change of momentum which it produces; so that, to compare forces, which is the essence of the process of measuring them, we must give them equal times to act, or we must measure a force by the rate at which it produces change of momentum. * * * Thus the measure of a force is the product of the mass of the body moved into the acceleration which the force produces on it." Unit force is, therefore, that force which, whatever be its source, produces unit momentum in unit of time. The earth's attraction for a body in our latitudes produces in that body, if let fall, in one second a velocity of about 32.2 feet per second. Hence, if we take 1 lb. as the standard of mass, the weight of a pound of matter is rather more than 32.2 units of force, so that the unit of force is rather less than half an ounce.

Unit momentum is that of 1 lb. of matter moving with a velocity of 1 foot per second. Unit force is that force which, acting for one second, produces in unit of mass a velocity of 1 foot per second. Momentum, then, is obviously not force. We may substitute ton for pound, or mile for foot, and the relative values will remain unaltered; but if we take minute instead of second, then the time unit increases sixty fold the nominal value of the momentum considered; while that representing the force is increased three thousand six hundred fold. Hence the two cannot possibly be equated. Now as we have shown that there is no such thing as centrifugal force, and as from the above it follows that the so-called accelerating force is not a physical idea at all, we have yet to deal with the term "living force."

And here we pass to Newton's third law, namely: To every action, there is always an equal and contrary reaction; or, the mutual actions of any two bodies are always equal and oppositely directed. And Newton proceeds further to point out—and here is that grand stumbling block of the perpetual motionist, no matter what form his mania may assume—that if the action of an agent be measured by the product of its force into its velocity, and if, similarly, the reaction of the resistance be measured by the velocities of its several parts into their several forces, whether these arise from friction, cohesion, weight, or acceleration, action and reaction, in all combinations of machines, will be equal and opposite. But actions and reactions here dealt with are no longer simple forces, but the products of forces into velocities; they are rates of work, the time rate of increase, or the increase per second, of a very tangible and real something, for the measurement of which Watt devised the practical unit of a "horse power." Now with a moderate exertion a man may raise a hundredweight, which in its descent might be employed to do work, but he is by any exertion unable to lift a ton; and after all his labor to do so, the weight will not do any work by descending again. Hence it appears that force is a mere name, and that the product of a force into the displacement of its point of application has an objective existence. And a simple mathematical operation shows us that it is precisely the same thing to say: the horse power or amount of work done by an agent in each second is the product of the force into the average velocity of the agent, and to say: *force is the rate at which an agent does work per unit of length.*

THE ENCOURAGEMENT OF INSANITY.

A good many honest but misguided people have expressed the belief that the SCIENTIFIC AMERICAN has been too severe in its remarks about spiritualistic frauds, delusions, and the like. Particularly disagreeable to such people has been our characterization of spiritualism as a mixture of self-deception, knavery, and craze. We are pleased therefore to find our diagnosis sustained by so excellent a medical authority as the London *Lancet*, which goes even further than we have presumed to, and raises a warning voice against those who are in any way party to such spurious manifestations of the psychological instinct. The *Lancet* does not hesitate to say that the practice of gathering neurotic people, at what are politely called *séances*, for the purpose of holding converse with denizens of the spirit world, is so debilitating to the mind and so debauching to the moral sense that it needs to be stigmatized in terms at once trenchant and decisive. "To speak plainly, while strong-brained beings may indulge in this form of dissipation without more serious consequences than perhaps a trifling weakness of memory, minds of less robust mould may suffer severely. Anything more perilous than the custom of permitting young persons of either sex to participate in this abuse of mind power it would be difficult to conceive."

Particularly blamable, the *Lancet* thinks, is the President of the "Psychological Society" and other patrons and leaders of "the last new craze." They ought to know better than to give their countenance and support to a pursuit in which weaker heads are in danger of being turned, to their permanent injury. Already mischief, perhaps irreparable mischief, has been wrought. "Minds that have hitherto done wonderfully well in the world are showing signs of weakness. The worry of trying to be quite sure whether there is a force outside the material world, which will bridge over the gulf between the present and the past—those who now tread the earth, and those who have passed out of normal sight and hearing—is beginning to tell on the mental strength of some who have been lured into the toils of a psychology, which is no longer a science, because it has cast adrift the principles of Nature and elects to run riot in vain imaginings and idle conceits."

These are hard words, but they certainly are neither unjust nor unnecessary. As symptoms of mental degradation, the recent actions and utterances of several once straightforward and sensible English scholars are surely painful enough to warrant any protest, however forcible, against the encouragement of such unsanitary pursuits and speculations.

MEDICAL PROGRESS OF THE PAST YEAR.

In accordance with its custom, the *Lancet* begins the new year with an extended review of the notable events of the past twelvemonth in the world of medicine and its allied sciences. From the thirty-six columns devoted to this valuable summary of progress, the following items are especially worthy of remembrance.

In the department of anatomy and physiology, several important advances may be noted. M. Malassez has continued his researches in connection with the blood, and has introduced the new term *blood-corpuscle capacity*, to designate the quotient obtained on dividing the number of blood corpuscles in an animal by the weight of the animal in grammes. Thus a rabbit, weighing 2,450 grammes and having 919,450 millions of blood corpuscles, has a blood corpuscle capacity of 375 millions. It is worthy of notice that the blood corpuscle capacity of carnivora, in consonance with their more active metamorphosis of tissue and manifestations of life, is much greater than that of herbivora. Heretofore the pressure of the blood has always been estimated by manometers introduced into the larger blood vessels. Dr. Kries has ingeniously shown that the pressure in the capillaries may be determined by applying pressure with a small plate of glass to the fingers, ears, or other accessible parts till pallor is produced. In this way he finds that the pressure in the capillaries of the fingers is ordinarily from 37 to 38 millimeters of mercury; if the veins of the arms be compressed, the pressure in the capillaries is increased three or four fold. Röhrig finds that the secretory activity of the mammary gland varies directly with the blood pressure.

Taking advantage of a fistulous orifice communicating with the larger intestine, Markwald has studied the digestive powers of that organ, and finds that it possesses no power of converting starch into sugar, while fibrin appears to undergo for the most part putrefactive decomposition, only a small part being probably absorbed. The practical lesson to be drawn from these observations is that, in cases where it is necessary to introduce nourishment *per anum*, pancreas triturated with meat is the best material to use.

Perhaps the most important event in therapeutics is the discovery of the power of salicin and salicylic acid over the course of rheumatic fever. Salicylic acid is preferred by some, salicylate of soda by others. They all have the power of wonderfully reducing temperature, and appear to bring the process of rheumatic fever to an end in as many days as it formerly took weeks. These remedies also give the profession new hopes of controlling others of the large class of diseases characterized by high temperatures. Of great importance too, are the notes of Cattaglia of Rome, on the cure of diphtheria by the local use of chloral and glycerin, with the internal administration of chlorate of potash. The local use of carbolic acid and glycerin, in the proportion of one part of the former by weight to six of the latter, has also been highly commended in the treatment of this fearful disease.

Much careful and laborious work has been done in the domains of surgery and pathology, but no important discoveries have been announced in either. The subject of lunacy has received much attention, and in connection with it the *Lancet* makes the pertinent remark that each year it becomes more strikingly evident that what has been miscalled "mental disease," and erected into a specialty, is in fact an essentially component part of general medicine. Mind symptoms cannot successfully or safely be studied apart from the phenomena of physical disease, organic and functional; and if the terrible onslaught of insanity is to be resisted, the battle must be fought at close quarters by general practitioners while cases are still recent and curable.

The International Medical Congress at Philadelphia was one of the important events of the Centennial year. It was attended by many respected representatives of foreign medicine and surgery. The impression made on the British visitors by the members of the profession whom they met here was, the *Lancet* has reason to know, of a very satisfactory kind; and that critical representative of British medicine is glad to believe that the condition of medical education in this country is more advanced than might be supposed from the chaotic state of medical legislation, and from the great number of medical schools purporting to grant qualifications.

WHOLESALE HEATING.

According to the Lockport papers, Mr. Holly's plan of heating cities by steam is soon to be put to the test of practical trial in that place. The scheme involves the division of the city into districts, and the establishment of a separate system of boilers in each district, with mains leading to the houses to be heated. That done, the citizens of Lockport will be enabled to dispense with stoves and fireplaces, as they already have with private wells and candlesticks, and regulate the temperature of their homes by the simple process of turning a faucet.

The plan is undoubtedly feasible, and, if properly carried out, cannot fail to effect an enormous saving in trouble and fuel. It is open to the serious objection, however, that the general introduction of steam for household purposes will necessitate the abandonment of almost all the appliances for heating and cooking now in use. Besides, the number of local boilers and attendants required to supply a town of any considerable size with the necessary steam must make the system altogether too complex and costly. Obviously a cheaper and more economical system of wholesale heating could be established by means of gaseous fuel. Gas is already supplied to most houses in towns of any size; and but few and comparatively inexpensive changes would be required to carry this self-propelling fuel to existing fireplaces, stoves, and cooking ranges, and burn it there. Now that gas can be manufactured for less than twenty cents a thousand cubic feet, the economy of its use for domestic heating is beyond question. No other fuel can be burned so completely or to so good an advantage, while nothing can be simpler than the means required for its distribution. Once introduced, the gas required for heating our houses and cooking our food need not exceed what is now paid simply for the cartage and handling of the coals we burn, after they have been laid down at the door.

Among the minor advantages of gas over steam for household uses, not the least are the facility with which the amount taken by each consumer can be determined, and the ease with which the supply can be adjusted to the demand, without waste. Gas will keep indefinitely without loss of heating power: steam will not; and it is not easy to see how provision could be economically made with it for any sudden increase or diminution of the amount of heat which consumers individually or collectively might require. Besides, with gaseous fuel, it would be possible to retain and increase the number of our cheerful and sanitary open fires, compared with which steam radiators present few attractions. Every charm of a hickory fire—the bright blaze and the radiant embers—can be had from a grate burning gas, with none of the evils and inconveniences of a wood fire; while with the use of the same ever ready and perfectly controllable fuel in the kitchen, all the uncertainties and no small part of the common mishaps in cooking might be entirely obviated.

It is surprising that Lockport, which has the credit of taking the lead in the matter of public lighting with gas, should not have given it the preference for public heating. Are there no more natural wells in that neighborhood to draw upon? It would be a good plan for some of the towns near flowing gas wells to immortalize themselves and lessen their expenses by utilizing in this way the precious products of Nature's laboratory, now going to waste. A large iron manufacturing company in Western Pennsylvania write us that all their smelting is done with gas brought from a natural well nineteen miles away, through pipes laid down by themselves. Any enterprising town, in the neighborhood of one of those splendid natural reservoirs of fuel, might do likewise, tapping a gas well for a public fuel, supply, just as other towns tap a lake or a river for a public supply of water. The example, once set, would be sure to be followed elsewhere, with public gas works where no natural source is to be found. It is one of those inevitable advances in public economy which it is safe to predict; and men now living may see it carried out in all well regulated towns.

PROPELLING VESSELS.

It is probable that many who have recently joined the noble army of subscribers to the SCIENTIFIC AMERICAN have no knowledge that there are many other methods of propelling vessels besides the use of the oar or paddle, the sail, the screw, the paddle wheel, and animal towage; and that many who have been our readers for years have no idea of the variety of styles of propellers devised by the ingenuity of the many inventors who have labored in this field. We therefore think that a brief description of some of the most prominent varieties may be acceptable to our readers and prevent the re-invention of many old and exploded notions.

Leaving out of further consideration the ordinary use of the means mentioned above, as too well known to require description, we would state that many patents have been obtained for different forms of and arrangements of the buckets in paddle wheels, some having them adjustable on the arms to give them the proper amount of dip, others having them set at an angle diagonal to the shaft, others showing pointed paddles; others have the paddles set obliquely to the central line of the spokes or arms of the wheel, and still others show the paddle wheels made in the form of drums to assist in floating the vessel; but the favorite change from the ordinary style is that known as the feathering paddle wheel, which consists in such an arrangement of the paddles as will allow them to enter and leave the water perpendicularly, so as not to beat it when entering or lift it when leaving, as do the fixed paddles. This is accomplished generally by journalling the paddles to the arms of the wheel, and providing them with guides of various descriptions that compel them to retain a vertical position on entering and leaving the water. A few of such wheels have been and are still used, but have met with comparatively small favor from practical men, as the loss from the beating and lifting of the water is not near so much as is generally supposed. Some of these feathering paddle wheels are submerged and run on vertical shafts, in which case the paddles are set vertically during that portion of their revolution when they act on the water and lay horizontally during the remainder of their motion.

One of the favorite ideas of would-be improvers on the paddle wheel is to convert it into an endless chain of paddles passing over two drums at a considerable distance apart so as to have more action on the water than the ordinary wheel. In some cases, the chain is very long and is supported between the drums by friction pulleys; and in other cases the chain is made so short or is so constructed as not to require the pulleys. In some forms of this device for propelling, there is a single chain of paddles, passing over the center of the vessel and underneath its center in a channel between two keels.

Several attempts have been made to displace the paddle wheel by substituting disk wheels, or solid wheels without paddles, acting only by friction as they revolve in the water. These wheels have sometimes been made with single plain disks, others have been provided with corrugated or undulating surfaces; in other cases, two or more disks, set at varying distances apart, have been employed; and in some instances these wheels have been formed of one or more disks, set in an inclined position on the shaft.

Vibrating and sliding paddles have also received much attention from inventors, some of whom so arrange their devices, that, like oars, the paddles descend into and pass through the water, and then rise clear of it before returning to the starting point; others, usually called duck's foot propellers, have their motions all the time in the water, but open out when travelling in one direction, and close up when going in the other, in the manner of a duck's foot; and still others are made of flexible material and work like the tail of a fish. In connection with vibrating propellers, we may state that several patents have been granted for devices for operating oars arranged in such a manner as will allow the oarsman to face the bow of the boat that he may the more readily see in which direction he is travelling.

Screw propellers have been made in almost every imaginable shape and arranged in almost every conceivable way and place. Many patents have been granted for using the screw as a means of steering as well as propelling, which is usually accomplished by connecting the screw to the shaft by a universal joint, and providing it with appropriate guiding mechanism so that it may be turned at any desired angle to the keel of the vessel.

Hydraulic propellers have also had their full share of attraction for inventors, and especially for those who wished to pocket the $100,000 canal boat prize. These propellers are made in many different forms, but consist essentially in the use of a tube through the boat provided with some means (usually a screw) of drawing in water at the bow and expelling it at the stern. Sometimes the tube forks at the stem and stern, so that the water may be expelled at either side for steering purposes. By reversing the water-forcing apparatus, and in some cases by changing valves in the tube, the course of the water is reversed, for backing the vessel. Something on the same principle as the above is the use of a wheel or screw in a channel beneath the boat between two keels, many different styles of which have been patented.

Several patents have also been granted for pneumatic propellers, in which air pumps are employed to draw in air and force it out against the water at the stern. In some cases steam from a boiler, or the force of gases generated by the firing of some explosive substance, is substituted for air and air pumps.

In addition to the above there are various styles of propelling devices adapted to shallow or small bodies of water, as rivers and canals, among which may be classed rope or rail traction, in which a rope is laid from one end of the route to the other, and is acted on by a wheel or drum on board the boat around which the rope is usually passed. The rope generally lies on the bottom of the canal or stream and either passes over the bow of the boat to the driving power and drops into the water at the stern, or over a wheel at the side of the boat. Sometimes the rope is suspended above the water, and then is usually clamped between two driving wheels, or between a driving wheel and an idler; and in other cases a chain or a fixed rail (either over the canal, or on its bank, or the canal bottom) is substituetd for the rope. In some cases the rail takes the form of a rack, on which runs a pinion driven by power on the boat. As somewhat analogous to this, we may mention that some inventors have proposed to lay rails on the tow path on which a light locomotive, driven by a boiler on board the boat, shall run and tow the boat by means of the flexible steam tube connecting the boiler with the locomotive.

Ground traction propellers of various styles have also been tried, some of which show driving wheels running in self-adjusting frames, so that they will always bear on the bottom of the canal or stream; others have poles driven by cranks or eccentrics; and still others have legs with shoes pivoted at the bottom: but the two last styles are essentially the same in principle.

Air propellers, or screws which act in the air instead of the water, have also been tried and patented, the object being to avoid the washing of the banks in steam propulsion on canals.

Windmill propellers, or rather the use of windmills to drive screws or paddle wheels, have also received some attention; and one of the patentees of such an arrangement has provided an endless chain horse power as an auxiliary force.

Several patents have been granted for wave power propellers, in which the waves, in rocking the vessels, are supposed to drive the screw or paddle wheel. The force of a running stream has been availed of to drive a boat across it with considerable success. In one case, there is a rope stretched across the river, on which run two pulleys connected with the bow and stern of the boat. The pulley at the bow is connected by a very short cord and the one at the stern by a longer one, thus holding the boat obliquely to the rope and the current, so that the force of the latter acting on the side of the boat will propel it across the stream. Another plan that has been suggested consists in attaching one end of a rope to a boat and the other end to an anchor located in the middle of the stream, at some distance above the place where the boat is to cross, in which case the boat travels in an arc, of which the rope forms the radius.

A method of making a boat travel against the stream by the power of the stream itself has been proposed, and it consists in a fixed cable lying in the bed of the river, which cable is acted on by a wheel or drum driven by a paddle wheel or screw impelled by the current. The cable may either have one end coiled up on board the boat, or have both ends anchored, as in rope traction before referred to.

The above gives but an incomplete sketch of the various means devised by the ingenuity of man to propel vessels through the water, as a description, be it ever so brief, of the different modifications of the various plans for propulsion would fill a good sized volume, there being probably upwards of eight hundred United States patents for propelling devices, to say nothing of the many foreign inventions for the same purpose.

MR. R. HITCHCOCK, of Watertown, N. Y., states he was the inventor of the clock propelled by a wind wheel, described in our issue of January 20 as the patent of C. B. Hoard. The patent was granted to Mr. Hitchcock after the decision of an interference suit.

AN excellent blacking for fine harness can be made by dissolving five or six sticks of black sealing wax in a pint of alcohol.

GUARDIOLA'S SUGAR AND COFFEE MACHINERY.

It is well understood, by those familiar with the manufacture of

SUGAR

according to the best and most correct scientific principles, that it is of great importance that all the operations be carried on with the utmost rapidity, otherwise the juice is liable to ferment, entailing considerable loss. In slow evaporating pans, the juice is exposed to another danger, termed "inversion," through which it loses its power of crystallization. In brief, the longer the evaporation lasts, the larger is the quantity of molasses obtained; and consequently the amount of crystallizable sugar is diminished in the same proportion. All open evaporating pans, wherein these liquids are boiled in large quantities at once, produce these evil effects. Pans evaporating *in vacuo* are free, to a certain extent, from these inconveniences; but a vacuum apparatus is very expensive, and requires skillful labor, besides the use of animal charcoal filters and their revivifying kilns, etc. The helix evaporator, illustrated in Fig. 1, although it works under the full pressure of the atmosphere, is claimed to have an evaporating power superior to that of any other open pan, and equal to that of any pan working *in vacuo*. It presents also other advantages, which no vacuum pan can have, namely, the separating of the impurities, by the same apparatus, during the ebullition of the juice. This is obtained through a very ingenious strainer that follows the whole length of the channel; not a drop of liquid is lost, and a beautiful, clear stream of syrup runs out of the evaporator, leaving little work for the filters. The impurities arrested and left on the strainer are readily removed by hand; boys or women can be employed for this purpose.

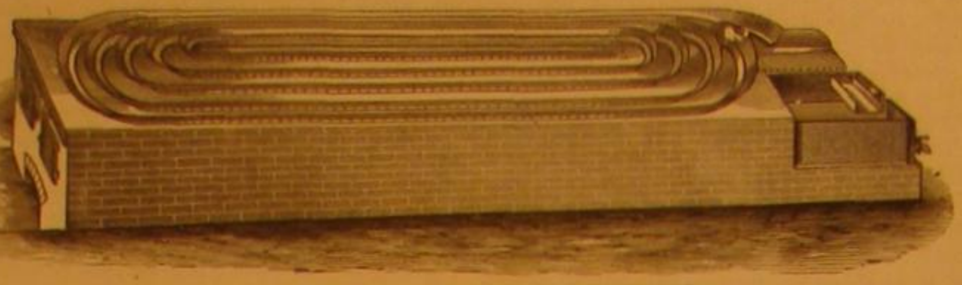


FIG. 1.—GUARDIOLA'S HELIX SUGAR EVAPORATOR.

The *modus operandi* is easily understood. The saccharine juice, after having been defecated, is directed, in a determined quantity, on to the top channel, and in its passage down to the end of the gutter it loses the greatest part of its water by evaporation, leaving on the strainer nearly all the impurities. The apparatus is calculated to produce, in about five minutes, defecated juice from, say, 8° to 25° Baumé, in a continuous stream, the amount being determined by the length of the channel. The economy of fuel claimed amounts to about 40 per cent; and as all the operations go on with greater rapidity, there is also a saving of time and labor. Of course, a constant degree of heat must be maintained in the furnace in order to obtain a constant density in the syrup: otherwise this can always be obtained by the use of a double pan, set on the same flue.

The train of sugar-making apparatus shown in our Fig. 2 is composed of three defecating pans set on the same level and on separate flues, a helix evaporator and a double flat pan, the latter being used to regulate with greater nicety the density of the syrup. This battery is so disposed that one pan discharges into the next below. The defecators keep the evaporator supplied with juice; while one is being emptied, another is filling up, and the third is in course of defecation. After filling up the defecators, a little water is run in the channel of the helix and into the double pan, and the fires are lighted. As soon as one defecator is ready, the water is stopped, and the defecated juice run along the helix, never allowing the channel to be bare. One after another, the compartments of the double pan are emptied, in order to receive the syrups supplied by the helix. In a few minutes the whole train is in good working order, and everything goes on smoothly. When work is stopped, a small stream of water is run in right behind the juice; this water protects the metal from burning, and at the same time cleans the apparatus. When the defecated juice begins to run and boil, the impurities coagulate and rise with the froth, spreading over the continuous strainer, and there they are deposited, allowing the clear juice to pass through the small holes and falling into the channel below. In this manner, the impurities are set aside and removed without causing the loss of a drop of liquid; in fact, this helix evaporator suppresses entirely the "scums." The syrup that comes out of this evaporator, in a continuous jet, is so pure and so rich in crystallizable sugar that it leaves very little for the filters to do. The quantity of the juice and the fire will regulate the density of the syrup, which has to receive its last concentration in a separate pan. The fire must be kept, as much as possible, under the helix evaporator, which receives the full benefit of it. When the syrup has reached the desired degree of density in the double pan, it may be directed, while hot, either into bag or bone-black filters. From the filters, the syrup is put into an open striker pan or into a vacuum pan for that purpose. A copper tilting pan, for direct fire, with a rolling damper (also the invention of Mr. Guardiola), which cuts off the fire instantaneously from under the pan, can be used to prevent the charring of the sugar.

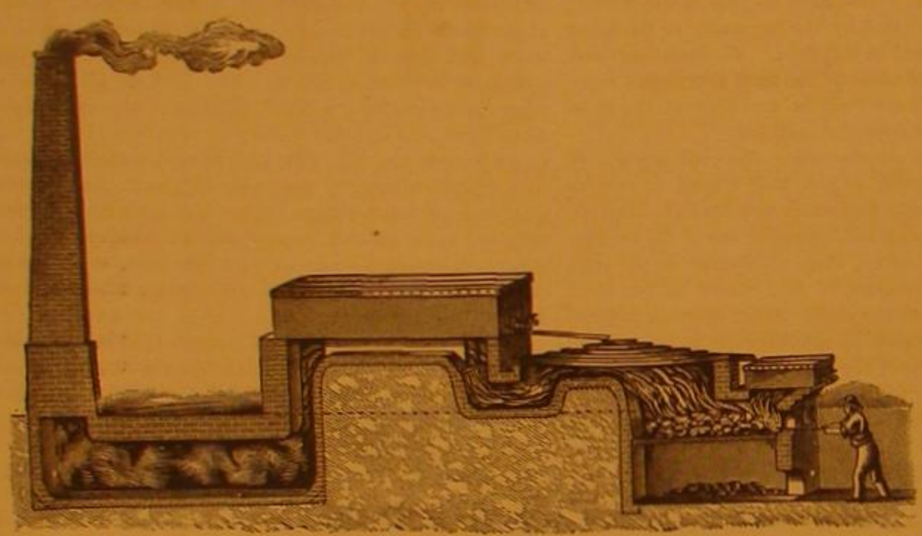


FIG. 2.—GUARDIOLA'S TRAIN OF SUGAR-MAKING APPARATUS.

The saving of fuel, time, and labor, by using this helix evaporator, is so great, says the inventor, that the attention of all persons interested in sugar making should be called to it. The apparatus will be made of any size desired, oval or round.

The helix evaporators, like the many other inventions made by Mr. Guardiola, are the direct result of practical experimenting to meet his own needs on his large estate, Chocolá, Guatemala, where they are in successful use. In addition to the sugar evaporators, Mr. Guardiola, who is already well known to our readers as the inventor of a variety of novel and useful apparatus relating to the preparation of

COFFEE

for the market, has invented several machines for processes in this important industry, for the accomplishment of which the appliances have hitherto been of the most primitive character; and his inventions are the result of the extended practical experience. His object has been the saving of time and labor, and the improvement of the quality of the product. It is hardly necessary, therefore, to add that the inventions herein described are worthy the consideration of persons engaged in the above-named industries. Mr. Guardiola has given his inventions a thorough trial, on a large scale, before bringing them before the public. The engravings which we present herewith represent machines for washing, drying, hulling, and polishing coffee, and also one for grinding corn when boiled for the purpose of making *tortillas*.

The washing machine, Fig. 3, is employed to get rid of a mucilaginous substance that adheres to the husk or inner cover of the coffee berry, after the pulp or outer cover has been removed. If the coffee is left in a heap for some hours, after having been pulped, this gummy substance is decomposed and is then easily washed off. The coffee, as it is gradually introduced into the machine, is simultaneously acted upon by a small jet of water. In a few seconds, the coffee emerges at the other end of the cylinder thoroughly washed, and passes to a sieve, when the water drains off and the berries are then ready for the process of drying. This washer is made of several sizes, to prepare any quantity of coffee desired.

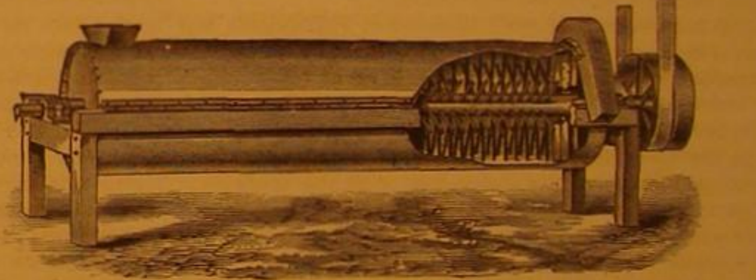


FIG. 3.—GUARDIOLA'S COFFEE-WASHING MACHINE.

The drying apparatus, Fig. 4, performs one of the most tedious and expensive operations in the preparation of coffee for the market. It has hitherto been the practice, in drying coffee, corn, cocoa, *etc.*, simply to spread the grains and expose them to the air and heat of the sun. This process would seem to be the most economical; but in cloudy or rainy weather, the drying completely stops, and often the planter sustains heavy losses through the delays and deterioration of his crop. The great number of people required in the sun-drying process and the length of time consumed are objections that every planter has experienced, and is desirous of avoiding. Every grain of coffee, etc., in this apparatus is kept constantly in motion by the rotating movement of the machine; while an even temperature pervades the whole mass. The vapors arising from the grain are instantly blown off by a current of hot air. A heater and fan accompany this apparatus, and the temperature is easily controlled. By this machine, Mr. Guardiola states, a planter can have his coffees ready for market 24 hours after he puts them in his drying machine.

MALT

has also been dried lately in the same apparatus in the city of Philadelphia, at a heat varying from 90° to 122° Fah., afterwards raised towards 160°, in much less time than is usually employed in the old brick kilns, with excellent results. The machine occupies very little space and requires but little attention. It is especially adapted for brewers' use, inasmuch as it separates all the radicles during the drying process, thus delivering the malt perfectly screened and clean. Mr. Guardiola assures us that he has dried corn and kept it for two years without its being injured by weevils, and this in localities where the grain usually became spoiled within three months. The corn was subsequently planted, and it germinated, thus showing that its vitality was unimpaired. One of these machines, as shown in our engraving, 16 feet long by 6 feet in diameter, is claimed to be capable of drying 10,000 lbs. of coffee or corn, or 300 bushels of malt, etc., per day, requiring less than 4 horse power to drive it. For smaller quantities, machines are made to be operated by hand.

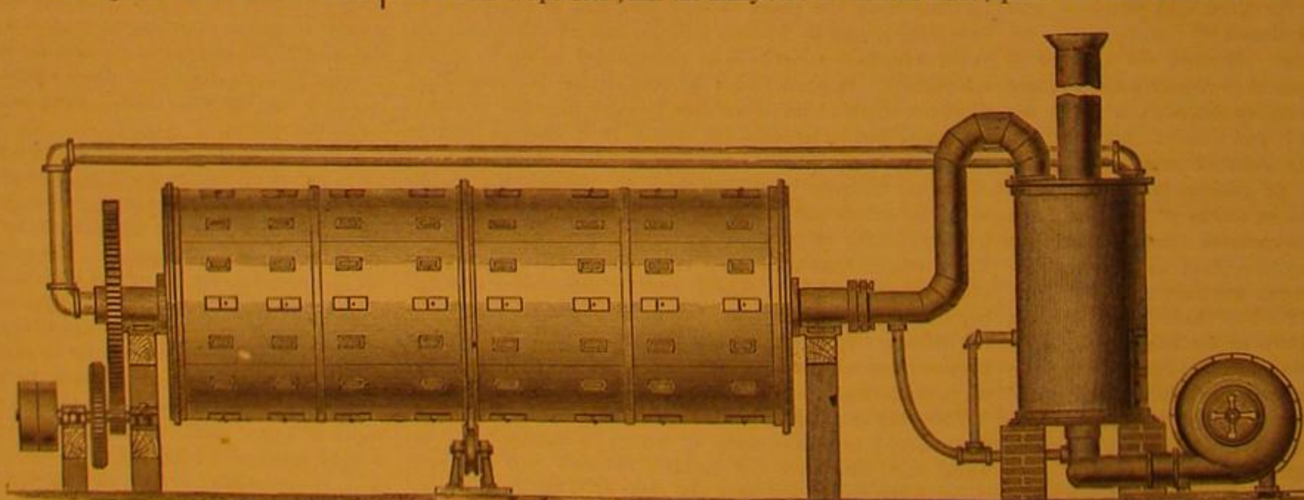


FIG. 4.—GUARDIOLA'S COFFEE-DRYING APPARATUS.

It has been a common objection made to former appliances for drying malt or grain that the principal aim has been too great a heat, thus rendering the grain liable to injury. Mr. Guardiola has avoided this danger, by using a low degree of heat throughout, particularly when the moisture in the grain is at its greatest. Fig. 5 is an end view of Fig. 4.

The coffee hulling and polishing machine, represented in Fig. 6, is remarkable for its simplicity. A mortar and pestle are its principal parts; and the construction is such that the coffee is cleaned and polished by the friction of one grain against another, moving in the broken chaff. The pestle is a cone, having on its surface oblique projecting ribs, set at proper distances from each other so as to form channels. The interior of the mortar is also provided with ribs and channels. The pestles drop simultaneously into the mortars, and the coffee is forced to move up and down the channels. The husk is thus broken and finally pulverized, leaving the coffee thoroughly clean. By opening a valve at the bottom, the contents of the mortar are discharged. No coffee grains are broken. Each mortar will clean about 150 to 200 lbs. coffee per hour. The battery shown in our engraving has 13 pots; the number, however, may be increased or decreased as desired.

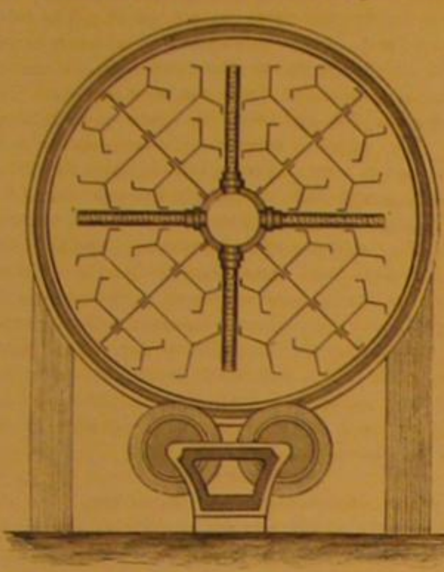


FIG. 5.—COFFEE DRYER. TRANSVERSE SECTION.

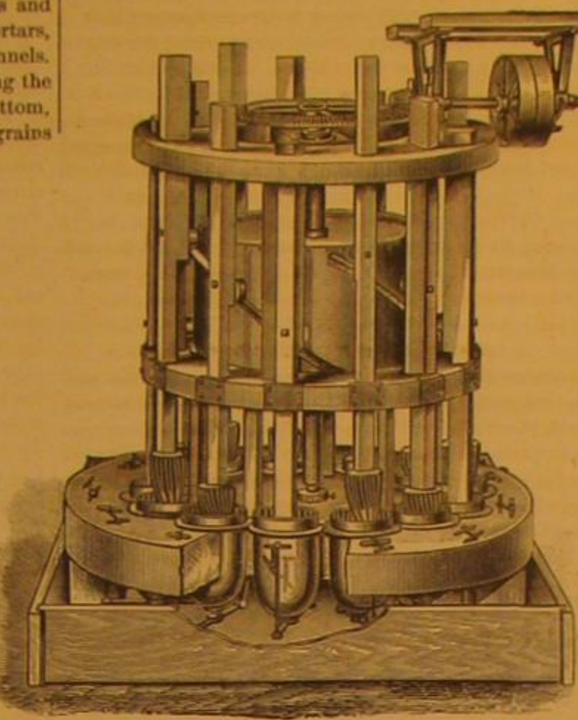


FIG. 6.—GUARDIOLA'S COFFEE HULLING AND POLISHING MACHINE.

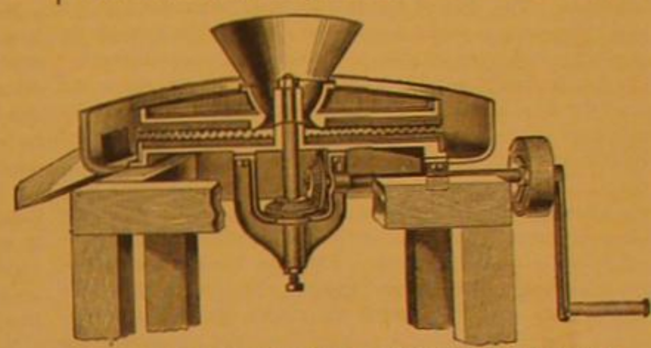


FIG. 7.—GUARDIOLA'S COFFEE HULLER FOR HAND POWER.

Fig. 7 represents a new coffee huller, useful where steam or water power cannot be had. The principal and most important feature of this machine is the elasticity of the rubbing surfaces. If the parts that come in contact with the coffee do not yield instantaneously, the coffee is injured and the loss is sometimes very great. But this machine has an elastic material acting like a very sensitive spring on the rubbing plates, so that the latter yield to the slightest pressure, while they are sufficiently rough and rigid to break apart the husk of the coffee.

Fig. 8 is a

CORN GRINDER,

an apparatus which is used principally in Mexico and Central America, where corn is boiled and then crushed and reduced to a fine pulp, for the purpose of making *tortillas*, or flat, round cakes, which, when toasted, form the principal food of the people. The machine is equally well adapted for grinding chocolate, seeds, paint, etc., as may be required.

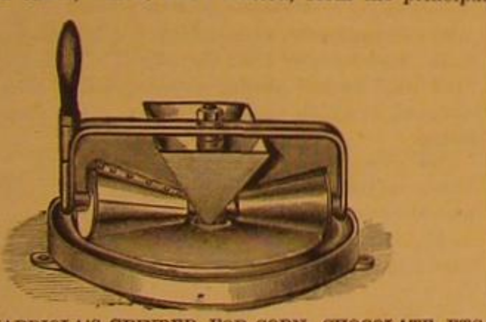


FIG. 8.—GUARDIOLA'S GRINDER FOR CORN, CHOCOLATE, ETC.

Messrs. Morris, Tasker & Co., of Philadelphia, Pa., have recently made a new set of Mr. Guardiola's machines; and they may be addressed as to either the sugar or coffee machinery. Mr. Guardiola's address is Chocolá, Guatemala, Central America.

Wanted a Postage Stamp Canceller.

The Government suffers yearly the loss of many thousands of dollars through the cleansing and re-use of postage stamps, after the same have once passed through the mails. About one thousand million stamps of all kinds are annually cancelled. Those printed on postal cards and envelopes, numbering, it is estimated, one third of the above total, cannot of course be used a second time. To prevent the remainder entering again into circulation, we rely on their being indelibly marked; but this important result no one has yet succeeded in attaining in a sufficiently simple and effective manner.

We still adhere to the old printers' ink besmeared pad and wooden hand stamp. In small post offices, where the clerk can take his time to the work, the above simple device answers all purposes, or at least is better than anything yet offered as a substitute; but in the offices of large cities, where the clerks are obliged to acquire marvellous celerity in handling the letters, it is almost a necessary consequence that some stamps are so lightly marked that the greasy ink is readily removable.

The question now is whether a mode can be invented which will both rapidly and effectually produce the requisite cancellation. The prospects in this regard are certainly not promising, if we may accept the experience of the Post Office Department, which, after two years of experimenting on all sorts of inventions for the purpose, has recently brought its tests to a close, and is actually no nearer a solution of the problem than at the outset. A *World* correspondent says that, in one corner of the Post Office building in Washington, there is a room containing some five hundred fruitless inventions. Most of them are inks. Fatty inks, metallic inks, sulphuric acid ink, which eats the stamp (also envelope and contents), caustic potash ink, which destroys the stamp or the post office clerk's skin on touching either, nitric acid ink, and any number of inks warranted to stand acids, but which promptly succumb to soap and water. One inventor brought a precious bottle of invaluable fluid all the way from St. Louis. He saw stamps cancelled with it proudly; but his gratification vanished when, ten minutes after, he saw the selfsame stamps washed clean with the all potent soap and water. Not a single ink submitted has stood the tests of the post office chemist; and even when that learned gentleman thought that he, profiting by the errors of others which he had so acutely detected, had certainly himself invented the elusive compound, the Smithsonian Institute chemist ruthlessly washed out the offspring of his genius. Chemical means in the form of inks are therefore failures; and nothing, thus far found, can surpass good printers' ink for obliteration purposes. A new chemical device has lately appeared which involves printing the stamps in colors produced by substances which, on being heated, change in hue. It is proposed, according to this, merely to heat the letters in the post office whence they are expedited. Three objections suggest themselves to the plan. First, heating letters will not postmark them, and it is highly desirable that postmark and obliteration shall (as is now the general rule) be effected simultaneously. Second, there is too much chemistry and heating apparatus about the invention to suit the average country post office. Lastly, packages containing cuttings of plants and many samples of goods could not be heated without ruining their contents. There are also various kinds of stamps proposed which, after once being affixed to the envelope, cannot be removed. Some years ago a quantity of stamps of this kind, seemingly printed on gelatin, were prepared in this city; but they failed to meet the approval of either the French Government or our own, to both of which they were submitted. It was practically impossible to preserve them, as a little moisture sufficed to curl them up, or caused them to adhere inextricably together.

Lastly are the mechanical cancellers, of which there are many. One harrows up the surface of the stamp with little hooks, too slow an operation; another jabs a stamp full of holes, but its ravages are easily cured by a little steam and a flat iron; another rips half the stamp off, but the knife is apt to get dull; and thus we might continue through a long category of inventions, which were all rejected in favor of hand stamp and pad.

Now we shall not for an instant credit the idea that our inventors are content to remain baffled by this problem, for we are convinced that there is a solution of it, and a practicable one. Let the inventors therefore understand the main points of the requirement: The mode of cancellation must admit of rapid use; must in nowise affect the contents of the envelope; must be applicable without special machinery or any special process; must be so simple as to require no more skill to use it than is now required to manipulate the hand stamp; must legibly inscribe the postmark and cancel the postage stamp, both simultaneously; must be cheap; if an ink, it must be chemically ineradicable, and yet not necessitate rare or costly chemicals for its manufacture; and if a self-destroying stamp, it must be as portable as the present ones. There is an excellent opportunity here for some inventor not only to confer a great benefit upon the community, but to secure for himself splendid rewards; for a thoroughly successful invention of this kind would be welcomed by every government in the world.

A Visit to a Slate Quarry.

At Festiniog are situate some of the largest slate quarries in North Wales. We find in the *Building News* the following graphic description of a visit to the locality:

Passing over an iron bridge we were soon in the midst of the busy scene. All around extended the workings, the sides of the mountains being strewn with slate, which to an outsider seems to be wasted in a very prodigal manner.

Down the precipitous sides, every now and again, a huge mass of slate is hurled by the quarrymen above, and as it jumps and tumbles down, the crackling and crashing of the waste slate adds not a little to the prevailing noise. In the distance we hear the boom of blasting, and in all directions trucks hurry along, some in strings laden with waste, while single ones rush up and down very steep inclines. These last are worked in couples with an endless chain and drum, the ringing, rattling noise they make being most startling to the visitor. Not infrequently these chains break, when, it may be imagined, the position of the unloading gang at the bottom is somewhat awkward.

At a certain point our guides stretched themselves prone upon the ground—we following their example—and crept to the edge of a cliff. Peering over, a sight met our view which was interesting to a degree; four hundred feet below lay the busiest and most remarkable portion of the workings. Almost immediately beneath us was a huge gray colored chasm, its entrance all misty with the smoke and dust of the blasting which was going on somewhere deep down in the bowels of the mountain. Around this opening for some distance was a cleared space alive with pigmy men, who were busy loading and unloading the various trucks which kept arriving from all directions, some appearing every now and again out of the chasm, others working by the tank system in stages, while the majority came pelting down the mountain side, held by a thin bright thread which glistened in the sun; this was the chain system spoken of. From the clearing around the chasm, lines of tramway led away to the railway, along which strings of trucks drawn by horses toiled continually. Leaving our birdseye view, we walked along until we reached the workshops. In a large building the different processes of bringing the slate into shape were going on in full swing; wheels spinning overhead, with driving bands in all directions, sawing, planing, and lopping the slate into sizes. Everything apparently was done by machinery, with but the one exception, as far as we saw, of rending or splitting the slate into the thin slabs technically known as ' slates;" this appears to be entirely done by hand. The process is very simple but very interesting. The render sitting upon a block, with a pad on his legs, is supplied by boys with slabs about an inch and a half in thickness. Taking one between his knees, after having selected the truest end, he taps it with a broad blunt chisel and mallet, prising it open; then, with a turn of the wrist, rends the slab in twain. Often when he appears to have come to the last slate which can be got out of the slab, he will again rend it, apparently as easy as the first time. We watched one man for perhaps ten minutes, while he did over a hundred slates, and did not see one mistake. After this process they are taken to a revolving hollow drum with stout iron blades, and are held by a man on a fixed bed or frame, with a gauge attached to it, and squared up into the different sized slates.

Leaving the shops we went on until we came to some sheds, where was a shaft descending to the lower workings, passing on our way an old man sitting in a slate hut, who, assisted by a boy only, was busy rending, lopping, and slacking small sized slates, looking as 'though he adhered tenaciously to the old style, and scorned the idea of the new-fangled machinery. At one of the sheds we procured candles and then waited for the tank, or skip, to come up, which it presently did with a laden truck; this being pulled off on to the tramway, we stepped on to the tank in its place. The water was then turned on, and the tank filling, the weight of the water soon counterbalanced the loaded (empty) tank at the bottom. The water being turned off, we began to move, and down we went, until, after about a minute's journey, a gentle bump told us we were at the bottom. A rumbling noise and a shout warned us of the approach of some trollies drawn by a pony. We just managed to evade them, but not without some of the party getting very wet. The train we returned by carried about 300 quarrymen, who cropped off the trucks at the nearest point to their destination. These men work in gangs and earn very considerable wages.

Communications.

Cotton Picking by Machinery.

To the Editor of the Scientific American:

Will you allow me space to answer a large number of communications received since the publication of my letter in your number of December 16 last?

Cotton is grown in rows or drills which are varied in the distance apart by the quality of soil. For instance, a rich soil produces large plants, and *vice versa*. Perhaps an average of distance would be 3½ feet. The drills are but little raised above the general surface when picking time arrives. If it were necessary for the successful working of a cotton picker, the plants could be grown in double rows, with a wider distance, especially in the poorer soils. The height of the plants varies from 12 or 15 inches upon poor soil to 6 or 7 feet upon the rich bottoms. The variation in a single field would be much less considerable. In general, the height may be stated as from 2¼ to 3½ feet. The plant is pyramidal in form, grows upright, and with a width proportioned to the height. It is rather woody, more so than elder, less so than the whortleberry. There is a central stem, which is perpendicular, and sends down deeply into the earth a tap root; from this, as a center, the roots below and the branches above radiate with some degree of regularity. The stalk would not be easily injured, as it is well protected by its branches. The size of the boll or pod, when fully grown and unopened, is about that of the black walnut, some being larger and some smaller. This pod bursts at maturity; the lint gradually unfolds itself and hangs down more and more for days and weeks, until at last it would drop out by agitation of the wind, if not gathered. The number of bolls to the stalk varies from ten or twelve to several hundreds. This varies with the size of the plant, and also with the selection of seed for prolific varieties. The bolls are situated upon foot stalks 2 or 4 inches in length, which make off from the main branches. They are borne upon all of the branches, both below and above. The bottom bolls are first to mature, and afterwards the others, upward in succession. The fruit is borne chiefly upon the exterior of the plant; but, as in the apple tree, some of it is to be found towards the center of the head.

The force required to extract the lint from the well opened pod is very slight. It might be represented by a weight of perhaps 1 oz. as the maximum, and from this down to nothing, when the lint falls of its own weight. The picking season in this latitude extends from September 1 to the close of December. The last of the crop is usually fully opened and ready for picking by or before the middle of November, and is constantly liable to damage until it can be picked out. The later pickings are usually more or less damaged by this delay, and command a lower price.

It would be difficult to state the average number of acres in cotton upon each farm and plantation; perhaps it might be put at 50 acres in this region, and further south 100 acres would be nearer the mark. The extremes could not be more definitely fixed than by stating them at from one acre up to two or three thousands. The yield of merchantable cotton per acre differs widely with soil and culture, as does corn, wheat, or any other crop. A fair average for this region would be probably 200 lbs. of lint, the extremes being from 30 to 1,000 lbs. One bag of 500 lbs. is a very successful crop upon the best lands without special fertilization.

Can the cotton be blown out of the boll? Yes, when it is very mature; but it is not likely that this could be a successful method of gathering. A draft of air might be useful to agitate the long locks of lint that card teeth might the more easily seize them. Would a team be likely to injure the plants? No, not if properly driven.

Personally I have no interest whatever in the growth or sale of cotton. I do not desire in any way to engage in the invention or sale of a cotton-picking machine. I am a physician, and do not desire to become anything else. My business carries me through the cotton plantations; I see a great and manifest agricultural want which I cannot supply. I have asked the use of your columns to bring this want before those whose business and whose interest it is to supply it. I have given my own thought upon the subject freely to the public; I cannot do more than this. In the invention of a successful cotton picker, I think I see in the near future an immense revolution in all the cotton industries of this country, the influence of which will be sensibly felt throughout our vast domain from Maine to Texas, from Oregon to Florida.

ROBERT BATTEY, M. D.

Rome, Ga.

Boiler Explosions.

To the Editor of the Scientific American:

In No. 2 of the present volume of the SCIENTIFIC AMERICAN, there is a letter from E. G. A., headed as above. In this letter he says "that it is very generally conceded by scientific and practical men that the most common, if not the sole, cause of boiler explosions is low water." He also says: "if an explosion occur, and you ask the engineer his opinion of the cause, he has no theory; but one thing he is certain of, and that is that the boiler was full of water a few minutes before the catastrophe occurred; and here he is at variance with all scientific men and the public generally." I think that whenever the pressure in a boiler becomes greater than the boiler is able to bear, it will give away, and a new boiler is sometimes made in such a bad manner that it will not bear anything like the pressure that it is expected to

E. G. A. goes on to suggest the use "of automatic water regulators and low water alarms to prevent these explosions;" but he says, "when you go to the proprietor for permission to put one on his boiler, he goes to the engineer, who, on account of ignorance, objects to it." Now any man who will give this one moment's thought will see that it is unreasonable to lay this blame on the engineer, who would not object to anything that would lessen his duties or take any responsibility off his shoulders. To think that he would object to anything that would give warning in time to save an explosion, and thereby save his own life, would be at variance with the laws of human nature, especially when it does not cost him anything. But the trouble lays in the expense to the owner. I will relate a circumstance which I heard the other day. I have a friend an agent for the sale of a water regulator and low water alarm. I said to him that I thought he could sell one to my neighbor. He said he could not, and that he went to the engineer with the instrument, who, after examining it, said that he thought it was a good thing, and would like that I should go to the owner and sell him one. "So," said my friend, "I went to the owner and explained the matter to him as well as I could. Said he, 'I pay my man for looking after that boiler; I will not buy this and pay him too.'"

D. KARNS.

St. Petersburg, Pa.

A Hint for a New Pomade.

Notwithstanding that we owe much to the Baconian philosophy, many discoveries have been the result of pure accident, and the "rule of thumb" has been the predominant feature in their development. When one reads of a Yankee specific for the growth of hair, which when spilt in the neighborhood of a doorstep over night resulted in a handsome door mat the next morning, one feels at liberty to exercise the fashionable faculty of scepticism. But when a British Consul tells a "plain unvarnished tale," we presume it must be received with becoming gravity. Still we cannot help remarking that the news conveyed by Mr. Consul Stevens in his last report to the Government on the trade of Nicolaieff would be indeed a blessing to bald heads, *if true*.

Mr. Consul Stevens states that a former servant of his, prematurely bald, whose duty it was to trim his lamps, had a habit of wiping his petroleum-besmeared hands in the scanty locks which remained to him; and after three months of lamp trimming experience and practice of his dirty habit, he found he had a much finer head of black, glossy hair than he ever possessed before.

Consul Stevens, therefore, tried the remedy on two retriever spaniels that had become suddenly bald, with wonderful success. During the summer of 1875 his attention was called to several cases of sudden baldness of bullocks, cows, oxen, and the loss of tails and manes among horses. His previous experience induced him to suggest the use of petroleum to the owners, and it was found that, while it stayed the spread of the disease among animals in the same sheds and stables, it effected a quick and radical cure on the animals attacked.

Consul Stevens says that the petroleum should be of the "most refined American qualities," and should be rubbed in vigorously and quickly with the palm of the hand. It should be applied six or seven times in all, at intervals of three days, except in the case of horses' tails and manes, when more applications may be requisite.—*Pharmaceutical Journal.*

Coal Miners' Relief Fund.

The Wilkesbarre Coal Company, after the occurrence of the Avondale catastrophe in 1869, established a benefit relief fund at the mines. The company gave the yield of the mines for one day, and the miners each gave a day's work, the amount raised being $6,000. Since that time this fund has been constantly and rapidly accumulating, every new miner giving the first day's work to the fund. The fund is deposited with the coal company, who pay 6 per cent. interest on the money. The trustees are selected by the miners. Since the establishment of the fund it has been changed, in order to include all the mines owned by the Philadelphia and Reading Coal and Iron Company, and more liberal provision has been made for families whose heads have been crippled or killed in the mines. It is provided that, "should any person, after having been in the employ of the company for upwards of one month, meet with a fatal accident in the discharge of his duty as a workman, his family shall be entitled for one year from date of death to the following benefits, provided that no person entitled to said benefits shall directly or indirectly engage during said time in the sale of intoxicating liquors: 1. $30 to be paid for funeral expenses. 2. $3 per week to be paid for maintenance of widow. 3. $1 per week to be paid for the maintenance of each orphan under 12 years of age." The total contributions to the fund, including interest, in the seven years have amounted to $93,217½. Of this $66,881¾ has been distributed in benefits, and $26,335¾ remains in the treasury.

The Great Ice Gorges.

An immense loss of property has resulted from the late great ice gorge on the Monongahela river. The flood, occasioned by the damming of the stream, on breaking its frozen barrier, swept the great ice masses before it, and these in turn destroyed everything in their path. Whole fleets of coal-laden barges were borne along like chips, to be crushed and sunk on striking a bridge pier or other obstruction strong enough to resist the terrible impetus. When the gorge reached Pittsburgh, seven large steamboats, besides a number of loaded coal packets and upwards of 300 barges, were swept away. Nearly all were filled with coal, of which it is estimated some 15,000,000 bushels were lost. The tipples used for dumping coal, built on the river bank, were destroyed for a distance of sixteen miles, and their wrecks, with those of the vessels, lie strewn over the shores in inextricable confusion. The loss in the vicinity of Pittsburgh is placed at $2,000,000, to which must be added the cost of clearing the channel of the *débris* which now impedes navigation.

At Cincinnati, the break-up of ice in the Ohio resulted in destruction almost as extensive, and 75 full and 200 empty coal barges, and several steamers, were sunk. It is estimated by coal shippers that the total damage caused between Pittsburgh and Cairo will not fall short of $12,000,000.

A Town Built on Ice.

A correspondent of the Detroit *Free Press* states that the fishermen on Saginaw Bay have erected a good-sized town of shanties far out on the ice. The dwellings are of thin wood, lined with thick building paper, and are attached to runners so as to be movable from place to place. The town already boasts a hotel. From this structure, which is larger than any of the dwellings, the view is truly astonishing, the shanties dotting the surface of the bay in all directions. The number is now about 300, and about 30 are arriving and being put up daily. The average number of occupants in each shanty is three men or men and boys, thus making, including the larger buildings and their occupants, not less than 1,000 persons already living on the ice. There probably will be twice the number on the ice by the first of February, and they can remain there in safety until the middle of March. Teams are constantly engaged in gathering together and hauling the fish thus caught by the men, who fish through holes in the ice to Bay City, whence they are shipped to all parts of the State. That all these people find it sufficiently profitable, to induce them to brave the perils and hardships attending this adventurous life, is proof that the aggregate revenue of the business must be quite large.

Heating Street Cars not Feasible.

Several newspapers of this city are advocating the warming of the street cars, a proposal which, in view of the manner in which those conveyances are used in New York, betrays a very decided lack of common sense. We suppose that there are few more disagreeable places on this mundane sphere than the interior of a Third avenue car in this season of the year, when packed with the average crowd which travels on that line. The floor is usually covered with slush and wet straw; and ventilation is conspicuous by its absence. Now to add to the reeking atmosphere of these cars the emanations of a hot stove would be simply to render the place unbearable to persons who fear aerial poison, and dangerous to health by the repeated sudden changes in temperature, due to the constant opening and shutting of doors. On some lines of cars which are crowded and which travel long distances, stoves may be, and we believe are already, used; but to place them on vehicles which are always thronged, and at certain hours literally packed, is certainly impracticable.

What is needed is good ventilation, a clean floor, and proper illumination at night. These can all be easily provided, and would do much toward rendering street car travel more comfortable.

Poisonous Fireworks.

Miss Helen Locke, a beautiful young lady living at Bristol, N. H., died recently from the effects of inhaling gas from "red fire," burned during a young ladies' tableaux entertainment, in which she took a part, given about six weeks before.

The above pyrotechnic mixture, "red fire," is quite a favorite at private tableaux exhibitions, but should be utterly banished from the parlor and the lecture room. Its fumes are highly poisonous. It is composed of nitrate of strontia, black sulphide of antimony, sulphur, and chlorate of potash. The crimson color is due to the strontia. The latter is a salt of the metal strontium, which is of light yellow color, nearly as hard as gold, and very ductile.

"Red fire" was formerly in common use in our theatres; but its poisonous character and danger as a combustible have caused its general abandonment. The same may be said of other firework mixtures. The lime light lanterns and lenses of different colors have been substituted, by which even greater brilliancy and variety of effects are obtained.

Fluids of the Mouth.

Dr. Hodson wisely calls attention in the *Medical Record* to the fact that, in any illness involving a feverish condition, the fluids of the mouth are constantly as intensely acid as respects the teeth as in any medicine administered by the physician, and, moreover, from the high temperature of the buccal cavity at such times, the power of these acids for evil is greatly augmented. Further, a direct consequence of these conditions is the especially rapid fermentation and decomposition of all food lodged between and around the teeth, and the consequent elimination of other deleterious acids. Dr. Hodson recommends rinsing the mouth with *liquor calcis* (lime water), diluted according to the sensitiveness of the mucous membrane, and flavored with a few drops of wintergreen or peppermint to make it agreeable.

THE relative strength of different forms of riveted joint, as compared with that of the solid plate, is as follows: The strength of the solid plate being 100, that of the single riveted joint is 56, double riveted 70, chain riveted 85.

Thomas Edward, Naturalist.

The name of Thomas Edward, of Banff, Scotland, appears as reference or authority on the pages of many standard British works on natural history; and he has the honor of giving his name to several new species of crustacea, discovered and classified by him. Birds, fishes, insects, zoöphytes, and crustacea have been in his principal lines of investigation. A working shoemaker, his researches have been conducted in the hours of daylight, after work hours and before; and the hours of the night have been employed for such hunts as could then be followed. He ambushed, or slept when he could no longer keep awake, in badgers' holes or other uninviting shelters, and he was on such terms with the inmates that they would let him alone. Weather, fair or foul, made no difference to him, except as it indicated what particular investigation he should follow. Of course, though little known abroad except among naturalists, he was a local celebrity. He was elected, in 1866, one of the thirty Fellows of the Linnæan Society, and afterward a member of the Aberdeen Natural History Society; and he received the diploma of the Glasgow Society. Neither of these appointments yielded any income, but his neighbors of Banff made him curator of their museum, with the not very munificent salary of four pounds four shillings, about $21, per annum. This was something tangible for a prophet in his own country; but his townsmen regarded him as "daft," nevertheless. The local magistracy gave him a special certificate, warning gamekeepers and policemen that he was not a poacher or vagrant, but a sober, respectable working man, engaged in natural history investigations. Nobody, however, could give him a certificate against the rheumatism, or against poverty; and now, at the age of sixty-three, he is spoken of as a "ragged, weather-beaten, rheumatic old man."

It is pleasant to add that better times have dawned on Thomas Edward. During the recent holidays, he received a letter of which the following is a copy:

"WHITEHALL GARDENS, CHRISTMAS DAY, 1876.

"SIR:—The Queen has been much interested in reading your biography, by Mr. Smiles, and is touched by your pursuit of natural science, under all the cares and trouble of daily toil. Her Majesty has been graciously pleased to confer on you a pension of fifty pounds a year.

"I am,

"Yours faithfully,

"BEACONSFIELD."

Now this was to the old man, who need be ragged no more, a most acceptable Christmas present. It exceeds what were his average earnings; when, in health, by full work he could earn a pound a week at mending shoes. The date, on an unofficial day, adds grace to the gift.

Mr. Samuel Smiles, author of "Self Help," "Character," "Thrift," and other books of an eminently practical character, mentions Thomas Edward in the book first named, published eighteen years ago. And he has just written an extended biography of the naturalist, which will doubtless be republished in this country and read with interest. In one thing Edward is not a model. He hated school, and played truant when he could; and when he attended, it was with pockets full of worse than rocks: bugs and reptiles to wit, which made him no eligible bench-fellow. Consequently, when he reached adult age, he was forced to learn as best he might how to read and write. His last appearance in any school was when a pet crow, concealed in his trousers, made responses during prayers, which were neither well timed nor edifying.

Steel Ship Building.

One noticeable feature in connection with the construction of the six steel corvettes now being built for the Admiralty by Messrs. John Elder & Co., of the Clyde, is the rapidity with which the work is being done. One instance of this may be discovered in the fact that the stem of each vessel is being cast in gun metal, a process which completes this portion of the work in a fortnight for each; whereas the old method of forging in wrought iron is said to require some four or five months' work. Messrs. Finlay & Davidson, of Port Eglinton, by means of their reverberatory or air furnace, which is capable of melting some thirty-five tons of pig iron, undertook the casting of the stems, each of which when finished is of the estimated value of $7,500. In outline each of these stems bears some resemblance to the prow of the war galleys of the ancients. Continuous at one end with the keel of the vessel, of which it is to form a prominent feature, the stem bends forwards and upwards, becoming about 15 inches thick along the anterior border, and attaining to about 4 feet as its greatest breadth. It then curves backwards and upwards, gradually becoming smaller towards the upper end, where it merges into the bulwarks of the ship; indeed, it may be said to consist of two curved arms meeting in the broadest part at a somewhat obtuse angle, and there becoming a sort of ram. Speaking roughly, each stem may be said to be about 45 feet long; and as it is all cast in one piece, it is not surprising to learn that in its finished state the casting weighs about 10 tons, and that its production necessitates the employment of a charge of 14 or 15 tons of metal.

Considerable care has, of course, to be exercised during the process of casting, which takes place much in the usual way, by the aid of loam and dry sand, and a wooden pattern. The essential ingredients of the metal are copper and tin, and in the casting of No. 4 stem the other day the charge consisted chiefly of old brass or bronze guns from Woolwich. At half past four in the morning the charging began, and by eight o'clock, there being a remnant from a former casting in the furnace, some 7½ tons were melted down. Gradually adding some 5 tons of metal up to one o'clock, 10½ cwts. of tin were admitted, and by two o'clock all was ready. Just immediately before tapping, a number of slabs of zinc or spelter, weighing about 1¾ cwt., were cautiously slipped into the molten mass, and the whole well rabbled. It was so arranged that the finished metal in the furnace should have something like the following composition: Copper, 16 ozs.; tin, 1¾ ozs.; zinc, ½ oz., the resulting alloy being guaranteed to stand a tensile strain of 15 tons per square inch. In all about 4 tons weight of old guns were used in the production of the charge of fully 15 tons. The furnace used in melting this mass of metal is formed of two portions, at right angles to each other—that most distant from the fire terminates in the chimney stalk, and in it the tapping hole is situated. Its total length is about 20 feet, by 3 feet 6 inches in breadth, but prior to its use for these castings its internal capacity was considerably reduced by a layer of firebricks being built. The running of No. 4 stem proved as successful as the others, and among the many features which appeared strange to the ordinary ironmoulder was the reception of some 8 tons of the metal into a kind of reservoir from which it passed through a shutter, raised at will by a lever, and on through no less than thirty runner gates. The extreme liquidity of the metal and its easy flow afforded ample opportunity for manipulation outside of the furnace; and with the great care taken that every attention be paid to the various details of the work, Messrs. Elder & Co. are enabled to turn out what is considered a triumph in the shipbuilding world.—*Iron.*

Planting, and What to Plant.

The selection of trees suitable for various soils and situations should be carefully considered. On light, poor, hilly lands, and moderately exposed, the larch is the most profitable tree to plant for a main crop; when the altitude or exposure is too great for the larch, a shelter screen should be planted with Austrian, Corsican, and Scotch pines, planting the Austrians on the outside or exposed sites, as they are of a more bushy habit than the others, and the best pines grown for shelter. The Scotch and Corsican pines thrive well and make excellent timber on exposed, poor plains, where the larch has been found to be a failure. On the other hand, the larch generally is more vigorous and less liable to disease when grown on the declivities of hills with a southwest, west, or northwest aspect, than in other situations, the reason being that the sun's rays do not reach these aspects so early in the day, and thus the trees do not suffer from late spring frosts so much as when planted on east or southeast aspects. Firs should be planted in judiciously chosen positions to give the most pleasing and natural effects without stiffness and formality. The Douglas and Menzies spruce, Nordman's silver fir, and the Wellingtonia, which are now more plentiful than they have been, and may be bought at moderate prices, might also be introduced in smaller groups in the lower sites, where the soil is tolerably deep and the situation somewhat sheltered; they are all hardy, fast growing, and beautiful conifers, being very effective when planted in groups amongst deciduous trees.

Where hardwoods are planted to form the permanent crop on thin, poor soils, the beech, sycamore, and sweet chestnut are the best sorts to select. When the soil is of a loamy nature and resting on clay, the oak and ash should be planted; the latter, particularly, will prove a profitable tree to plant extensively where the land is suitable to its healthy growth, as the supply of copse or maiden ash timber is at the present time not equal to the demand, and likely to be still more scarce in the market. We would, therefore, say plant ash in preference to any other hardwood when forming new plantations, or filling up copses, wherever it is found to thrive. In copses on poor, hilly ground, sweet chestnut and hazel should be planted where blanks occur; in wet bottom land, alder, willow, and poplar are the most suitable sorts to plant; on chalky lands the hazel alone is sure to succeed best; it is a most accommodating plant, will thrive in almost every kind of soil, and is very profitable as underwood, always commanding a good price and ready sale where there is a demand for grate and hurdle wood.

Whenever the weather is favorable for planting operations, push forward without delay any forest tree planting that may be in progress, or the formation of any new plantations which may be contemplated during the present season; also drainage by means of open ditches and trenches, where naturally wet, or where there is not sufficient natural fall for surface water, likewise the enclosure of the ground by the erection of substantial fences to protect the young trees from damage by the inroads of cattle; and the cutting, clearing, and burning of furze, brambles, heath, or any other strong growing material of that kind that is likely to impede the work of planting or interfere with the healthy growth of the plants. These are all necessary preliminaries to forest tree planting that should have been finished ere this, in order that the work of digging the holes and planting the trees may progress speedily during seasonable weather, and when the ground is in a good condition to put in the plants. As soon as the latter are received from the nurseries, they should be taken without delay to the ground where the planters are at work, and heeled in thinly in a trench, their roots being securely covered over to prevent them from getting dry, and to protect them from frost.

[A correspondent of the London *Garden* gives the above information on the selection of trees adapted to various soils. We would add that the present is the season for removing and transplanting large trees; but it is necessary that provision should previously be made for taking them up with a large ball of frozen earth.—EDS.]

Selecting Timber.

There are certain appearances characteristic of good wood, to what class soever it belongs. In the same species of wood, that specimen will in general be the strongest and the most durable which has grown the slowest, as shown by the narrowness of the annual rings. The cellular tissue, as seen in the medullary rays (when visible), should be hard and compact. The vascular or fibrous tissue should adhere firmly together, and should show no wooliness at a freshly cut surface; nor should it clog the teeth of the saw with loose fibers. If the wood is colored, darkness of color is in general a sign of strength and durability. The freshly cut surface of the wood should be firm and shining, and should have somewhat of a translucent appearance. A dull chalky appearance is a sign of bad timber. In wood of a given species, the heavier specimens are in general the stronger and the more lasting. Among resinous woods, those which have the least resin in their pores, and, among non-resinous woods, those which have least sap or gum in them, are in general the strongest and most lasting. Timber should be free from such blemishes as "clefts," or cracks radiating from the center; "cup shakes," or cracks which partially separate one annual layer from another; "upsets," where the fibers have been crippled by compression; "rind galls," or wounds in a layer of the wood, which have been covered and concealed by the growth of subsequent layers over them; and hollows or spongy places, in the center or elsewhere, indicating the commencement of decay.—*Rankine.*

Whitewashing.

Samuel Smith claims, in the *English Mechanic*, that the following is a correct scientific and practical rule: Well wash the ceiling by wetting in twice with water, laying on as much as can well be floated on, then rub the old color up with a stumpy brush and wipe off with a large sponge. When this is done, stop all the cracks with whiting and plaster of Paris. When dry, claircole with size and a little of the whitewash. If very much stained, when this is dry, paint those parts with turps, color, and, if necessary, claircole again. To make the whitewash, take a dozen lbs. of whiting (in large balls), break them up in a pail, and cover with water to soak. During this time melt over a slow fire 4 lbs. common size, and at the same time, with a palette knife or small trowel, rub up fine about a dessertspoonful of blue-black with water to a fine paste; then pour the water off the top of the whiting, and with a stick stir in the black; when well mixed, stir in the melted size and strain. When cold, it is fit for use. If the jelly is too stiff for use, beat it well up and add a little cold water. Commence whitewashing over the window, and so work from the light; lay off the work into that done, and no: all in one direction, as in painting. Distemper color of any tint may be made by using any other color instead of the blue-black—as ochre, chrome, Dutch pink, raw sienna for yellows and buff; Venetian red, burnt sienna, Indian red, or purple brown for reds; celestial blue, ultramarine, indigo for blues; red and blue for purple, gray, or lavender; red lead and chrome for orange; Brunswick green for greens.

The Nautigon.—A New Scientific Instrument.

An instrument for the use of navigators, patented in Europe through the SCIENTIFIC AMERICAN, has recently been invented by the Rev. Dr. Thomas Hill, late President of Harvard College, which is called by the manufacturer (C. H. Farley, of Portland, Me.) the Nautigon. It solves instantly, by mere inspection, without the use of tables, any problem in spherical trigonometry, with sufficient accuracy for the principal problems of practical navigation. It requires no more time and no more mathematics to work out an observation by this instrument than to take the sun with a sextant. Thus, with a sextant, chronometer, and nautigon, the navigator needs no logarithmic tables. An observation of altitude gives instantly, by inspection of the nautigon, the ship's time and the azimuth of the sun or star, enabling the observer at once to get his longitude and the deviation of compass. The time of rising or setting of any heavenly body and its azimuth is determined with the same ease. The course for great circle sailing is also visible from inspection of the instrument. If the chronometer is out of order, the nautigon gives the altitude of moon and star, making it only necessary to observe the distance with a sextant. The correction of the lunar distance is the only problem too delicate for the nautigon, which gives angles to the nearest minute of arc; it would be too expensive for ordinary use, if it were made for the nice adjustment of seconds of arc. Even here, however, the corrected distance can be found, to the nearest minute, by the nautigon, giving a valuable check on the computation, easily applied.

A NEW SUN.—M. A. Cornu, in a note to the Paris Academy of Sciences, gives an account of his spectroscopic observations of the new star, 4th to 5th magnitude, lately discovered in *Cygnus*. The light of the star, he says, appears to possess exactly the same composition as the envelope or chromosphere of our sun.

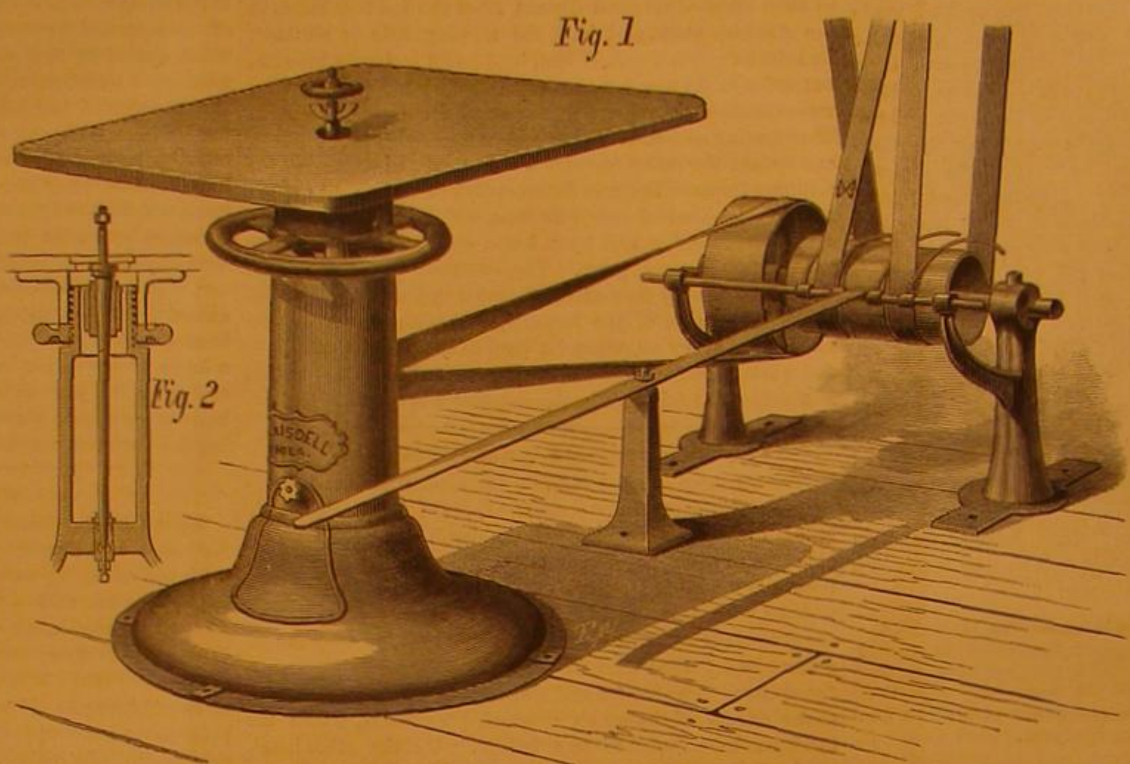
DWELLING HOUSES IN LONDON.—In a quarter of a century, from 1849 to 1874, more than 270,000 houses are declared to have been added to London, making an average of 10,813 houses per annum; and in one particular year of commercial activity, at least 18,000 were built.

IMPROVED UPRIGHT MOULDING MACHINE.

In the improved upright moulder shown in the accompanying illustration, there are several excellent features. The table is lowered or raised by turning the hand wheel, while the socket of the table, being a plain and truly bored hole, fitting to a neat working fit over the thread upon the standard, is always kept true and is not liable to get out of true, as it would be were it threaded itself. Furthermore, the table, being fastened with a set screw, will stand true even though the table socket had worn so as to become loose upon the screw or thread. Upon the thread on the standard, a groove is cut down to the bottom of the thread or a little below it; and into this groove the end of the set screw projects. Thus the table is prevented from turning, while the set screw is prevented from damaging the thread upon the standard. The tables upon all large machines are made square, as shown in our engraving; while those for small machines are made round, as shown in the engraving in our advertising columns.

The spindle or shaft, it will be seen, is provided with cone bearings, running in composition brass boxes, at top and bottom, the lower one being of smallest diameter, so that it will pass through the upper one when putting the shaft into its place. Beneath the lower bearing is placed the set screw shown in the sectional view; by means of which screw a perfect adjustment of the bearings may be made. In both the upper and the lower boxes are enclosed cavities for the introduction of cotton waste or other similar material and oil, so that perfect lubrication is ensured while the bearing is at the same time kept clean. To further ensure this latter object, the oil holes are provided with plugs, easily removable when the bearings require a new supply of oil. The spindle is made of the best cast steel; and from the design of its bearing and the proximity and rigidity of the bearings, it runs at the highest of speeds with quietness and without undue wear. The cutter carrier, or cutter spindle, is coned similarly to a lathe center, and is furthermore held to its place by a nut; so that, while it is certain to run true, it is at the same time capable of carrying any required amount of cut; and it also enables the cutter spindles to be changed from ½ to ¾ and 1 inch, to suit light or heavy work. The loose pulley is made self-oiling by a very simple device; and it is a noteworthy fact that there is not a bolt and nut about the whole machine. The cutters are reversible, and danger of accident is removed by the use of the guard shown. The machine is of good material, and it received the highest awards at the American Institute Exhibition of 1875 and at the Centennial Exhibition.

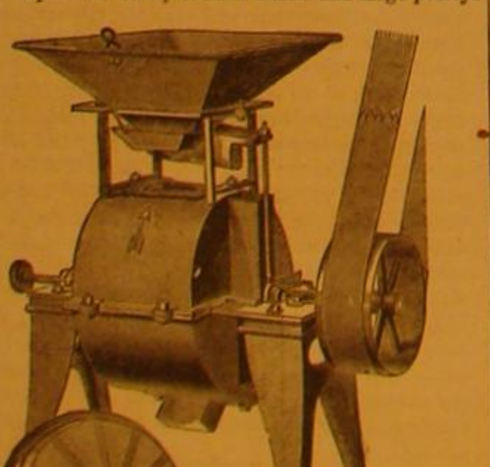
For further particulars, address the patentee and manufacturer, J. H. Blaisdell, 20 North 4th street, Philadelphia, Pa.



BLAISDELL'S UPRIGHT MOULDING MACHINE.

THE SCIENTIFIC GRAIN MILL.

We illustrate herewith a new mill for grinding grain, middlings, minerals, or paint. Among the advantages claimed are that it requires no costly counter shafts and large pulleys



in order that a high speed may be obtained. It is a French burr mill and corn cob breaker combined; it will remain true in line while shaving both sides of tender bran between the millstones; it has journal boxes with caps to take up wear; it is simple in design; and finally, the millstones may be easily removed and dressed.

The bedplate is cast solid in a single piece. It has the stone case in the middle, with large dirt spaces at each end, so that the dirt falls to the floor without passing into the journal boxes. The space around the stones measures 2½ inches, and there is a bottom discharge to prevent clogging. The bedstone is secured in an iron ring, bolted against the end of the stone case, forming a dust-tight joint. It is trammed to the runner with three set screws. The journal boxes, which, as already stated, have caps to take up wear, are lined with Babbitt metal, and are seven inches in length. The screw conveyer, corn cob breaker, eccentric, and pulley are all fast to the spindle, the latter being cast to the running stone with zinc. The temper screw at one end of the bedplate rests against a hard plate, and the latter against the spindle. The pulley has a hub on one side, and the journal box passes half way through on the other side, to remove the strain of the belt from the spindle. This allows the belt to approach from any angle, and to be removed without unsewing. The mill is raised on legs as shown, so that a bottom discharge is allowed, while the expense of a foundation is avoided. The hood rests upon the bedplate, there being a heavy twine packing between the two; and a large feed trunk at its end extends down to the cob breaker. The feed shoe is damzeled in front by the eccentric on the spindle, and the hopper has a valve in the bottom to control its discharge.

The manufacturers state that either the 12, 20, or 30 inch mill will make first quality of wheat or rye flour after having been ground into face, turning out fine large bran, discharging the flour round, live, and cool, making as good a yield as any four foot stone, and all this without keeping the flour between the stones, rubbing, heating, and killing it long after it is fine and should be discharged. This mill is especially adapted for regrinding middlings, and requires one horse power for every 300 lbs. per hour. When grinding paint in oil, two scrapers are added, one L-shaped, bolted against the hind side of the running stone. This scrapes the case clean outside of both stones. The other scraper is bolted to the bedstone, passes inside the L scraper at its free end, and scrapes the running stone clean. An open space around both stones is thus kept.

For further information, address the manufacturers, Messrs. A. W. Straub & Co., 1357, 1359, and 1361 Ridge avenue, Philadelphia, Pa.

Simultaneous Weather Observations.

Every day, at precisely 7:35 o'clock, A. M., Washington mean time, simultaneous weather observations are taken from 106 stations in the United States, from the deck of every United States naval vessel, no matter in what part of the world she may be, from 8 stations in the West Indies, 28 in Canada, 58 in Great Britain, 6 in Algeria, 13 in Austria, 1 in Belgium, 6 in Denmark, 48 in France, 23 in Germany, 1 in Greece, 30 in Italy, 1 in Japan, 4 in the Netherlands, 4 in Norway, 4 in Portugal, 27 in Russia, 2 in Spain, 6 in Sweden, 2 in Switzerland, and 6 in Turkey. There is now needed only the organized aid of the mercantile marine, which can be given without loss of time, to place the entire northern hemisphere under a system of daily observations.

A Snake Rain.

The Kentucky meat shower, which attracted so much attention recently, has now been supplemented by a rain of live snakes in Memphis, Tenn. Thousands of little reptiles, ranging from a foot to eighteen inches in length, were distributed all over the southern part of the city. They probably were carried aloft by a hurricane and wafted through the atmosphere for a long distance; but in what locality snakes exist in such abundance is yet a mystery.

What Came in a Potato.

A friend of ours received a day or two ago through the post office, from Olympia, Washington Territory, a roundish, irregular package, which on examination proved to contain a large potato. Further investigation showed that the potato had been cut in two and the inside scooped out, and in the cavity were found flowers and leaves, which, as he learned by a note previously received, had been picked in a garden in the open air on the 26th day of December. The flowers, pansies, geraniums, and others, were as fresh and bright as if they had been gathered within an hour, though their journey across the continent had occupied 15 days. Olympia is in about the latitude of Quebec, though its winter climate is not more severe than that of Memphis.—*Worcester Spy.*

Training Camellias.

It is seldom that one sees camellias trained, says the London *Garden;* still it is perhaps as good an arrangement as can be effected with old spindly plants. If the branches be tied in as closely as possible, they will soon break freely from the old wood and make well furnished plants, which they will rarely do if left to themselves. Plants of this description are excellent for planting at the foot of pillars or iron supports in a conservatory. They furnish the lower part with green foliage where ordinary creepers would not succeed; and when other large growing creepers are trained up these pillars to the roof, the camellias serve to hide the ugly, bare stems; and when in a healthy condition and full of flower, they are exceedingly attractive.

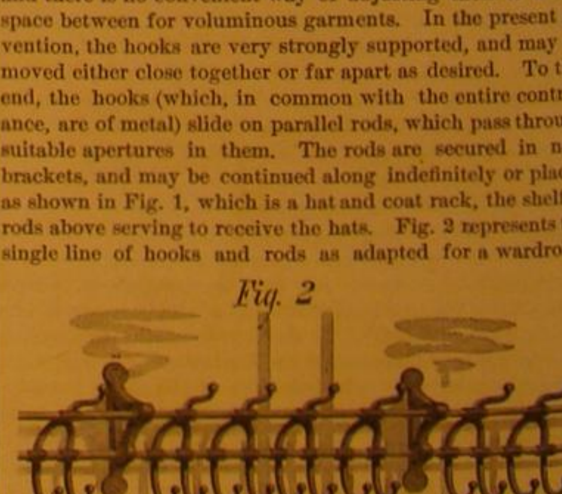
IMPROVED HAT AND COAT RACK.

A large number of the portable hooks for the suspension of garments, hats, etc., are pivoted or otherwise arranged in wooden frames, so that their construction is not very strong. At the same time, the relative position of the hooks is fixed,

Fig. 1

and there is no convenient way of adjusting them to afford space between for voluminous garments. In the present invention, the hooks are very strongly supported, and may be moved either close together or far apart as desired. To this end, the hooks (which, in common with the entire contrivance, are of metal) slide on parallel rods, which pass through suitable apertures in them. The rods are secured in neat brackets, and may be continued along indefinitely or placed as shown in Fig. 1, which is a hat and coat rack, the shelf of rods above serving to receive the hats. Fig. 2 represents the single line of hooks and rods as adapted for a wardrobe.

Fig. 2



The hooks, it is claimed, cannot break off or pull out, while they may be disconnected from the rods and the latter from the brackets at pleasure.

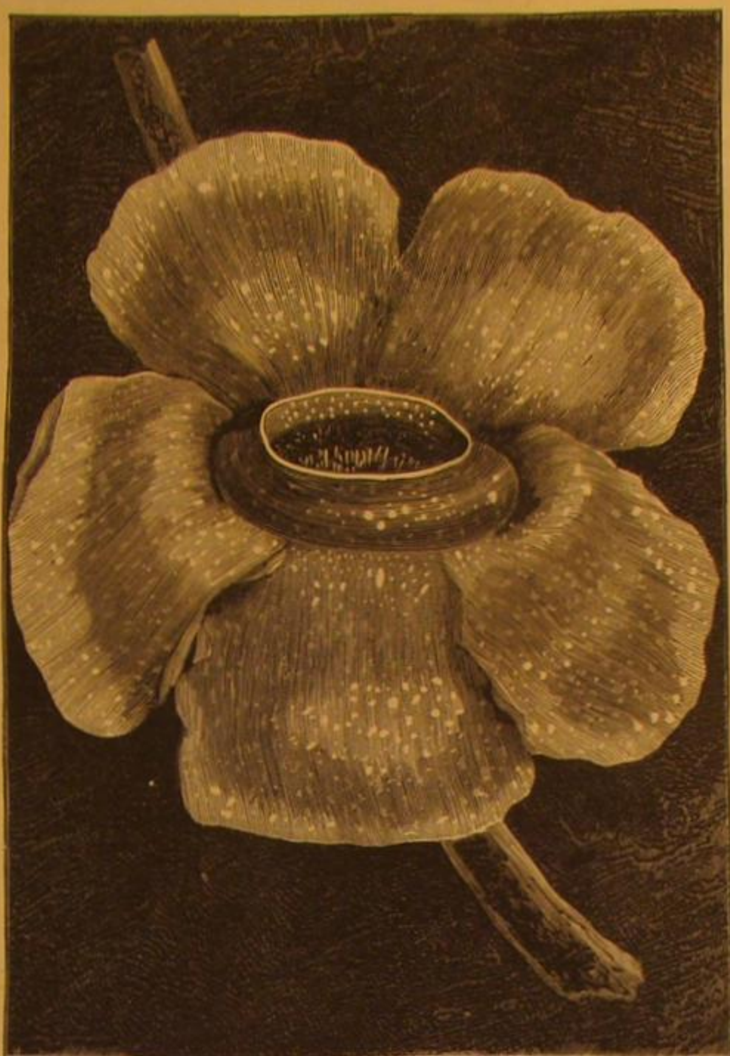
For further particulars regarding agencies, sale of rights, etc., address the inventor, Mr. Russell R. Dorr, 206 Third street, Burlington, Iowa.

THE LARGEST FLOWER IN THE WORLD.

The wonderful flower represented in our engraving is that of the *Rafflesia Arnoldi*, a plant discovered by Dr. Arnold in the Island of Sumatra some sixty years ago. The various species now known are all parasitic, not, however, to the branches of other plants, but to the roots. Entirely destitute of leaves and green in color, these singular vegetables are provided with scales or bracts which conceal and envelope the flower previous to opening. A swelling beneath the bark of some huge surface-appearing root of a large tree announces the coming of a flower. Soon the bark splits, and the bud, resembling the head of a young cabbage, bursts, showing five great lobes which open and roll back slightly on the edges. Then a circular ring appears surrounding a deep cup, in the center of which is the ovary. Below the edges is a kind of gallery wherein are numerous stamens in which is located the pollen, the fecundating action of which it is impossible to comprehend unless it be assumed that insects intervene for its transportation.

The remarkable feature of the flower is its colossal size, the largest species, here represented, being 39 inches in diameter. The central cup holds six quarts of liquid, and the total weight of the flower is over 15 lbs.

The *Rafflesia patina* of Java is somewhat smaller in size. The brick red color of the perianthus, as well as the lighter spots with which it is sprinkled, give to the flower a curious flesh like appearance. The cup and the central plateau carrying the stamens are of a dark red, while the odor of the plant is almost meat-like. In Java, the natives regard the flower as sacred, and the priests prepare from the tannin which it contains an astringent mixture useful in cases of hæmorrhage.



THE RAFFLESIA.

Bronzing Composition.

A composition of about 6 parts sulphate of potassium or similar sulphate, 6 parts of salt of lead, 12 of ammonia or similar salts, 3 parts acetic acid, 3 of hydrochloric or similar acids, when in combination, form a mixture with which Mr. L. J. Roucou, of Birmingham, England, gives to articles manufactured of copper, brass, zinc, or other metals, the color of bronze, as desired, by bath or application. By altering the proportions, and adding or taking away from any of the above described substances, he obtains a different mixture, which, when applied to the surface of works or articles made of gold, silver, and other metals, whether by brushes or otherwise, will preserve to the said works and articles their original color, and prevent their oxidization.

The Andes and the Amazon.

In a review of this new work by Professor James Orton, of Vassar College, the editor of *Nature* says: "We know of no single work containing a fuller, more brilliantly written, and at the same time more trustworthy general account of the basin of the Amazon and its many wonders. We are sure that all into whose hands the work may fall will agree that few more attractive and at the same time more instructive works of travel have been written." We may add that a considerable portion of the valuable information given in this work was originally presented to the public in the SCIENTIFIC AMERICAN, in the series of letters written to us from Brazil and Peru by Professor Orton during his original explorations. He is now again in South America making further investigations of the same region; and if his time permits our readers will have some additional contributions from his pen.

ASPARAGUS IN WINTER.

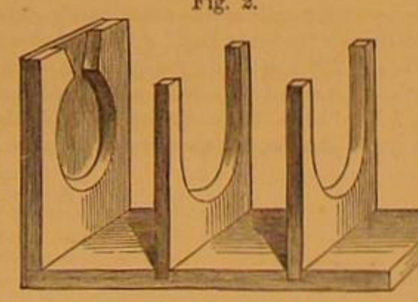
There is probably no vegetable that repays the trouble of artificial cultivation better than asparagus. It grows rapid-

Fig. 1.

ly and attains great size when properly cared for; and it may be made a source of great profit, large quantities of it being grown under glass in France, and sold in winter at high prices. M. Jacquisson, of Chalons, France, a well known horticulturist, has introduced a plan of forcing asparagus, so simple that our engraving (Fig. 1) is sufficient to explain it. He uses an ordinary wine bottle with the bottom cut off. These bottomless bottles, when well corked, are placed over the asparagus head just as it is beginning to rise above the ground. The asparagus being thus protected not only grows fast, but is so tender that the whole of it may be eaten. The air being kept from it, the development of the woody fiber of the plant is retarded, while that of the cellular tissue is accelerated. Cultivated in this way, asparagus is as expeditiously cut as when grown in the ordinary manner, sufficient light passing through the bottle to show when the heads are ready for gathering. In addition to this, the small amount of light which passes through the bottle gives the asparagus a rosy tinge which greatly improves its appearance.

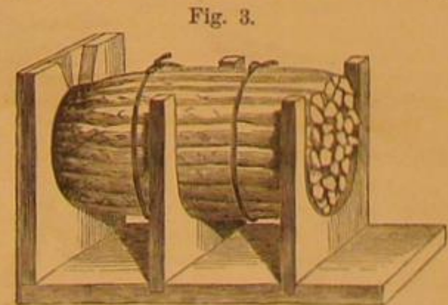
Numerous simple devices for holding the heads of asparagus while they are being tied in bunches are in use; and they are useful to the gardener, as carefully put up bunches are far more salable than irregular bundles of unevenly arranged heads. Fig. 2 shows an implement of this kind,

Fig. 2.



called the Sartrouville buncher. When filled, the tips of the heads are brought close together, the diameter of the space for the tips being less than that of the other openings in the

Fig. 3.



upright boards. When the frame is nearly full, the shoots are passed in through the wedge-shaped opening shown. Fig. 3 shows the same buncher when filled.

A New Solvent for Silk.

Schlossberger first suggested the use of an ammoniacal solution of protoxide of nickel for dissolving silk. Persoz proposed to use chloride of zinc, and Spiller used concentrated hydrochloric acid. J. Loewe recently described a new solvent, the cold alkaline solution of copper with glycerin, which is not inferior to the above, and with great dilution surpasses them. In very weak solutions, the silk is acted upon slowly; if moderately concentrated, the silk swells up on moistening it a short time; and with a larger quantity it soon dissolves to a thick liquid, which can be filtered, although it filters slowly. By adding hydrochloric acid to the filtrate, the dissolved silk separates in the form of a white jelly; frequently this separation is very slow, and the filtrate appears like a cold solution of gelatin. Wool, cotton, and linen, after being in contact with this solution for hours, is neither attacked by it nor taken up by it. It appears as if the solvent power of the alkaline glycerin and copper solution only extends to the silk. In mixed fabrics, the silk may be readily detected, and even quantitatively determined.

Silk which has been dyed black with iron salts dissolves with more difficulty and less completely, for the reason that the fibers are surrounded and protected by the insoluble oxide of iron. Such silk should be soaked for some time in sulphide of potassium or ammonium, and washed, and the sulphide of iron thus formed dissolved out with dilute hydrochloric acid. It then dissolves more readily, because of the partial removal of the iron. By treating the sample with dilute hydrochloric acid and metallic zinc, in special cases, this end may be accomplished. Silks dyed with other colors do not exhibit this difference in solubility, which depends upon the protecting action of the iron salts. In black mixed fabrics this treatment must precede the test for the other fibers. White wool acquires a blue-black color in the copper solution, but this is easily removed by an acid bath.

The alkaline copper solution is prepared as follows: Dissolve 16 parts of pure sulphate of copper in 144 to 160 parts of distilled water, and add 8 to 10 parts of pure glycerin, specific gravity 1·24, and mix thoroughly by shaking. Into this, while cold, drop slowly a solution of caustic soda until the light blue precipitate of hydrated oxide of copper at first formed is completely dissolved to a dark blue liquid, which is preserved without filtering in a closely corked bottle. If the ingredients are pure, it will keep for an indefinite length of time without the slightest change. It should not be kept in glass stoppered bottles unless the stoppers are waxed.

This solution may also be used hot to detect the presence of grape sugar or glucose, in the usual manner.

THE PINKS.

A French contemporary remarks with much reason that the constant production of novelties in floriculture has caused many beautiful flowers to disappear from our gardens. Rare and new varieties engage so much attention that the simple originals, from which so many costly specimens are directly derived, are almost forgotten. The pelargonium is now sought for, not the geranium; the tea rose and the yellow rose are more frequently seen in hot houses than the hundred-leaved and the moss roses with which we used to be familiar; and the carnation has caused the humble pink to be slightingly passed by. But the last named flower is one of singular beauty, and is known in great variety of colors and delicate gradations of tint; and its blossoms, which are grouped together at the top of firm stalks, are particularly well adapted to bouquets. It is hardy, and will readily accommodate itself to change of soil and climate. It is readily multiplied by slips or cuttings, although it may be grown from seed; and a mass of the plants two or three feet in diameter will form when in full blossom an ornament on which any garden may fairly boast itself. Three distinct

shades of color are shown in our engraving; but the number of tints of this pink family is very large, and all the varieties yield a powerful and agreeable fragrance.

A TRANSPARENT mucilage of great tenacity may be made by mixing rice flour with cold water, and letting it gently simmer over the fire.

SPOKE-MAKING MACHINERY.

Our extracts this week from Knight's "Mechanical Dictionary"* relate to lathes, planers, and other machines for making spokes. This apparatus, owing to the irregular forms of spokes, is specially constructed for their manufacture, and embodies mechanical devices of exceeding ingenuity. In Fig. 1 is illustrated a

SPOKE LATHE,

based on Thomas Blanchard's lathe for irregular forms. The spoke is placed between centers in a lathe head, and is approached to or drawn away from a cutter, in accordance with the shape of a pattern which governs the proximity of the tool to the work. The pattern spoke is in the upper part of the machine, and the guide pieces on each side govern the position of the revolving cutter, which acts upon the material placed between the lower centers.

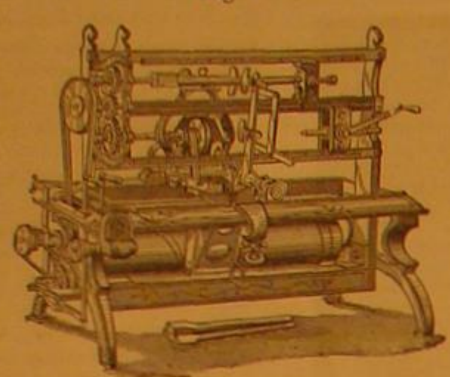


Fig. 1.

The lathe shown in Fig. 2 is adapted for turning handles for axes and other implements, as well as spokes. The work, *a*, and pattern, *b*, are fixed between centers and revolved upon a carriage, which is automatically traversed in a longitudinal direction, and at the same time swung by the upright guide, bearing against the pattern, so as to present the work to the action of a set of cutters fixed in the rotary head, *d*; the amount of this swing and consequent penetration of the cutters is dependent upon the shape of the pattern, of which the work is thus caused to present an exact copy. Adjustments are provided for forming several sizes of work from the same pattern.

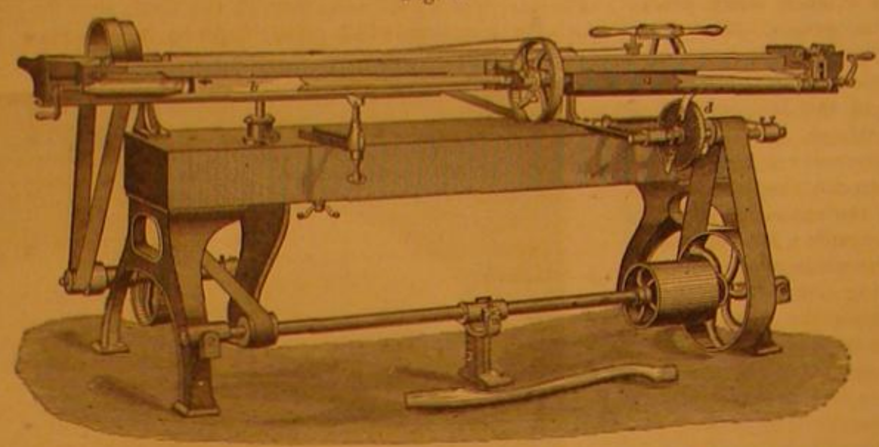


Fig. 2.

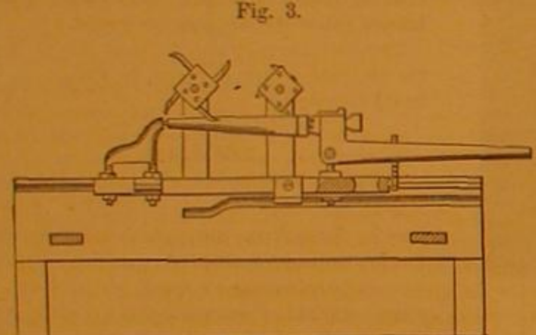


Fig. 3.

Fig. 3 is a machine for dressing a spoke lengthwise of the stuff, the spoke or the cutter being so moved, the one relatively to the other, that the required shape is produced. In the example, the piece is clamped between the dog in the bent lever and the opposite center; the clamp lever is held in position by a support placed under it and upon the bench. The carriage is reciprocated on the ways, beneath the roughing and the finishing cutter, a guide bar determining the presentation to the cutter, so as to confer the proper shape.

Fig. 4 is a machine for centering a hub, so that it may be bored truly for the spoke mortises. The standard forms a support for the adjustable portions of the apparatus. The point of the hub rests on a block keyed up by wedges. The butt of the hub rests on a pivoted bar whose carriage is vertically adjustable on the standard by a lever and rod in the rear. The mandrel bolt clamps the pivoted hub rest to a bar on the back of the standard.

Fig. 5 represents a machine for planing the sides of spokes and bringing them to a uniform shape; the edge of the tenon may be tapered at the same operation if desired. The spoke is placed upon the table, *c*, where it is held against a stop, adjustable to different sized spokes; the table is pushed forward to an amount determined by the previous adjustment of a collar on the stop, bringing the side on the spoke in contact with the cutters on the rapidly rotating cutter head, *b*, which at once dress that side of the spoke and tenon; it is then turned over, and the other side similarly dressed. On drawing the spoke forward and releasing it from the stop, the desired bevel is given to the edge of the tenon by means of the cutters, the particular inclination being determined by an adjustable angle gauge.

* Published in numbers by Messrs. Hurd & Houghton, New York city.

SPOKE-TENONING MACHINES

are used for forming the tenons on the outer ends of spokes. In Fig. 6 the hub, having the spokes inserted, is placed on a circular iron plate upon the workbench, and is held fast by adjustable clutches upon the head piece, *a*. The whole apparatus is secured to the bench by a screw and nut and lever, *b*. Surrounding the screw is a collar, *c*, and in like manner the bottom plate is surrounded by a collar, *d*. From these collars extend jointed adjustable arms, *e f*, the middle part of each of which is a right and left hand nut corresponding to screws on the ends of the other joints. These arms carry at their ends the brace guide, *g*, which has vertical adjustment to suit different sized hubs by means of two screws simultaneously operated by a hand wheel, and working in the tubes, *h h*, which slide in the tubes, *i i*. In the end of the brace guide is a nut, which is not threaded on its outer side, and turns freely in the guide unless held by a set screw; when this is made fast, the screw shaft, *k*, feeds in either direction, according as the hand wheel, *l*, is turned to the right or left. The depth of tenon is gaged by a collar, *m*, adjustable at any point on this shaft. The tenons are formed by a hollow auger held by the brace, *n*, the apparatus being rotated around the fixed hub as a center.

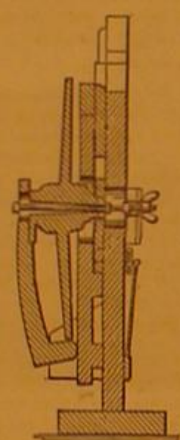


Fig. 4.

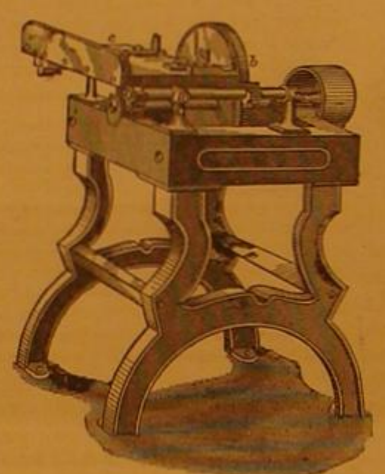


Fig. 5.

The machine shown in Fig. 7 is adapted for tenoning cabinet work as well as spokes. The two cutter heads, *a b*, are raised or lowered by means of a screw and hand wheel to each, and are adjustable to vary the thickness of the tenon or the depth of the shoulder as required, the carriage always remaining stationary. For spoke tenoning, it is provided with a light adjustable attachment on the carriage for grasping the spoke, and a saw for cutting it off to the proper length, at the same time that the tenon is cut.

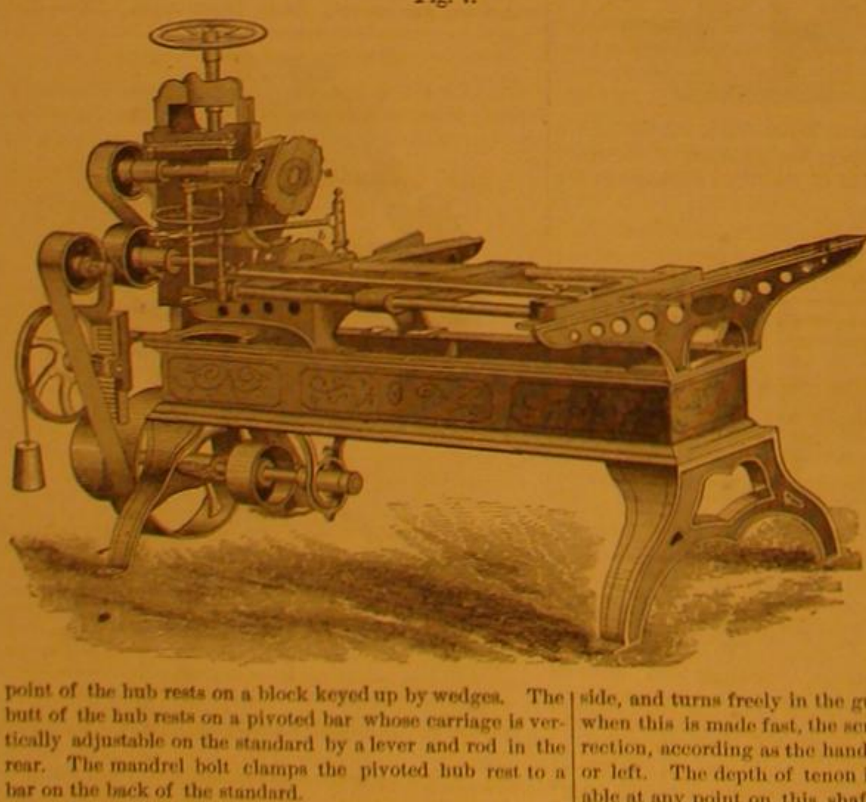


Fig. 7.

Fig. 8 is a

SPOKE-THROATING MACHINE.

The throat of a spoke is the portion of diminished thickness a short distance from the hub, to give a certain degree of flexibility to the spoke. See the lower figure in the illustration, where it is purposely slightly exaggerated to show it the more clearly. The machine is intended for shaping and smoothing the throats or necks of spokes, preparatory to insertion in the hubs. It has an iron frame. The cutter head revolves on a steel shaft, running in self-oiling boxes, and can be so constructed as to make the throat of any desired shape. The frame upon which the spoke to be throated rests is hinged on a slide bar which passes back and forth over a guide, which, in connection with the knives on the cutter head, regulates the shape of the throat. The spoke is placed under a lever, and held firmly while passing back and forth; ordinary spokes can be throated on both sides by simply changing the guard, which is accomplished by the hand lever on the end of the machine. A

Fig. 8.

SPOKING MACHINE

is represented in Fig. 9, and is used for setting spokes in the hub with a uniform dish. It has a fixed standard, A, and a movable standard, C, carrying pillow blocks adjustable as to height by means of screws, and a head, N, which may, to vary its elevation, be hinged in either one of a series of notches, P. The hub is laid with its ends resting in the pillow blocks, and clamped by the rod, J, which works into a nut; and the spoke is adjusted to the required dish, and firmly held, while being driven, by means of a gage block, Q, operated by a cranked screw, R; while a hook and chain, U, attached to a bevel-edged lever engaging one of the notches in the rack T, hold it to the gage, and prevents its moving too far in the opposite direction. Each spoke is successively driven and the wheel removed, the head, N being turned on its hinge.

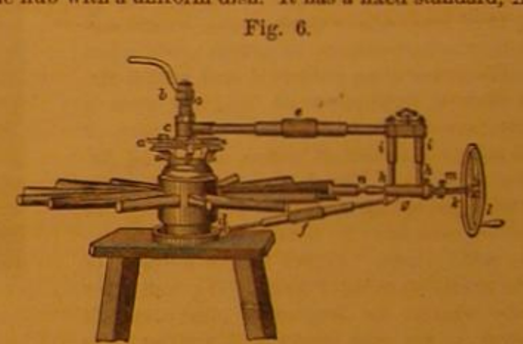


Fig. 6.

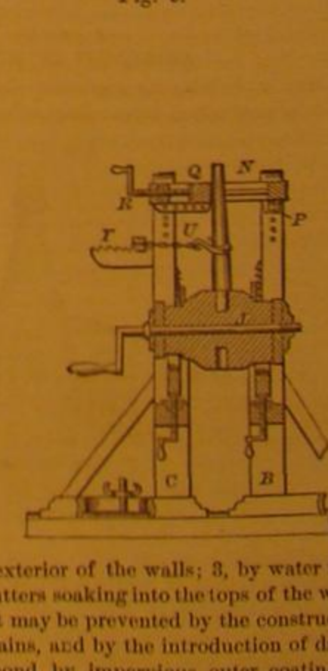


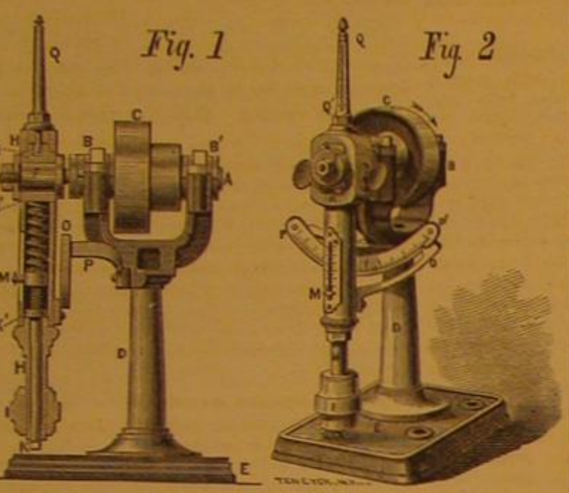
Fig. 9.

Damp Walls.

The walls of a building are liable to be charged with moisture, 1, by wet rising in them from the damp earth; 2, by rain falling upon the exterior of the walls; 3, by water from the roofs or leaking gutters soaking into the tops of the walls. Of these evils, the first may be prevented by the construction of dry areas or air drains, and by the introduction of damp-proof courses; the second, by impervious outer coatings or by the use of hollow walls; and the third, by the use of projecting eaves with proper gutters, or, where parapet walls are used, by an upper damp course.—*Notes on Building Construction*

IMPROVED LUBRICANT-TESTING APPARATUS.

We illustrate herewith Professor R. H. Thurston's machine for testing lubricants, the construction of which is clearly shown in the sectional view, Fig. 2. At F is the journal on which the lubricating material is to be placed for test. This journal is on the overhung extremity of a shaft, A, which is carried in bearings, B B', on a standard, D D', mounted on a base plate, E E'. The shaft is driven by a pulley, C, at any desired speed. Where desirable, a counter may be placed at the rear end of the shaft to indicate the number of revolutions. Usually, the shaft is driven at a fixed speed, corresponding to the velocity of rubbing surfaces approximating that of journals on which it is proposed to use the oil. In the inventor's practice, a standard speed of 750 feet per minute is adopted. The test journal, F, is grasped by bearings of bronze, G G', and with a pressure which is adjusted by the compression of a helical spring, J. This spring is carefully regulated, and the total pressure on the journal and the pressure per square inch are both shown on the index plate, N N', by a pointer, M. Above the journal is a thermometer, Q Q', of which the bulb enters a cavity in the top brass, and which indicates the rise in temperature as wear progresses.



The brasses, thermometer, and spring are carried in a pendulum, H, to which the ball, I, is fitted; and weights are nicely adjusted in such a manner that the maximum friction of a dry but smooth bearing shall just swing it out into the horizontal line. The stem, K K', of the screw, which compresses the spring, projects from the lower end of the pendulum and can be turned by a wrench. A pointer, O, traverses an arc, P P', and indicates the angle assumed by the pendulum at any moment. This angle is very large with great friction, and very small with good lubricating materials. This arc is carefully laid off in such divisions that dividing the reading, by the pressure shown on the index, N N', gives the corresponding co-efficient of friction. The machine can also be arranged to give the friction directly.

In practical use, a standard quantity of oil is placed on the journal. The bearings are slipped on and set up to the proposed pressure; the machine is started at the speed determined upon, and the observer notes the time, speed, pressure, and temperature. These observations are repeated and recorded at regular intervals, and cease when a rapid rise of temperature to an objectionable or dangerous extent indicates that the lubricant has become destroyed.

The machine is made by the mechanical laboratory of the Stevens Institute of Technology, Hoboken, N. J., and by Messrs. Bailey & Co., of Salford, near Manchester, England. It is adapted to the uses of makers of and dealers in lubricating materials, and all classes of consumers of the same. It was patented through the Scientific American Patent Agency.

The American Railway System.

The total length of the railways in operation in the United States on the 1st day of January, 1877, was seventy-six thousand six hundred and forty miles, being an average of one mile of railway for every six hundred inhabitants. The railways are as follows:

	Miles.		Miles.		Miles.
Alabama	1,722	Kentucky	1,464	Ohio	4,680
Alaska	0	Louisiana	589	Oregon	251
Arizona	0	Maine	987	Pennsylvania	5,896
Arkansas	787	Maryland	1,092	Rhode Island	182
California	1,854	Massachusetts	1,825	South Carolina	1,352
Colorado	950	Michigan	3,437	Tennessee	1,628
Connecticut	925	Minnesota	2,024	Texas	2,072
Dakota	290	Mississippi	1,028	Utah	486
Delaware	285	Missouri	3,016	Vermont	810
Florida	484	Montana	0	Virginia	1,648
Georgia	2,308	Nebraska	1,181	Washington	110
Idaho	0	Nevada	714	West Virginia	576
Illinois	6,980	New Hampshire	942	Wisconsin	2,575
Indiana	4,072	New Jersey	1,594	Wyoming	459
Indian Territory	281	New Mexico	0		
Iowa	3,937	New York	5,520	Total	76,640
Kansas	3,226	North Carolina	1,371		

A New Fire Detecting and Extinguishing Apparatus for Ships.

Mr. Daniel W. Howes, of East Dennis, Mass., has patented through the Scientific American Patent Agency, November 14, 1876, a novel means both for detecting and extinguishing fires on shipboard, one and the same apparatus serving both purposes. A system of perforated pipes is led through the hold or other portions of the vessel to be protected and connected with a fan blower. The latter communicates with a receptacle for carbonic acid gas. In order to remove hot air or dangerous gases produced in the process of spontaneous combustion, connection between fan and gas receptacle is shut, so that the former acts as an exhaust. If any fire be present in the hold, the smell of smoke in the air withdrawn, will announce the fact. If such is found to be the case, communication with the carbonic acid gas reservoir is opened and the air discharge of the blower closed, so that the latter then forces the gas through the pipes, whence it escapes at the perforations and so extinguishes the fire.

Recent American and Foreign Patents.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED DUMPING DEVICE.

William Willes, Salt Lake City, Utah Terr., assignor to himself and Wm. H. Rowe, of same place.—This invention was illustrated under the name of the "Lightning Dumper" on page 4 current volume. It is an excellent and strongly constructed device for loading and unloading vessels and vehicles with substances that may be dumped without injury; for dumping mortar and rubble in building concrete walls, and for other similar uses.

IMPROVED RETORT FURNACE FOR STEAM BOILERS.

George K. Stevenson, Valparaiso, Chili.—This inventor proposes a new furnace for burning coal dust, which is made in the shape of a retort, of firebrick, open at both ends, and provided with radial or inclined discharge channels at the upper parts. This is placed in position on the supporting walls, and is partly charged with a quantity of wood and coal, and lighted. The apparatus by which the powdered fuel is introduced is then placed in position and the fuel fed to the furnace, after the coarse fuel is thoroughly ignited by the blast from a blower used in connection therewith. The powdered fuel is then continually introduced, care being taken to remove the ashes from beyond the mouth or inner end of the retort, which can be done in a few minutes. The apparatus may be detached and replaced, and the operation proceeded with, without a great decrease of temperature, as the firebrick retort retains some of the heat from previous firing. The fuel is said to be completely consumed by the addition of air injected with the same into the retort, and thereby a high and uniform degree of temperature be kept up, while the fire may be instantly interrupted without the loss of large quantities of fuel, and also be started again with great rapidity, so as to facilitate the getting up of steam in boilers.

IMPROVED FORCE PUMP.

Chas. Houston McKeehan, Texarkana, Ark.—The pamp consists of four vertically-acting plungers, operated in pairs, alternately, by slotted reversely-vibrated levers. The plungers force the water out of a valved receiving or suction chamber into another, whence it passes into the exit pipe.

IMPROVED ORE-ROASTING FURNACE.

William K. Aldersley, Colusa, assignor to Abbott Quicksilver Mining Company, Colusa, Cal.—A useful invention for the reduction of quicksilver ore, devised by an inventor well acquainted with the practical necessities of the industry. The forming of adobes of fine dirt is dispensed with, and the ore reduced by the application of heat, both to the top and bottom of the ore, during its gradual passage through the furnace. The latter is provided with double fireplaces, and a double inclined roasting sole, along which the ore is fed from a feed hopper, with adjustable check, to the slag pit. A longitudinal partition divides the furnace into two sections, through which the fire is drawn, passing over the top of the ore, while a heating chamber below the furnace floor heats up the ore from below. We are informed that the furnace has in practical use proved economical both in time and in fuel.

IMPROVED BOAT-LAUNCHING APPARATUS.

James Strachan, Goderich, Ontario, Canada.—In this device the boat davits are attached not directly to the ship out to horizontal portions which by rollers and guides traverse thwartship ways. They are connected and secured laterally by diagonal braces. They may be moved bodily inboard, so that passengers can easily step into the boat from the deck. The davits are moved outboard and the boat is lowered in the usual way.

IMPROVED TALLOW CUP.

Devore Parmer, Fort Madison, Iowa, assignor to Hugh McConn, of same place.—An excellent invention which will doubtless prove of great convenience to millers. The cup in which the tallow is placed also receives the spindle. When the latter becomes heated the tallow of course melts and runs down into the bush. Friction is thus relieved, the spindle cools and the melting ceases, and this operation is repeated as often as the heating occurs. The action is therefore entirely automatic. The cup is applicable to vertical shafts of various descriptions, and is effective in preventing heating and the accumulation of dust.

IMPROVED WINDMILL.

Charles B. Post, New London, O.—This embodies a new and simple construction of the governing mechanism which renders the windmill self-regulating under any wind pressure. There is an ingenious combination of regulated levers which as the wheel revolves with increased velocity turn the vanes so as to expose less surface to the wind. The vanes have a twisted or winding surface. This seems to be a device well calculated to add to the efficiency of perhaps the cheapest motor a farmer can use.

NEW HOUSEHOLD INVENTIONS.

IMPROVED SAD IRON.

Salathiel C. Fancher and William W. Judson, Kansas City, Mo.—In this improved reversible and self-heating sad iron there are novel means whereby the flow of alcohol from the lamp to the burner is regulated, and a new and valuable feature is supplied in a tube that extends from a point near the top of the lamp to the interior of the sad iron, running along the wick tube to the burner, where the gas generated in the lamp by the heat of the iron is consumed as fast as generated.

IMPROVED LAMP EXTINGUISHER.

Martin P. Flanders, Au Sable Forks, N. Y.—A useful safety appliance for lamps so constructed that the leverage exerted by a sliding weight and wire frame on a cap swings the same over the wick tube, and extinguishes thereby the flame without being obstructed by sticky coal and oil particles, as is frequently the case with the common sliding extinguishing tubes in use.

IMPROVED FLY FANS.

Samuel W. Mills, Kingsville, Mo.—This is an ingenious arrangement of fans secured to a vertical shaft which rises from the center, say of a dining table. By means of a very simple treadle and pulley mechanism some one sitting at the table can cause the shaft and fans to rotate and so drive flies from the dishes.

IMPROVED DOUGH KNEADER.

Ezra Staples, Rochester, N. H.—It is well known that nothing is so essential to the production of good light bread as thorough kneading. When large batches of dough are to be worked, this becomes an exceedingly arduous operation; and even in the small quantities necessary for family use the work is by no means light. The present inventor therefore merits the thanks of bakers and housekeepers for an ingenious machine for kneading the dough in a thorough manner. By turning a roller in one direction, and then in an opposite direction, a moulding board is carried forward and back simultaneously beneath it, while a top roller with eccentric cams serves to regulate the pressure of the kneading roller on the dough.

NEW MISCELLANEOUS INVENTIONS.

IMPROVED ORGAN ACTION.

Archibald N. Hanna, Murray, Ind.—This invention consists of the arrangement of several sets of reeds that are operated with or without stops, by different pressure on the keys, a light pressure operating only the first set of reeds, a heavier pressure the first and second sets, by actuating a shorter series of pitman or push pins, and a still heavier pressure, a still shorter series of pins of the third set of reeds. In this way a change of the music from a soft tone to medium or very loud tone, and, vice versa, from a loud tone to medium and a very soft tone, may be accomplished without moving the hands from the key board.

IMPROVED BALE TIE.

Bell Hempstead, Little Rock, Ark.—This improvement consists in constructing an open rectangular frame with a hook upon one of its bars, which hook is extended laterally to the bale band, and formed of one and the same piece of metal with the frame. One end of the band is passed through the open rectangular frame and bent around, while the other is slotted to receive the hook.

IMPROVED SLATE PENCIL SHARPENER.

William H. S. Hennaman, Philadelphia, Pa.—There are few sounds more annoying to sensitive nerves than that produced by the sharpening of a slate pencil with a knife. In schools, where such pencils are constantly required to be sharpened, the operation, besides making constant noise, often involves cut fingers of young children, or else is the cause of perpetual requests to the teacher for its performance. The present invention suggests a simple little device which may easily be attached to every child's desk. It consists in a V-shaped file or rasp, made convex in the direction of its length, and provided with graduated teeth, coarser at the upper and outer edge of the V, where the greater portion of the cutting is done, and finer in the angle of the V, where the point of the pencil is formed. The file is conveniently mounted in a block of wood.

NEW AGRICULTURAL INVENTIONS.

IMPROVED FENCE.

Orlando Cleaveland, Middlesex, N. Y.—The movable panels are supported between short stakes which stand in pairs, those of each pair being inclined toward each other at a right angle or thereabout. The heads of the stakes are bound together by wires, and the projecting ends of the lengthwise boards of the panels lap past each other and rest on the binding wires between the stake heads; a wire brace is also applied for holding the fence panels vertical and rigidly in place.

IMPROVED COMBINED WHEELBARROW AND CULTIVATOR.

John D. O'Callaghan, Chattanooga, Tenn.—The tray and legs of the wheelbarrow are so constructed and connected together that they may be readily detached from the truck or wheeled frame, whenever it is desired to use a cultivating attachment, thus saving the cost of a frame for the latter.

IMPROVED CORN-HUSKING MACHINE.

John Lund, East Oxford, Ontario, assignor to David N. Moore and John Henry, Beachville, Canada.—This is a very ingenious invention that will doubtless interest farmers, as it husks corn very rapidly, whether on or off the stalk. The mechanism consists of a vertically-reciprocating knife, operated by treadle, that cuts off the ear from the stalk, while an ejector, passing down with the knife, releases, by a lever and pawl arrangement, a spiral governing spring, and throws out the ear. The release of the treadle carries the knife up, and draws the ejector back in position to allow its locking pawl to drop into place until the knife descends again for cutting.

IMPROVED CHURN.

Friend Murdock, Centreton, O.—The new feature in this churn lies in the shaft of its rotary dasher which, provided with flanged sleeve in combination with a latch for retaining the crank in place. The general construction embodies many other useful improvements, notably a spout through which hot or cold water may be introduced for tempering the cream. Provision is also made for a thermometer by which the temperature of the contents can always be observed.

IMPROVED AUTOMATIC GATE.

William Nairn, Monterey, Ill.—This is an ingeniously constructed gate, which can be opened and closed by the occupant of a carriage without requiring his moving from his seat. A weight on the side to which the passerby comes is raised by a cord, then the latch is lifted by a cord, when the weight on the opposite side of the gate swings it open. After passing through, the weight which opened the gate is raised, which allows the other weight to close it.

IMPROVED HARVESTER.

James D. Winans and Gilbert Vandusen, Sycamore, Ill.—An endless chain of cutters work in a recess in a cutter bar, and in the forward part of the platform, and the latter is so pivoted in arms that when raised and lowered the necessary gear wheels always remain engaged. New devices are provided to catch the grain and rake it from the platform. The invention as a whole embodies many valuable novelties in construction which commend it to the examination of all agriculturists.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED WAGON GEARING.

Levi W. Frederick, Hall, Ind.—The new features in this invention are, first, a brace that passes along the top of the reach, and its rear end is slotted to receive the rear king-bolt. The brake bar attached to the brace rests upon a plate secured to the forward part of the rear hounds, and has hooks fastened to it, which hook upon the ends of the said plate. The brace plate and hooks keep the brake bar always parallel with the rear axle, and thus in position to apply the brake shoes to the wheels. To the rear side of the brake bar is pivoted a rod which controls the brake mechanism. The invention has for its object to render the gearing stronger, freer in movement, and more fully under the control of the team.

IMPROVED SEWER TRAP.

Frederick B. Wells, Montreal, Quebec, Canada.—This invention suggests a simple and ingenious device for preventing the escape of sewer gas without obstructing the flow of surface water. It consists of a conical or funnel shaped tube, that is supported on a top ring, and provided at the lower end with a cup shaped and weighted trap. The latter extends by an annular flange around the lower end of the cone, to seal the same until it is forced open by the weight of the collecting water. The whole apparatus is easily removable to afford access to the sewer; and the conical shape of the tube prevents its rupture in case of the freezing of the contents.

IMPROVED LEVER PAWL AND RATCHET FOR WAGON BRAKES, ETC.

James R. Robinson, Shawnee Mound, Mo.—This is an ingenious device so constructed that when pressure is applied to force the lever forward the pawl slides over the teeth of the ratchet bar and engages another tooth. Thus the brake is applied with a degree of force corresponding to the pressure on the handle; but the pawl is released from such engagement when the handle is pressed backward.

Notes & Queries

P. M. S. will find an article on windmills on p. 241, vol. 32.—G. M. F. will find a description of a Rhumkorff coil on p. 219, vol. 32.—J. G. A. will find directions for bluing rifle barrels on p. 123, vol. 31.—C. A. M. will find on p. 266, vol. 34, directions for making an electric machine.—C. B. P. will find on p. 218, vol. 31, directions for drilling glass.—O. O. O. will find something on violins on p. 75, vol. 36.—H. E. W.'s query as to lightning rods was answered on p. 44, vol. 36.—H. N. T. & Co. will find a recipe for tinning brass by the boiling process on p. 10, vol. 28.—A. C. G. will find an answer to his query as to electro-magnets on p. 44, vol. 36.—G. S. will find directions for nickel plating on p. 235, vol. 33.—J. B. D. will find directions for making copying ink on p. 123, vol. 32. For copying without a press, see the description of the manifold process, on p. 154, vol. 30.—C. M. will find directions for making soft soap on p. 379, vol. 31.—P. M. will find a description of the caloric engine on p. 66, vol. 34.—H. P. will find directions for building an icehouse on p. 251, vol. 31.—C. T. H. will find an article on working in compressed air on p. 406, vol. 30.—C. S. can waterproof his leather boots by following the directions on p. 155, vol. 26.—C. A. B. will find a formula for the proportions of a safety valve on p. 363, vol. 29.—B. T. will find directions for galvanizing iron on p. 346, vol. 31.—J. T. M. will find a method of calculating the power of a wind wheel on p. 241, vol. 32.—J. F. will find an elaborate article on the power of small steam engines on p. 33, vol. 33.—D. H. L. will find a recipe for French polish on p. 11, vol. 32.—E. M. E. will find a description of the gyroscope on p. 91, vol. 31.—W. W. will find directions for making rubber hand stamps on p. 155, vol. 31. To coat iron with copper, see p. 90, vol. 31.—R. & A. will find on p. 43, vol. 33, a recipe for marine glue that will answer the purpose of a waterproof cement for labels.—W. S. can fireproof his shingles by following the directions on p. 290, vol. 28.—J. C. R. will find a recipe for a depilatory on p. 186, vol. 34.—A. E. H. will find something valuable on the nature of electricity on pp. 195, 228, vol. 32.—D. D. V. will find a recipe for a shoe polish on p. 75, vol. 26.—J. M. T., U. M., B. H., J. A. M. J., W. F. C., E. S. B., C. H. S., L. A. S., B. H. C., and others, who ask us to recommend books on industrial and scientific subjects, should address the booksellers who advertise in our columns, all of whom are trustworthy firms, for catalogues.

(1) H. L. W. asks: What is the size of the smallest engine that is capable of driving a pair of millstones 4 feet 4 inches in diameter and a bolt reel 18 feet long? A. If you wish to work the mill up to full capacity, you will need an engine of from 40 to 50 indicated horse power; but you can do fair work with an engine only half as powerful.

(2) B. H. asks: What pressure will my boiler stand? It is ⅜ inch thick in the body, and ⅝ in the ends; it is of cast iron, 4 feet long by 11½ inches internal diameter. A. Working pressure, about 100 lbs. per square inch.

(3) J. P. L. asks: How can I calculate the power required to punch sheet metal? A. Professor Rankine's expression for calculating the work in foot pounds per stroke is: 12,500 × circumference of hole × (thickness of plate)².

(4) E. J. D. asks: How many lbs. weight, dropping 25 feet, will work three lift and force pumps, the pumps making 40 strokes per minute each, and raising water 60 feet, being each 3 inches diameter of barrel with 5 feet stroke? How long would it take the weight to descend? A. The question is rather indefinite; but if you will specify your meaning more plainly, we will endeavor to answer you. It might be well to send a sketch of your device.

(5) E. J. W. asks: 1. How can I find the height and diameter of a smoke stack for a horizontal boiler? A. Make it with cross section equal to about ⅛ of the grate surface. 2. Should a boiler set in brick have a larger smoke stack than one not set in brick? A. It is not necessary, other things being equal.

(6) C. H. asks: Please tell me if it is advisable to use a cross pipe on a double-acting water ram, from the ram to the head? A. We would be glad to receive a sketch and description of the present or proposed arrangement; and if you send one, we shall be better able to advise you.

(7) S. S. asks: In the case of pulleys with curved arms, is the strength of the arms at all affected by the direction in which the pulley is made to revolve? A. We do not think the difference is of much importance.

(8) C. B. H. asks: With a pipe 2½ inches in diameter, with 5 feet head, on a 9 foot overshot water wheel, what amount of power will I get? A. With a well constructed wheel, you might obtain ⅓ of a horse power.

(9) R. P. D. asks: Is there any difference in the obstruction of the flow of the water, between the same rock in the same race (the depth of water being the same in both cases) being placed at right angles, or at an angle of say 45°, with the bottom of the race? A. As we understand the question, we think there would be no difference.

(10) J. H. asks: How large a volume of water can a 10 horse engine raise to the height of 150 feet? How large a continuous round stream would that volume make if not subjected to pressure? A. It will depend upon the size of the pipe, which can be large or small, and the columns of water will still be solid; but the volume discharged in a given time will vary because different amounts of power will be expended in overcoming the friction of the pipe.

(11) T. T. E. asks: Who was the maker of the first steam locomotive in the United States? What was the man's name who ran it, and where did the trial trip take place? A. The first locomotive that ran in this country was built at Stourbridge, England, by Mr. Horatio Allen, and was imported for the Delaware and Hudson Railroad. This was in the year 1829.

(12) W. W. B. asks: Is there anything that I can do to the glass in my show windows to prevent dampness freezing thereon? A. The remedy is to keep the air inside the store dry, so that there shall be no moisture to form ice crystals on the windows.

(13) J. A. W. asks: What is the proper number of the wire used for winding the magnet for the engine described in the SCIENTIFIC AMERICAN SUPPLEMENT of May 6, 1876? What is the proper size for the magnet? A. Engines of this kind can be made of various sizes; a small one with cores about an inch and a half long, and wound with about 200 feet of copper wire, will work well with one or two cells of battery of low resistance.

(14) E. A. S. says: A friend and I want to put up a short telegraph line. Will it work without a relay instrument? If so, how many ½ gallon cells of the Callaud battery will it take at each end? To work without the relay, how many feet of No. 22 insulated copper wire will it need around each core of the electro-magnets of the sounder? Will it work with ground circuit, or would it be best to use double wire? If we use the ground circuit, how large an iron plate shall we bury? Will silver do, instead of platinum, for tips on the sending key? A. It is difficult to answer your questions definitely, as they are in themselves indefinite. From six to ten cells in all will work a line of about a mile length without a relay, the sounders having 250 or 300 feet of No. 32 copper wire each. The ground circuit should not be used for very short lines. Silver is not a good substitute for platinum contacts.

(15) A. S.—Use a little litharge in your ink. The burnishers used in finishing plated goods are of various forms; some of them are used in the lathe. They are usually made of hard, polished steel or bloodstone.

(16) P. F. asks: 1. How can I dissolve bones with acid? A. Digest the bones for some time in warm, strong hydrochloric acid. 2. Is sulphuric acid best for this purpose? A. No. Hydrochloric acid is best. 3. What sort of vats are used? A. Large vessels of stoneware or porcelain-lined iron are best. 4. How much acid is required to dissolve a ton weight of bones? A. The amount of mineral salts contained in bones varies to some extent with the age of the animal from which they were obtained, the younger bones contain the smaller proportion. The average amount of inorganic constituents of the bones of cattle is from 40 to 70 per cent, the principal part of which consists of tribasic phosphate of lime. In practice, it will be found that a weight of acid equal to that of the bones is needed.

(17) J. B. asks: What is a good preparation for preparing canvas duck or cotton cloth to prevent mildew? A. Soak it in a strong alum solution and then in a bath of ammonia water. Wash it well afterward with plenty of water.

(18) J. V. B. asks: What oil is the best to soften lithographic rollers? A. Cover the rollers with glycerin, not oil.

Would a coating of liquid glass adhere to polished steel? A. Yes.

(19) A. F. asks: How are hairpins varnished? A. The varnish consists of gum copal or anime with fine ivory black, turpentine, and a little boiled oil. The coating is applied by dipping the smooth pins in a very thin solution of the above, and drying at as high a temperature as the varnish will bear without injury. This treatment is repeated.

(20) M. G. P. asks: Are not meerschaum pipes, after they have been used a time, subjected to some process to bring out the color? A. No; but they are sometimes artificially colored with annatto and tobacco oil.

(21) W. M. says: I have discovered a new or partly new method of case hardening: Heat the cast metal to a white heat, then feed the part to be hardened with prussiate of potash, pulverized, until the metal comes to a low red; then dip the metal in muriatic acid. This is a quick and reliable process.

(22) J. L. I. asks: 1. Is it practicable to increase the steaming capacity of a small portable engine by a smaller upright tubular boiler suspended in the smoke chamber in such manner that the heated gases shall surround a part of the auxiliary boiler and also pass up through its tubes, the feed water to be supplied by the pump at the crosshead first to the auxiliary boiler, and thence pass by a pipe inserted in its shell at the height of its proper water line, to the main boiler? Steam is to be also taken by a pipe from the top of the auxiliary boiler to the steam dome of the main boiler. A. This arrangement may answer, if the products of combustion leave the boiler at a very high temperature. 2. How can I burn coal dust in a small portable engine? A. The general idea is to increase the draft, and prevent the coal dust from forming into large masses so as to choke up the air spaces.

(23) G. T. asks: 1. What power can be obtained from a small engine, the cylinder of which is 2x6 inches stroke, with steam at 60 or 70 lbs. pressure, running at 150 revolutions per minute? A. About 1-horse power. 2. What size boiler, horizontal and set in brick, would it require? A. Make one 18 to 20 inches in diameter, and 3 feet high.

(24) T. K. says: In a work on engineering, this rule is laid down for finding the working pressure of steam boilers: 34,000 lbs. per square inch is the tensile strength of boiler iron; the rule for ⅜ inch plates is to divide 4,250 by the diameter of the boiler in inches. The quotient is the working pressure, being one sixth of the bursting pressure. And it says that the rule for ½ inch plate is to divide 5666·6 by the diameter of the boiler in inches, and the quotient is the working pressure. I find that the figures in the first rule are got by dividing the tensile strength by 8, and the figures in the latter rule by dividing the tensile strength by 6. What I want to know is, by what rule are these divisors, 8 and 6, obtained? A. These numbers are assumed, it being considered advisable to allow a large margin on the safe side in proportioning boilers.

(25) A. W. S. asks: Where can I find the method for working out the transit of Mercury of 1878? A. In the *Nautical Almanac*, published by the Bureau of Navigation, Washington, D. C., the figures are published three years in advance for the purpose of ships which are taking long voyages.

(26) G. H. W. asks: Can egg or blood albumen be preserved for several months? A. Yes. Dry it perfectly by allowing to stand in a close vessel over pumicestone moistened with oil of vitriol.

(27) J. R. asks: Where can I get silica for making infusible brick? A. The dried sand from the sea shore, or calcined and ground quartz rock (which is pure silicic acid) will answer.

(28) M. D. K. says: I have a safe with two vaults inside, and a combination lock on each. One of them is now locked, and the combination lost. I wish to get it open, but see no way but to drill a hole on a line opposite to the holes that are in the tumbler wheels, so that a wire can be inserted to change the combination. The place where I want to drill is 2½ inches thick and of chrome steel, so hard that no steel drill will have any effect on it. Can I use a diamond drill? A. The best forms of diamond drills are patented, and you will probably find it cheaper and more satisfactory to obtain one, with full directions for use, from a manufacturer. It is quite likely, however, that you can soften the metal sufficiently, by the aid of a blowpipe, to penetrate it with an ordinary drill. It may be remarked, in addition, that combination locks can frequently be picked without great trouble by experts; and, if you can have the safe opened in this manner, it will probably be more satisfactory than either of the others.

(29) J. E. F. says: In answer to G. W. R., you say: "Use 10 to 13 lbs. sulphuric acid to 100 lbs. tallow, to separate the stearin from the olein? Is the olein, thus separated, used for butter purposes? If not, what is the proportion of acid to 100 lbs. tallow? A. This method is not employed in the manufacture of butter from suet. See p. 337, vol. 35.

(30) J. R. C. asks: Please publish a recipe for printers' red ink? A. Boil linseed oil till smoke arises, then apply a lighted paper stuck in a cleft stick; and then remove the pot from the fire, allowing the oil to burn till it can be drawn out into strings half an inch long. Add 1 lb. rosin for each quart of oil, and ½ lb. dry brown soap cut into slices; put the latter in cautiously, as the water in the soap causes a violent commotion. Then grind up the oil with sufficient pigment. Vermilion, red lead, carmine, Indian red, Venetian red, and the lakes are all suitable for printing ink. Grind on a stone with a muller.

(31) C. P. B. asks: If a ball be fired from a gun resting on the ground in a perpendicular position, will that ball have acquired the same velocity and momentum in its descent when it reaches a point 10 feet from the muzzle of the gun that it had in its ascent when it was at the same point? And will it penetrate as far into a piece of wood in its descent, say 10 feet from the muzzle of the gun, as it would have penetrated in its ascent had the ball struck the wood at the same distance from the muzzle of the gun? A. No; but in a vacuum it would.

(32) M. L. F. says: I have a water tank 18 inches in diameter and 3 feet high. How many lbs. weight will it require to force the water 30 feet high through a ¾ inch pipe? A. It will depend upon the velocity. It will take a weight of about 3,300 lbs. to just sustain the column of water in the pipe; and by increasing the weight, the water will be forced out.

(33) J. K. asks: How much power (rated as horse power in a steam engine) can be got from a suspended weight weighing 5 tons and falling 5 feet per hour? A. Your figures give 0·0282 of a horse power, nearly $\frac{1}{35}$.

(34) J. H., Jr., asks: What is a safe working steam pressure per square inch for an upright boiler 30 inches in diameter, by 6 feet high, with twenty 3 inch flues, 4 feet long, made of 3-16 inch iron? A. From 50 to 60 lbs.

(35) E. J. B. asks: What is the chemical symbol for attar of roses? A. It consists of two compounds, one of which has but little odor. It is polymeric with olefiant gas, but its composition is not accurately known. Miller gives it as $(C H_2) x$, x being the unknown constituent.

(36) H. H. B., Jr., says: I have made several small models of sheet brass and cast brass; and in finishing I use a dipping bath of nitric acid, which leaves a beautiful finish on sheet brass and brass wire, but the castings turn a dirty, coppery black color. How can I remedy this? A. The rolled brass usually contains a larger percentage of zinc (yellow brass); besides its surface is denser and more uniform than that of cast brass. Use more dilute acid, and touch it up a little subsequently with rouge or tripoli powder.

(37) W. E. C. asks: I wish to use secondhand tomato cans, and a good many of them are very rusty. What solution can I steep them in to take off the rust, so that they can be used again? A. Try a pickle of dilute oil of vitriol. We do not think it advisable to attempt using the cans again for fruits or vegetables without first having retinned them, which is not impracticable.

(38) C. M. M. Co. says: We tried acetic acid with glue for covering silver on mirrors, but it did not work to our satisfaction. Please let us know some other methods? A. Use genuine asphalt (free from coal tar) and spirits of wine. After the addition of the latter allow to stand some time before using. Make of a suitable strength for using, and give as many coats as requisite for your purpose.

(39) G. H. B. asks: What is the best disinfecting agent to use in a room where persons sleep at night, and are also employed during the daytime? On building a fire, a close heavy smell fills the room. Carbolic acid and water sprinkled on the floor seems inadequate and evaporates rapidly. Can you suggest any harmless agent that will kill the close smell? A. The first thing to be done in a case of this kind where carbolic acid, which is one of the most powerful disinfectants known has been tried, and found, as you say, inadequate, is to investigate the room and its surroundings, and discover the cause. It must be remembered that disinfectants at the best but palliatives of the evil; and if the source remains, the smell and perhaps miasm may be generated faster than its capacity for injury is destroyed by any disinfectant, however powerful. A room without such positive source of noxious gases, should not become positively offensive, even when occupied by a number of persons day and night. Instead of being regarded as a substance easily volatile, carbolic acid is one of the most persistent disinfectants, and the objection to it is not the thoroughness with which it does the work, but that its odor is so penetrating as to be to many unendurable. Use chloride of lime exposed in shallow vessels, if not too disagreeable to you. This does the work of disinfection very thoroughly. Or you can use a more elegant, though somewhat more expensive disinfectant, in the shape of permanganate of potash; and a solution of this salt in water containing persulphate of iron (Condy's fluid) is excellent.

(40) U. S. A. asks: How can I make a liquid for shampooing the hair? A. Take carbonate of ammonia ½ oz., carbonate of potash 1 oz., water 1 pint. Dissolve these, and add tincture of cantharides 5 fluid ozs., rectified spirit 1 pint, good rum 3 quarts. Moisten the hair with the mixture, rub till a lather is formed, then wash with cold water.

(41) H. J. asks: 1. How high above the water line on a return flue boiler can I, with safety or without danger of burning the iron, risk running the fire? A. The fire should not strike any part of the boiler above the water line. The products of combustion, after passing through the flues and having been cooled down, are sometimes returned along the sides and over the top of the boiler. 2. How can I tell the horse power of a boiler and of an engine? A. We do not know what is meant by the horse power of a boiler. As for your engine, the power will depend upon the pressure of steam, the point of cut-off, and the piston speed. See p. 33, vol. 33.

(42) L. W. S. asks: Will a two flue boiler, 28 feet long and 48 inches in diameter, supply with steam an engine 16 x 30 inches, running at 75 revolutions per minute, if I double the length of the grate bars, making them 7 or 8 feet long, using dry pine slabs for fuel? A. The boiler will be large enough for average work if the engine is well designed, but probably will not supply sufficient steam to run the engine up to full power, with steam following for 9-8 or 7-8 of the stroke.

(43) C. C. B. asks: What kind of lamp is most efficient for heating the boiler for a small steam engine? What oil is the best? A. Good alcohol is the

best fluid for use in any lamp where luminosity is not requisite, and smoke is objectionable. For this purpose crude methylic alcohol (methylated spirit wood naphtha) is nearly, if not quite, as useful, and is very much cheaper. Any of the heavier oils, such as lard, sperm, mineral sperm, and many of the heavier distillates of petroleum, may be used for this purpose with very good results, provided a suitable tubular boiler and a tall chimney is employed. Under these conditions complete combustion is obtained and there is no soot deposited.

(44) A. B. Y. says: 1. I have been making clay moulds from type, and I have taken a beautiful impression every time; but it always cracked in the drying. Is there anything that would prevent its cracking? A. Add a little plaster of Paris and salt; dry at a very moderate temperature at first, and the mould will not crack. 2. What could be put into the clay that would make it very hard after it was dried? A. Try a strong solution of water glass and aluminate of soda.

(45) J. L. A. says: Is there any known acid that will cut or eat glass? If so, what is it kept in, and what use is made of it? A. Hydrofluoric acid is used for this purpose. The acid is usually kept in vessels of gutta percha or lead. It is obtained by gently heating together fluorspar and strong oil of vitriol in a suitable retort, and dissolving the evolved gases (fluoride of hydrogen) in distilled water.

(46) F. E. K. says: 1. Our boilers are 22 feet long, and 44 inches in diameter, thickness of shell is 3-8 inch, of heads 1-4 inch, with two 16 inch flues. The heads are stayed with 5 stay rods, and 20 stay bolts. There is one 4 inch safety valve for the two boilers. I once asked you what is the greatest pressure they will safely bear. You replied: From 50 to 60 lbs. Do you consider them low pressure boilers? A. The term "low pressure" is rather indefinite. Thus, 50 or 60 lbs. per square inch might be considered high pressure for marine boilers, and low pressure for small stationary boilers. In the case of your boilers, the pressure is not much below the average that is maintained in boilers of about the same size. 2. What is the safest and best mode of testing boilers? A. Fill the boiler with water, load the safety valve to the desired pressure, and heat the water gradually.

(47) P. W. S. says: I have a tank or cistern holding about 90 barrels coal tar. What is the best manner to get it out, as the cold weather prevents dipping it out? A. If it becomes too thick to be taken out with a dipper, it is scarcely probable that an ordinary pump can be used. You might employ some form of steam ejector in which the steam would first soften the tar, and then force it out; or a steam pipe might be introduced into the tank, and when the tar was softened it could be dipped out.

(48) J. J. S., and others: The specific heat of water is found to be higher than that of any other substance, and for this reason is taken as unity. If we take 1 oz. water at 174° Fah., and 1 oz. ice at 32 Fah., and put them together, we shall have, when the ice has melted, 2 ozs. of water at 32°. The ounce of water has therefore parted with 142° of its heat in melting the ice, which heat is said to have become latent. Water, at the normal atmospheric pressure, boils at 212° Fah., which is its maximum of temperature. Here again this apparently anomalous phenomenon occurs. When the temperature of the water reaches 212°, it becomes stationary; and further addition of heat is absorbed in converting the water into steam, which has the exact temperature of the water which produced it. Here also has heat been rendered latent, with an accompanying change in form of the water. As from ice to water, likewise from water to steam: or from solid to liquid, from liquid to gaseous. On condensation of the steam and recongelation of the water, the exact amount of heat absorbed or rendered latent is given out. A certain weight of steam condensed at 212° gives out 950 of latent heat. In its descent from 212° to 32°, it gives out 180° sensible heat, and again in its recongelation it restores 142° of latent heat, amounting together to 1,272°. Pressure influences the boiling point of water, and for that reason water may, by the application of adequate pressure, be heated so as to melt lead. Likewise, as the pressure decreases, the boiling point is lowered. At the hospital of St. Bernard, in the Swiss Alps, which is 8,400 feet above the sea, water boils at 184° Fah.

(49) J. M. L. says: Please tell me the best method of clarifying cotton seed oil? A. The best method is to treat with sulphuric acid, and afterwards with steam, as follows: The agitator is constructed of wood, lined with lead. After introducing, say 500 gallons oil, the agitator is set in motion, and 26 lbs. oil of vitriol are added by means of a perforated leaden trough, so as to spread it as a shower over the whole surface of the oil. The time employed in the addition of the acid should not be less than 30 minutes, and the agitation should be continued for 8 hours. It is then allowed to stand for 10 hours, the acid drawn off, and the oil pumped into a steaming tank of iron. It should then be steamed for 8 hours with ½ inch steam pipe, at 20 lbs. pressure. Allow to stand for 30 hours, draw off water, and pumped into receiving tanks (of wood lined with lead). A competent carpenter should be able to construct the apparatus. The lead lining should of course be burned, not soldered.

(50) S. E. E. asks: Please find enclosed some powder called porous silica, for polishing metals, etc. Can this be made artificially? A. A similar article may be prepared by treating a strong solution of water glass (silicate of soda) with a small quantity of strong oil of vitriol. If the solution has been sufficiently strong, after standing a few hours in a warm place it will completely gelatinize. Wash this well with cold water, decant or filter off the washwater from the gelatinous silica (hydrated silicic acid), place the latter in a suitable vessel, and dry over a good fire. See also articles on pp. 20 and 240, vol. 35.

(51) J. McI. asks: 1. What is the most simple process of converting chloride of calcium into chloride of lime (bleaching powder)? A. This is not feasible. Hypochlorite of lime (chloride of lime, bleaching powder) is commercially prepared by exposing slightly moist slaked lime to an atmosphere of chlorine gas, which absorbs it largely. 2. Is not muriate of lime the same substance as chloride of calcium? A. They are different names for the same substance. The latter is the proper appellation. 3. Can dry silicate of soda be dissolved by water alone, hot or cold? A. It is quite soluble in boiling water. Cold water does not dissolve it very rapidly.

(52) M. B. asks: How can I remove the pitch stains from an engraving? The stains were from the colored gum exuding from the retaining board of the frame. A. Soak the print for some time in hot water, and then in a solution (strong) of chloride of lime. This will remove the stain without injuring the engraving.

(53) A. J. D. says: 1. I wish to make some of the glue by the recipe given in your reference book, but do not know what kind of ether to use? A. Use good petroleum naphtha instead of the ether. It is maintained by many that this gives much better results. The naphtha should be warm. 2. Will vulcanized rubber answer? A. Vulcanized rubber will not answer. Use crude caoutchouc. The ether referred to in the recipe was what is commonly known as sulphuric ether or common ether.

(54) E. J. B. says: One work on chemistry mentions oil of rose as an essential oil containing oxygen, and another says it contains no oxygen. Can you tell me its composition? A. The essential oil of rose is destitute of oxygen; it is a carbo-hydrogen compound. The proper formula is $C_{16}H_{16}$.

(55) T. H. K. asks: What can be done with copal varnish when it gets thick and candied? Can it be thinned, so that it can be used? A. It will be necessary to melt the candied varnish, and, while fused, to add a sufficient quantity of oil of turpentine. Great caution should be exercised in order to avoid accidental ignition of the violently boiling turpentine. The vessel should be covered and removed from the source of heat immediately after the turpentine is added. In many cases, it is advisable to add a little raw oil to the fused varnish before introducing the turpentine.

(56) D. P. W. says: In SUPPLEMENT No. 19 is given a description of a small electric locomotive. Can one be made to run with Leclanché battery of 4 small cells? If so, please give about the size to make the different parts of the locomotive. A. The Leclanché battery is not suitable for such work. See answer to G. U. S. on this page.

(57) G. U. S. says: I wish to construct an electric locomotive the same as described in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 19. Of what size should the magnets and cores be, and with what size and quantity of wire should they be wrapped to give the largest possible powers with a six cell Grove battery? A. Use about 230 feet of No. 18 copper wire for the four helices and make the cores about 1½ inches long.

(58) A. B. L. asks: 1. How many and what size cells will be necessary to produce an electric light sufficiently powerful for the electric light misroscope? A. Fifty half gallon cells will answer well. 2. What form of battery will be the best? A. Grove or Bunsen. 3. What will be the approximate cost for running the same, per hour? A. Probably about 50 or 60 cents. 4. What should be the diameter, shape, and focus of the lenses composing the condenser? A. Double convex and three or four inches in diameter; they are supplied with the lamps. 5. Can the effects of the heat on the object and objective be obviated by interposing a glass cell filled with ammonia-sulphate of copper, alum, or some analogous solution between the condenser and object slide? Would it have the same effect if the cell were interposed between the light and the condenser? A. Yes; but, as a general thing, it is scarcely necessary. 6. Will the electric light give off enough heat to necessitate the use of iron for the camera, or would old mahogany well clamped inside do as well? A. The lamp should be of sheet iron. 7. Should the condenser be fixed permanently as regards the object stage, or should there be means of varying the distance between stage and condenser? A. Better make it adjustable. 8. Where, if anywhere, can I find detailed description of electric light or oxyhydrogen gas microscope? A. See remarks on solar microscope in almost any work on physics.

(59) F. J. S. asks: 1. I want a solvent for vulcanized rubber or old rubber shoes, etc., to make a cheap solution, which, on cooling, will leave a coating of rubber. A. Place the material, cut in small shreds in a strong (boiler iron) air-tight vessel, provided with a good safety valve, and introduce into it 4 or 5 parts of bisulphide of carbon for each part (by weight) of rubber. Close all the openings, and place the vessel over a suitable water bath, or, what is better, have a small steam coil inserted within the boiler. Heat for an hour at the boiling point of water. This will insure the complete solution of the rubber. The vapor of the bisulphide is very inflammable; and when mixed with air, it is explosive when ignited. For these reasons, as well as because of the offensive odor of the solvent, the operation is best conducted in the open air, and with steam heat only.

How can I recover the sulphuric acid from the waste, after the washing of nitro-glycerin? A. In the manufacture of sulphuric acid from pyrites, the pyrites are subjected to a roasting process with a plentiful supply of air, and the resulting sulphurous acid gas, together with nitric acid vapor and steam, is conducted into a series of large, lead-lined chambers, the floors of which are covered with a layer of water, which dissolves and condenses the sulphuric acid as fast as formed. Sulphuric acid cannot be manufactured economically on a small scale by any of the methods now in use. The necessary plant is very expensive.

(60) F. S. asks: 1. Can you give me a recipe for making good, clean gunpowder? A. Rifle powder consists of sulphur, 10 parts, finest charcoal, 15 parts, nitre, 75 parts. Each of the several ingredients is first dried and reduced to an impalpable powder; then they are mixed thoroughly, and moistened with water. The paste is then ground together between stones to insure a close and uniform admixture, after which it is removed, pressed into blocks and dried. When dry, these blocks are brought against a revolving toothed wheel, which granulates the powder. The granular powder is then passed through sieves which remove all the coarser granules, and prepared for market. It is difficult to manufacture good gunpowder on a small scale, and its manufacture is attended with some danger.

1. Is it safe to use cocculus indicus for catching fish, and are the fish so caught poisonous? I have seen boys use it (bruising the berries and mixing them with flour paste); and after getting the fish they sell them to the Chinese. A. The berries do contain poisonous fluids, and should not be used for any such purpose. 2. Is it lawful? A. We are not aware that there is any law to this effect.

(61) F. H. asks: About how strong a solution of bichromate of potash would you use in mixing Indian ink for drawing purposes, by the method given on page 26, vol. 36? A. Reduce a small quantity of the bichromate to powder and dissolve in a limited quantity of boiling water. There should be an excess of the salt beyond what is taken up by the water. When the solution has cooled, pour it off from the residue, and bottle. When required for use, dilute the solution with about one third its volume of water, and it is ready for use.

(62) W. K. D. says: In reply to A. L. C., who asks how to protect lead pipe laid in the ground, from frost: Do not under any circumstances use sawdust to fill in around the pipe if you can dig a ditch only 2 feet deep. Unless you can get this pipe below the frost, sawdust will be utterly useless. If you can dig 3 feet deep, and fill in hard with dry coal culm, you will find your object attained. If you can get but 2 feet below the surface, the only sure way would be to make a box, say 1 foot square, the whole length of the pipe, and fill in with dry culm, laying the pipe in the center. Make three sides of the box first, fill half with culm, lay the pipe, then fill full with culm, and nail top board on. If you have plenty of culm, fill a few inches over the box before throwing in the dirt.

(63) W. N. asks: How can I refine petroleum to convert it into kerosene oil? A. Crude petroleum is first washed by agitation with water, then with sulphuric acid (oil of vitriol), and the last traces of acid removed by washing again with water. It is then run into capacious stills fitted with suitable condensers and a gentle heat applied, when the lighter products, naphtha, benzine, etc., immediately begin to distill over and are condensed and collected separately. As the temperature is raised from time to time oils of greater specific gravity come over. Kerosene oil is one of these distillates. See p. 808 of the SCIENTIFIC AMERICAN SUPPLEMENT for full particulars.

(64) C. C. says: I have a Brussels carpet which has been damaged by rain; and the green dye from a wool mat has run into it. What will take that color out and restore the carpet as before? A. Before we can give you any definite advice we must see a sample of the material, or know what constitutes the green dye. Try alcohol and water, or methylated spirit.

(65) S. W. D. E. asks: 1. What are the component parts of firebrick, and how are they proportioned and mixed? A. They consist principally of an impure variety of fireclay (silicate of alumina) containing a very small quantity of organic matter. The clay is freed as far as possible from any gravel which it may contain, moistened thoroughly with water, moulded into the requisite form by suitable machinery, and dried in the air. When sufficiently hard to bear handling, they are subjected to a moderate heat in a kiln, and afterward heated strongly. This treatment removes the last trace of moisture, and consolidates the brick. 2. How much pressure to the square inch will firebrick stand? A. This depends a great deal upon the quality of the brick and the way in which the strain is applied. The limit of tensile strength in the average fire brick is, perhaps, about 100 lbs.

(66) W. B. H. says: Will you give me a recipe for making paraffin paint? A. Mix together good asphalt and paraffin in equal parts, melt, and stir well together. Add to this a small quantity of finely ground caustic lime with constant stirring, and apply to the surfaces of the tank with a large brush. When this has cooled, put on another coating of pure molten paraffin, applied quickly and evenly.

(67) W. J. P. asks: I have an emery wheel of 2 inches face and 6 inches depth for grinding skates, etc. I broke it while driving the spindle in. The fracture has the appearance of good cast iron. It broke into nearly equal halves. How can I unite them? A. The stone may be cemented by means of a paste of oxychloride of zinc (used largely by dentists). Cover the fracture surfaces with a thin coating of the paste, place the pieces accurately together, and press strongly in a vise. To insure a strong joint, it should be left undisturbed in a warm place for a week or two.

(68) F. H. asks: Is it easier for an engine to drive a certain amount of machinery when placed close to it than at the end of long shafts, line as well as intermediate? A. Yes.

Is there a saving of fuel in having a large boiler and a large engine; I mean large for the amount of work to be done? A. In general, it is more economical to have the boiler large enough to furnish all the steam that is required with very slow combustion, or, in other words, to have a boiler that is considerably larger than is absolutely necessary. The engine, however, will generally be most economical when working up to the full power at which it was designed to run.

(69) J. C. M. asks: Which are more easily drawn, high wheels or low ones, provided they are loaded alike? A. We presume you intend a comparison between wheels of large and small diameter. A load on the large wheels can be drawn more easily than when on small wheels, on account of the greater leverage afforded by the former. If there were no resistance to motion other than the inertia of the body to be moved, the large wheels would have no advantage over the small ones.

(70) McC. Bros. ask: 1. Will injectors lift water as well as discharge it, or do they require a head of water? A. They are made both lifting and non-lifting. 2. Will they work water as hot as 150° or 200° Fah.? A. It is best not to heat the water more than 120°. 3. Will muddy water wear them out very rapidly? A. They will probably not work satisfactorily unless the water is passed through a strainer or filter. 4. What are the comparative merits of injectors and good steam pumps? A. There is not very much difference.

(71) A. D. asks: 1. An upright tubular boiler is 9 feet high and 40 inches in diameter, with 190 tubes, 2 inches in diameter and 6 feet long, with 3 feet heating surface in grate and firebox. Firebox is 32 inches in diameter. How many cubic feet of water would a boiler of this size evaporate in one hour, pressure being 100 lbs. to inch? A. Between 7 and 8, with a strong draught and good coal. The evaporation of a boiler depends largely, of course, on the rate of combustion, and the above figures are for a high rate. 2. One cubic inch of water, under pressure of 100 lbs. to the inch, is converted to steam. Would it expand to 1,600 times its volume, pressure remaining the same, or would it be less or more? A. One cubic inch of water would make about 280 cubic inches of steam of 100 lbs. pressure.

(72) W. S. asks: If a cylinder, filled with compressed air, be brought to a red heat, would there be danger from a sudden ignition of the oxygen within, or would the expanse of air be gradual up to that temperature? A. There would be no danger. Oxygen is not combustible.

What is electricity as produced by friction? Can it be a substance eliminated from the air, or produced by a finer division of its particles as the air is ground up in its passage between the cushion and cylinder. A. Probably no one can tell you exactly what electricity is; but your definition would be generally regarded as a statement of what it is not.

(73) J. C. D. asks: What is the best material for covering a cylinder of an engine, to prevent radiation? The cylinder is steam-jacketed with steam from boiler at 70 lbs. pressure. The outside of cylinder is covered with wooden lagging with space left for the non-conducting filling. A. Use felt for the filling, and lag with wood as you suggest.

(74) H. M. says: In a recent issue, you give an answer on the subject of crocus. I wish to say that crocus is made as follows: Calcine sulphate of iron, then roast it with a strong fire until acid vapors cease to rise; cool, wash with water until the latter ceases to affect litmus, and then dry.

(75) E. C. asks: We are at work out of doors, and our tools on cold mornings are all right; but if held to the fire, the frost comes out, although it was not seen before. I claim that the frost is in the steel, all through it, because they break much more easily. Another claims that the frost does not go into the steel. A. The appearance is caused by the condensation of the moisture in the atmosphere, due to the sudden variation of temperature. The same effect is caused by ice water in a glass.

(76) F. H. T. asks: I am building a small engine, 1½ x 3 inches, and I hardly know how to proceed. Is it necessary to have packing rings on piston, or will it do to just turn the piston so that it will fit in the cylinder nicely? A. A solid piston nicely fitted and say $\frac{1}{16}$ inch thick would do; but a ring would improve it.

(77) R. D. H. says: 1. By diminishing the speed of the governor, can I increase the speed of the engine? A. Yes. 2. What will be the safe working pressure in pounds of steam of a boiler 26 inches in diameter and 48 inches long, of ¼ inch thick iron, single riveted with several 3 inch flues? A. About 50 lbs.

(78) H. Isenbeck, St. Petersburgh, Russia: For grain elevators, address Gill & Mansfield, New York Central Railway, 60th street, New York city, or George Milson, Buffalo, N. Y.

(79) T. H. S. asks: 1. How many quart cells of the gravity battery will be necessary to work a telegraph in my house, and should they be connected for quantity or intensity? A. Three or four cells should be sufficient, connect in series. 2. How can I arrange a gong for a burglar alarm so that it will keep striking for 2 or 3 minutes after the current is connected? A. Join one end of the magnet wire to the armature lever, use a spring for the back contact, and connect this to the rest of the circuit as the magnet wire would be if the instrument was used in closed circuit.

(80) C. S. asks: Would a die made of an alloy of copper and tin in equal parts do to stamp on copper, or would it be too brittle? A. We know of no alloy that would answer this purpose.

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

H. H. T.—We should be happy to see the specimen of the tin ore mentioned. The specimen you send is a piece of cast iron containing much carbon. The matrix is slag from a blast furnace. You did not pay sufficient postage on your letter; 12 cents due.—H. V. H.—No. 1 is arsenide of nickel. No. 2 is apophyllite (carbonate of lime). No. 3 is magnesite. No. 4 contains chlorite, undefined crystals of carbonate of lime, and garnet. No. 5 appears to be slag from an iron furnace. No. 6 is clay containing a small percentage of sulphur and crystals of carbonate of lime.—No. 7 is calamine.—G. O. P.—We did not find gold in the sample sent us.—W. B.—No. 1 contains zinc and lead. No. 2 consists principally of zinc.—G. S. Y.—It is what is known as spiegeleisen, a carburet of iron usually containing a small percentage of manganese. It is not a natural formation. It is used in the manufacture of Bessemer steel.—S. M. W.—Your oil will make a very good lubricant, if freed from the bituminous matter which it contains. It contains a considerable percentage of paraffin oil. Send us a larger sample of it.—A. V. S.—Your stone has been pronounced by dealers to be very good, as far as may be judged from so small a fragment, for polishing purposes and hones. If it can be quarried in large pieces, sufficiently homogeneous and without flaws, it may prove marketable. We have seen similar stones from Arkansas.—G. S. B.—It is geocronite, a double sulphide of antimony and lead.

E. D. L. asks: Can any one give me the dimensions of the old English standard and the American wire gauges? Does Stubs' steel wire gauge correspond to either of the above?—L. W. F. asks: What is the method pursued by hub cutters for transferring a new design upon steel in the manufacture of jewelry and coin?—S. D. says: There is a certain species of wood used in England for boring tin plates. Some say it is a vhard pine imported from Belgium, others that it is species of ash. Does any one know what it is?—V. C. asks: How is inlaid woodwork done, and how are the colors for dyeing the wood made?—F. P. says: There is a species of hawk, called in Vermont blue hawk, whose true name I would like to ascertain. Its back is very dark; it is bluish in color, with the breast rather of a brick color. It is nearly as large as the hen hawk. It has crooked wings like the wings of an eagle, it flies very rapidly, and it makes great havoc among young chickens, etc., which it seizes without stopping, making a rapid swoop upon them. It is hardly ever seen except in the neighborhood of its nest, which is always made on the bare rock, on lofty cliffs. The eggs are of a very dark red, a little mottled with white. It is very noisy, and screams when any one goes near the nest. What is its proper name?

COMMUNICATIONS RECEIVED.

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

On a Bread Toaster. By T. C. H.

On Boiler Explosions. By J. R. R. M., and by H. P. G. C.

On the Climate of Oregon. By M. W. W.

On Aerolites. By J. S. D.

Also inquiries and answers from the following:

G. K.—H. M. S.—J. A. H.—C. H. P.—J. G. G.—T. S. —J. A. G.—O. J. S.—C. R. S.—S. L. M.—O. B. S.—S. —F. E. J.—G. W. S.—R. H. M.—W. H. R.—P. A. B.— J. R.—J. M. V.—E. M.—W. G. R.—C. F. E.—E. R. C. —B. S. G.

HINTS TO CORRESPONDENTS.

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

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

Hundreds of inquiries analogous to the following are sent: "Who sells paper bag machines? Who sells refrigerators? Who sells steel springs for use in small motors? Who sells parlor skates? Whose is the best nautical telescope? Who sells a fireclay preparation, porous enough to admit the passage of gas, as in a wire gauze burner?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

OFFICIAL.

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FOR WHICH

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January 9, 1877,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

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

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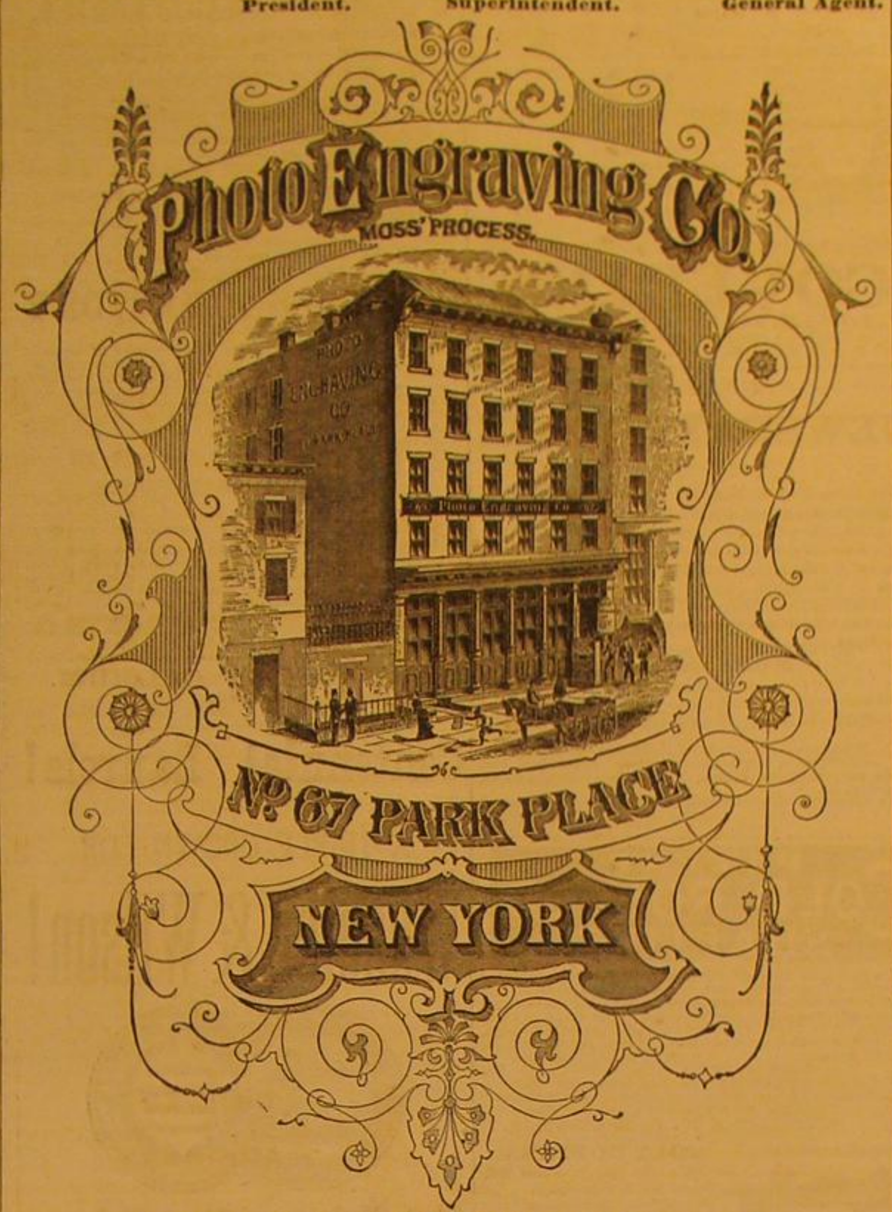

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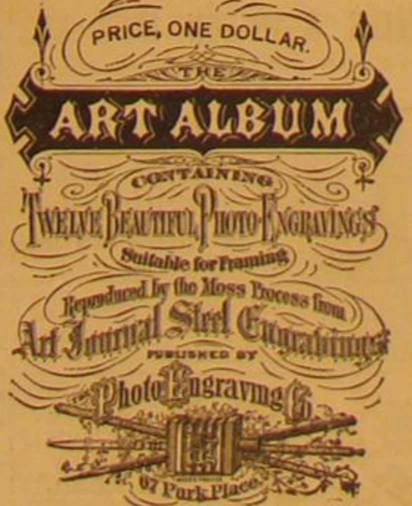

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