### The Story of an Invention.

It may not be generally known that an important invention in connection with the manufacture of carpets originated as follows: An operative weaver, in one of the largest establishments in this country, was engaged in weaving a carpet that in its finished stage would appear as a velvet pile. At that period this description of carpet was woven much in the manner of Brussels, the loops being afterward cut by hand —a slow and costly process. These loops are formed by the insertion of wires of the requisite thickness to form the loop; they are then withdrawn. This weaver—whether by cogitation or as the result of a bright thought—came to the conclusion that if these wires were so constructed as, on being withdrawn, to cut the loops, thus instantly completing the formation of the pile, it would be a great saving of labor and time, and a great economy. Taking one of the rods, he changed its form to the required shape, ground a knife edge upon it, took it to his looms, and inserted it into the web—all the while maintaining strict secrecy—and with some degree of excitement watched its weaving down until the moment for its withdrawal. This came, the rod was drawn out, the loops were cut, and the experiment was a perfect success, the pile being cut with great evenness.

The weaver, with a shrewdness often wanting in inventors, doubled up the rod and hid it away, wove down the line of cut loops upon the roll, then "knocked off," or stopped his loom, and proceeded to the office of the mill, where he demanded to see the principal. The clerk demurred to this, asking if he himself could not do all that was required; but no, the weaver persisted. Then the manager tried, but with the same result; only the principal would suit the weaver. The employer was informed of the operative's persistence in determining to see him; so he at once ordered him to be admitted. This was done, and the weaver stepped into the well furnished and handsomely carpeted office of the manufacturer. His employer addressed him: "Well, John" (for so we will call him), "what is it you want?" "Well, maister, I've getten summut yo mun hev," replied John. "Wodn't yo like a way ut makkin t' loom cut th' velvet piles?" continued the weaver. "Yes! that I would!" replied the employer; "and I will reward any man handsomely who brings me a plan of doing it," added he. "Awm yore mon, then," said the operative. "Wod'll yo gi' me?" he further asked. After some further conversation a bargain was struck, and a sum agreed upon, which the weaver should be entitled to claim in the event of his plan for automatically cutting the pile of the carpet being a success. Arrangements were made for its trial; the weaver made his preparations; the master, the manager, and one or two confidential employés gathered around the loom upon which the experiment had to be made, all others being sent outside the range of observation. The new form of wires were inserted, woven down, and withdrawn, leaving a well cut pile upon the face of the carpet. The weaver had won his reward, for it was honorably paid. An annuity of £100 was settled upon him, which he continued to enjoy until within a recent date, and for anything we know to the contrary may be enjoying yet. He retired from the weaving shed, determined to spend the rest of his days in ease and comfort. His employer secured by patent the benefits of his invention, it being one, among several others, which contributed to place that manufacturing establishment in the foremost rank in the trade, while its owners attained wealth and social eminence as the reward of their prudent enterprise.—*Textile Manufacturer.*

### Engineering Progress.

In a recent address on the "Status and Prospects of Engineers," delivered before the Liverpool Engineering Society, the President, Wm. Graham Smith, said that the scientific progression of the profession had been gradual and ceaseless, though the ancients had executed works of greater magnitude than those undertaken at the present day. Among the familiar examples of ancient prowess are Lake Moeris, an irrigation reservoir 150 square miles in extent; the pyramids of Gizeh, constructed 5,000 years ago. Tubal Cain was a worker in metals, and to show the ancient lineage of the profession, George Smith has ascertained from an ancient tablet that the title "Master of Works" existed in Assyria 700 B. C. The remains of works are to be found in Egypt, China, and indeed all over the world, clearly denoting that the ancients possessed great engineers. Among the ancient titles known are those of "Lord of Canals" and "Establisher of Irrigation Works." Vast as are the works of the ancients, they by no means exhibit skill equal to that shown at the present day. The Suez Canal and Mt. Cenis Tunnel, through nature's barriers to national intercommunication, have been opened by the skill of men now living. The blowing up of the mass of rocks in the Hell Gate, the deepening of the Mississippi river, the construction of the East River Bridge, New York, and the great underground railways of London, are all instances of the scientific progress of engineering, and will long remain to immortalize the names of their builders.

THE "Illustrated Annual of Rural Affairs," for 1878. Luther Tucker & Sons, publishers. Albany, N. Y. Price 30 cents. A valuable little work.

### THE REPRODUCTION OF MUSICAL TONES BY ELECTRO-MAGNETISM.

The following observations on the subject of the reproduction of musical tones through the agency of electro-magnetism have recently been presented by Philip Reis, at the Free Institute at Frankfort-on-the-Main, and we find them translated into the *Journal of the Telegraph:* The problem is to produce by the action of the voltaic current audible signals or tones instead of visible signs. In the process of reproducing tones by electro-magnetism an artificial imitation of the mechanism of the human ear is employed, consisting of a stretched membrane corresponding to the tympanum,

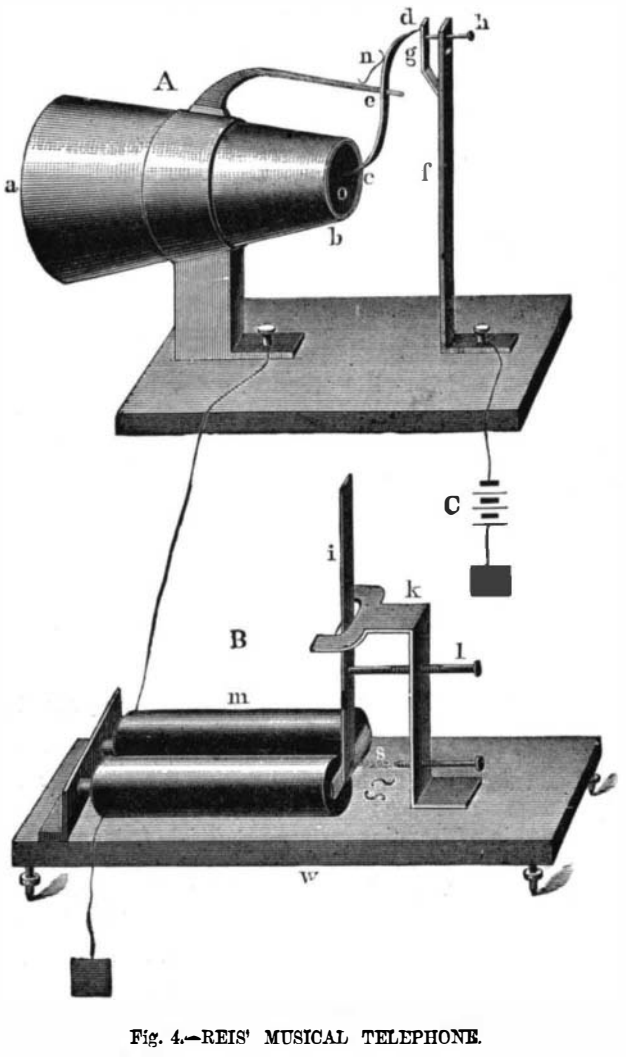
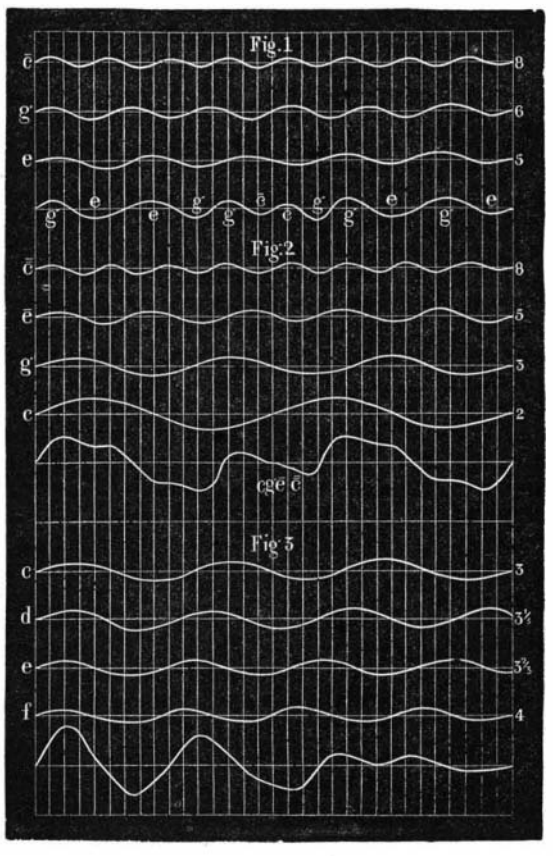



Fig. 4.—REIS' MUSICAL TELEPHONE.

which by its vibrations opens and closes an electric circuit extended to a distant station by a metallic conductor.

If we analyze the process by which the ear distinguishes a simple sound, we find that a tone results from the alternate expansion and condensation of an elastic medium. If this process takes place in the medium in which the ear is situated, namely, the atmosphere, then at each recurring condensation the elastic membrane or tympanum will be pressed inward, and these vibrations will be transmitted, by the




TONE CURVES.

mechanism above referred to, to the auricular nerves. The greater the degree of condensation of the elastic medium in a given time, the greater is the amplitude of the movement of the tympanum, and consequently of the mechanism which acts upon the nerves. A series of vibrations, a definite number of which are produced in a given time, and of which we thus become cognizant, is called a tone. If several simple tones are produced simultaneously, the sound conducting medium is subjected to a force which is the resultant of several simultaneously existing forces acting upon each other according to the ordinary laws of mechanics. In accordance with this principle we may construct from the condensation curves representing several simultaneous tones a single resultant curve which will correctly represent the effect produced upon the ear,

Fig. 1 shows a curve representing a composite tone formed by the combination of three simple tones, in which all the relations of the components return successively.

Fig. 2 represents such a curve formed of more than three tones, in which the relations do not appear so distinctly, but a musical expert will readily recognize them, even when it would be difficult in practice for him to distinguish the simple tones in such a chord. We can understand by reference to Fig. 3 why it is that the ear is so disagreeably affected by a discord.

The apparatus of Professor Reis is so constructed as to respond to these sonorous vibrations, however complex, while the application of the electric current thereto renders it possible to reproduce similar vibrations at any required distance. In this manner musical tones may be telegraphically transmitted from one point to another.

Referring to Fig. 4, A is the transmitting and B the receiving apparatus, which are supposed to be situated at different stations. For the sake of clearness, the appliances by which the apparatus is arranged for reciprocal transmission in one direction or the other have been omitted. The tone-transmitter, A, Fig. 4, is on the one hand connected by a metallic conductor with the tone receiver, B, at the distant station, and on the other with the battery, C, and the earth, or the return conductor. It consists of a conical tube, *a b*, about 6 inches in length, and having a diameter of 4 inches at the larger and 1½ inch at the smaller end. It has been found by experiment that the material of which the tube is constructed has no influence upon the action of the apparatus, and the same is true as to its length. An increase in the diameter of the tube is found to impair the effect. The inner surface of the tube should be made as smooth as possible. The smaller or rear end of the tube is closed.

In order to prevent the interference occasioned by the action of the sonorous vibrations of the atmosphere upon the back side of the membrane, when making use of the apparatus, it is advisable to place a disk about 20 inches in diameter upon the tube, *a b*, in the form of a collar or flange, at right angles to its longitudinal axis.

The tone receiver, B, Fig. 4, consists of an electro-magnet, *m*, mounted upon a sounding box or resonator, *w*, and included in the circuit of the electrical conductor from the transmitting station. Facing the poles of the electro-magnet is an armature which is attached to a broad but thin and light plate, *i*, which should be made as long as possible. The lever and armature are suspended from the upright support, *k*, in the manner of a pendulum, its motion being regulated by the adjusting screw, *l*, and the spring, *s*.

In order to increase the volume of sound, the tone receiver may be placed at one of the focal points of an elliptical chamber of suitable size, while the ear of the listener is placed at the other focal point.

The operation of the apparatus is as follows: When the different parts are in a state of rest, the electric circuit is closed. If an alternate condensation and rarefaction of the air in the tube, *a b*, is produced, by speaking, singing, or playing upon a musical instrument, a corresponding motion is communicated to the membrane, and from thence to the lever, *c d*, by which means the electric circuit is alternately opened and closed at *d g*, each condensation of the air in the tube causing the circuit to be broken, and each rarefaction in like manner causing it to be closed. Thus the electro-magnet, *m m*, of the apparatus at B becomes demagnetized or magnetized, according to the alternate condensations and rarefactions of the body of air contained in the tube, *a b*, and consequently the armature of the electro-magnet is thrown into vibrations corresponding to those of the membrane in the transmitting apparatus. The plate, *i*, to which the armature is attached, transmits the vibrations of the latter to the surrounding atmosphere, which in turn conveys them to the ear of the listener.

It will be seen, therefore, that the result produced by this apparatus is not the veritable transmission of sound by means of the electric current, but is simply a reproduction of the tones at some other point, by setting in action at this point a similar cause, and thereby producing a similar effect. It must, however, be admitted, that while the apparatus which has been described reproduces the original vibrations with perfect fidelity so far as their number and interval are concerned, their intensity or amplitude cannot as yet be transmitted. The accomplishment of this latter result, therefore, must await the further development of the invention.

It is in consequence of this defect in the apparatus that the more inconsiderable differences of the original vibrations are distinguished with great difficulty, that is to say, the vowel sounds are heard with more or less indistinctness, for the reason that the character of each tone depends not merely

upon the number of the sonorous vibrations, but upon their intensity or amplitude also. This also accounts for the observed fact that while chords and melodies are transmitted and reproduced with a surprising degree of accuracy, single words as pronounced in reading or speaking were but indistinctly heard, although in this case also the inflections of the voice, interrogative, exclamatory, etc., could be distinguished without difficulty.

### Nitro-Glycerin Explosives—Their Storage and Transportation.

The use of high explosives is constantly on the increase, and the problems of safe manufacture, handling, and transportation of such substances have become matters of very great importance. Gunpowder and gun cotton have been entirely superseded for blasting and mining purposes by nitro-glycerin, dynamite, and dualin; and nitro-glycerin has now given place to the explosive powders formed from it. These are, in brief, a mixture of nitro-glycerin with any non-fusible (sometimes fusible) powder, the proportion of the admixture being the gauge of the explosive force. By the use of these explosive powders or pastes many undertakings become possible which otherwise would not have been attempted; much time is saved, and fully one third of the former cost. The great silver mines of Nevada are blasted exclusively by dynamite and similar compounds; they are in general use in the mines of California, Utah, Colorado, Arizona, Missouri, Michigan, Pennsylvania, New Jersey, and New York, and very extensively throughout the United States, for all work requiring explosive force.

#### NITRO-GLYCERIN.

Nitro-glycerin, which may be called the base of all modern explosive powders, is a light colored, oily liquid, about 50 per cent heavier than water, which gravity causes it when poured into a bore hole filled with water to sink and displace the latter. Its manufacture is quite simple: 2½ parts, by weight, of strong nitric acid are mixed with 5 parts of strong sulphuric acid; after this mixture has cooled, 1 part of pure glycerin is carefully added, and stirred in, care being taken to keep the temperature below 70° Fah. The nitro-glycerin, which quickly forms, is then separated and carefully washed in cold water. The explosive force of nitro-glycerin is generally computed as ten times that of gunpowder, but this is rather an overestimate; still it is undoubtedly the highest explosive force known at present.

Experiments made by military committees in Europe have further confirmed that the sensibility of nitro-glycerin to mechanical shocks is much less when frozen than when liquid. In the transition state, however, the sensibility seems to be rather increased, especially in respect to light shocks, such as those arising from packing for transport; this is confirmed by the experience of the laboratory and factory. To obviate such difficulty, such places and the sheds where cartridges are made are now heated by water, as the agent best fitted to distribute an equable temperature.

A paper recently translated by Captain Hess, for the Institution of Civil Engineers, London, gives some valuable information on the subject of freezing the nitro-glycerin. It appears that though in the purest form, as tri-nitro-glycerin (containing 18·5 per cent of nitrogen), the freezing point is from 39° to 53·6° Fah. (according to Ott), there is generally a considerable mixture of the ethers with the commercial article, causing it to bear, before congealing, sometimes a temperature as low as 17·6° Fah. According to Champion, some blasting oils would not solidify in a temperature of 5° to 10° Fah. Zero, which could easily be obtained and maintained by means of freezing mixtures or highly volatile fluids, would render the storage and transportation of this dangerous liquid comparatively safe. In change of location, however, where a much warmer temperature may be encountered, the danger would soon be as great as ever. With the explosive oils of commerce, as a rule, congelation takes place partially, and under the influence of lengthened cold the process of thawing is slow and gradual.

#### DYNAMITE.

Dynamite, which, as already mentioned, is, in its various forms of powder, the next in force to nitro-glycerin, was commenced as a manufacture in 1867, and the quantity now annually made in the United States and Europe reaches 15,000,000 pounds; and it must continue to increase. One remarkable fact deserves attention: that, whereas in mixtures of gunpowder and the fulminates with inert substances the explosive power is diminished in proportion to the adulteration—the direct effect being to make the combustion less rapid—on the other hand the absorbents used in the nitro-glycerin powder do not strictly retard its explosion in any degree, but they add vastly to the safety in handling and transportation. A mixture of the oil, in proper proportion, with pulverized infusorial earth, charcoal, chalk, ashes, or plaster-of-paris, makes a comparatively dry powder, but of high explosive power, with the great advantage of standing much hard usage.

How, then, is it exploded? The ordinary means is by the use of a heavy percussion cap, or "exploder," consisting of a copper shell, like a common gun cap, and containing ten grains or more of fulminate of mercury. The exploder is not fired by percussion, but by a fuse, or by electric wires inserted in contact with the fulminate. A powder made of 50 per cent of nitro-glycerin and 50 per cent of infusorial earth is very dry, and cannot be exploded except by a triple force exploder, and when the charge is strongly and tightly confined. On the other hand, a powder of 50 per cent of nitro-glycerin and 50 per cent of mica scales or fine sand is very wet and leaky, and explodes almost as easily as the liquid oil.

An explosion of dynamite occurred in San Francisco while the powder was being prepared for a large blast underwater. The loose powder, in the course of being packed into cartridges, was, it is represented, set on fire from the pipe of a workman, and before it could be extinguished the fire reached exploders in other cartridges.

#### DUALIN.

Dualin is a diversified mixture, from the saturation of poplar pulp with nitro-glycerin, to 60 per cent of nitro-glycerin 40 per cent of sawdust, etc., etc. In the case of dualin, the lower the temperature the more sensitive it is to friction.

A bill was introduced at the late special session of Congress to amend the law in relation to the transportation of such explosives, but we have heard no further of it.

The present United States law bearing on the subject was passed July 3, 1866, before dynamite was invented, and was designed to regulate the transportation of nitro-glycerin. There is some doubt as to its application to the nitro-glycerin compounds. In a case before the United States District Court for the Northern District of New York, it was held that dynamite or "giant's powder" was not within the law; but there is no certainty of this as an established interpretation. Under the law, such compounds cannot be carried on public conveyances unless packed in metallic cases, the latter surrounded with plaster-of-paris, and outside must be placed the mark, "Nitro-glycerin—Dangerous."

There is much deception and smuggling of the various articles as other freight, and surreptitious freight may be put along with passenger trains. As almost all transportation of these compounds extends through more than one State, State laws with diverse requirements could afford no relief; but it seems just that the General Government should also recognize and enact according to the discriminations made at the present stage of experience and knowledge of the substances—not giving too much credence to claims of safety set up either by the manufacturers or users of the substances. The following are some main points for a just and fair law:

1. Great restriction or entire prohibition of transportation of liquid nitro-glycerin, or of any leaky powders, with inspection to secure such result. Frozen nitro-glycerin to be permitted in refrigerating cars, and on freight trains only.

2. Permission for dry explosive powders to be carried on freight cars only, or on trains not carrying passengers.

3. Explosive powders to be packed exclusively in regulation cases.

4. Percussion caps or exploders, or any article that might extraneously cause explosion, not to be permitted in the same car or vessel with the powders.

5. Each package should be plainly marked on the outside with the names and proportions of the various ingredients.

There is some discussion as to the comparative safety of metal, wood, and paper cases for the powders. It is a question of vibration. Some form of nitro-glycerin—possibly dualin—was in a can at the Hoosac Tunnel, in contact with a rail, and about 350 feet from a blast. The agitation of the can, caused by the vibration of the rail, produced an explosion, which, it is presumed, would not have occurred had the vessel been of wood or paper.

Herr Gossie, of Antwerp, constructs, either in a railway car or in the earth, a water-tight reservoir, divided by means of T and angle irons into compartments of equal capacity, in which the explosives (suitably packed in water-tight boxes) are placed after the reservoir is filled with water.—*American Exchange and Review.*

### Origin of the Letter Stamp.

The alleged origin of the stamp had a tinge of romance in it. It was thirty-seven years ago that Rowland Hill, while crossing a district in the North of England, arrived at the door of an inn where a postman had stopped to deliver a letter. A young girl came out to receive it; she turned it over in her hand and asked the price of postage. This was a large sum, and evidently the girl was poor, for the postman demanded a shilling. She sighed sadly, and said the letter was from her brother, but she had no money; so she returned the letter to the postman. Touched with pity, Mr. Hill paid the postage and gave the letter to the girl, who seemed very much embarrassed. Scarcely had the postman turned his back when the young inn-keeper's daughter confessed that it was a trick between her and her brother. Some signs on the envelope told her all she wanted to know, but the letter contained no writing. "We are both so poor," she added, "that we invented this mode of correspondence without paying for our letters." The traveler, continuing his road, asked himself if a system giving place to such frauds was not a vicious one. Before sunset Rowland had planned to organize the postal service on a new basis—with what success is known to the world.

### A New Lime Light.

At a recent meeting of the Warrington Literary and Philosophic Society (Eng.), a new lime light not requiring oxygen gas was exhibited by Mr. Fletcher. This gentleman stated that until about five years ago metallurgists and others had no practically available source of heat for experimental work giving temperatures between that of an ordinary gas or lamp blowpipe and the oxyhydrogen jet or electric arc. After the general introduction of his hot blast blowpipe, experimenters supposed that a lime light could be obtained, and the danger and cost of making oxygen gas could be dispensed with. But all experiments in this direction had proved a failure for the reason that the high temperature jet is exceedingly small, and only illuminates a tiny spot of the lime; if made larger in size the temperature falls too low to be of service for this purpose. From the outcome of some experiments in a totally different direction he obtained what is possibly the germ of a practically available light, having a distinct actinic or chemical power, and is white, showing all colors precisely as in daylight. The little furnace he exhibited, although a toy to look at, would, he stated, melt with ease one half pound or more of copper, cast iron, and steel, and he thought with a slight modification would fuse platinum. It would with a simple blowpipe soften a crucible of the most refractory clay. The *Mining Journal* gives Mr. Fletcher's relation of the discovery:

Some time ago needing a small block of caustic lime which he had not at hand, he put a bit of limestone in his furnace to burn the carbonic acid out. On looking at it in a few minutes he found the lime illuminated the workshop, and the light was painful to the eyes. This suggested the point that if an ordinary lime cylinder were protected by a non-conducting casing over all parts except when the light is required, a good light might be obtained. The casing he uses to the lime is the same as that of the furnace—that is, a mixture of one part ganister or refractory clay, and six of sawdust, rammed in a mould and fired. This makes after burning a firm cellular mass, in texture almost like pumice stone, and its power of retaining heat is such that in this casing, which is only ½ inch thick, he can melt ½ lb. of cast iron with a simple blowpipe, and can then take the furnace, crucible, and all in his hand without feeling the heat to any inconvenient extent. As a jacket for ordinary furnace work this mixture will, perhaps, prove one of the most valuable materials, in all the places except where exposed to mechanical wear. The lime light burner which he exhibited is simply a block of lime partially cased with this material, and a blowpipe of ordinary construction, except that the gas is mixed with air to a certain extent before the blower commences to act on it. Owing to this previous mixture, the blower has less air to supply, and the combustion is quicker; in fact, so rapid and perfect is the combustion of gas that this blowpipe on a larger scale may compete with the hot blast. A sheet of platinumgauze held in the hottest part of the flame is fused and perforated almost instantly, and the lime becomes sufficiently heated to give a white light, which he had tested, and found to be equal to about 95 candles. This flame is noisy and quite unfit for the magic lantern. There is, however, the possible germ of a greater future in it.

### The White Incrustation on Bricks.

At a meeting of the Philadelphia County Medical Society, held December 26, this subject was reported upon by the Committee on Microscopy, Dr. Jos. G. Richardson, chairman. The committee decided the white deposit to be sulphate of magnesia, better known as epsom salts. In the deposit, the microscope revealed the presence of epithelial scales from the human skin, and the *débris* of many plants. The sulphuric acid comes from the coal gas and the coal burned in the city; the base, or magnesia, is from the bricks themselves, a large quantity being found in the clay of which they are made. It is not regarded as in any way injurious, though quite unsightly and destructive to the walls. This coating may be prevented by a thick coat of paint on the wall, or the immersion of the bricks before use in a bath of sulphuric acid, and subsequently to the action of running water.

### Relative Cost of Water and Steam Powers.

The cost of the water power equipment at Lowell was, for canals and dams, $100, and for wheels, etc., another $100, per horse power. But this, as a first experiment, was more costly than a similar equipment need be. At Saco, the expense incurred was $175 per horse power; but at a later period, for turbines with high heads, the expense would be less. A construction and equipment, solidly carried out, with the latest improvement in wheels, would not cost over $200 per horse power, and would, under favorable circumstances, cost less. An estimate at Penobscot was for $112.50 per horse power. If the construction be with wooden dams, and the equipment with lower grade wheels, then the cost would be about $50 per horse power; and although the construction would be less permanent than the more solid, it would outlast any steam apparatus. On the other hand, Fall River estimates of steam equipment, exclusive of foundations and engine houses, run from $100 to $115 per horse power. A Boston authority gives $115 per horse power for nominal 300 horse power and upward, inclusive of foundations and masonry. Similarly, a Portland authority places it at $100 per horse power. The actual cost of steam equipment in the water works of various cities of the United States varies from $150 to $300 per horse power.—*The Water Power, Maine.*

### How to Destroy Lice on Cattle.

S. D. says: In answer to a question asked by one of your correspondents, relative to destroying lice on cattle, take common lamp oil, mixed with kerosene—not much kerosene—rub along backbone and around the eyes and nose, as they come there to get moisture; they will soon disappear. Too much kerosene will take the hair off.

### New Mechanical Inventions.

Mr. William H. Pierce, of Tolono, Ill., has patented a new Valve Gear, in which a rod from the hub of the balance wheel of the engine connects with an upright arm having a handle and also two pins arranged equidistant from the shaft, which are used for reversing the engine. Attached to the shaft is an arm, which receives a movable slide, to which last the cut-off connecting rod is pivoted. By adjusting this slide the strokes of the piston can be lengthened or shortened, and the steam supply to the cylinder regulated.

Mr. Paul S. Forbes, of New York city, has patented a new Rotary Condenser, made of a tube coiled into wheel form, and having its ends projecting at the centers of its opposite sides. It is placed in the well of a vessel and constantly revolved in the cold water therein, thus serving to condense the exhaust steam from an engine connected with it.

In order to avoid the work of cutting the screws in a lathe and turning the head and stand, Mr. William Guthrie, of Galva, Ill., has devised a new Jack, both the male and female screws of which are cut in ordinary bolt and nut cutting machines, and both the head of the male screw and the case or stand of the female screw are accurately cast upon the screws after the latter are cut.

Mr. Benjamin W. Hoyt, of Manchester, N. H., has invented a Lath Holder for temporarily supporting laths at any height on the wall. It is made of two hinged sections that turn on a swiveled top piece, with supporting hooks. The lower part has a crosspiece with curved or braced arms, like a basket, for holding the laths, and the middle part additional pointed arms or hooks for being supported on the studding of the wall.

An improved combined Wrench and Vise has been patented by Mr. Homer T. Gates, of Hartford, Ohio, in the jaws of which an object may be securely clamped by turning a nut. The vise may be completed by simply inserting the handle of the wrench in a socket made for the purpose. The construction of the wrench is also such that it may be used in places where wrenches ordinarily cannot be used.

In a new Machine for Cutting Wooden Cogs, invented by Mr. Warren L. Morris, of Victory, Ga., the cutting head, formed of the rotary shaft and its attached knives, has three cutting edges formed in different planes, and respectively used for cutting the working end of the cog, the tenon that fits in the mortise of the cog wheel, and the shank of a cog for receiving a key for securing the former in the wheel rim.

Mr. Ira Winn, of Falmouth, Me., has patented a machine for Removing Bark from Wood. There are a fixed and a revolving spindle for supporting and rotating the stick to be denuded, a centering device for holding the stick until it is engaged by the spindles, a yielding knife for removing the bark, and a stop for shifting the feed.

A new Bit Clamp for Boring Machines has been devised by Mr. Frederick Dezendorf, of Cornwall-on-Hudson, N. Y. It may be adjusted to different sized shanks of bits to firmly hold the same, and consists of two pins that are fulcrumed to the ends of a rigid T piece of a threaded center piece, and are adjusted by a conical nut turning on the latter.

A new Windlass Water Elevator, patented by Mr. Thurston B. Barber, of Baltic, Conn., has an improved construction of chain wheel which prevents the chain from slipping or being wound thereon, and improved devices for tilting the buckets, and a generally new arrangement of mechanism for lowering and raising the latter.

Mr. Edward G. Hall, of Healdsburg, Cal., has patented a new Ore Roasting Furnace for the reduction of cinnabar ores. The ore is placed in a hopper, whence it passes to a drying chamber, being carried along by a coned and tapered screw conveyer. During the passage it is heated sufficiently to drive off the volatile matter. It then goes to a wasting chamber in which is a conveyer which carries it ultimately to another chamber provided to receive it. The quantity of ore carried through the furnace is regulated by sliding the hopper. If the latter is placed over the smaller portion of the conveyer, a less quantity of ore is taken away by the screw than when the hopper is adjusted over the larger portion.

A new Self-Oiling Axle Box for coal cars, devised by Mr. James Dawber, of Braidwood, Ill., is so constructed that when the car is dumped a quantity of oil flows from an oil chamber to cotton waste, from which it is supplied to the axle.

Mr. Michael Waters, of New York city, has invented an exceedingly ingenious apparatus for automatically replacing a car the wheels of which have run off the track. We cannot explain the mechanism of the device without the aid of drawings. Its operation, however, is briefly as follows: As soon as the car wheels leave the track, broad flanged auxiliary wheels take their place upon it. These are rotated by the forward motion of the car. Mechanism is thus set in operation which carries these wheels outward until they are of the same gauge as the truck wheels, and the car being also raised, the truck wheels are brought over the track. It only remains to lower the car by automatically acting devices to replace it on the rails.

A new Windmill, devised by Mr. John J. Kimball, of Napierville, Ill., embodies two wheels which are geared together and so constructed and arranged that the wind which escapes through one wheel will reach on the blades of the other one. The speed of the wheels may be regulated, and they are caused to edge more or less to the wind as the force of the same increases or diminishes.

Messrs. George and Thomas Shaw, of Dukinfield, England, have patented a Machine for Polishing Vegetable Fibers, such as are used for brush making. The material is heated with a dressing of sizing mixture and then submitted to the action of brushes, whereby they are rendered lustrous and in a measure waterproof.

Mr. George J. Kautz, of Emporium, Pa., has devised a new Sawing Machine, which is an improvement on the apparatus patented by him April 17, 1877. The invention consists of feed mechanism for the lumber, constructed of a weighted top roller and lower spiked roller, in connection with an intermittently-revolving spiked feed roller. There is also a revolving circular saw, turning in a swinging frame. A lever arrangement throws the feed mechanism and saw in or out of gear by a suitable clutch device with the driving shaft, and regulates the cutting off of the lumber.

Mr. W. H. Whitely, of Joslin, Mo., has invented a new Double Acting Pump, in which there is a double valved piston with two valved suction pipes and a discharge pipe. The advantage claimed for the double suction is that twice as much water is taken up at a stroke as is the case with ordinary pumps, and that the discharge by short strokes is as great as when long ones are made.

Mr. George W. Hooper, of Greene, Me., has also devised a Double Acting Force Pump. A double valve box is located at the foot of a cylinder in which works a valveless piston. There is a water way on one side of the cylinder which communicates therewith at its upper end, and also with one of the compartments of the double valve box. A new packing is used on the piston rod.

An improved Propelling and Dry Dock Attachment for Vessels, devised by Mr. James Curtis, of Middletown, Mo., consists essentially of balanced propelling wheels at the end of a lateral revolving shaft, in connection with water induction and eduction trunks. The latter are arranged with tightly closing, hinged or sliding gates that may be closed, forming a chamber or dry dock, from which the water is pumped for repairing the wheels.

Mr. Edmund Golucke, of Crawfordsville, Ga., has devised a new Horse Power for ginning cotton, threshing grain, sawing wood, etc. The improvement consists chiefly in the construction of the gear wheels, which are made of wood with the cogs formed in the shape of tapering plugs inserted between fixed partitions and held by pins which are imbedded partly in the tapering plug and partly in the fixed partition, the plugs being held in place laterally by a removable disk or plate. The improvement also consists in the means of attaching the draft levers to the post of the king wheel, whereby they are more securely held in place.

Mr. Stephen M. Redfield, of Maryville, Mo., is the inventor of an improved Tenoning Machine, in which adjustable planes are pressed upon the board by strong band springs, so that they cut equally at both sides when reciprocated by a hand lever.

## Business and Personal.

*The Charge for Insertion under this head is One Dollar a line for each insertion.*



## Notes & Queries

(1) R. R. R. asks for a recipe for mending china? A. Make a paste of powdered quicklime and white of egg and apply it to the parts to be united.

How is the first span or wire made in building a suspension bridge, where it is impossible for a boat to cross? A. A kite can be used to carry a string across, and by means of the string a rope is pulled over.

(2) C. M. says: I have a cellar floor cemented with ordinary Newark cement. A fine dust sweeps from it every time it is swept. Is there any preparation of silicate of soda or water glass that will cover this cement so as to glaze it, and prevent the surface cement from such abrasion? A. No: none that would serve practically as a remedy. A cheap earthen or cement tile would afford the relief sought. There is a tile made of cement concrete, having a cement face hardened by a patented process, that promises to be very useful in situations like those that you refer to, but it is not yet put upon the market by a manufacture sufficient to supply the demand that will arise for it.

1. Is a wire rope of galvanized iron wire, say of the size of one's forefinger, a suitable electrical conductor? A. Yes. 2. Would such rope answer as well as an ordinary iron rod of ⅝ inch iron? A. No.

(3) F. J. T. asks: 1. What is the nature of soluble glass or silicate of soda? A. It is simply a soda glass having a large excess of soda. It is completely dissolved by continued boiling in water, forming a clear sirupy liquid, used as a varnish for making artificial stone, etc. 2. Can it be mixed with white lead without detriment? A. White lead (lead carbonate) may be mixed with it to form a brilliant white paint; but not the oil lead. 3. Can it be used as a sizing for plastered walls before painting without causing the paint to peel or crack? A. No, not very well.

(4) J. M. H. wishes a recipe for making oiled walnut for furniture? A. There are different processes; one is to partially fill the pores of the wood with a coat of shellac varnish first, and then to finish with a coat of boiled linseed oil. The finest surface is given by applying a preparation called "wood-filler," and then finishing with the oil. This preparation can be obtained ready for use from the large paint and varnish dealers in this city.

(5) M. M. G. writes: A church in this city has a motor operated by the water in the city pipes for the purpose of blowing their organ. The engine is an oscillating one. The water enters through a 2½ inch pipe under a pressure, say, of 25 lbs. After doing its work it is discharged through a 2½ inch pipe into a cistern, the outlet being submerged to save atmospheric pressure, and then into a street sewer, say 30 feet from the engine. Is this discharge pipe large enough, it being the same size as the inlet pipe, to carry away the water after it has been relieved of its pressure? The engine does not work satisfactorily. The fall in the discharge pipe to the cistern is, say, 8 to 10 feet, the fall occurring 20 feet from the engine. A. The areas of the pipes should be inversely as the square root of the head of water in feet. In this case the outlet pipe should be 3 times the diameter of the inlet pipe; the former discharging into the open air. To get the full benefit of the fall of 8 or 10 feet, the water should be discharged above the water in the cistern, and the pipe not submerged into it. You do not avoid the atmospheric pressure by submerging the pipe.

(6) W. N. B. asks for a simple formula for artificial or cement stone for paving purposes? A. Almost all the successful processes are patented. What will prove probably to be the most successful is the carbonizing process, which consists in subjecting the pure cement surface to a bath of carbonic acid gas under pressure. This gives a surface as hard as the hardest marble.

(7) B.R. writes: It is well known that much of the soap in use contains impure elements and is liable to breed disease. Cannot science give us a substitute which shall be free from these objections? A. The use of soap is simply to furnish an alkali which with water will combine with the natural oily exudation of the skin. A little ammonia or borax may be used instead.

How can a feverish condition of the eyeballs and eyelids be removed without medicine? A. Bathe the eyes in cold water freely, do not use them to read either by gas or lamplight or near a window, avoid rich and greasy food, and keep the blood cool with any mild aperient.

(8) F. J. S. wants to know if rain water will become hard in a cement cistern? A. Yes, so long as there is any lime in the cement to be absorbed by the water.

(9) T. F. F. asks how to clean carpets simply and cheaply? A. Use ox gall, 1 pint to a pailful of water, with scrubbing brush and floor cloth, after-