Correspondence.

Straw Lightning Conductors.

"Straw is about the last material one would think of using for a "lightning rod;" but according to a French journal, it answers the purpose admirably. It had been observed that the straw had the property of discharging Leyden jars without spark or explosion, and some one in the neighborhood of Tarbes got the idea of constructing lightning conductors, which were formed by fastening a wisp or rope of straw to a deal stick by means of brass wire, and capping the conductor with a copper point. It is asserted that the experiment has been tried on a large scale around Tarbes, eighteen communes having been provided with such straw conductors, only one being erected for every 60 arpents, or 750 acres, and that the whole neighborhood has thus been preserved from the effects, not only of lightning, but of hail also. *The Journal of the Society of Arts* says: This statement comes from a respectable source; and the apparatus being extremely simple and inexpensive, it is at any rate worth the trial. Copper conductors are out of the question in ninety-nine cases out of a hundred, but every cottager almost could set up a straw one."

To the Editor of the Scientific American:

On reading the above account of straw lightning rods which you sent me, I made the simple experiment of measuring the electrical resistance of a small bundle of straws, and found it to be very high indeed, say a million or two times as great as a copper wire of the same size. This really disposes of the question of usefulness for lightning conductors; for, not to mention other considerations, with such a resistance as this, the straw rod, if struck, would be instantly ignited, if not even blown to pieces by an explosive combustion.

The real question of most importance to a lightning rod is, however, not what will become of it after it is struck, but, strange as it may sound when first stated, what certainty there is of its being struck. Thus: Suppose it to be proved that a given rod if struck would carry to the ground all the electricity entering it, but that this same rod was far less likely to be struck than the adjacent gable of the house: What use would such a thing be as a protection? Evidently we have first to consider the conditions which will secure the striking of the rod in preference to anything else near it, and then it will be time to inquire as to its capacity to carry off the fluid when it gets it.

I have already indicated, on a previous occasion, and you have ably discussed, the very simple conditions involved in this first and most important problem. Briefly they are these: That the lightning rod should offer a path to the earth presenting many hundred times less resistance than any of the neighboring accidental paths, made up of metal pipes, rods, nails, bolts, hinges, stove pipes, gutters, and the like, interspersed with woodwork, human beings, and other destructible matter. The electric fluid, when it finds presented to it two equally good roads, impartially divides itself and sends half its substance by each route. If it finds two routes where the obstructions or resistances are as one to ten, then it sends ten times as much of itself by the easy as by the difficult road. In order that a rod, therefore, should keep all of a flash to itself, it must offer immensely superior inducements in the way of conduction to the ground. If it does this, then it is an absolute protection to all around it, and not otherwise. Now experiment has proved beyond a question that the conducting power of a given substance varies with its cross section or weight per running foot; and therefore, when we take a rod of some good conductor, such as copper, and make it thick and connect it thoroughly with the earth, we get an easy path to the earth, for any cloud-collected electric fluid. What we must do, moreover, is to make this path so easy that no chance road shall come anywhere near it for easiness.

Under the existing state of affairs, with the large quantity of metal used in our buildings, this can only be done when we have either a very thick rod or its equivalent obtained by uniting the rod near the roof to the very water, gas, and other pipes which would otherwise be its rivals. A conductor fulfilling the above conditions will always be easily able to carry all the electricity that strikes it. We constantly see recommendations of this or that form of rod because it has more surface, and electricity of high tension travels chiefly on the surface. Grant that this last statement applies in full force to lightning, yet we see that it is of no practical importance. Increase of surface will not diminish resistance or improve conducting power. This we know by countless experiments, and the opposite is not even claimed. If, therefore, a certain rod has not substance enough in it to make it an efficiently good conductor, squeezing or twisting it into any possible form will not do it any good in the direction of securing the attention of the lightning to it; and if it is not struck, of what comfort is it to believe that, if the lightning (which went into the house and set fire to it or killed the inmates) had only gone to the rod, it would have traveled to its own delight on the outside of the same? Lightning is not to be outmanœuvered cheaply in this way, either by a thin piece of metal, whose insufficient conducting power is *not* increased by giving it a ribbed surface or a spiral twist, nor by a non-conducting straw.

I have said nothing here of another way in which the low resistance of a lightning rod is effective, namely, in facilitating induction and thus charging itself and the air above it oppositely to the thundercloud, by which means the discharge is still further determined in the line of the rod. But this only adds to the force of my former argument in favor of good and abundant conductors.

In conclusion, I can only regard the French straw theory as a *canard*, though if it had originated in this State (N W Jersey) I should have considered it only the consequence of a verbal ambiguity, as we know that New Jersey lightning, moderately diluted, passes with great facility along a straw.

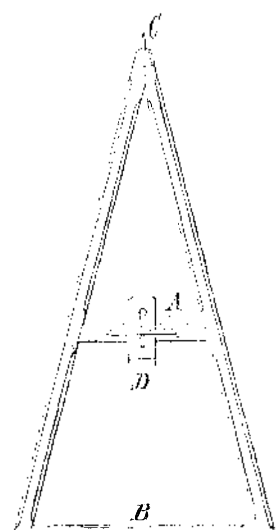
Stevens Institute of Technology. HENRY MORTON.

[Possibly some of our readers may not be familiar with the fact that apple whisky is known by the name of New Jersey lightning.—EDS.]

Grinding Plane Irons.

To the Editor of the Scientific American:

Seeing in a recent number of your paper a description of a device for equalizing the wear on grindstones, I send you an illustration of a holder for plane irons, chisels, etc., with which one man can both turn the stone and grind the tool much more accurately than by holding it in his hand.



A is a piece of spring steel, 8 inches long, bent at each end, with thumbscrew. You grasp the holder with the left hand, at B, sticking the point, C, into a board or the wall, at such a distance from the stone as to bring the iron, D, in the right position on the stone. By raising or lowering C, the bevel is regulated.

J. M. RICHARDSON.
East Cleveland, Ohio.

Cable Telegraphy.

To the Editor of the Scientific American:

In your issue of November 7, 1874, you publish a communication from Mr. T. A. Edison, Newark, N. J., referring to a paper read before the British Association by W. K. Winter, on an improvement in cable telegraphy. Mr. Edison says that the principle shown was invented by himself, and patented both in England and in this country some three years ago, and that it is used by the Automatic Telegraph Company. Permit me, as the consulting electrician of that company (and as owner of all the electro-chemical automatic telegraph patents used by said company), to deny *in toto* the above assertion, and to show how the case really stands, in order that Mr. Edison (as well as other parties) may know how it is himself.

In the first place, the party referred to, Mr. W. K. Winter does not claim any improvement in automatic telegraphy, but simply an improved method of operating a galvanometer or other receiving instrument by means of the induction coil and earth contact, wherein he uses the primary and secondary wires of an induction coil as a balance or Wheatstone bridge, whereby the increase of the current through the primary wire not only induces a current in the secondary wire, but causes a self-induced current to flow, being in fact an equivalent for the condenser with shunt helix. Mr. Winter's patent bears date December 6, 1872.

In the second place, Mr. T. A. Edison professes to claim (in an English patent under date April 26, 1873) one or more electro magnets in the shunt circuit, to neutralize the attenuations of the pulsations in the main line circuit, and bring the line to a normal condition, to prevent tailing upon the chemical paper of a chemical telegraph: in fact, an equivalent for a condenser with shunt helix.

In the third place, I claim (under patents of dates October 18, 1870, August 29, 1871, April 9, 1872, April 22, 1872, September 10, 1872, September 2, 1873) the use of electro-magnetic rheostats, rheostat overflow dams, condensers with shunt helices, or accumulators *per se*, in a shunt or branch circuit, in combination with an electro-chemical automatic telegraph, to bring the line to a normal condition, prevent tailing, and produce rapid work.

As a twenty years' subscriber to your valuable journal, I ask that you will do me the justice of inserting this my reply.

Passaic City, N. J. GEORGE LITTLE, C. E.

A SIMPLE PLAN OF VENTILATION.—The following simple method for ventilating ordinary sleeping and dwelling rooms is recommended by Mr. Hinton in his "Physiology for Practical Use": A piece of wood, three inches high and exactly as long as the breadth of the window, is to be prepared. Let the sash be now raised, the slip of wood placed on the sill, and the sash drawn closely upon it. If the slip has been well fitted, there will be no draft in consequence of this displacement of the sash at its lower part; but the top of the lower sash will overlap the bottom of the upper one, and between the two bars perpendicular currents of air, not felt as draft, will enter and leave the room.

IN causing anæsthesia by subcutaneous injections of chloral, M. Colin states that weak solutions should be used; and when forced into veins, the operation should be performed very slowly, so as not to cause syncope. Veins near to articulations should be avoided.

M. HANNECKER uses for the oxyhydrogen light (and obtains increased brilliance) a cylinder composed of carbonate of lime, magnesia, and olivine, compressed by hydraulic pressure. The olivine used is a natural silicate of magnesia.

Institution of Naval Architects.

The Institution of Naval Architects, John street, Adelphi, London, have issued the following list of subjects on which communications are desired:

1. On the construction and armament of ships of war.
2. The effect on naval construction of torpedoes or other modes of submarine attack.
3. On the life and cost of maintenance of merchant steamships.
4. On the preservation of the hulls and cargoes of ships from the effect of bilge water, leakage, condensation, and other causes of internal decay and corrosion.
5. On the disposition and construction of bulkheads, and on their attachment to the sides of iron ships.
6. On the masting of ships, and on iron and steel masts and yards.
7. On the ventilation of ships by natural and forced drafts, with details of any system in actual operation.
8. On the fouling of ships' bottoms and its prevention.
9. On machines for the economizing of labor in the construction of ships.
10. On the use of machinery for economizing labor on board ship, whether merchant ships or ships of war, and whether for loading or manœuvering.
11. On telegraphic or other communication of orders on board ship.
12. On the construction of slips and launching ways, and on the launching of large ships.
13. On the present state of knowledge of the strength of materials as applied to shipbuilding, with especial reference to the use of steel.
14. On methods for the proper strengthening of ships of extreme proportions, and on the precautions necessary to insure their safety at sea; also on the lengthening of ships.
15. On the straining effect of engines of high power on the structure of ships, and the arrangements necessary to obviate them.
16. On legislative interference with the construction, stowage, and equipment of ships.
17. The design, construction, and measurement of yachts.
18. On floating structures other than ships, such as docks, lighters, pontoons, and so forth.
19. On ships for special purposes, such as light ships, telegraph ships, cattle and special passenger ships, and others.
20. Actual measurements or records of sea waves; their hight, length, periodic time, and speed of advance; or their profiles.
21. On the results of the best modern practice in ocean steam navigation, with reference to the latest modern improvements, such as surface condensation, superheating, compound engines, and the like; also the value of each of these taken separately, and especially the results of any actual experiments to test this point.
22. On the friction developed in marine steam engines of different forms; and on the difference between the gross indicated horse power developed in the cylinder, and the net effective horse power available for the propulsion of the ship after working the air pump, slide valves, and other moving parts of the engine.
23. On economy of fuel in marine engines, with detailed results.
24. On methods for starting, stopping, and reversing marine steam engines of high power.
25. On marine boilers, their form, rate of combustion, and the proportion of their various parts.
26. Information as to the alleged rapid deterioration of marine boilers supplied with water from surface condensers, and the remedies for the same.
27. Exact information—either experimental or theoretical—on the efficiency of propellers.
28. On any novelties in the construction, equipment, or fitting of ships.
29. On any novelties in the construction, arrangement, or details of marine engines and propellers.

Iron Ore Bed in New York City.

We find it stated in several of our English contemporaries (and it will be news to most of our residents) that "some excitement has been aroused in New York by the discovery of a rich vein of hematite iron ore in the heart of the city, by some workmen who were digging foundations for a new building. The vein, which is 30 feet wide, was found at a depth of only 4 feet from the surface." We expect to hear, by the next foreign mail, of the erection of a smelting furnace at the mine "in the heart of the city."

We were led, by this startling announcement from across the water, to inquire into the facts of the remarkable discovery; and we learn that some laborers, engaged in digging a foundation on the corner of Washington and North Moore streets, struck a layer of scoria and cinders, the *débris* of some furnace, which had been used for filling in the ground a long time ago. Our reporter was shown some specimens of the "ore," deposited in barrels by the workmen, who seemed quite delighted at the sensation which their discovery had created abroad.

Curious Apples.

Doubts are entertained by some pomologists as regards the truth of the statement made that apples have been grown in which two or more varieties were blended into one, that is, apples having one section sweet and the other sour. We have seen such fruit and therefore know that it has been produced. A tree bearing apples of this nature formerly stood in a gentleman's garden in Georgetown, Mass. It was of large size, and in some years produced several bushels of ruit. The owner sold the apples as curiosities, and frequently individual specimens brought large prices. It was exceedingly interesting to examine the crop, as one apple differed widely from another, and there was difficulty in finding two precisely alike. A few were found in which almost exactly one half was sweet and the opposite sour, but a majority were made up differently. Sections, one quarter or one sixteenth, more or less, would be sweet or sour, and the remainder would be of the opposite kind. The line of demarcation on the skin was distinctly defined, the sour portion having a reddish color, while the sweet was of a pale green. There was no mistaking the flavor; the sour portion was very sour, and the sweet very sweet. On the same tree apples grew which were uniform in kind, some being entirely sweet and others entirely sour.

This pomological freak was brought about by a careful process of budding, two buds of different varieties being divided, and one half of each joined together, so as to adhere and grow in that condition. As none of this fruit has been seen of late years, we conclude that the tree has perished.—*Boston Journal of Chemistry.*

We can corroborate the foregoing, having ourselves seen them growing, and tasted apples that were sweet on one half and sour on the other. This was several years ago. The tree which produced this curious fruit was upon the premises of the Rev. Dr. Ely, of Monson, Hampden county, Mass.

PRACTICAL MECHANISM.

NUMBER XIII.

BY JOSHUA ROSE.

PISTON RINGS.

The tension referred to in our last (see page 293) is, in all probability, caused by the unequal cooling of the ring after it is cast.

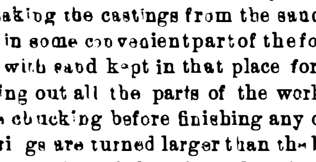
Iron and brass molders generally extract castings from the mold as soon as they are cool enough to permit of being removed, and then sprinkle the sand with water, to cool and save it as much as possible. The consequence is that the part of the casting exposed to the air cools more rapidly than the part covered or partly covered by the sand, which creates a tension of the skin or outside of the casting. The same effect is produced, and to a greater extent, if water is sprinkled on one part of a casting and not on the other, or even on one part more than on another.

It has already been stated that brasses contract a little, sideways, in the process of boring, and that work of cast metal alters its form from the skin of the metal being removed; this alteration of form, in both cases, arises in the case of a piston ring from the release of the tension.

It sometimes occurs that a piece of work that is finished true in all its parts may unexpectedly require a cut to be taken off an unfinished part (to allow clearance or for other cause), and that the removal of the rough skin throws the work out of true in its various parts, as, for instance: a saddle of a lathe being scraped to fit the lathe bed, and its slides finely scraped to a surface plate; or the rest itself being fitted and adjusted to the cross slide of the saddle. If, when the nut and screw of the cross slide are placed in position, the nut is discovered to bind against the groove (of the saddle) along which it moves (the nut being too thin to permit of any more being taken off it) there is no alternative but to plane the groove in the saddle deeper, which operation will cause the saddle to warp, destroying its fit upon the lathe bed, and the trueness of the Vs of the cross slide, and that to such an extent as to sometimes require them to be refitted.

The evil effects of this tension may be reduced to a minimum by taking the castings from the sand and placing them in a heap in some convenient part of the foundery, and covering them with sand kept in that place for the purpose: and by roughing out all the parts of the work which are to be cut at one chucking before finishing any one part.

Piston rings are turned larger than the bore of the cylinder which they are intended to fit, and, as before stated, sprung into the cylinder. The amount to which they are turned larger depends upon the form of split intended to be given to the ring; if it be a straight one, cut at an angle to the face of the ring, which is the form commonly employed, the diameter of the ring may be made in the proportion of one quarter inch per foot larger than the bore of the cylinder, sufficient being cut out of the ring, on one side of the split, to permit the ring to spring in to the diameter of the cylinder, when the ring may be placed in the cylinder and filed to fit, taking care to keep the ring true in the cylinder while revolving it to mark it. But if the ring is intended to be of the form here illustrated, the ring must be made of a larger proportionate diameter, the proportion depending upon how much the ends of the ring are intended to lap each other, the lap being from *a* to B, in Fig. X.

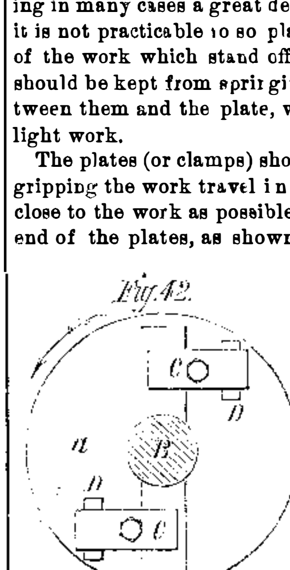


There is more work entailed in giving a piston ring this form of split, but it is undoubtedly superior to the plain one. Another plan to give spring to a piston ring is to turn it to the same diameter as the bore of the cylinder, and then to pene it all round on the inside face (that is, the bore), the result being that, when the ring is sawn in two (which is all that is necessary in this case), it will spring open and be of a larger diameter. When, however, it is placed in the cylinder, it will require to be sprung together again to the diameter to which it was turned (the split being open to the width of the split cut by the saw), so that it will not require much, if any, filing to fit it to the cylinder.

LATHE WORK.

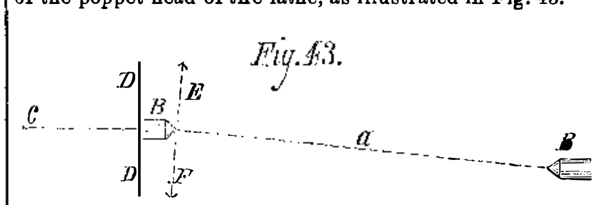
When bolts and plates are employed to hold rough work, care must be taken to place the plates over those parts of the work which touch against the chuck or face plate against which the work is bolted; or the pressure of the plates on the work will spring it, and when it is taken out of the lathe (or other machine) it will spring back to its original position, and the part that has been cut will be no longer true, causing in many cases a great deal of unnecessary vise work. If it is not practicable to so place the plates, then those parts of the work which stand off from the face plate or chuck should be kept from springing by having wedges driven between them and the plate, which is of great importance in light work.

The plates (or clamps) should be so placed that the ends gripping the work travel in advance, the bolts being kept as close to the work as possible and the packing at the other end of the plates, as shown in Fig. 42. *a a* represents the chuck plate, B is the work, C C are the plates, and D D are the packing pieces. Heavy cast iron work requiring much turning to be done to it between the centers should have wrought iron plugs screwed on the ends, and the centers put into the wrought iron; because centers, if of cast iron, cut, and soon run out of truth. Before boring or turning work that is chucked, if there is sufficient room, put a rod of iron between the centers to counteract any end play there may be in the spindle of the lathe. In applying a steady rest, be careful not to put an unequal strain on the work by screwing any of the jaws tighter than the others, or it will spring the work out of the straight line, in which case the cut taken by the tool will not be parallel. When there is sufficient room, use a boring bar with a small tool in it for boring holes; for the extra strength of the boring bar enables the tool to take a heavy cut, which a boring tool having a slight body would not do, in consequence of the springing.



If work chucked in a lathe is much heavier on one side than on the other, bolt a weight on the chuck (near the light side of the work) sufficiently heavy to counterbalance it, otherwise the centrifugal force generated by the revolutions of the heavy side of the work will cause it to revolve eccentrically, and to be in consequence turned untrue.

In turning a cone on anything which is held between the centers of the lathe, the dog or clamp used to drive the work must be so placed as to be able to move to accommodate the varying angle of the center line of the work to the center line of the poppet head of the lathe, as illustrated in Fig. 43.



The dotted line, *a*, represents the center line of the work; B B are the lathe centers. C is the center line of the poppet head of the lathe, D D is the chuck plate, E is the position of the center line of the dog or driving clamp at one side of the lathe center, and F is its position when the lathe has made one half of a revolution; from which it will be perceived that the tailstock of the lathe, being moved out of the center line of the headstock of the lathe, the end of the dog or clamp which is driving the work advances toward and recedes from the chuck plate at every revolution, and liberty must therefore be given it to move in that manner.

In boring brasses for journals, place a piece of sheet tin in the joint of the brasses, and bore them the thickness of the tin too large, which will make them fit well on the crown when the tin is taken out; for brasses bored with the joints close together always bind on the sides, and will not fit down on the crown without being filed.

The same end may be attained by boring the brasses a trifle too large, so that filing a little off the faces of the joint will let them together and down on the crown; but the above described plan is the best.

The amount of shrinkage to be allowed for contraction, on holes in cast iron of two or less inches bore, should be so little that, the outside callipers being gaged to touch the shaft very lightly and the inside callipers or gage to touch the hole only sufficiently to feel the touch, you can just see plainly between the two when they are placed or gaged together.

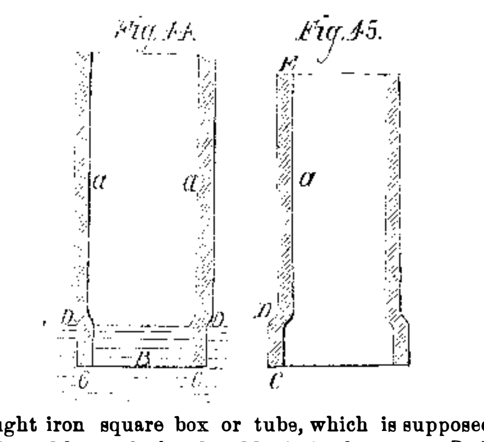
For larger sized bores, proportionately increased allowance should be made, so that a hole of 12 inches diameter will have less than $\frac{1}{64}$ of an inch of shrinkage. Wrought iron may be given a little more shrinkage, and steel one half less in the case of the 12 inch hole.

EXPANSION AND CONTRACTION.

Much labor and expense may often be saved by employing the principles of expansion and contraction to refit work For instance, suppose a bolt has worn loose: the bolt may be hardened by the common prussiate of potash process, which will cause it to increase in size, both in length and diameter. The hole may be also hardened in the same way which will decrease its diameter; and if the decrease is more than necessary, the hole may be ground or "lapped" out by means of a lap A lap is a mandril used to grind holes which are not quite true, are a trifle too small, or have been hardened and cannot therefore be cut by a tool A lap may be simply a piece of rod copper, or an iron mandril with tin or lead cast around it. The diameter of a lap should be turned to be an easy fit at both ends in the hole and a trifle larger in the middle, so that the hole which it is intended to grind will fit tightly on the middle of the mandril, the latter being about three times the length of the former.

The operation is to place the lap through the hole which it is to grind and then between the centers of the lathe; then, while the lathe is running at a high speed, supply the lap with oil and grain emery, moving the work back and forth along the lap until it will pass easily from end to end, when the lathe may be stopped and the lap indented with a cold chisel, and supplied with oil and emery, and the grinding operation proceeded with as before. The work should be held upright and on each side of the lathe alternately, so that its weight shall not cause the grinding to be excessive on one side of the hole. Only about $\frac{1}{64}$ of an inch of shrinkage can be obtained on a hole and bolt by hardening, which, however, is highly advantageous when it is sufficient, because both the hole and the bolt will wear longer for being hardened.

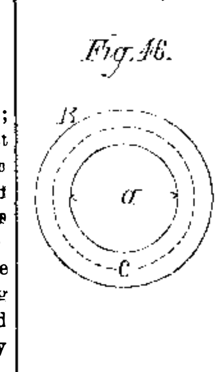
For closing long holes, boxes, etc., the water process may be employed, as represented in Fig. 44. *a a* is the section of



a wrought iron square box or tube, which is supposed to be made red hot and placed suddenly in the water, B, from its end, C, to the point, D; the result is that the metal in the water, from C to D, contracts or shrinks in diameter, and compresses the hot metal immediately above the water line, as the small cone at D denotes. If then the box or tube is slowly immersed in the water, its form, when cold, will be as described in Fig. 45, that part from C to D maintaining its original size, and the remainder being smaller.

It must then be reheated and suddenly immersed from the end, E, nearly to D, until it is cold, and then slowly lowered in the water, as before, which will contract the part from D to C, making the entire length parallel but smaller, both in diameter and bore, than before it was thus operated upon.

Small holes to be reduced in bore by this process should be filled with fire clay, and the faces nearly or wholly covered with the same substance, so that the water will first cool the circumference, as shown in Fig. 46 *a* represents the hole, B the circumference of the washer supposed to be operated on, and the dotted line, C, the fire clay filling the hole and nearly covering the face; so that the part not covered will cool first, and, in contracting, force inwards the metal round the hole, which is prevented from cooling so quickly by the clay and therefore gives way to the compressing force of the outside and cooler metal.



This principle may be made use of for numerous purposes, as for reducing diameters of the tyres of wheels, reducing the size of wrought iron bands, or for closing-in connecting rod straps to refit them to the block end, the mode of operation for which is, in the case of a rod whose strap is held by bolts running through the block and strap, to bolt the strap on the rod to prevent it from warping, to then heat the back of the strap, and (holding the rod in a vertical position) submerge the back of the strap in water to nearly one half its thickness.

If the bolts are not worn in the holes, or if the strap is one having a gib and key, they may be merely put into their places without placing the strap on the rod. Even a plain piece of iron shrinks by being heated and plunged into water, but only to a slight degree, and the operation cannot be successfully repeated. Eccentric rods which require to be shortened, say $\frac{1}{64}$ of an inch, may be operated on in this manner, in which case care must be taken to immerse them evenly so as not to warp them.

Prizes for Essays.

The Academy of Arts, Science and Belles Lettres of Caen, France, offers a prize of eight hundred dollars for an essay on the subject of the functions of leaves in the vegetation of plants. A dissertation on the present state of science on this question, including the results of personal experiment, showing new facts tending to confirm or modify the doubtful points in theories now admitted, is required. The papers must be submitted before January 1, 1876.

Another prize, of one hundred dollars, is offered by the Academy of Sciences of Rouen, for a treatise on the advantages to be obtained by the conservation and improvement of cider by the employment of the processes of heating now applied to wines. The award will be made during the coming year.