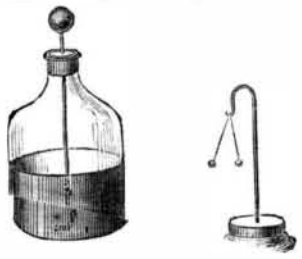
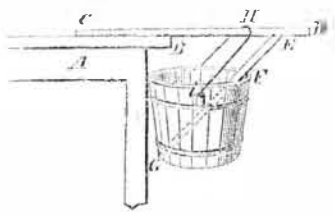
Continuing our electrical experiments, we have, in the accompanying illustration, two pieces of apparatus that will serve to illustrate the principal laws which this force obeys. The first is a bottle, covered inside and outside, about three-quarters its hight, by tin-foil, and having a metal rod passing through its cork, being connected by a piece of chain with the round ball or loop outside. It is called the *Leyden jar*, because it was supposed to have been contrived by M. Cunæus, of the city of Leyden, at the close of the year 1745; but Dr. Priestley ascribes its discovery to Mr. Von Kleist, dean of the cathedral of Camin, who announced its phenomena in the same year.



It acts as a reservoir of electricity. If the ball be presented to the prime conductor of the electrical machine, a series of sparks will pass from the machine to the jar, and will, so to speak, accumulate on the interior tinfoil. It would be more proper, perhaps, to say that the inside of the jar becomes in a higher state of excitement than the outside, and in consequence, if, after many sparks have passed into it, the outside is grasped in one hand and the finger of the other presented to the ball, a powerful shock will be felt, having just the force of the sum of the small shocks which have passed into it. The force being in a more active state inside than out, seeks through the best conductors (your arms) to regain its equilibrium; and so powerful is the effort which electricity makes to be always equal, that should you go on charging a Leyden jar, without discharging also, it would discharge itself through the air, making that its conductor.

The little stand also in the illustration is for the demonstration of attraction and repulsion. A bent wire may be inserted in a piece of wood, and two pith balls connected by a bit of silk may be thrown over a hook at its extremity. Take a piece of sealing-wax and rub it on your coat sleeve, then apply it to one ball, which will instantly fly to it, and then as suddenly fly away, and communicate its electricity to the other ball. The explanation of this is, that the sealing-wax, having more electricity than it wants, *attracts* the pith ball, and when that has got its fill of the same kind of electricity, *repels* it, thus demonstrating a great, if not the greatest law of this force, and which, with the simple apparatus we have described, our young readers can prove in a variety of ways; this law is, that bodies similarly electrified *repel* each other, while bodies differently electrified *attract* each other.



To change the subject entirely to a seeming wonder, we will tell you how to support a pail of water by a stick, only half of which, or less, rests upon the table. Let A B be the top of the table, and C D the stick which is to support the bucket. Place the handle of the bucket on the stick in such a manner that it may rest on it in an inclined position, as H *i*, and let the middle of the bucket be a little within the edge of the table; to keep this apparatus properly in its situation, place another stick, E F G, with the end resting against the bucket at the bottom, its middle, F, resting on the opposite top edge of the bucket, and its other extremity, E, against the first stick, C D, in which a notch must be cut to retain it. The bucket will thus be kept in its situation without inclining to either side, and if not already filled with water, it may be filled with safety.

Lamson's Combination Tool.

The tool represented in our engraving is a combination of many, and is remarkable for its compactness and portability. It contains a punch, a screw-driver, an awl, and two square screw wrenches of different sizes. It is applicable as a *vade-mecum* to the wants of the machine-shop, factory, store, hotel, household and office, and will be a great aid to mechanicians who travel from city to city doing light work.

In our engravings, Fig. 1 represents it open, showing all its parts, and Fig. 2 shows it as closed, to go into the pocket or box.

A B, A′ B′ are two arms of a pair of pincers pivoted together at *c*, and provided at the short end, A′, with a punch, D, fitting into a corresponding recess in B′; in each of the short arms is cut a V-shaped recess, which when closed makes a square screw wrench, *a*. Close to the pivot on the longer arms is another [illegible] wrench of a different size, *b*. Each of the arms, A B, has [illegible] cut in it, and in these recesses fit the tools, E and F; the awl, E, being pivoted to the end of A, so that it can turn and fold back, as in Fig. 2; to B is

Fig. 1

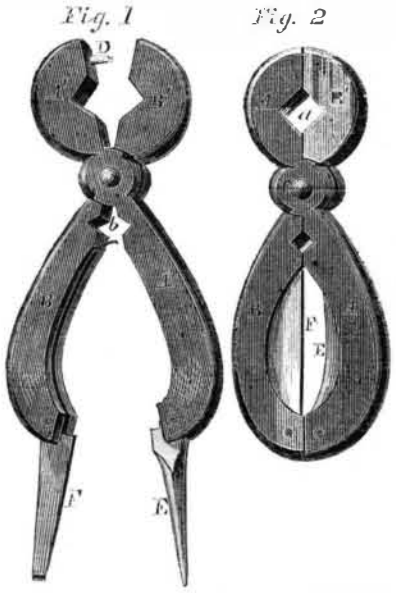


Fig. 2

pivoted a screw-driver, F, which can also fold back when not in use; a spring is arranged at the back of these recesses to open the pincers. The recess is so cut at the end of the long arms that it forms a step or support for the tool that is in use; the tool that is shut up leaving sufficient room for it to fit partly into its recess, so that both arms have a hold upon it.

It is a combination of the most useful tools, and was invented by D. A. J. Lamson, of New Worcester, Mass., who will give any desired information. It was patented September 15, 1857.

Skagg's Method of Tightening Tires.

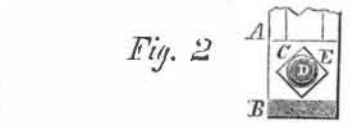
The old method of making a tire perfectly round, and having its ends welded together, and while expanded by heat placing it on the wheel, which, by its contraction in cooling, it tightly grasps, is open to the objection that when the wheel shrinks from dryness, or expands from moisture, the iron tire does not equally expand and contract; so that sometimes it is too loose, and at others too tight, on the wheel. This has been, in some measure remedied by having the ends of the tire, instead of being welded together, connected by a screw, so that they may be brought closer together, to compensate for the shrinking of the wheel. Although possessing many advantages, this method is open to the serious drawback, that an imperfect joint is caused by the space between the ends of the tires. A cap has been fitted over the joint to remedy this difficulty, but has not perfectly succeeded.

Our illustration represents a method invented by N. J. Skaggs, of Talladega, Ala., by which all the advantages of a tire that can be tightened are obtained, and at the same time an almost unbroken or continuous joint is made in any position of the tire.

Fig. 1 is a side view of the improvement, and Fig. 2 a cross section of the same. A A are the fellies of a wheel, constructed in the usual way. B is the tire, which is shrunk on the wheel as we have described above; the ends are not united by a weld, but have

Fig. 1

Fig. 2



square heads, C C, formed on them, one on each, the heads being formed on the inner side of the tire, their outer ends abutting against the opposite ends of the felly, A, which are not connected (see Fig. 1). D is a rod, having a right and left screw thread formed on it, and a square, E, in its center. The screw portions of the rod pass into the heads of C C′, and connect the ends of the tire. These ends are so arranged at their surfaces, *c c′*, as to form a "lap joint," that is, a recess is formed on one head, *c′*, and the piece, *c*, of the other head overlaps it.

From this description it will be seen that a continuous joint or connection is formed, and that the bolt, D, is protected without the use of a cap or socket. The square, E, is turned by an ordinary screw-wrench, which by turning D, draws C C′ nearer together, or further apart, so that the tire may be always kept tight on the wheel.

It is a very simple and complete contrivance. Further information may be obtained by addressing Mr. Skaggs, as above. This tire was patented November 3, 1857.

Performances of Mill Engines.

Messrs. Editors—We have seen a number of statements in the Scientific American relating to improvements in steam engines to save fuel, but we do not recollect seeing any statements regarding the amount of work performed with a given amount of fuel, which would give those who are not acquainted with a steam engine, a better idea of its power and fuel-economizing qualities than merely to state the amount of fuel consumed per horse power.

We have put into a grist mill which runs three pairs of stones (two of four, and one pair of three feet) an engine, the cylinder of which is 10 inch bore and 24 inch stroke, making 150 revolutions—or 600 feet velocity of piston—per minute. The boiler of it is 20 feet long, 48 inches in diameter, has one 24 inch flue, and is set in a brick arch. On an average, it consumes one bushel of bituminous coal to grind ten bushels of wheat or rye. When the grain is dry, the engine will grind 200 bushels of wheat or rye with 20 bushels of coal, but when the grain is damp, it will not grind quite so much. We do not think this is so much work as can be performed with a boiler of superior construction, but there are grist mills running in Western Pennsylvania which consume 50 bushels of coal in grinding 200 bushels of grain. We would like to see some statements of what a low-pressure condensing steam engine can do, or has done, in grinding grain, with the amount of fuel consumed.

Hamblin & Heath.

West Greenville, Pa., February, 1858.

[The above letter relates to a very important question. From the statements regarding the fuel consumed and work done by an engine, however, we cannot receive a proper idea of its *power*, but a very just idea of the *duty* it performs. For example, if an engine grinds 200 bushels of grain in five hours, and consumes 20 bushels of coal to do so, its power will be twice that of an engine which consumes only half the amount of fuel, but takes ten hours to do the work. The power of engines is a different question from that of the duty of engines, which latter merely takes in two elements of calculation, namely, the amount of work done by a certain quantity of fuel. It is upon this principle that the Cornish engines are judged. Our correspondents are perfectly right, however, in considering the boiler as part of the engine—it is the principal part; and we think their communication should do good, in leading those to look into the subject who have steam engines performing so small an amount of duty as those referred to in Western Pennsylvania. Besides the construction of the engine, the arrangement of the gearing, shafting, &c., should always be given, because much power may be expended in overcoming unnecessary resistance, friction, &c., by a bad arrangement of the machinery.—Eds.

A chair was patented Feb. 16th, which will continually give currents of cool air on alternate sides of the operator, by the person simply moving the chair—a pleasant and easy motion—three inches from right to left and *vice versa*. The inventor is L. R. Breisach, of this city.