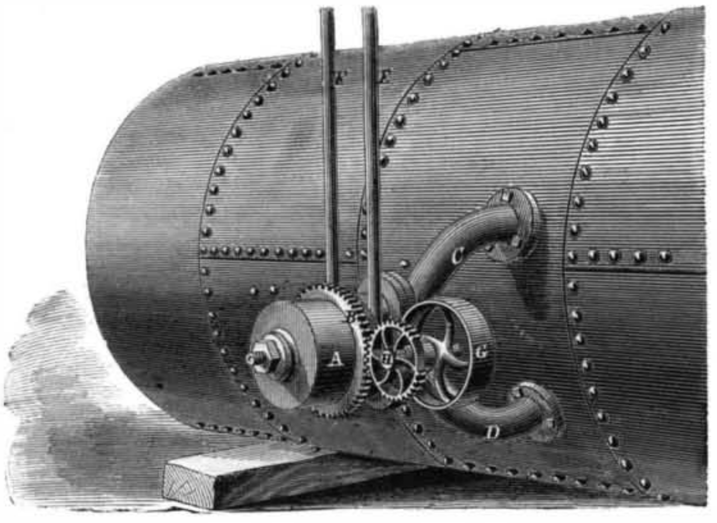
Patent Boiler Feeder.

Force pumps for feeding boilers are not always reliable, and even when the adaptation of the principle and the workmanship of the pump can be depended upon, constant oversight and care is required. For these reasons an automatic feeder for steam boilers has been considered a great desideratum. There are some devices which have been used and are now employed for this purpose, which by many are considered improvements on the ordinary force pump. The engraving illustrates, in perspective, one of these plans which has received strong commendation.

It is an automatic boiler feeder which is operated by the live steam of the boiler. The chamber, A, revolves on a spindle, and is furnished with a toothed disk, B. The chamber is kept in position by means of a nut and a steel washer which is hollow, or concave, and acts as a spring. The face of this chamber abuts on a plate to which the pipes, C and D, communicating respectively with the steam and water space of the boiler, are connected, and also with the pipes, E and F, communicating severally with the external atmosphere and with a water tank. The chamber, A, is furnished with two apertures, opposite each other, which, by its revolution, are brought intermittently in contact with apertures in the pipes, C, D, E, and F.



WIDGEON'S BOILER FEEDER.

The revolutions of the chamber, A, are produced by means of the pulley, G, and pinion, H. The pinion has a portion of its teeth on opposite sides cut away to allow the action of the chamber in taking the water to be forced into the boiler, and in expelling the steam contained in the chamber.

One of the apertures being opposite that of the pipe leading from the water pipe, the other corresponds with the open air pipe, allowing the steam in the chamber to be expelled and the water to fill the chamber. A partial revolution closes these ports and opens those from the pipes, C and D, by which the steam from C forces the water through D into the water space of the boiler. This process is repeated indefinitely.

Patented March 13, 1866, by J. R. Widgeon. For additional particulars address Frederick E. Frey, Bucyrus, Ohio.

Vulnerability of Iron-clads.

In our issue of Oct. 20 we briefly commented on the experiments at Shoeburyness, with the Woolwich nine-inch gun and the Palliser chilled shot, expressing the opinion that the London *Times* was not correct in deducing, from the penetration of the eight inches of iron plating with its eighteen inches of teak backing, the conclusion that the supremacy of iron-clads was ended. We stated that it was doubtful if the Shoeburyness target was equal in resisting power to our monitor turrets of twelve inches of iron, which could be increased to twenty-four inches.

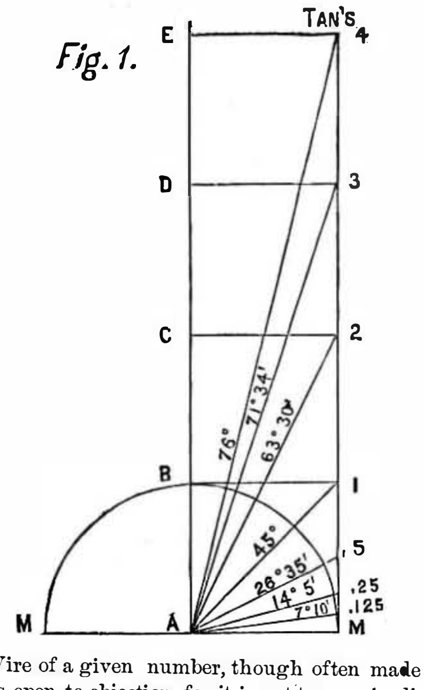
Mr. John Bourne, in a letter to the *Engineering*, substantially agrees with these remarks. He says: "If the 9-inch gun, with 45 lbs. of powder, can pierce an 8-inch plate with 18 inches of teak backing, when furnished with the Palliser projectile, what effects may we not expect from the 13½-inch, 15-inch, and 20-inch guns when firing similar projectiles with from 70 to 120 lbs. of powder? In my opinion, the side armor of modern iron-clads should not be much less than 18 inches thick, backed by three or four feet of oak, and by the monitor system of construction this thickness is attainable on a displacement similar to that of the *Bellerophon*. The turret should be 24 inches thick, and should carry two 20-inch wrought-iron guns. Such an iron-clad, it might fairly be expected, would remain secure from penetration for some years. But 8-inch or 10-inch armor cannot be expected to keep out the shot fired even from existing guns, to say nothing of the more powerful guns which the next few years will be sure to bring forth. Why should we leave any thing in doubt in so vital an affair? Why should we, with our knowledge of the growing power of ordnance, so adjust our means of resistance as to be hardly able to withstand even its present force? With our present knowledge of what guns, even of moderate size and with moderate charges, can do, it would be quite inexcusable to allow ourselves to be again taken by surprise in this matter; and I maintain that any thickness of armor, much less than what I have specified, would be futile, and should not be contemplated at this time of day."

THE ANTHISTOMETER OR MEASURER OF RESISTANCE.

At a late meeting of the Polytechnic Association Dr. L. Bradley presented the following article in introducing his combined tangent galvanometer and rheostat, an instrument designed for conveniently and accurately measuring the resistance which conductors of electricity oppose to the free transmission of currents.

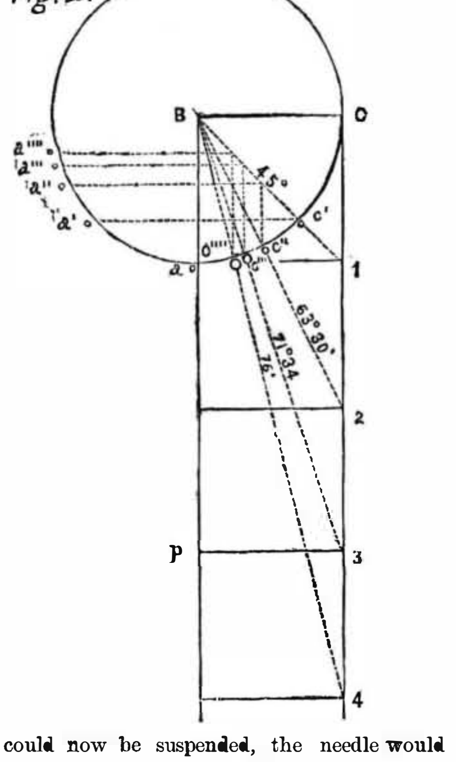
The subject of a uniform standard of resistance has long engaged the attention of electricians, but without arriving at satisfactory results.

Fig. 1.



Wire of a given number, though often made use of, is open to objection, for it is apt to vary in dimensions and resistance. The standard unit of this instrument approximates one mile of No. 8 iron wire. In construction it consists of coils differing in resistance from one-quarter of a mile to 150; which, by means of switches, may be increased to 1,200, and the graduated sliding bar subdivides the one-quarter of a mile into hundredths. The true tangent galvanometer should measure the strength of a current in circulation, as directly proportional to the tangent of the angle of deflection. Common galvanometers do not fulfill the requisite conditions for this, for the adventitious force which is sent through the galvanometer coil never acts with the same uniformity upon the needle in all its deviations as the terrestrial magnetism does, for when the coil is narrow and the needle long, the inductive influence upon the needle is greatest when at or near the meridian; but, as it deflects, its extremities pass away from the rays of induction, and its deflections grow less and less, so that the rule is no longer in force. To obviate this difficulty, he first made a coil of four layers whose width equaled the length of the needle; but now the difficulty was in the opposite direction. Upon reflection, the expedient presented itself of making a compound needle composed of several thin flat needles fixed upon a light flat metallic ring, so as to form a complete circular disk having indexes to show the degree of deflection. The compound needle polarized and mounted was found to move with great celerity, and being under the influence of the same number of convolutions in all its deflections, will fulfill the conditions required in demonstrating the theorem that the intensity of currents is proportional to the tangent of the angles. The following is the verification: Let A M, in the annexed diagram, geometrically represent the force of the terrestrial magnetism which is made the unit of directive force. If an electric current be sent through the galvanometer coil, whose directive force, A B, equals the terrestrial force, the tendency would be to direct the needle in a perpendicular line. If this

Fig. 2.



force could now be suspended, the needle would point due east and west, but the combined action will direct it to the point, 1; this cuts the quadrant at 45 deg., the line M1 being the tangent of 45 deg., which is 1. Increase the intensity to twice this force, and represent this by the line A C, then the force A M and A C will direct the needle to the point; 2, applying the quadrant, we find this line cutting the circle at 63 deg. 30 min., of which the tangent is 2. We may increase the parallelogram erected on A M at pleasure, and the combined forces will always cause the needle to point diagonally to the opposite angle, whose hight is the tangent of the angle of deflection. It is generally admitted that the correlation of forces in magnetism is the same as that of gravity, each within its sphere, the former finite, the latter co-extensive with the universe. Let us suppose that to a graduated wheel (Fig. 2) we attach a pound weight at *a*, it will take a position in the plumb line. We may consider this pound weight to be a constant unit of force corresponding to that of terrestrial magnetism in Fig. 1. If we attach at C, a force equal to *a*, the two are then related the same as A M and A B, in Fig. 1, and will stand equally distant from the line of centers of gravity at *a'* and *c'*, the wheel having turned just 45 deg. By doubling the force, it will descend to *c''* and the weight *a'* will ascend to *a''*, that is just twice the distance from the line of centers as c", is found, and the plumb line, it is seen, cuts the wheel at 63 deg. 30 min., whose tangent is 2. It is unnecessary to multiply examples, to show that whatever be the force, the distance of the weights from the line of centers will be inversely proportional to the weight, and the plumb line will cut the wheel at the degree whose tangent is directly proportional to the weight, therefore the intensity measured, by the true tangent galvanometer, is proportional to the tangents of the angles of deflection of the needle. To prove the accuracy of my galvanometer, I will give the results of five observations. This instrument has three coils, the first for intensity consists of three layers of No. 32 copper wire, giving 3·1 mile resistance; the second, for common mixed currents, has one layer of No. 28 wire, resistance of .4 mile, the remaining coil for quantity alone, is a simple plate of copper whose resistance is entirely null. The power employed was four cups of Hill's battery, passed through the first coil, then through coil No. 2, against resistances differing from 4·1 to 151·1. Isodynamous, or equally intense currents, being obtained, the resistances introduced were 4·1 11·1 41·1 81·1 and 151·1 mile. The tangents of the deflection of No. 1, from 75 deg. to 8 deg. 30 min., divided by those of No. 2 from 40 deg. 10 min. to 2 deg., gave the quotients 4·4 4·3 4·4 4·44 and 4·3. Such results give indications of a very true tangent galvanometer, equaling in accuracy the large, cumbersome and inconvenient instruments that have formerly been used. By intricate computation and by means of tables, results sufficiently reliable for ordinary purposes may be obtained from the common galvanometer, but the labor and difficulty attending such methods render them unavailable for practical use. To employ this improved galvanometer and rheostat for testing the power of a magnet, pass a current through, and note the deflection of the galvanometer, then switch off the current through the resistance coils of the rheostat until the needle settles at the same degree as when on the magnet, the figures on the rheostat corresponding to this degree will show at a glance the resistance. For determining the resistance of a battery cup, pass the current as before, then reverse the poles, thus the mean or average deflection can be obtained and compared in the same manner as when determining that of a magnet.

Squaring the Circle.

From L. D. G. we have an article, in which he claims the solution of the long-mooted problem of "squaring the circle." Upon a critical investigation of his process we think he has misunderstood the problem itself. It is essentially a geometrical, and not a mathematical problem. We regard the squaring of the circle as a question belonging to a similar class with the *ignis fatuus* of the perpetual motion, and like that, incapable of practical demonstration. The efforts of our correspondent seem to have been directed to forming a square of the same area of a given circle. His operation is simple, being merely the finding of the area of a circle from its diameter, and the elimination and defining of the lines of a square containing the same amount of surface. His rule for it is this: "To find the circumference of a circle take eleven-fourteenths of the diameter and multiply by four; or in other words, take forty-four fourteenths of the diameter, which gives the circumference." For large circles this is approximately correct and is easily worked. For small circles of a few inches the fractions will hamper and annoy. The area he finds by "multiplying eleven-fourteenths of the diameter by the diameter. Seven-elevenths of the area of the circle is the area of the square contained in the circle. The square root of the area of the circle will give the sides of a square equal in area to the circle."

There are no sums representing equally any portion of a circle and the sides of a square, so the attempt to make the two coincide must be forever futile. The decimals for finding the circumference of a circle usually employed are 3·1416+. These may be carried to 3·14159265+, and so on indefinitely, even so far as to two hundred places of decimals, as in the *Engineer* of Sept. 28th. It is manifest that the process may be continued forever, and as no coincidents can ever be found between the elements of a circle and those of a square, the idea of squaring the circle by a geometrical solution is vain.

Correspondence.

Salvation of Ships in a Gale.

MESSRS EDITORS:—The occasional occurrence of one of those terrible disasters at sea, the loss of a passenger steamship by losing control of the ship, leads to the inquiry whether there cannot be some practicable means provided or devised to meet these particular emergencies. If the engine of a steamship breaks down during a hurricane, she is lost, no matter how strong she may be or how well appointed; she becomes a helpless mass, lying in the troughs of the sea and presenting her whole broadside squarely to blows which are capable of tossing five and ten-tun blocks of granite about like cord wood; and it is only a matter of a few hours' time for the best of ships to be battered and beaten to pieces.

The loss of the *Evening Star* is owing directly to her becoming unmanageable—her rudder chains became jammed, and being uncontrolable, she was, as a matter of course, soon battered to pieces. The *Great Eastern* broke her rudder a few years since, and was nearly lost, and had she been caught in a regular hurricane she would have been ignominiously beaten to pieces like any other ship. The ship was never yet made that could survive, for any length of time, under such conditions. It was so with the fine new steamship *San Francisco,* which sailed from New York in 1853, bound around Cape Horn for California, with a regiment of United States troops on board; she was overtaken in the Gulf Stream by a heavy gale, and being crippled became unmanageable and at the mercy of the elements, and was soon so battered that the force on board, by bailing and throwing out cargo, could barely keep her afloat for a day or two until ships at hand could get an opportunity to take them off the wreck. While lying in this crippled state, by one single blow of those terrible seas, one hundred and seventy-nine souls, officers and soldiers, were washed overboard and lost. I believe there is a remedy for such cases. If a ship can be kept head to sea, or nearly, so that a sea must strike her sides at an angle, then the whole aspect becomes changed, and a bad sea becomes comparatively harmless; besides, the motion of a ship becomes much less violent, which not only lessens the strains upon her hull but gives the crew a better opportunity to do something toward repairing or preventing damages. Sailing ships are less liable to become entirely unmanageable than steamers, as, if they ship a sea, no fires are put out, and if one mast or sail gives out they have others left; if the rudder becomes broken or disabled the ship can be managed to a considerable extent by the sails, independent of the rudder, while, if a steamer loses the use of her rudder, what sails she has usually are of little consequence with heavy wheels dragging in the water.

Every passenger steamship should be obliged to carry a heavy iron drag for "lying to" by in such emergencies; this drag should be made in such form that it could be used ordinarily as a water tank, so as not to be useless lumber in the way. It should be braced and made sufficiently strong to stand an external pressure of about 100 lbs. to the square inch, and have a heavy ring bolt in each end; and when such an emergency should arise as to require it as a drag, then the tank should be emptied and closed water tight and shackled to one of the anchors by a chain say 50 feet in length. The tank having been bundled overboard, the anchor is then let go in the ordinary way. After one or two "shots" of chain cable have been paid out, a second tank or drag can be shackled to the cable as before. With several of these drags distributed at intervals, a very elastic mooring would be obtained, owing to the nature of its construction. With two chain cables shackled together and out ahead, with such drags attached, the *San Francisco* and *Evening Star* would have made good weather of it instead of being battered to a mass of kindling wood. Keep a ship head to sea and she will "live forever." These drags are no new experiment, but have at one time and another saved many a vessel. Spars, or something of the sort, are usually lashed to an anchor and let go.

The complaints of the papers about the life boats of the *Evening Star* rolling over and over after being launched, and of the ship being lost when the life boats would float, are all nonsense. These disasters will always occur as often as a steamship breaks down at sea in very heavy weather, and becomes unmanageable. M.

New York, October, 1866.

Iron and Steel.

MESSRS. EDITORS:—The pneumatic or air-blast process, for the conversion of crude molten iron into refined iron or steel, and refined steel ingots, fit for forging or rolling purposes, is now beginning to be brought into practical use by our iron and steel manufacturers. In England the same process has been in use a few years longer than in this country. The quality of our American pig iron is admitted to be well adapted to the use of the air-blast process as a decarbonizing and refining agent for converting crude iron into ingots fit for the forge or the rolls. And our American pig is of superior quality to the English metal made with coke. This mode of converting crude iron with air blast was patented in England by Henry Bessemer in 1856, and for the past few years has gone into general use in that country for the manufacture of refined steel, T-rail, locomotive tire, car axles, boiler plate, etc. The invention was patented in the United States by Christian Shunk, and for which he holds three several Letters Patents, commencing August 28, 1854, and has, therefore, prior title to any in Europe or in the United States; and having discovered and experimented in the use of said process many years previous to that date.

The alleged discovery of Robert Mushet, of England, claiming the use of "manganese and carbon" in the manufacture of steel, is old, the same having been patented in England many years before [see 2d Curtis page 330], and has always been used by steel manufacturers in England and in this country. Nor is it new to add carbon to iron at a high heat to produce steel, which Mushet describes in his alleged patent. That iron, at a high heat, will combine with carbon, and thereby produce steel, has always been known and practiced by steel manufacturers, and is as old as iron and steel itself. And the same mode has always been practiced in the manufacture of steel, by the "black-lead crucible" process for making steel, by adding carbon to combine with the fluid iron in the crucible to produce steel for molding into ingots for forging.

In my pneumatic process, by continuing the air blast a few seconds longer to reduce the carbon, more carbon, or crude metal containing carbon, can be added to increase the carbon again to the kind of yield desired, which goes to show the utility and simplicity of the patented invention; and the same is protected in every mode, and so decided by our courts in similar cases. [2d Curtis. Nisely *vs.* Harford. See also Forsyth's patent, same book, page 109]. It would be just as novel for Robert Mushet to patent the common mode for welding a particular kind of iron or steel by the use of borax—and that would be no novelty at all—as his alleged discovery, as to add carbon to iron at a high heat in the air-blast crucible, to produce steel, a thing known by all steel manufacturers since the first invention of steel. Mushet's alleged discovery failed in England for want of novelty, the thing being known long before. And he failed to introduce it into public use in the United States within eighteen months from its date, as required by our patent laws in relation to aliens; but his alleged discovery was void from the first for want of novelty.

The machinery for rolling steel locomotive tire, etc., patented by Henry Bessemer, of England in 1859, and subsequently patented in the United States, July 1865, was an abandonment in this country by the lapse of time, and the same became public property in the United States.

CHRISTIAN SHUNK.

Greenville, Pa.

DIRT is destructive, as well as disgusting.