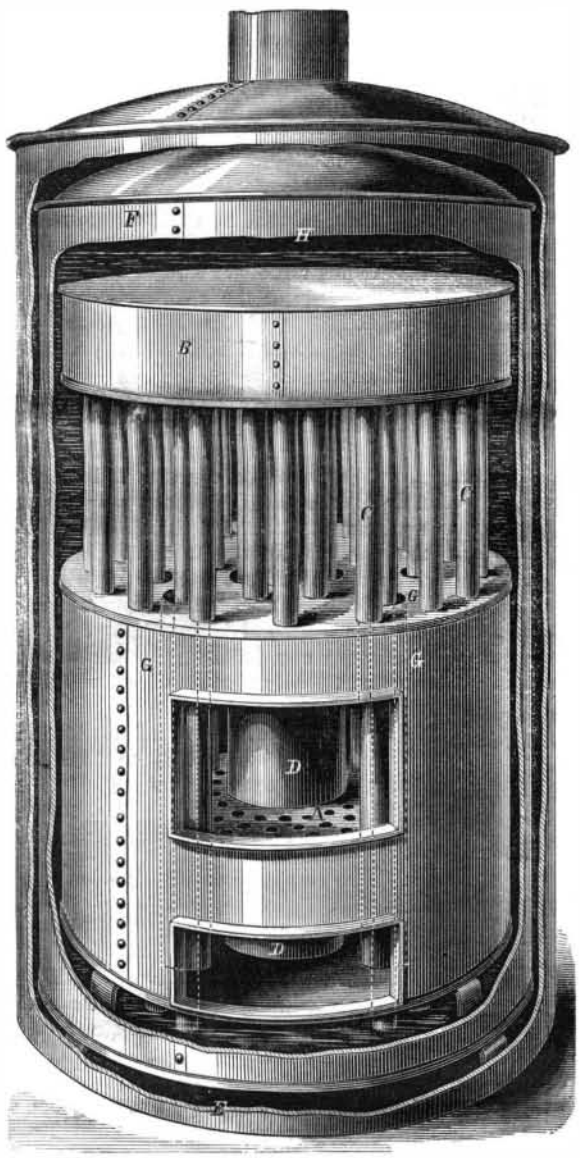
Scientific American.

A WEEKLY JOURNAL OF PRACTICAL INFORMATION IN ART, SCIENCE, MECHANICS, CHEMISTRY AND MANUFACTURES.

Vol. XI.---No. 5. (NEW SERIES.) | NEW YORK, JULY 30, 1864. | $3 PER ANNUM (IN ADVANCE.)

Improved Steam Boiler.

Economy in fuel is one of the greatest things to be desired in a steam boiler, and when we have joined to this quality strength of parts, and a thorough circulation of the feed water, we shall obtain a first-class apparatus. In the engraving published herewith a steam boiler, constructed on peculiar plans, is represented. It is designed to not only obtain great area of heating surface, but to so direct the products of combustion that they shall unite or combine at high temperatures, and thus give off heat which would otherwise be lost.



MILES'S STEAM BOILER.

In the engraving, A is the fire-box (the outer shell of the boiler is cut away entirely in order to show more important parts), and B the combustion chamber, connected to the fire-box by the tubes, C. Through these tubes the heat ascends to the chamber, and returns downward through a central flue, D, which extends from the combustion chamber above, to the chamber, E, below. From the latter part the heat rises and envelopes the sides of the inner cylinder, F, which contains water. It will be seen that the water is all about the tubes, C, and that they are surrounded with other tubes, G (as shown by dotted lines), of a greater diameter, where they pass through the fire-box; these other tubes, G, are therefore full of water, which is heated directly in the fire, and also by the return of the gases which entered the combustion chamber. The tubes, G, not only maintain a perfect circulation of the feed, but by having comparatively large area they obviate the tendency to foam, which vertical water wheels are liable to, and deliver the water heated, without violent ebullition, into the solid water contained in the larger part of the boiler. The inner water and tube chamber sets upon legs, and is adequately stayed in its place by ratchet bolts, etc., as usual. We have omitted these and the stays, to avoid making the engraving complex. The hight of water over the crown of the combustion chamber is shown by the dotted line, H.

The plan of this boiler appears to be good and economical, and we have no doubt but that excellent results will be obtained in its use. It was patented through the Scientific American Patent Agency, on April 19th, 1864, by Chas. M. Mills, of Vineland, N. J., and assigned to himself and C. F. Jones; for further information address either of the above parties.

Gun-cotton.

Professor Abel, of London, who has so carefully investigated the gun-cotton, thus sums up the peculiar properties of this explosive substance:—"When inflamed, or raised to a temperature ranging between 137° and 150° centigrade, it burns with a bright flash and a large body of flame, unaccompanied by smoke, and leaves no appreciable residue. It is far more readily inflamed by powerful percussion than gunpowder; the compression of any particular portion of a mass of loose gun-cotton between rigid surfaces will prevent that part from burning when heat is applied. The products of combustion of gun-cotton redden litmus, and contain nitric oxide, hence they have a corrosive action on gun-metal. In the open air it may be inflamed, when in actual contact with gunpowder, without igniting the latter; in a confined space (as in a shell, or the barrel of a gun) the almost instantaneous rapidity of its explosion produces effects which are highly destructive, as compared with those of gunpowder, while the projectile force exerted by it is comparatively small." For these reasons Professor Abel—who is chemist to the War Department—does not think we are yet in a position to use gun-cotton as a substitute for powder."

THE boat in which Hammill was to row against Ward on the 19th instant, on the Monongahela river, in Pennsylvania, weighs only thirty-seven pounds, although nearly thirty feet long. It is built of Spanish cedar, and fore and aft is covered with oil silk. The sculls are nine and a half feet long, and both together only weigh four pounds.

BURDICK'S FLASK LOCK.

It is well known to molders and persons connected with machine-works that the common flasks for casting metals in are very imperfect in their construction, so far as regards accuracy and facility of adjustment. It very often occurs that complicated castings or even simple ones are spoiled from the cores being thrown on one side, or the two parts of the flask being shifted when put together after the pattern has been molded. In any case care is requisite to prevent accidental misplacement of the parts.

The lock herewith represented is intended to prevent the evils referred to, and is a simple and secure attachment for the purpose. It consists of two metallic plates, A and B, the lower one, B, having

Fig. 1.

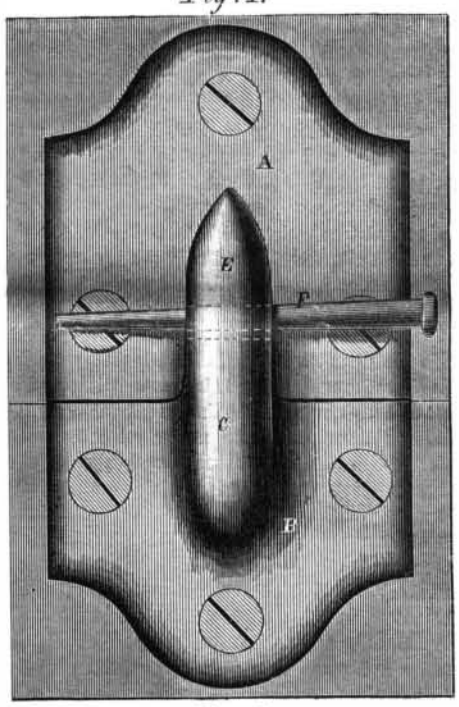
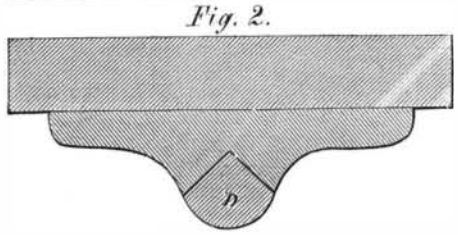


Fig. 2.



a tooth, C, projecting upward. This is fitted to the casting, A, by a beveled face, D (see section Fig. 2). There is also a shoulder, E, cast on the inside of the tooth, C, as shown by the dotted lines in Fig. 1, and a key, F, is fitted to the recess, so that it bears upon the tooth at the top and on the plate, A, at the bottom, thus binding (when the key is driven) both halves of the flask together. It will also be seen that the V-shaped faces, D, prevent any lateral motion of the flasks one upon the other, so that the parts must be true when put together, and always in exactly the same relation to each other. These V-faces also match easily so that the flasks need not be jarred from one side to the other to find the proper place to unite them. This practice often causes pieces of the sand in the upper flask to fall into the lower one and injure the outline of the casting when it is poured. The expansion of the flask from heating when the metal is poured does not derange this

flask lock in any way, and in other respects it is a useful and valuable substitute for the ordinary attachment. A common nail is used for a key, as that is often mislaid, or in the way of the molder, and nails are always at hand, being used in the work continually.

This invention was patented on April 26th, 1864, by Orrin H. Burdick, of Auburn, N. Y., and assigned to Orrin H. Burdick and D. M. Osborne. For further information address D. M. Osborne & Co., Auburn, N. Y.

FAIRBAIRN ON STEAM BOILERS.

Boiler Explosions.—At a very early period, or about the time when engineers and the owners of steam engines found that a considerable amount of saving was effected by increasing the pressure and working the steam expansively, as had been done in Cornwall in the pumping engine some years previous, it was looked upon as impossible to apply the same principle of expansion to steam engines which gave motion to a fly-wheel and the machinery of a manufactory. This imaginary impossibility existed for a considerable number of years; but time and experience revealed that the principle was applicable in both cases, and that the inertia, or *vis viva*, of a fly-wheel was the same as that produced by a vertical lift of the pump-rods and water combined in the reciprocating motion of the steam engine. This having been ascertained, a new conception burst upon the less cautious of the community in the desire to do more work with less fuel and at less cost. Hence followed the desire not only to economize, but to increase the pressure beyond the resisting powers of the boiler, and thus, through ignorance and without consideration, to incur risks of explosions that too frequently were attended with loss of life. It was in this stage of disaster when I was repeatedly called upon to investigate the causes of these accidents that I became acquainted, to some extent, with the theory of explosions, and to which, without the aid of the chemist or mathematician, I had to work my own way to conclusions as best I could. No doubt I might be sometimes wrong; but so are most others laboring under new and untried positions, with nothing to guide them but their own judgment and experience.

In these investigatious I, however, witnessed sufficient to convince me that the great majority of the accidents arose from the mal-construction of the boiler and excess of pressure, too frequently caused by ignorance or gross neglect. These facts led me into a long series of experiments to determine the best and strongest form of a boiler, in the first instance, and the density, volume, and pressure of steam, in the second. It moreover led to the establishment of an association which, in my opinion, has saved more lives, and done more good for the maintenance and protection of property, than any other institution in the kingdom.

It is true there are other associations on the principle of insurance; but these are established for the purpose of securing good dividends to the shareholders, while that over which I have the honor to preside is perfectly gratuitous, and is founded exclusively, at a comparatively small cost, for the protection of life and property. The directors have no pecuniary advantage, directly or indirectly, and give their services gratuitously for the benefit of those who choose to trust their boilers to careful periodical inspection.

I have considered it my duty to mention these facts, and to entreat the owners of this district to avail themselves of the security offered by this association, and they will find not only greatly increased security, but a considerable amount of economy, in the management and durability of their boilers.

Numerous theories have been promulgated to account for boiler explosions; such as shortness of water, red hot plates, explosive spheroidal water gases, collapse of flues, and over-pressure. The most reliable, however, are those of Mr. Colburn and the Astronomer Royal, both of whom appear to have arrived at the same conclusion. Mr. D. K. Clark has also directed his attention to this subject in his article on the steam engine, published in the last edition of the *Encyclopedia Britannica*. Mr. Colburn, in a short but excellent treatise on the causes of boiler explosions, disposes of the erroneous theories of electricity, decomposed steam, spheroidal ebullition, and at once advances the practical causes, instantaneous in their operation, which so frequently lead to boiler explosions. These, according to Mr. Colburn, are as follows:—

1st. The rupture, under hardly, if any more than, the ordinary working pressure of a defective portion of the shell of the boiler—a portion not much, if at all, below the water line.

2nd. The escape of the free steam from the steam chamber, and the consequent removal of a considerable part of the pressure upon the water before its contained heat can overcome its inertia and permit the disengagement of additional steam.

3rd. The projection of steam combined, as it necessarily must be, with the water, with great velocity, and through a greater or less space, upon the upper sides of the shell of the boiler, which is thus forced completely open, and perhaps broken in pieces.

4th. The subsequent disengagement of a large quantity of steam from the heated water, now no longer confined within the boiler, and the consequent projection of the already separated parts of the boiler to a greater or less distance.

These appear to be the chief causes of boiler explosions, as announced by Mr. Colburn. The Astronomer Royal appears, in his paper read at the last meeting of the British Association in this town, to have arrived, with some slight variations, at similar conclusions.

The Astronomer Royal states that:—"A little consideration of the changes in the state of the water and steam which occur during the bursting of a steam boiler, will show that very little of the destructive effect of an explosion is due to the steam which is contained in the steam chamber at the moment of the explosion. The rupture of the boiler is effected by the expansive power common at the moment to the steam and water, both at a temperature higher than the boiling point; but, as soon as steam escapes, and thereby diminishes the compressive force upon the water, a new issue of steam takes place from the water, reducing its temperature. When this escapes, and further diminishes the compressive force, another issue of steam, of lower elastic force, from the water, takes place, again reducing its temperature; and so on, till at length the temperature of the water is reduced to the atmospheric boiling point, and the pressure of the steam (or rather the excess of steam pressure over atmospheric pressure) is reduced to 0. It is the enormous quantity of steam, of gradually diminishing power, which is thus produced from water during the course of the explosion, that causes the disastrous effects of the explosion. Compared with this quantity, the small volume of gas which may happen to be in the steam chamber at the time, is, in boilers of ordinary construction, wholly insignificant, and may be entirely put out of sight in the succeeding investigation.

"2nd. If we compare the course of changes in bursting in two boilers—a large one and a small one—we see that the order of changes is the same in both; but that to reduce the temperature of a large body of water, by a certain number of degrees, a large volume of steam must escape, whereas to reduce the temperature of a small body of water, by the same number of degrees, a large volume of steam (smaller in the same proportion as the bulk of water) escapes. Thus it will appear that the whole volume of escaping steam at a given pressure, and the whole destructive energy of the steam, are proportional to the bulk of water.

"3d. For measure of the destructive energy of the steam, we must suppose the simplest and most easily measurable case, namely, that the steam in expanding drives the piston along a uniform cylinder. It is necessary to ascertrin the value of the pressure F when the steam has expanded so far as to have pushed the piston to the distance x. Then the measure of the total energy is $f d x$ F, the integral being taken from the point where the piston was in contact with the water to the point where the excess of pressure of the steam above atmospheric pressure= 0."

From my own inquiries in the more early stages of boiler explosion, I have generally traced these catastrophes to over pressure. This term "over pressure" has been objected to, but the literal meaning of the expression is, that whenever the elastic force of the steam from within exceeds that of the resisting powers of the boilers, explosion ensues. This may arise from such causes as defective safety valves or corrosion, where explosion may take place at the ordinary working pressure; or it may arise from collapse of the flues, or from mal-construction. One thing is, however, self-evident, viz., that the strength of the boiler in all its parts must greatly exceed that of the pressure of the steam, if we would avoid explosions.

Talent and Opportunity.

Previous to the year 1706, the brass ordnance for the British Government was cast at the foundry in Moorfields; but an accident which occurred there at the above date, led to the removal of the foundry to Woolwich. The circumstances connected with this change are interesting, as well as instructive.

It appears that a great number of persons had assembled to witness the re-casting of the cannon taken by the Duke of Marlborough from the French; and there happened to be among them a young German artisan in metal, named Schalch. Observing some moisture in the molds, he pointed out to the spectators around him the danger likely to ensue from an explosion of steam, when the molds were filled with the heated metal; and at the instigation of his friends, this apprehension was conveyed through Colonel Armstrong, major-general of the Ordnance, to the Duke of Richmond, then in attendance, as the head of the department. This warning was, however, disregarded; but Schalch retired from the spot with as many of the bystanders as he could persuade to accompany him. They had not proceeded far before the furnaces were opened, and, as Schalch had foretold, a dreadful explosion ensued. The water in the molds were converted into steam, which from its expansive force caused a fiery stream of liquid metal to dart out in every direction. Part of the roof of the building was blown off, and the galleries that had been erected for the company were swept to the ground. Most of the foundry-men were terribly burnt; some were killed; and many of the spectators were severely injured.

A few days afterwards, in answer to an advertisement in the newspapers, Schalch waited upon Colonel Armstrong, and was informed by him that the Board of Ordnance contemplated building a new foundry, and had determined, from the representations made to them of Schalch's ability, to offer him the superintendence of its erection, and the management of the entire establishment, when completed. Schalch readily accepted the appointment; he fixed upon the Warren at Woolwich, as the most eligible site for the new building; and the ordnance which were cast here under his direction were highly approved of. Thus, almost by mere chance, was the young German appointed to a situation of great trust and emolument, which he filled so ably, that during the many years he was superintendent of the Royal Arsenal, not a single accident occurred, amidst all the dangerous operations of gun-casting. He retired, after sixty years service, to Charlton, where he died; and his tomb may be seen in Woolwich churchyard.

Taming Fish.

A little girl residing near a pond in Massachusetts, has succeeded in taming some of the fish, by throwing crumbs of bread, crackers, etc., into the water. The species called perch seem to be the most tractable and docile. One of them often takes the end of her finger in his mouth, while another will glide gently into her hand and turn on one side, and so remain, apparently reposing, till raised quite to the surface. The little girl walks out on a plank, sustained a few inches above the water, and before she reaches the end of the plank, the fish may be seen darting rapidly towards their feeding ground. The larger ones, especially, are disposed to drive off the smaller ones, but she keeps order among them by means of stick with a sewing needle attached to the end of it, and when one picks a quarrel he gets a stab and is off at once.

Insurance against Tornadoes.—The Pike County *Democrat* (Illinois) has this advertisement:—"Fire and Tornado Insurance Company, Freeport, Ill., insures against loss or damage by fire, windstorms, and tornadoes. Capital secured by chartered lien on real estate, cash value, $200,000."