THE INCRUSTATION OF BOILERS.

[Condensed from Engineering.]

It is somewhat curious that while the complaints of inconvenience resulting from the incrustation of boilers are so numerous, the attempts to avoid those inconveniences by providing boilers with pure water should be so few. Boiler owners are ready enough to patronize patent fluids, compositions, and a variety of nostrums having for their object the prevention of incrustation, but we rarely find efficient appliances in use for purifying the water before it enters the boiler, and thus rendering such doctoring as we have just referred to unnecessary. It must not be supposed, from what we have just said, that we object *in toto* to the employment of chemical means for preventing incrustation; on the other hand, we believe that such means may be employed with great advantage in a vast number of cases, but we consider, first, that chemical "anti-incrustators" should not be applied indiscriminately and without a knowledge of the impurities which it is desired to remove; and, second, that as far as possible the purification of the feed water should be effected before it enters the boiler, and not in the boiler itself.

Many of our manufacturing towns are, as is well known, very badly off for water available for use in boilers, and pre-eminent amongst these towns is Oldham. Oldham stands on elevated ground, and is supplied with water conveyed a considerable distance from boggy ground at a higher level, and the supply is, moreover, so limited that the foul water from drains has to be used for boilers and for condensing purposes. Under these circumstances it has, of course, been necessary to provide means for purifying the water. In the first place, to make the water fit for use for condensing purposes, it is made to pass in succession through three settling reservoirs, the second reservoir receiving the overflow from the first, and so on. The injection water is taken from the last reservoir and the waste water from the hot well flows back into the second. The boilers are fed from the hot well, the feed being filtered on its way to the boilers. In one establishment the filters consist of a number of vertical cast-iron vessels strong enough to stand an internal pressure of 25 lbs. per square inch more than the boiler pressure; these vessels being each provided, at about the middle of its hight, with a perforated plate or grating, on which a layer of calcined bones, about 3 ft. in thickness, is placed. The water is forced by the feed pump up through these bones, and is led off from the top of the filter to the boiler. The water in the hot well is so filthy that the bones become choked with dirt in about half a day's working; and each filter is therefore cleansed twice a day—namely, during the dinner hour and at night—by blowing steam downwards through it. By this simple means the bones are thoroughly cleansed and the filters made ready for work again. The results obtained by the use of the plans we have described have been of a very satisfactory kind, and the whole arrangement is so simple as to commend itself at once to those suffering from the use of very dirty water.

In the case of non-condensing engines an arrangement of feed-heater in addition to the filters is employed, so as to obtain a supply of hot clean water. For this purpose the water is conveyed from the last settling reservoir into a covered tank, 6 ft. deep by 6 ft. 3 in. wide, having the water level regulated by a ball-cock, so that it is maintained 9 in. below the cover. At one end there is fixed on the cover a vertical cylindrical feed-water heater, 12 ft. high by 2 ft. 6 in. in diameter, this heater being traversed by tubes, whilst at the opposite end of the cover stands a vertical pipe, 20 in. in diameter, 30 ft. high, and open at the top. By means of a circulating pump the water is lifted from the cistern and made to fall in a shower down the pipe just mentioned, meeting in its course the exhaust steam from the engines, which is made to pass down through the tubes of the feed heater, then over the surface of the water in the tank, finally rising up through the vertical pipe, to be met by the falling shower. By this arrangement the water in the tank is heated to about 170°, at which temperature it is taken off by the feed pump and forced, first through a bone filter, and then through the feed-water heater to the boiler, which it enters at a temperature of about 210°. By the employment of this arrangement, an important saving has been effected in fuel and labor, and the boiler, which formerly had to be cleaned out every week or fortnight, now has to be cleaned at holiday times only.

In many cases trouble is experienced from the presence of an excessive quantity of bicarbonate of lime in the water used for feeding boilers, and in such cases Clark's process for purifying the water might frequently be resorted to with advantage. It is very usual to speak of the presence of large quantities of carbonate of lime in water, but this is an error, the carbonate of lime being almost insoluble, a fact on which Dr. Clark's process is founded. This process consists, as many of our readers are no doubt aware, in treating the water containing the bicarbonate of lime which it is desired to remove, with lime water, or a kind of milk of lime, the effect being that the lime thus added deprives the bicarbonate of a portion of its carbonic acid, thus converting it—and being itself also converted—into carbonate of lime, which, being almost insoluble, is deposited. The greater part of the lime will be deposited in the mixing tank; the water drawn off may be subsequently filtered by passing it slowly upwards through another tank partially filled with small pieces of coke. The coke is contained in a loose cylindrical casing within the tank, so that it can be conveniently renewed when clogged with lime. This apparatus has been at work over two years, and it has been found to be very effectual in keeping the boiler clear of all hard scale.

Although, however, the adoption of such methods of purification as those above described will be found exceedingly beneficial in a vast number of cases, yet we believe that ultimately it will be acknowledged that the only true remedy for bad water is the adoption of surface condensers. In applying surface condensers to land engines arrangements will in many cases have to be adopted differing greatly from those employed at sea. The condensing water available on land, in many instances is of such an impure kind that such condensers as are fitted to marine engines would be clogged by it in less than a week. In these cases the condensers should be so arranged as to permit of all parts being thoroughly accessible, and they should be made to stand rough work. Where the condensing water contains much floating matter, and where appliances for purifying it cannot conveniently be provided, evaporative surface condensers are particularly suitable, as they can be made without any passages to clog up, and with all the surfaces in contact with the condensing water fully exposed at all times. Condensers of this class, in fact, have been far from receiving the attention to which their simplicity and the comparatively small amount of water with which they can be worked, entitle them. Probably the chief objections to them are their cost and the space they occupy; but the first can scarcely be considered excessive, when their advantages are taken into consideration, and by a little management they can generally be arranged to occupy space which would not otherwise be turned to account.

In instances where, from some cause or another, surface condensers cannot be applied, and where, notwithstanding bad water being used, elaborate arrangements for treating it cannot be employed, attempts should still be made to cause the water to deposit the greater part of its impurities in a separate receiving vessel, in which the water may be heated under pressure, rather than in the boiler itself. The boiler should only be allowed to receive with the water such matters as cannot practically be removed elsewhere, and if this result were generally sought after, we should hear little of over-heating, distorted flues, and a host of other troubles which now annoy the boiler proprietor, to say nothing of the more serious failures which are but too frequently caused by incrustation.

THE LAND OF FIRE AND ICE.

By Professor Willard Fiske, in the Cornell Era.

Was there ever such an anomaly as the island of Iceland? Geographically it belongs to the Western continent, and yet, historically and politically, it is a member of the Eastern. It lies close under the Arctic circle, where winter prevails during three quarters of the year, and is surrounded by seas filled with icebergs; and yet boiling geysers and fountains of heated steam burst everywhere from its surface, while great volcanoes pour down into its valleys and upon its plains streams of molten lava. The nearest neighbors of the Icelanders are the Eskimos of Greenland; yet while the Eskimos are sunk to the nether level of ignorance, the Icelanders have raised themselves to an elevated plane of enlightenment. And so the wonderful island lies there, a link between the two hemispheres; a site where the most opposite of elements, heat and cold, are constantly contending for sovereignty; the seat of a race of the highest civilization in close contact with a race of the lowest barbarism. Nor does this end the chapter of contradictions. Lying almost beyond the range of either animal or vegetable production, the island still yields commodities which many more favored localities cannot furnish. It rivals semi-tropical Italy in the value of its sulphur mines, temperate Germany in the variety of its mineral waters, Scotland and Norway in the fertility of its salmon fisheries, and annually produces, in proportion to its population, three times the number of horses and sheep raised in our own State of New York. It exports several articles which are either found nowhere else, or, if found, are of greatly inferior quality, such as the down of the eider duck, which makes its way to every palace, and upon which the heads of all the kings of the earth easily or uneasily lie, the feldspar so largely used in optical experiments, and that semi-carbonized wood, known as surtubrandur, which, as a material for the manufacture of furniture, equals the famous ebony of the tropics. A land of glaciers, and suffering keenly from the chill winds that blow off the icy shores of Greenland, Iceland's chief harbors are open all the year round, while those of the Baltic, far to the south, are frequently closed. A treeless country, its inhabitants often burn the costliest of woods—mahogany, rosewood, and Brazil wood—which has been borne to them from the tropics, at no expense for freight, by the current of the Gulf Stream. A land where wheat will not ripen, its people possess in abundance a vegetable growth, the *lichen islandicus*, which, in far richer countries, is accounted a luxury. A nation almost destitute of schools, all of its sons and daughters are taught to read and write from their earliest years.

The history and philology of the island present features equally strange and striking. It is the smallest of all Teutonic communities, while its speech is the most ancient, and, grammatically, the richest of all the Teutonic dialects. In it are preserved the oldest poems, the oldest political orations, and the oldest religious ideas of our race. It is, as has been said, the feeblest of all Teutonic communities, yet it was the first to develop a republican system of government, the first to establish trial by jury, the first to compile codes of law. The colonization of the island furnished a parallel in the ninth century to the colonization of New England in the seventeenth, its pioneers seeking its barren shores for the self-same reason that led the Puritans to the rock-bound coasts of Massachusetts and Connecticut. Its sturdy sons helped to delay the fall of the Eastern Empire by enlisting in the body guard of the Byzantine monarchs; took part, under Rurik, in the foundation of the Russian monarchy; took part, under Rollo, in the establishment of that Norman dynasty which subsequently conquered England; set up kingdoms, and left traces of their speech, in Ireland and Scotland; built churches and towns in Greenland; and preceded Columbus, by five hundred years, on the dreary, watery path which led to the mainland of America.

No nation so small as Iceland has so large a literature The number of printed books amounts to many thousands, and the number of unprinted works, preserved as manuscripts in the public libraries of Europe, is at least equally great. Nor is this literature, as is the case with many minor nationalities, and with most colonial communities, made up of translations, but is almost wholly composed of original works. With the exception of the Bible and a few theological works, Homer and one or two other classics, Milton, Klopstock, Pope, and portions of Shakespeare, Byron, and Burns, very little of the literature of other nations has been translated into Icelandic. The modern literature, especially of this century, is rich in poetry and in poetical works.

The Icelandic throws a flood of light upon the history of the English language. In their early stages, so nearly connected were the two tongues that we can very well imagine an intelligent Anglo-Saxon and an intelligent Icelander making themselves mutually understood, with some little slowness and difficulty perhaps. At a later period the Icelandic greatly influenced the English, especially in its northern dialects, so that most of the dialectic words used by Burns are at once comprehensible to the student of the insular language. Yet, notwithstanding its importance to the English scholar, the Icelandic has hitherto been, to the great mass of students of English lineage, a sealed book. While the philologists of Scandinavia were making broad reputations by their investigations in the old Northern domain, while the philologists of Germany were cleverly availing themselves of this field, the English knew so little of the harvest which was awaiting the reaper, that the number of men in England and America who had ever paid any attention to Icelandic might almost, until within the last decade, have been reckoned up on the fingers of a single man. But in England a new era has dawned. The labors of Laing and Dasent and Thorpe in Icelandic literature are beginning to excite interest in the Icelandic language, and a great impulse has latterly been given to the new movement by the publication of the first part of an excellent Icelandic-English lexicon, through the agency of the University of Oxford.

But through it all, through the present days when its speech opens up a mine of wealth to the linguist of every Germanic tribe, as through those past days when its writers were the chroniclers of all the neighboring Germanic nations, the venerable island floats upon the gray waters of the distant Northern sea, the wonder alike of the naturalist and the philosopher. The former sees in it a display of nature's powers under forms which they nowhere else assume; the latter sees in it a nation, weak in numbers, maintaining unchanged for almost a thousand years, against obstacles never before surmounted by man, its language, its literature, and its customs.

The Prussian Percussion Fuse.

The percussion fuse used by the Prussian artillery consists of a small metal socket into which fits a metal striker, which is a nearly cylindrical piece of brass, having at one end a needle point. The socket with the striker in it is carried in the shell, being fixed in its place by means of a screw plug which screws into the nose of the shell. The screw plug is tapped for the reception of a small detonator, which, however, is not screwed in until the shell is required to be used. The striker, being free to move forward by its own weight, would, of course, be liable directly the detonating plug is screwed in, to cause an explosion by falling forward upon it, either by the accidental tilting forward of the head of the shell, or from the jar given in loading, or by the sudden movement of the parts at the moment of firing. To prevent this, a stout iron pin is passed through the head of the shell, and through the fuse between the striker and the detonator, preventing any contact between the two. The centrifugal force generated by the rotation of the shell throws out the pin immediately the shell has left the bore, and there is now nothing to prevent the striker from coming into contact with the detonator. But this it cannot do until something occurs to suddenly check the flight of the shell—in other words, until the projectile impacts upon the ground or against some obstacle, such as a man's body, which will momentarily reduce its velocity. At that moment the striker falls forward, on the same principle and from the same cause as a bad rider is thrown over his horse's head when the beast stops suddenly in its gallop. These fuses have been much extolled, and some writers have not hesitated to ascribe to them a great part of the successes of the Prussian artillery, yet, says the *Pall Mall Gazette*, they are open to many serious objections, and very far from uniform or satisfactory in their action, even in peace time. The Belgians, who copy the Prussians very closely in their artillery *matériel*, use the Prussian percussion fuse, and Capt. Nicaise says that out of 8,245 shells and shrapnel fired with this fuse between 1863 and 1869, there were 128 premature bursts=1·5 per cent; 433 fuses slow in action=5·25 per cent; 131 blind fuses=1·59 per cent; being a total of 692 failures=8·39 per cent. Exception may also be taken to the employment of a fuse which necessitates the operation of fixing a detonator and pin at the moment of firing—an operation which has to be very carefully performed for fear of accidents. If in the hurry of action the pin should be omitted, or if it should fall out of the shell, or if the man holding the shell and charged with the duty of keeping the pin in its place should happen to be shot, an ac