

## Selected Articles.

### INCRUSTATION OF STEAM BOILERS.

We have recently noticed corrosion as one of the ills to which the boiler is heir, and we will now consider another of a less insidious but not less dangerous nature, viz., incrustation. This evil is too frequently regarded merely as a matter of inconvenience, or, at the most, as a nuisance of which the owners of boilers would be very glad to be relieved. But this is a false light in which to view it, for it is a source of positive danger, and not unfrequently the cause of steam boiler explosions. Witness the facts of a recent colliery boiler explosion. Here was a plain cylindrical egg-end boiler 40 ft. long by 5 ft. 3 in. diameter, made of 3-8th in. plates, and working at a pressure of 30 lbs. per square inch. It was fitted with two sufficient safety valves, and two floats, one of them having a low-water alarm whistle. The plates over the furnace became overheated, and the boiler was rent in four pieces. There was no evidence of a deficiency of water, but the cause of the overheating was attributable simply to the sedimentary character of the water. The number of boilers which suffer from incrustation is very large; indeed, to find one that does not is quite exceptional. It impedes the satisfactory examination of a boiler, inasmuch as it renders it difficult to ascertain the precise condition of the plates. It sometimes deludes by awaking groundless suspicions of corrosion; more frequently, however, it conceals defects, for it is often found that corrosion is stealthily going on under the deposit which is causing it. A great waste of fuel is one of the evils resulting from incrustation; in addition to this, and apart from overheating, there must be a considerable increase in the wear and tear of boilers. In internally double-flued boilers, the undue longitudinal expansion given to the furnace crowns increases the tendency to groove at the front end plate. In these boilers this action is always present to a greater or less extent. In localities where good water is not to be had, incrustation renders the adoption of tubular boilers impracticable, thus excluding this economical class of boiler from more general use. But the injurious effects of water which will cause incrustation are not always limited to the boiler. The steam carries over a considerable quantity of earthy matter into the engines, and so necessitates an increased amount of grease for the piston and slides. As an illustration of this fact it may be noticed that, where the feed-water of boilers is taken from brooks subject to torrents which stir up the mud, the enginemen find the pistons and slides clog if they neglect the precautionary measure of extra lubrication.

The causes of incrustation do not lie very deeply hidden; it is therefore, but a simple matter to determine them, existing as they do in the water with which the boiler is supplied. Carbonate and sulphate of lime form the principal constituents of water. The carbonate in precipitating forms a loose powder, but the sulphate a hard crust. Both together will also form a solid incrustation, more or less hard in proportion as the one or the other of the salts predominates. This deposit, when

allowed to accumulate, forms a hard scale which adheres very tenaciously to the iron and is troublesome to remove. There is, no doubt, much difficulty experienced by the owners of boilers in judging of the quality of the water they have to use, but it is always open to them to have a chemical analysis made; and this is often essential when there are two or more sources of supply in the same locality, as the water, although apparently obtained from the same primary source, may differ very greatly in its composition at two different points. There is an instance of this in a well which produced almost pure water, containing an alkali, but no lime. From this well a boiler was supplied for many years without any incrustation having been formed, the boiler being cleaned by simply brushing out. Within half a mile of this well another was sunk, but which yielded water containing so large a proportion of lime that in a few weeks a thick incrustation was formed within the boiler fed with it. Both wells were sunk through the London clay into the chalk. It is a fallacy to attempt to estimate water from its appearance; transparency does not always mean purity. A specimen of water of perfect apparent purity taken from a London pump, gave, on testing, 140 grains of different kinds of salts per gallon of water, whilst a sample taken from the Thames—considered bad enough—yielded at the most 20 grains of salts per gallon tested.

Of the preventions and remedies which have been proposed from time to time, it may be said their name is legion; they form the subject of a goodly number of patents. Among the preventives are various methods of filtration and purification by chemical processes, whilst the remedies consist chiefly of a variety of compounds best known as "boiler compositions." Both these find supporters and objectors, and this arises from the fact that there are instances in which, either from accident or a judicious choice, selection is made of a remedy which proves suitable to the disease, whilst, on the other hand, an improper antidote is very often applied, it being frequently supposed that one description of boiler fluid, or other scale preventer, is applicable in all cases. Where water is found to form a rapid incrustation, it should be submitted to chemical analysis, the result of which would indicate the proper remedy. Apart from the doctoring processes, are several simple and inexpensive remedies which have proved very effective in preventing incrustation. One of these consists in placing small logs of oak, with the bark on, in the boiler, which has the effect of reducing the carbonate of lime to a kind of sludge, which falls to the bottom and thus preserves the boiler perfectly clean. This plan has been pursued by one of the London water companies for many years with perfect success. Mahogany sawdust has been employed with advantage for the same purpose as the oak logs. It acts in two ways: first, mechanically, by offering so many small points on which the carbonate and sulphate of lime may be deposited, and secondly, by a peculiar action of the extractive matter in the wood. This applies more particularly to oak, especially when green, in which state it should be used. In North Wales the water used in boilers is often perfectly green, and oak sawdust is administered in considerable quantities. Chlo-