ON A REMARKABLE BOILER CRUST, COMPOSED OF SULPHATE OF LIME. BY WILLIAM WEST, ESQ., F.R.S.

It has been common to speak of bicarbonate of lime, or carbonate of lime dissolved in water by excess of carbonic acid, according to the opinions on a theoretical point, of authors describing the same substance, as yielding the crust or "fur" of steam boilers, and either to deny or overlook the share which sulphate of lime has in the formation of this troublesome deposit. Among those who have gone so far as to deny the existence, or at least the practical importance, of sulphate of lime in these crusts, is Dr. Ritterbandt, the proprietor of a very ingenious, and I believe in some situations a very effectual patent method for preventing incrustations of the carbonate, by introducing Chloride of Ammonium into the boiler.

At that temperature, carbonate of ammonia is driven off, and the highly soluble chloride of calcium remains, in place of insoluble carbonate of lime. I have, however, so often found in these crusts, not merely a notable, but a considerable proportion of sulphate of lime, that I have on different
occasions, when my subject required, called attention to its presence, and expressed an opinion, which I have found much to confirm, that it is even more troublesome and mischievous than the carbonate alone. The specimen before you was formed, under somewhat peculiar circumstances, in a low-pressure boiler. It contains not a trace of carbonate, yields not a bubble of effervescence with acids, and its solution in a large quantity of water yields, with chloride of barium, a quantity of sulphate of barytes, closely equivalent to what it would furnish if pure anhydrous sulphate of lime. It contains a little iron. It is not the curious salt discovered by Professor Johnston, containing half an atom of water to each atom of sulphate of lime, (for ten grains, finely powdered, lost by exposure to a red heat, only three tenths of a grain,—less than a quarter of an atom of water), and therefore, hygro-metric, or accidental; and the sulphate is essentially anhydrous. The deposition of sulphate of lime from a solution far below saturation takes place in a manner which I described some years ago, in the Journal of the Royal Institution. As each bubble of steam is disengaged during brisk ebullition, the sulphate of lime of course separates; for its re-solution time would be required, but before that can take place many other particles are separated, and these rapidly cohere into portions large enough to subside, and to resist yet more the solvent power of the water. I have elsewhere, and on other occasions, stated my belief that though gypsum, in its hydrous and ordinary crystals, is a softer mineral than calc spar, yet that boiler crusts containing much sulphate of lime are harder than those composed wholly or chiefly of carbonate. The present specimen curiously confirms this opinion. I am assured by the workmen that not only is it with difficulty removed by the tools usually employed for such purposes, but that even the "Sate," or hard chisel used for cutting cold iron, is sometimes broken or turned by this crust.