that "the salt-spray corrosion test may . . . be taken as a particular simulation of marine conditions," does not command general acceptance. I have consulted Dr. Bengough, who has had wide experience of this test, and he informs me that it all depends on how it is carried out. It was introduced by the Bureau of Standards, and as carried out by them certainly did not simulate marine conditions, since the articles in question were exposed to salt spray kept permanently moist. If the test is modified so that the articles are alternately wetted with salt spray and dried at intervals, a nearer approximation to marine conditions is obtained. Salt spray, however, is not sea-water spray. The latter contains a variety of salts and some colloidal substances. A still closer approximation is furnished by using sea-water spray with alternate wetting and drying. Even this, however, is not the same as marine conditions themselves. Dr. Bengough's view is that no artificial test of this kind which has yet been devised can really take the place of natural marine conditions.

Mr. Wernick's statement that chromium may act as a cathode against iron is very probably true. Certain chromium alloys do behave in this way. Chromium-plating is therefore comparable to nickel-plating rather than to zinc-plating. The question is, is it better to plate with a cathodic material such as nickel or an anodic material such as zinc? The cathodic material will only protect if it is non-porous. Most electrolytic deposits are porous, but if they are hard the porosity can be greatly reduced by polishing. A view widely held by those with a practical experience of plating is that the protective qualities of nickel are largely connected with the fact that it can be well polished. Chromium deposits should have the same character. Anodic coverings such as zinc will protect iron even if porous, but only at the expense of the zinc. The protection will continue until the zinc is used up by the anodic corrosion. It is not difficult to understand why salt-spray tests give good results with zinc-covered articles, but it does not follow that these would have a long life in a marine atmosphere, because the rate of attack of zinc by sodium chloride solution in the presence of oxygen is very rapid, as is well known.

H. C. H. C.

### A Relic of Sir Edward Frankland.

IN "Sketches from the Life of Edward Frankland," printed in 1902 for private circulation (Spottiswoode and Co., 1902), and which for the greater part is his autobiography, reference is made to his apprenticeship days in Lancaster.

Frankland mentions a "delightful occupation devised to prevent my idle hands from finding 'some mischief still'; . . . this was the making of mercurial ointment.

"In a room on the first floor there was a very large marble or serpentine mortar, about 2 feet internal diameter. The pestle was about nine inches in diameter and one foot long, with a wooden shaft about six feet long securely fixed into it, its other end working loosely in an iron ring fixed to a beam in the ceiling. Thus the pestle could be worked round and round and backwards and forwards in the mortar.

"For the preparation of mercurial ointment, about fourteen pounds of hog's lard and five or six pounds of quicksilver were placed in this mortar and had to be triturated until a magnifying glass failed to show any globules of mercury. This blending of mercury with lard is an exceedingly tedious operation; working, in the aggregate, two full days a week, it required about three months to complete it. Moreover, the resistance to the motion of the pestle in the lard is very great, making the labour very hard and the arms ache."

Owing to a rumour that a relic of Sir Edward Frankland might still exist in Lancaster, the writer called on the present owner of the premises at which Frankland served his apprenticeship (Mr. A. H. Robertson) and was shown the mortar and pestle situated exactly as described above, covered with

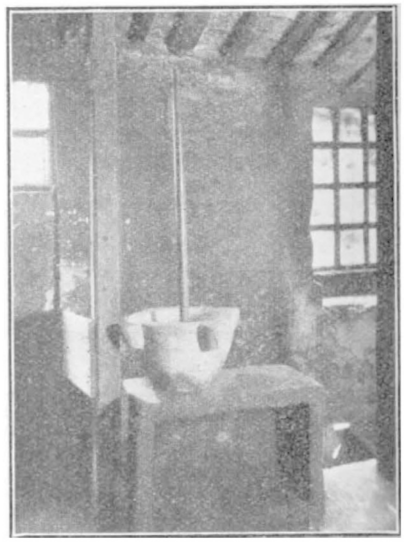

FIG. 1. Room at Lancaster with pestle and mortar used by Sir Edward Frankland.

the dust of ages, in the semi-darkness of a small upper room where one could visualise the apprentice and his successors grinding in the true 'Mantalini' spirit of submission.

Mr. Robertson has generously presented the mortar and pestle to the Lancaster Museum, where it will shortly find a permanent home.

The accompanying photograph (Fig. 1) showing the old mortar and pestle *in situ* was taken by Mr. Wynespeare Herbert of Lancaster.

W. F.

### Unusual Microstructure in Iron and Tungsten.

IN the *Metallurgist* for June 24, 1927, page 88, F. S. Tritton describes some unusual microstructures in iron. One of these, originally described by Andrews in 1895, is found in pure re-melted electrolytic iron in the cast condition. The large crystals of which it is composed appear to be broken up by numerous sub-boundaries, but the etching tints indicate that these secondary grains have nearly a uniform orientation within the boundaries of the main crystal. Tritton has confirmed this by the appearance of the slip planes when the metal is strained.

Some years ago we observed a similar structure in tungsten which had been quickly cooled from the molten state. The appearance of an etched section (× 200) is shown in Fig. 1 and is identical with the structure shown by Tritton. The difficulty of developing the sub-boundaries by etching is greater when the longer axis of the small grains, which have a columnar shape, is in the plane of the specimen, as in the case of iron. As the large crystals in our specimen are several millimetres in diameter, it has been possible to determine the orientation of the small grains within the boundaries of one crystal. A beam of X-rays was directed upon the polished