these faults, and enables us to obtain a pure cement copper with a very small consumption of iron. The solution obtained with the bath of protochlorid of iron can contain no persalt of iron in solution, and if protoxyd of copper alone has been employed will hold three equivalents of copper combined with two equivalents of chlorine, so that they will be precipitated by two equivalents of iron, being at the rate of 59 parts of metallic iron for 100 parts of metallic copper. If, from the presence of much dinoxyd, or from other reasons, the greater part of the copper be present as dichlorid, it will be remembered that this requires only one equivalent of iron to precipitate two equivalents of copper, being at the rate of 45 parts of iron for 100 parts of metallic copper.

The precipitation of copper from the solutions is at first rapid, especially if these are hot, and kept in agitation. Inasmuch as the waste liquors are not rejected in this, as in the ordinary process, the long digestion with iron required to remove the last portion of copper is dispensed with, and the liquid, after having given up the greater part of its metal, is withdrawn and used for the treatment of a fresh portion of ore. The prolonged action of the air on the bath is thus avoided, and we obtain a cement copper almost entirely free from insoluble iron salts, and with the consumption of a minium quantity of iron.

The Regenerated Bath.—If the action of the air be excluded it will be found that the bath, after complete precipitation of the copper by iron, will be nearly as rich in protochlorid of iron as before the solution of the copper. The loss, which is due to the separation of a portion of oxychlorid of iron during the solution, is variable, and in some cases does not exceed six per cent. The various ways of supplying this loss are three : (1) The direct addition to the bath of a portion of protosulphate or protochlorid of iron. (2) The addition of a portion of sulphate of copper from the roasted ore, and (3) the use of sulphurous acid. Of these the first requires no explanation, and the second and third will be explained under the two following headings. The proportion of iron in the bath should be determined from time to time by the following method : A small portion of the bath, freed from copper by digestion for some hours with metallic iron in a stoppered bottle, is diluted with 50 parts of water,