

zinc-oxide industry; and, as in other cases, we now produce this material of a quality equal in all respects to that hitherto imported. Works capable of producing 50 tons or more per week are running regularly, and, given reasonable protection against unfair competition, there seems no reason why the whole of our requirements should not henceforward be met from domestic sources.

The oxide is manufactured by distillation of hard spelter, scrap, etc., with subsequent burning of the volatilized metal to oxide, which is collected in bag-house plant in the usual way. Technical details as to pipe arrangements, fan-capacities, etc., have been worked out, and the conditions necessary for the production of the highest quality product have been established. No doubt there will still be competition from American oxide, produced directly from ore, owing to the lower cost of the raw material employed. This oxide, though of inferior color, is suitable for many purposes, such as rubber filling; moreover, it possesses the advantage of high density. Oxide production from ores and residues though not yet established in this country is being investigated, and there is reason to anticipate that this may eventually prove successful.

In South Wales zinc-dust ("zinc blue") has recently been manufactured direct from metallic scrap and a product obtained which is far superior to that derived as a by-product from the retort process; the latter usually contains about 85% of active zinc, whereas the former carries not less than 95%. The demand for high-grade zinc-dust in the dyeing industry is large, and, owing to its superior reducing value, it should have a good outlet in gold-precipitation.

The prepared fume is screened in a flour-miller's bolting machine; owing to its granular character no difficulty is experienced in screening. The product though excessively fine is uniform in size of particle and free from dust; under the microscope each grain is seen as a brilliant metallic sphere. A word may be said as to the perfection of the bolting machine for screening fine powders; this has been developed to meet the stringent requirements of the corn-milling industry and if better known would no doubt find application in screening dry crushed ore.

A wider general knowledge of the practice of industries other than our own would, I believe, lead to the discovery of many appliances which could be adapted to our special needs. For example, the filter-press was well known to the potter before its value was recognized in ore treatment. He has, from our point of view, the worst possible type of clayey material to filter and in addition contamination by iron rust must be avoided; hence he adopts a press with wooden frames. We could perhaps reciprocate by introducing to him the vacuum-filter and pulp-thickeners.

Pottery. While on the subject of pottery an interesting application of gold may be referred to, though this perhaps comes rather within the province of chemical industry than metallurgy. It is not commonly recognized that the gold decoration of cheap pottery consumes a large amount of the metal in such a manner that it never returns to the market. The gold-line decoration on cheap cups and the 'solid' gold handles on cheap 'ornamental' vases is in fact gold of almost the highest degree of fineness employed in the arts. The compound as employed consists of an organic salt of gold in an oily medium, and as applied does not contain more than about 6-9% of metal. The de-

sired decoration is painted on the otherwise finished ware, which is then heated to about 700°C., far below the melting-point of gold. Over 90% of the compound, consisting of the oils and medium, is thus burnt away, leaving the perfectly uniform coherent film of gold with which we are all familiar. The metallic components consist essentially of pure gold, but modified to the extent of about 1% with other metals, which brings about the brilliant metallic film; and it is interesting to remark that if absolutely pure gold be employed no such film would result, the effect being instead a dull earthy pink deposit. This affords another example of the influences of a small amount of a foreign metal on the mass, a feature so frequently met with in almost every branch of metallurgy. So coherent is the film, in spite of the loss of over 90% of the original compound, that it may be used as a satisfactory base for electro-deposition thereon of another metal, such as silver, for decoration or other purposes. Platinum behaves in a similar manner, and it is possible that for certain purposes porcelain dishes coated with gold or platinum by this means may be of service in the laboratory.

As another illustration of borrowing from other industries, the metallurgical furnace-builder may derive much assistance from the glass industry and *vice versa*. Oil-firing, now so commonly employed in smelting, is well known to the glass-maker, who may have experience in its use not generally known to the metallurgist. My object in the above remarks is to call attention to the advantages which must result from a freer interchange of knowledge and experience between our various industries. To this end one of our leading societies, the Society of Chemical Industry, has in normal times an annual program of visits to various works, giving members the opportunity of inspecting operations in which they are not directly interested.

Copper. For developments in the metallurgy of copper we naturally look to the United States. Thanks to the publicity given to progress in the States and to their excellent technical publications, we have been made familiar with recent advances and it thus becomes unnecessary to refer to them in detail. Among such, reverberatory practice (due to the ever-increasing amount of flotation concentrate to be smelted) may be mentioned. In this connection the increased throat-area, with correspondingly larger burners for oil or coal-dust firing resulting in largely increased output per furnace, should be noted. The El Paso 130-ft. furnaces burning oil have reached a daily capacity of over 960 tons with a consumption of 0.61 barrel of oil per ton. Leaching of oxidized copper ores by ammonia, so often suggested in the past, has come within the domain of practical metallurgy. For example, it is reported that the Calumet & Hecla Mining Co., in a plant treating 2,000 tons of tailing per day, is recovering copper at a total cost of 6.25 cents per pound, with a loss of only one pound of ammonia per ton of ore. Further developments have also taken place in acid-leaching plants in connection with which A. W. Halin's process deserves mention. He passes the acid solution through a number of ore-charges until the solution becomes neutral. It is then delivered to a tank containing fresh ore whereby the ferric iron is precipitated, whence, after acidification, the solution passes to the electrolyzing plant for precipitating the copper. The treatment of ore in heaps by leaching, following Rio Tinto practice, is also being extended in America.