of acid used, nitric acid showing a greater loss than hydrochloric and sulphuric. On the other hand with impure zinc, that in ordinary use, nitric acid gave the purest bullion, but with lead-free zinc dilute sulphuric acid gave both the purest bullion and the lowest acid loss.

A comparison between melting direct and a preliminary treatment with sulphuric acid gave results depending on the purity of the slimes; where these had been passed through a 40-mesh sieve to free them from coarse zinc, melting direct gave a fairly pure bullion and at least as good results as with acid treatment, but with scrap and coarse zinc included the advantage lay with the latter method.

The least total loss in the first set of nineteen experiments was 0.75 per cent., and this was obtained by treatment with sulphuric acid before melting. An experiment with lead-free zinc gave a total loss of only 0.52 per cent. with direct fusion of the sieved slimes, the coarse zinc being treated with sulphuric acid and the residue added to the slimes. Pure zinc invariably showed a smaller loss than with ordinary zinc, and very careful work on identical lines showed such gain, or lessened loss, to be 0.2 per cent.

Treatment of the slimes with strong solutions of alkali and cyanide, with or without subsequent acid treatment, gave heavier losses.

There was, however, considerable variation in the results obtained, though the general direction of the losses was well established, and to limit such variation as well as to still further study the effect of the use of lead-free zinc in the cleaning-up operations, the final sets of experiments were carried out, in which all the samples were taken from the same bulk of previously prepared and well-mixed gold slimes, as mentioned above, and these samples were then submitted to variations in treatment. Similar experiments were also made with the slimes from lead-free zinc prepared under identical conditions. The results were as follows, the loss for simple melting with borax being taken, as x:—

Melting with borax	x
Roasting, then melting	x + 0.23 per cent.
Sulphuric acid, then melting	x + 0.17 "
Sulphuric acid, roasting, and then melting	x + 0.40 "
Nitric acid, then melting	x + 0.29 "

and x in the case of pure lead-free zinc amounted to 0.43 per cent.; in the case of ordinary zinc it was greater than this, the amount of excess exceeding the 0.2 per cent given above.

With lead-free zinc, sulphuric acid gave the purest bullion and roasting the most base, the roasted bullion being more base than that melted direct with borax. With ordinary zinc, however, nitric acid gave the purest bullion; sulphuric acid came next; direct melting with borax yielded bullion considerably baser than the others. The loss by acid treatment was greater than with lead-free zinc, and the loss by roasting less; it is suggested that the presence in the slimes of lead, which is converted during the roasting to fluid lead oxide, may account for the lessened loss in roasting with the ordinary zinc.

These last results confirm those from former experiments, and show that with ordinary zinc, as well as with lead-free zinc, direct melting with borax gives the great loss, and that the safest method of purifying the bullion is by sulphuric acid treatment; that the use of lead-free zinc with a sieving arrangement renders any special method of purification unnecessary, and diminishes the treatment loss. All the experiments agree in showing that roasting is the cause of more or less heavy loss, and though effective with ordinary zinc in raising the grade of the bullion, is less efficient than acid treatment for this purpose.

It is therefore suggested that in cleaning up means should be employed to avoid handling, and to limit the number of vessels used, and that roasting should be absolutely avoided. The following description of a plant has been prepared on these lines.

Zinc boxes (extractors) to have steel side launders for discharging the slimes direct through a 40-mesh sieve into small steel vessels with perforated bottoms, over which a filter cloth is placed. These steel vessels fit into small vats, one for each vessel, and are arranged so that the overflow of slimes passes into a large vat of sufficient capacity, from which the lighter slimes which have passed out of the small steel vessels in the overflow may be collected by the aid of a filter connected to a vacuum receiver, to which all the filters are connected. The slimes may thus be collected and sent to the drying and mixing plate immediately after cleaning up, the one vessel having sufficed for the whole operation; but if acid treatment is used, the steel vessel with its contained cake of slimes, is taken to the acid vat and emptied into it. The acid vat may be of wood, lead lined, or of steel coated with special protective varnish, or of aluminum, which answers perfectly and is clean, and is not attacked by sulphuric or even nitric acid. The dissolved slimes are washed with hot water and filter-pressed, or preferably run into a detachable steel-lined filter vat with a vacuum connection, washed, vacuum dried, mixed with fluxes, and melted. The author prefers a vacuum vat in place of a filter press as being cleaner, easier to handle, and leaving the slimes in one mass without the inconvenience and loss attendant upon the use of the many connections, plates, and filter cloths (all impregnated with gold slimes) necessary to a filter press.

Purity of Gold Bullion.—The fine, amounting to from 3d. to 1s. 9d. per ounce of fine gold, imposed by the London refiners upon base bullion containing lead, has caused much attention to be paid to the question of the advisability of returning bullion so pure as to avoid these heavy charges. An investigation has also been made into this matter, and a suggested remedy is to replace the zinc ordinarily used for precipitation by a special brand of lead-free zinc.

In the early days of the cyanide process the investors feared that lead-free zinc would not be sufficiently energetic to precipitate effectively the gold present in very dilute solutions, but in recent experiments with some lead-free zinc, which contained a minute amount of iron, it was found that in every instance, whether with strong or with exceedingly dilute solutions, a better extraction was obtained with this zinc than with that ordinarily in use, with the single exception of a fortnight's run, in which the results were equally good.

The importance of this result will be understood when one recognises that the adoption of the lead-free zinc will give a purer bullion, and thus avoid the refiners' charges of, on an average, 9d. per ounce; will lessen the amount of slimes to be treated and the loss during clean-up of 0.2 per cent., as shown above. Against this is the greater price of the lead-free zinc, but as it takes with low-grade tailings an average amount of 1 lb. of zinc to produce 1 oz. of gold, it is easy to calculate that even if lead-free zinc were 11d. per lb. dearer than the ordinary zinc it would still be preferable and cheaper to use the former brand, but, as a matter of fact, the difference in price is very much less than this sum.

In conclusion, it is suggested that increased extrac