Outside Plate Amalgamation.—The amalgamated copper plates are usually laid down immediately under the lip of the mortar-box, and, being of the same width as the front of the box, the pulp requires very little distribution on to the plate. There is no reason why the plates should be placed in this position or be confined to that width, as they are certainly in the way and liable to injury while shoes, bottoms, and screens are being changed. They would be subject to less vibration if placed some distance from the crushing-machine.

The crushed pulp is run in so thin a stream over the plates that the friction causes it to travel in little wavelets which are supposed to bring every part of the pulp in contact with the amalgamated surface; but still the practice of running coarse and fine material together over plates set on the same grade and with the same flow of water must certainly be wrong, because if the conditions are suitable for fine, they cannot properly treat the coarse material. To obtain the thin stream the water is reduced, thereby thickening the pulp, and as the speed of flow must be sufficient to keep the heavier and larger particles moving it cannot possibly be expected that the finer particles of gold, travelling in this stream of muddy and slimy water, ever get a chance of coming in proper contact with the amalgamated surface. A small water-supply and a high inclination of table will probably give better results than the opposite conditions, always allowing that there is ample water to make a thinly fluid pulp. A finely crushed or clayey ore requires more water and less grade than coarsely crushed ore, while one rich in sulphurets requires more water and a steeper grade than clean quartz.

The mechanical effects of sand and water passing over the amalgamated surface often cause scouring—*i.e.*, the granulation of mercury and amalgam from the plates—and this is all the more noticeable where the quantity of water or grade of the plate is unsuitable for the unevenly crushed material, and when heavy substances such as heavy spar, scheelite, or base minerals are present. The theory of plate amalgamation demands a clean amalgamated surface carrying a small excess of mercury, with the grade of the tables and quantity of water so adjusted that every particle of escaping pulp shall be brought in contact with that surface. The quantity of water must be sufficient to make a thinly fluid pulp, and the speed of flow should only be fast enough to keep the particles on the move. Scour will take place to a small extent with the finest of sands, but the object is to reduce it to a minimum. It is therefore evident that the present system of plate amalgamation is totally unsuitable for treating the uneven pulp issuing from the stamper-boxes, and that classification according to size is absolutely necessary before the extraction of the gold is commenced. Amalgamation does not require force, but only proper contact. It is certainly better to allow that portion which will not amalgamate to pass on and be extracted by other methods in its natural state than to attempt to save it by violent agitation. By forcing amalgamation, mercury and amalgam are lost in such a condition as to render the saving and after-extraction a difficult process; for that portion saved in concentrates would be partially brought together by the action of the concentrator, and the larger pieces, after roasting, would be more difficult to dissolve by chlorination. Then the action of the cyanide would be too slow to dissolve that portion in the tailings unless it happened to be in an oxidized condition; but the principal loss would be in the finest slimes which often constitute the richest part of the tailings and certainly the most difficult to treat. The evil effects of improper amalgamation have apparently never been taken into serious consideration, and I feel certain it would repay every millman to give more attention to this part of the process and find out the condition in which the gold leaves the plates.

Having pointed out many defects and irregularities in our modern system of crushing and amalgamation, let me in conclusion suggest some improvements in the method of working:—

First, dispense with inside amalgamation. Let the ore be reduced by rock-breakers to even a half-inch mesh and be pulverised in the stamp-battery to the requisite degree of fineness as quickly as possible, and give every facility for its discharge through the screens when so crushed. *In short, use the stamp-battery solely as a crusher.*

To do this, maintain a high speed with a low drop in such order as to keep an even layer of material on the dies and at the same time facilitate the discharge. Design the mortars narrow, give sufficient screen-area, and keep regular—with the aid of chock-blocks, without plates—as shallow a discharge as possible. The weight of the stamper may probably stand increasing, but it is first necessary to bring the weight of the mortar-boxes up to their proper proportion, those at present being too light to give the true effect of the blow.

As already stated, the mechanical portion of a stamp mill has been greatly improved upon, but it is the method of working that requires altering. Our engineers can show us returns of the increased tonnage crushed per stamp, but we must also remember that the weight of that ton (2,000 lb.) is considerably less than that crushed some years ago. No doubt the present mill crushes more per stamp than those without the aid of rock-breakers, self-feeders, &c., but still we find that increased quantity passed over the same width of copper plate with less water to save the free gold.

Secondly, do not amalgamate by force, but by contact.

The coarse pulp on leaving the mortar-boxes should be classified by hydraulic sizers, and thus separated into two or three different grades the latter number for preference. Three products would result—First, coarse sands; second, fine sands; and, third, slimes; each of which should be passed over separate sets of amalgamated copper plates with a spread, quantity of water and grade to suit each product. In the present mills we find the grade of tables and quantity of water being constantly altered. It is seldom that two millmen can agree which is best, because the plates in both cases are expected to do an impossibility. The correct method of treating each product from the separators should be arrived at in a systematic manner—by first ascertaining the quantity of water required to bring each into a thinly fluid pulp, then a suitable spread of amalgamated plate surface for each quantity is arranged, and finally, the fall on each set of tables is so adjusted that the particles are just kept continuously on the move and nothing more. For the coarse sands containing the bulk of the heavy gold and sulphurets the spread would be small, but the water would flow over the plates practically