defect of this system lies in the fact that piling a lot of ore in the form of a cone does not mix it, as the advocates of this system claim. Dropping shovelful after shovelful of ore on top of a cone, instead of building up a homogeneous pile, actually produces a very perceptible sorting action, whereby the fines build up where they fall on the center of the cone and the soarser particles roll outward and down the sides. This is illustrated in

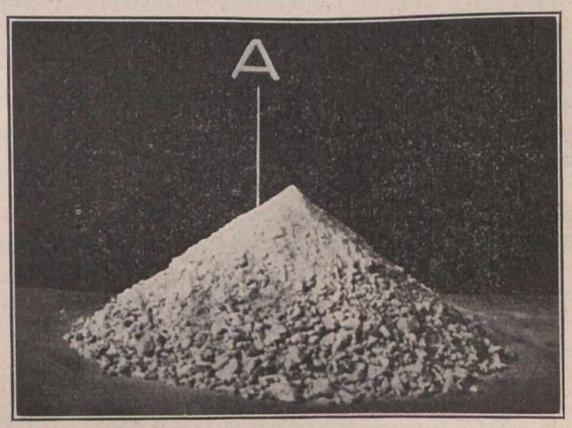


FIG. 4.—SAMPLE CONE WITH DRAWN CENTER.

Fig. 1, which is a half-tone from a photograph of a cone built up in actual sampling practice and bisected by a sheet of glass. This section shows conclusively the great difference in the relative proportion of coarse and fines between the outer and inner portions of the cone, and also makes it perfectly clear that even after the cone has been spread out into a pancake, as shown in Fig. 2, the fines in the lower portion of the cone will be entirely undisturbed. The most uniform and best results are obtained by coning around a rod, as shown in Fig. 3. By this means the center of the cone is maintained in a vertical line, and if care is taken in working down the cone to a "pancake," as shown in Fig. 2, and separating the quarters by steel blades, so that there is no difference between the quadrants taken for the sample and those thrown into the reject, the results give a fair approximation of the truth, though it is not possible to duplicate results very closely by this method, even at its best.

It would take altogether too much space here to enumerate the different schemes which unprincipled

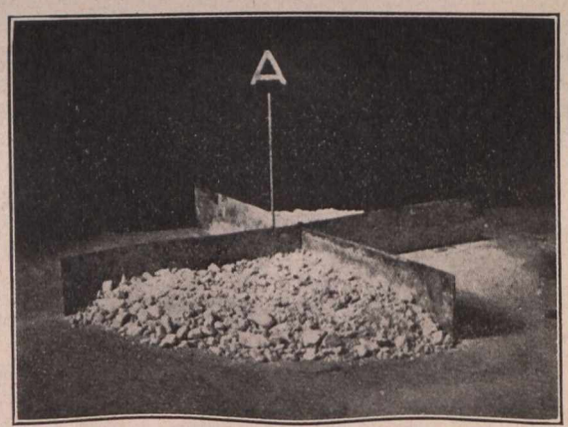


FIG. 5.—SAMPLE WITH DRAWN CENTER SPREAD OUT.

operators have introduced into this method for the purpose of "throwing" the sample, and description of one of them will suffice.

The most ingenious of these plans, and one which is so difficult to detect that it can be carried on directly under the eyes of a skilled observer without detection, is what is known as "drawing the center." The cone is started on the floor, as shown in Fig. 3, but without any rod to determine the position of the center. The operator in charge of the work, in dropping his shovelfuls of ore on the top of the cone, does it in such a manner as to draw the center of the cone imperceptibly in a certain direction, so that by the time the entire sample is piled and ready for spreading, the apex of the cone, shown in Fig. 4, is several inches, we will say, to the SE. of the original center, which is indicated by the perpendicular line, *A*. The ore may now be spread as usual with shovels or with a board, and cut and marked into quadrants by steel blades in alignment with the four points of the compass, as shown in Fig. 5, where the rod, *A*, indicates the original center of the cone, which, of course, has been entirely undisturbed by the mixing and spreading of the upper portion. By rejecting the NW. and SE. quarters an excess ratio of the fines is eliminated, and since these are generally the richest ore the metallic contents of the two retained quadrants, shown in Fig. 5, will be somewhat less than the average of the original pile. Suppose a 2,000-lb. lot is to be reduced to 62.5 lb., it would mean that the "quartering" (really halving) would have to be repeated five times, and if at each stage the sample taken represented 98 per cent. of the actual value of the cone, the final sample would only give 90.3

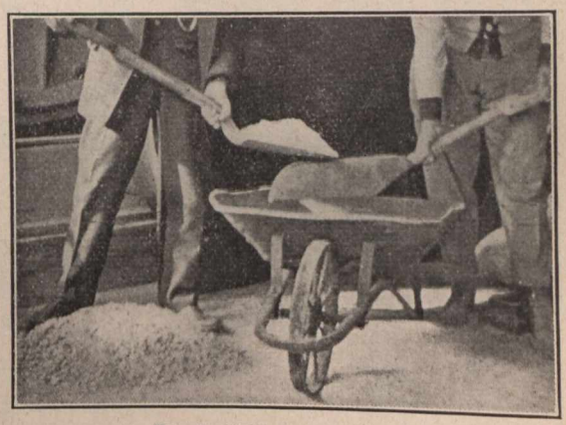

FIG. 6.—U-SHOVEL SAMPLING.

per cent. of the true value of the cone, as shown in the following tabulation:

| | Original Lot. | First Cut. | Second Cut. | Third Cut. | Fourth Cut. | Fifth Cut. |
|---|---|---|---|---|---|---|
| Weight, lb., . . . | 2,000 | 1,000 | 500 | 250 | 125 | 62.5 |
| Percentage of true value, | 100 | 98 | 96 | 94.1 | 92.2 | 90.3 |

The shifting of the cone-center is easily carried out; in fact, it is difficult to avoid it unless some definite means of preventing it is adopted. Fig. 1 shows very clearly the structure of a cone with a "drawn" center, and in this instance the effect was entirely unintentional.

The irregularities in the results obtained by Cornish sampling, together with the cost of operation and the amount of room required, soon brought about what is known as "split-shovel" sampling, in which the ore is thrown from a broad shovel, handled by one operator, upon a narrow "U"-shaped shovel, held by another workman, usually directly over a car or wheelbarrow, as shown in Fig. 6. This method, while it requires two men to do what normally appeared to be the work of one, was cheaper than Cornish quartering, but it proved no great improvement over the latter in point of accuracy, since carelessness in almost any direction interferes seriously with the results.