The earliest attempts at mechanical sampling were made by subdividing a falling stream of ore; a process based on the supposition that an ore-stream could be mixed so as to be perfectly homogeneous. Both analysis and experience have shown that this ideal condition is impossible, and mechanical devices for taking a portion of the ore-stream all of the time have been almost entirely displaced by machines designed to take all of the ore-stream for a portion of the time. It is not practicable to produce a stream of ore which shall be continuous in value through every part of its length any more than

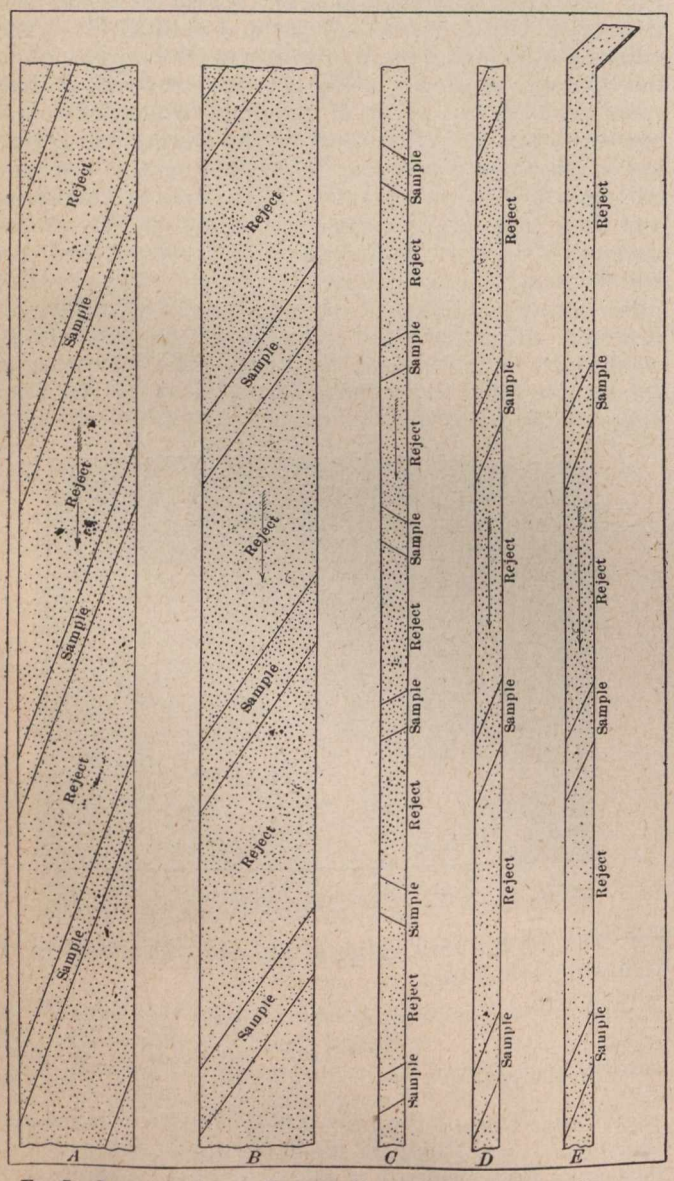

FIG. 7.—SHAPES OF SAMPLE-SECTIONS TAKEN BY THE CHARLES SNYDER, BRUNTON, AND VEZIN SAMPLERS.

it is possible to produce a stream of ore that is constant in value throughout its width; but by taking a small sample entirely across a falling stream at very short intervals it is found that, while no single cut would give an exact representation of the composition of the entire lot, the average of thousands of these small samples is so nearly correct that results can be duplicated within very narrow margins, or, in other words, that individual errors are balanced. This was not the case with the devices used for taking a portion of the stream all the time, since the errors due to feed, inclination of spouts, or wear on the bottoms of the spouts are constant, and do not vary during the time the samples are being taken.

Almost coincidental with the discovery of the fact that accurate samples could be obtained by taking all of the stream for a portion of the time, came a very considerable improvement in rock-crushing machinery, so that the modern engineer has a much better opportunity to construct a satisfactory plant than the builder had 20 or 30 years ago. Not only are the rock-breaker and rolls of to-day greatly improved in design, but the manufacturers have availed themselves of modern cheap steel to give all parts an excess of strength over any possible strain, while the use of alloy-steels for the wearing surfaces permits the machines to be kept in much better repair, and requires fewer stoppages for renewals. For sampling-work, crushers and rolls can now be had which are almost as well made as the ordinary steam engine, and so designed as to give complete accessibility for renewals and for cleaning.

Gyratory breakers of the Gates type have the advan-

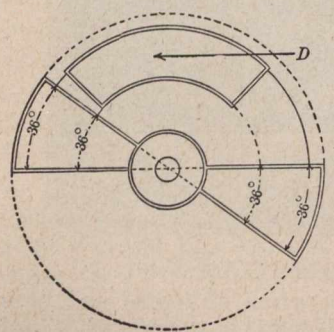

FIG. 8.—DELIVERY-SPOUT OF CHARLES SNYDER SAMPLER. CUTTING-EDGES RADIAL.

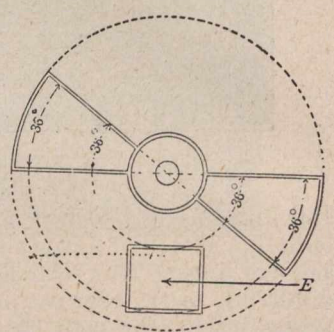

FIG. 9.—DELIVERY-SPOUT OF VEZIN SAMPLER. CUTTING-EDGES RADIAL.

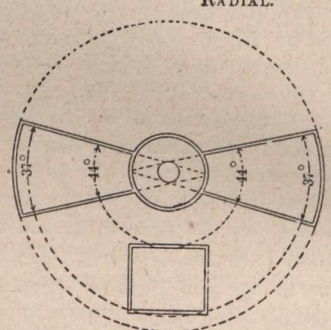

FIG. 10.—CUTTING-EDGES NOT RADIAL.

tage of delivering a very uniform product, and in crushing ores that are hard and dry this type forms by all odds the best initial crushing machine; but with ores that carry wet clay, slate or other substances which will "pack," it is necessary to use a swinging-jaw crusher, preferably of the Blake type. Rock-breakers may be set to crush to any desired fineness, but it has been found that too great a reduction in the size of the product very materially reduces the capacity. In large crushers it is not usually advantageous to attempt to crush below 2 inches in size.

First-class rolls are now always belt-driven, which eliminates the noise and danger attending the operation of the old-fashioned trains of gears. The best practice in roll-crushing is to crush not smaller than half the diameter of the particles fed to any given machine. This rule gives approximately the maximum crushing capacity with the minimum production of fines and the lowest expenditure for power and metal. Rolls require a steady feed, and one which is uniform across the entire width of the shell; consequently, nearly all modern rolls are