mental short trial on a single machine, and the results of a steady working of one or more arranged to work automatically.

In running the machine, the point of greatest importance is regularity—regularity in speed, regularity in the delivery of materials on to the belt, and regularity in the supply of clear water. The necessity for this is obvious to any one who thinks of the work to be done by an automatic machine. With hand-labour the judgment of man regulates the means employed in conformity with varying conditions; but in a machine, the object of which is to supersede hand-labour, it becomes obvious that, having once adjusted the movements to effect a certain object under certain conditions, the desired result can only be attained by the maintenance of the necessary conditions. In this concentrator, supposing the inclination of the belt to be fixed for a certain class of material, the regulation of the work to be accomplished is affected by three things—viz., the speed with which the belt revolves, the rapidity of the shake, and the supply of clear water at the head. Having adjusted these three conditions to a given feed delivered on the belt, that feed must remain pretty constant: the result, both in richness of the mineral collected and the poverty of the "tailings" or waste, will be then continuously maintained. It remains now to examine separately the regulating effect of the three conditions mentioned above.

The revolution of the belt is the agency by which the delivery of the clean material is effected. The necessity for a proper travel is perceived if the result of the two extremes be considered. Supposing the belt to remain stationary, no delivery of mineral could possibly take place; while, if a great travel were communicated, everything which falls on the belt from the sand-distributor, No. 1, would be rushed past the clear water at No. 2 and collected in the tank. Between these extremes there is the desired mean, a speed which shall be sufficiently great to deliver continuously all the mineral collected by the belt, but not so fast as to require a flood of water at No. 2 to keep back the sand. If the ore treated be poor in mineral, the upward motion of the belt should not exceed 20in. per minute; if richer, the speed is increased, and the inclination of the belt is also increased.

To examine the influence of the shaking-motion, two extreme cases can also be cited. In the absence of it, with the ordinary supply of material coming on to the belt, no separation can be effected by a reasonable stream of water at No. 2; the greater part of the rock passes over into a tank with the mineral; it "packs" upon the belt. To drive the crank-shaft H at a furious rate, and thus violently agitate the belt and its load, has the effect of working everything off the foot of the table. In this matter, as with the revolution of the belt, there is clearly a desirable mean, a speed at which the material on the belt is kept in gentle motion, lightly suspended in the water, and thus easily carried by it down the belt—a speed which allows and facilitates the settlement of the mineral from the rock, and disturbs it not when once settled on the belt. The customary rate of driving this shaking-motion varies from one hundred and eighty to two hundred revolutions of the shaft H per minute; the former speed being for fine, light "slimes," the latter for rough and heavy sand.

As regards the regulation of the water delivered at No. 1, keep the field between No. 1 and No. 2 nicely covered with water, and bring the mineral through by regulating the uphill travel. To make the final separation of mineral from sand some little judgment is necessary. As already stated, the delivery-holes in the water-launder are 3in. apart across the whole width of the belt. The clear mineral creeps up between these small jets of water, so that, as delivered over the head of the belt at A, the form is that of longitudinal streaks, further or nearer apart, and of greater or less width, according as the richness of the material treated is different. The primary object to be attained in the adjustment of the uphill travel is that the clean mineral shall be allowed to pass over into the tank at the same rate as it is fed on to the belt in the mixture to be separated. For example, suppose that in every hour 800lb. of mixed rock and mineral passes on to the belt, and that the mixture contains 5 per cent. of heavy mineral—say galena. Now, disregarding the small loss of mineral in the proper waste or tailings, the uphill travel must be so regulated that there is a steady delivery of mineral at the rate of 40lb. per hour. No more than this can possibly be delivered unless rocky impurities are allowed to pass and be weighed in; and if less than this pass there must be a continual accumulation of mineral on the belt, which will eventually produce loss in the waste. This may perhaps seem a rather delicate point to hit, and appear difficult to execute, but in reality it is a very simple matter, on which the eye furnishes a sure guide. The gauge by which this adjustment is rendered easy is the extent of "head" of mineral showing at the point No. 2, where the water strikes the belt. Again, the weight of mineral as it gets strong and heavy forces it more past the water. Should the discharge of mineral exceed the quantity falling on the belt, sand or rock will be found close up to the jets of water, and by-and-by passing them in place of mineral. If the uphill travel be too slow the mineral collects below No. 2, forming a great "head," extending towards No. 1, and even below, in which latter case an increased loss of mineral will assuredly take place in the waste. When working properly a small head is always kept below the jets of clear water, and the mineral comes over clean and regularly. A few hours' experience will instruct any one sufficiently on this fact; and, having once adjusted the uphill travel, the machine will work continuously and uniformly as long as the conditions are kept constant; nothing more than this can be expected of any machine.

In starting the machine the driving-belt is slipped from the loose to the tight pulley on the counter-shaft. The whole frame F, with the end rollers A A and B and C, and the belt E, immediately commence a gentle oscillation. It is hardly necessary to say that previous to starting all the working-parts must be oiled. At first the machine may naturally work somewhat stiffly, but after a few hours' running every part will be found to move remarkably smoothly and easily. The machine should work almost noiselessly: if there be any jar or knock the cause must be found and a remedy applied. These jars can be easily remedied, and are not faults in the machine, but in the setting-up and adjustment. If the shaking-motion be found to work smoothly and without a jar the uphill travel or progressive motion can be given. The machine is now at work, and some clear