

by using these pebbles time and power are economised. The ore is fed continuously into the hopper B, and thence is fed by gravity into the pulverising-cylinder C, where the impact and grinding action of its own particles, combined with that of the pebbles and of the walls of the rapidly-revolving cylinder, reduce the ore to an impalpable powder, without compression of the particles, the fineness of which, before it passes through the discharge end of the cylinder at the trunnion  $c^1$ , is determined by the number of revolutions made by the cylinder and the length thereof. I find by actual test that under the feed or flow of the ore from the hopper B, the said feed being occasioned by gravity alone, the course of the particles of ore through the cylinder is approximately a spiral, beginning at the feed end of the cylinder and ending at the discharge end, and that by the time the ore has travelled this distance it is sufficiently pulverised for the purposes of my process. It will be obvious that by lengthening the cylinder, or by increasing the rate of revolution, or by prolonging the grinding, other things being equal, the fineness of the ore will be proportionately increased at the discharge end. Comminution may be had in the cylinder either in the presence of water or dry; but ordinarily the use of water is found to be of advantage. However, practice in each case must determine the particular requirements of each ore-body to be ground—whether it shall be ground wet or dry; and with some ores it may be desirable to use another lining than porcelain for the cylinder.

The comminuted ore may be tested to determine its fineness by taking a sample of discharge and passing it through a screen made of silk fibre. Platinum screens may also be used as fine as 200 wires to the linear inch, but for the finer states of comminution silk gauze is the only means of testing. This comminuted ore is discharged into an amalgamating-pan E, which, as will be seen, is of a simple and ordinary construction, but is provided with a cover  $E^1$ , having an opening for a faucet or the like, and a chute  $E^2$ , arranged at one side, which extends above the pan and embraces the out-periphery of the outer flaring end of the trunnion  $c^1$ . This arrangement of cover and chute with the flaring trunnion of the pulverising-cylinder prevents waste of the powdered product as it falls into the pan, insures the delivery of such product within the pan, and retains it therein.

In using the amalgamating-pan I avoid a flow of water, and merely admit enough water to the pan to moisten the pulverised ore and form a thin paste with it. By avoiding the use of flowing water one cause of waste is eliminated, as it can easily be seen that any flow of water would carry off some of the gold in its finely-divided state.

The pan E is provided with mullers  $e$ , which may be of any usual or suitable construction and material, and are driven in the usual way by a shaft geared with the power-shaft. There is an inclined well  $e^2$  in the bottom of the pan, which is provided with a plug or tap  $e^3$ , and the entire contents of the pan may be discharged there from time to time by removing the tap or plug  $e^3$  and washing the charge into the settler F.

From the time the ore leaves the hopper B until the ore, mercury, amalgam, and water are washed into the settler F the fine dust produced is prevented from floating in the air and from being lost thereby, or by reason of draughts, gusts of wind, or the like.

The settler F has a stirrer  $f$ , which consists of radial arms  $f^1$  provided with shoes or plows  $f^2$ , and the whole is driven in any suitable manner, such as by the central shaft  $f^3$ , which is geared to the power-shaft P.

The amalgamation of the pulverised ore is accomplished by allowing a limited amount of water to flow into the pan E—just enough water to form a thin paste with the quantity of ore to be treated—say, from a ton to a ton and a half—and then adding sufficient mercury to amalgamate the gold—say, a tank of 75 lb. The discharge from the cylinder may continue or may be stopped for the time being, but if the discharge is continuous there must be a continuous supply of mercury. The muller is set in rotation at about sixty revolutions per minute, and this rate is continued until the amalgamation of the gold in the ore is completed. By panning a sample the progress of amalgamation can be easily determined. As soon as the amalgamation is completed the speed of the muller is reduced, the plug or tap  $e^3$  is removed from the orifice of the inclined well  $e^2$  at the bottom of the pan, and water is turned on to wash the whole mass of pulp and amalgam into the settler F. The water which washes the charge from the amalgamating-pan serves also to dilute the pulp and make it sufficiently fluid to enable the mercury and amalgam more readily to settle into the well of the settler, which is shown in the drawings as  $f^4$ . In this settler the amalgam and mercury are finally cleaned and separated from impurities, which are drawn off through the holes  $f^5$  in the periphery of the settler, these holes being provided, of course, with plugs  $f^6$ . After sufficient cleansing by means of the revolution of the stirrer-arms and the settling of the mercury and amalgam into the well  $f^4$ , the mercury and amalgam are finally withdrawn through the said well, or through its orifice, which is provided with a plug or similar device  $f^7$ . The mercury and amalgam withdrawn from the settler are treated in the ordinary way for the recovery of the gold and the saving of the quicksilver.

It is to be understood that several amalgamating-pans and several settlers or washers may be used in connection with the pulveriser, either in series or otherwise, as may be most convenient and effective; but I find that ordinarily, with the minute and hardened pulverisation of the ore which I effect, two pans and one settler are ample in the treatment of the product, as amalgamation with pulverised and unhardened ores is rapid.

My process has been used in the treatment of telluride ores, and resulted in extracting therefrom between 25 and 33 per cent. of the entire amount of gold therein.

My process contemplates a practically continuous operation, the ore being fed forward from the hopper through the pulverising-cylinder into the amalgamating-pan, where it is treated with mercury, and from the amalgamating-pan the whole mass is washed into the settler, where the amalgam and mercury are cleaned and separated from the rest of the mass; and each and every step in this feeding-forward is accomplished by gravity alone. While this is apparent enough in