Patented Aug. 27, 1935 2,012,830

UNITED STATES PATENT OFFICE

2,012,830

FROTH FLOTATION PROCESS

Oliver C. Ralston and Clarence R. King, Clarkdale, Ariz., assignors, by mesne assignments, to Phelps Dodge Corporation, New York, N. Y., a corporation of New York

No Drawing. Application October 6, 1930, Serial No. 486,747

5 Claims. (Cl. 209—167)

This invention relates to the concentration of minerals and has for an object the provision of an improved flotation process. More particularly, the invention contemplates the provision of an improved differential flotation process.

The process of the invention involves control of the alkalinity of flotation pulps in order to reject undesirable minerals and permit the recovery of separate concentrates of two or more valuable minerals.

Our invention is particularly adapted for use in conjunction with froth flotation processes involving wet grinding of coarse sulphide minerals or ores, classification of the ground product, and introduction of resulting pulps containing particles of suitable sizes into flotation cells for treatment. According to some heretofore customary practices, an alkaline substance such as lime is added to the ball mill with the ore or mineral to be ground. Such substances are consumed during the various operations through oxidation and reaction with the sulphide minerals. The extent to which the alkaline substance is consumed varies in different operations, and in a single operation in accordance with changes in the character of the ore or mineral being treated and in accordance with changes in conditions, such, for example, as exposure to oxidizing influences and character of grinding, which cannot be controlled exactly.

While consumption of the alkaline substance proceeds through the grinding, classifying, and flotation operations, the major portion is consumed during the grinding operation in the course of which fresh mineral surfaces are being exposed constantly and when conditions are more conducive to oxidation. In the treatment of many types of ores, it is desirable to maintain the pulps alkaline at least during a portion of the flotation operation, but in view of the fact that consumption of alkaline substances varies constantly in each of the operations involved, it is difficult to predict the alkalinity of the pulps in the flotation cells when specific amounts of alkaline substances are added with the feed to the grinding mills.

We have found that consumption of alkaline substances proceeds rather uniformly throughout the flotation operation and that by establishing predetermined amounts of alkaline substances in the feed to the flotation machines, the alkaline character of the pulp in various stages of the flotation operation may be forecast. The desired alkalinity of feed or pulp entering the flotation cells may be established in any suitable manner, as, for example, by varying the amounts of alkaline substances added with the feed to the grinding mills, or by adding fixed amounts of alkaline substances with the feed to the grinding mills and making suitable corrections in the pulp entering the flotation cells.

We have also discovered that differential flotation operations involving the treatment of ores containing sulphides of copper, zinc and iron may be conducted advantageously when the pulp entering the flotation cells is maintained at an alkalinity equivalent to from .01 pounds to 1.0 pound of CaO per ton of water and when suitable mineral collecting, frothing, activating and deactivating agents are employed at appropriate stages. We prefer to employ pulps containing two to five parts, by weight of water to one part of ore or minerals.

In treating an ore containing sulphides of copper, zinc and iron, we prefer to first recover a copper concentrate and subsequently recover a zinc concentrate. The zinc concentrate may be retreated to obtain a product higher in zinc. It is desirable to maintain different degrees of alkalinity in the pulps employed in obtaining the rougher copper concentrates and the rougher zinc concentrates and in retreating the rougher zinc concentrates. Generally, satisfactory results may be obtained by treating a pulp of relatively low alkalinity to recover a rougher copper concentrate, increasing the alkalinity of the resulting tailing pulp to provide a pulp suitable for the recovery of a rougher zinc concentrate, and retreating the zinc concentrate in a pulp in which the alkalinity is maintained at a value intermediate the values in the pulps employed in obtaining the rougher zinc and copper concentrates. During the flotation operation for the recovery of the copper concentrate, we prefer to maintain an alkalinity equivalent to from 0.02 to 0.20 pounds CaO per ton of water in the pulp entering the flotation cells. For the subsequent recovery of a zinc concentrate, we prefer to maintain an alkalinity equivalent to from 0.20 to 1.0 pounds CaO per ton of water in the pulp entering the flotation cells. In retreating the zinc concentrate, we prefer to maintain an alkalinity of from 0.04 to 0.40 pounds CaO per ton of water in the pulp entering the flotation cells.

As alkaline reagents we may employ one or more of the commonly used reagents such as lime, sodium carbonate and sodium bicarbonate.

While pulps of any desired densities may be employed in the various stages of the process when degrees of alkalinity within the limits set