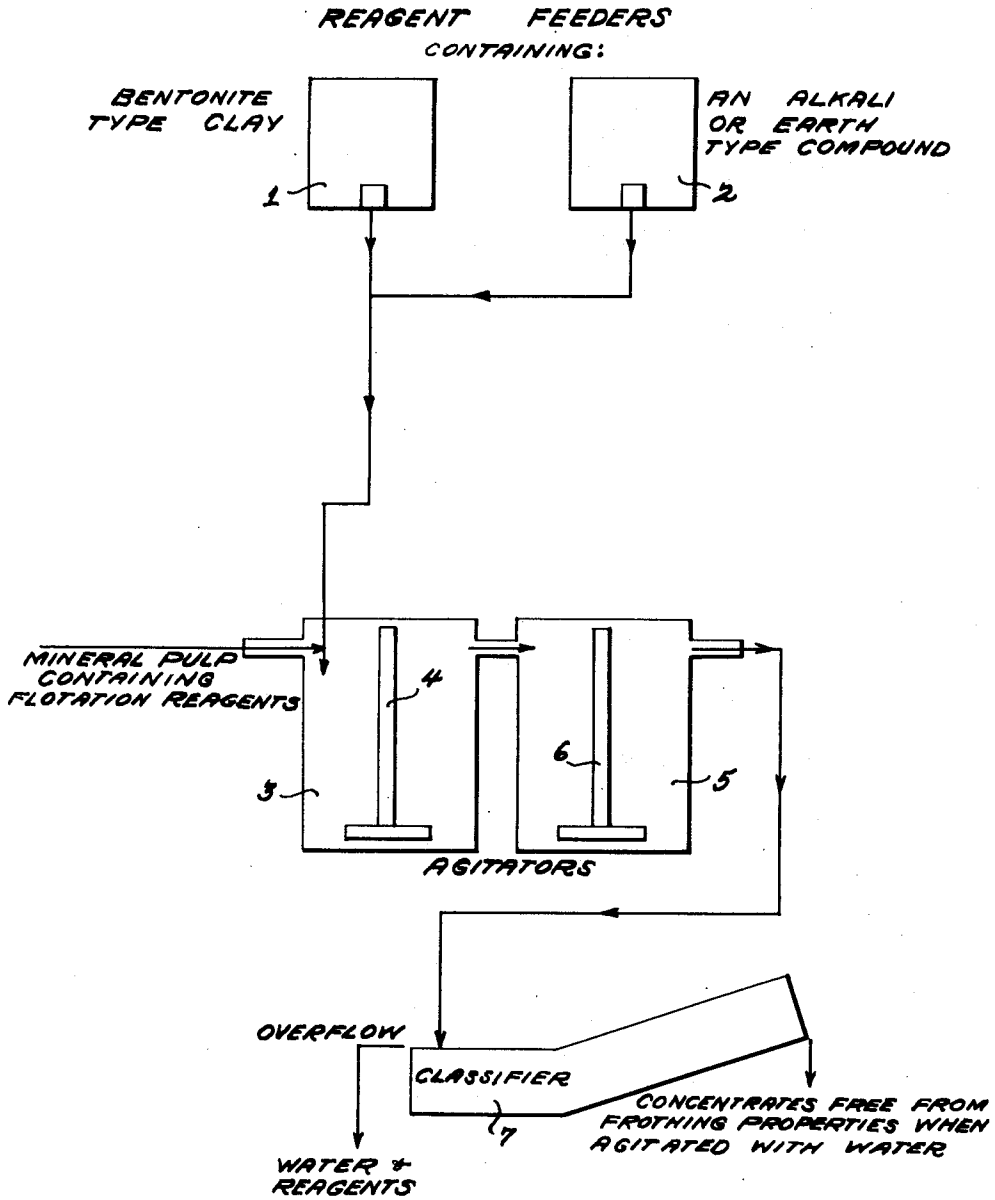
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PROCESS FOR TREATING FROTH FLOTATION CONCENTRATES

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PROCESS FOR TREATING FROTH FLOTATION CONCENTRATES

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The use of sink-and-float concentration operations for effecting concentration of ores and minerals is well-known. Among such operations there are commonly employed froth flotation procedures, wherein lighter constituents of a mineral body or the like being concentrated are suspended in a foam or froth produced by the use of foam-producing reagents, such foam having sufficient viscosity to float off lighter particles of the mineral body being concentrated while allowing heavier particles to sink through the foam and reagents for settling into the bottom of the tank or cell in which the operation is carried out.

In accordance with the usually resorted to procedures employing froth flotation of non-metallic minerals, it often happens that the valuable mineral is obtained from the flotation cells associated with the froth, and it is found that after dewatering and drying, the resulting concentrates still contain flotation reagents, which may be an impedance in the further processing of the concentrates, or at least in a loss of valuable reagents. For example, the presence of these reagents on the concentrates prevents them from being wholly wettable with water, and also tend to reform the concentrates into a froth or foam, particularly in circumstances where the concentrates may be re-pulped in water for further processing. In many industries using these non-metallic minerals which have been concentrated by flotation, this feature is very troublesome and in some circumstances, actually prevents the use of the concentrates. This is particularly true in the ceramic industry where, in most cases, the mineral necessarily has to be re-slurried with water and agitated. In these cases, the froth or foam produced by the residual flotation reagents left on the mineral particles provides a most difficult problem in obtaining a good casting or workable slip or slurry of the mineral or of a composition where a flotation concentrated mineral forms a slip or slurry.

The present invention relates to a process for removing such residual flotation reagents from flotation froths or pulps containing flotation reagents, and the invention has for one of its objects rendering the mineral concentrates from froth flotation operations completely free from residual contained flotation reagents so that such concentrates may be fully water-wettable and unable to reform into froth by the addition of air and water.

A further object of this invention is to de-oil flotation froths containing non-metallic minerals

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which have been floated with a class of flotation reagents known as cationic or amine type reagents commonly used to float non-metallic minerals.

Further objects of the invention will become apparent as the description proceeds, and the features of novelty will be pointed out in particularity in the appended claims.

In accordance with the present invention, it has been discovered that such concentrates can be freed effectively from entrained or occluded froth-producing reagents by the addition of adsorbent clays such as bentonite or the like during the re-pulping and agitation of the concentrates, or that the flotation concentrates can be treated at the flotation plant by agitating the froth with bentonite. In this way, the froth-forming tendencies of the mineral concentrates are completely destroyed, and the concentrates then may be wetted completely with water and aerated in a water slurry without any tendency to form a froth.

A further feature of the present invention resides in the discovery that the incorporation of a small amount of lime, alkalies, or alkaline-reacting compounds in combination with the adsorbent clays, further improves the water-wetting tendencies of the mineral concentrates. Such addition of alkaline-reacting compounds also neutralizes any acid which usually is employed in flotation concentration of non-metallic minerals using cationic-type reagents.

The procedure of the present invention will be understood more readily by reference to the accompanying drawing, which illustrates in diagrammatic manner, a flow sheet illustrating the operational steps of the process of the invention.

In accordance with the drawing, a slurry of bentonite is prepared in a suitable tank or receptacle 1, and a water solution of a suitable alkali or alkaline earth compound is prepared in tank 2. These solutions are flowed together into an agitator 3 which is fed a pulp of the mineral concentrates containing flotation reagents. The materials are mixed thoroughly together by means of a propeller-type agitator 4, and preferably overflow into a second and similar agitation tank 5 provided with a propeller-type agitator 6. The resulting mixed slurry passes to a classifier 7, wherein the flotation reagents and the concentrates become separated and stratified, the resulting reagent-free concentrates settling to the bottom of the classifier as indicated and withdrawn therefrom, whereas water, the frothing reagents and adsorbent clay are withdrawn from

the top of the classifier as overflow. The concentrates are found to be completely free from the froth-producing reagents, and to be completely wettable with water when re-pulped therein.

The process of the invention will be understood still more clearly from the following illustrative examples taken from actual operating runs of the process, and illustrating specific conditions of operation as applied to particular concentrates. It will be understood that the specific quantities of materials employed and specific operating details may be subject to variations depending upon the particular mineral concentrates being employed, and consequently the following examples are to be regarded as being typically representative of the process as actually carried out.

Example I

A feldspar froth which had been floated with hydrofluoric acid and Armac T (an amine cationic type reagent) which possessed strong froth-forming properties was treated with 0.75 pound per ton (dry basis) bentonite, and with 0.25 pound per ton (dry basis) lime and 35 per cent solids as a water slurry in an agitator for two minutes. It was found that this treatment removed completely all traces of the reagents, and the feldspar was wetted easily with water and showed no tendency to re-form a froth upon addition of air while being agitated.

Example II

A mica concentrate in froth form was treated with 1 pound per ton (dry basis) bentonite and 0.5 pound per ton of lime (dry basis) and agitated two minutes at 25 per cent solids as a water slurry. It was found that this treatment removed all reagents and acids and rendered the mica completely water-wettable, with no froth-forming tendencies when aerated as in a water slurry.

Example III

A sericite concentrate in froth foam was treated with 1.0 pound per ton (dry basis) bentonite and 1 pound per ton lime (dry basis) and agitated for three minutes at 20 per cent solids as a water slurry. It was found that this treatment removed all reagents and made the sericite completely water-wettable.

Example IV

A feldspar concentrate in froth foam was agitated for two minutes as a water slurry of 30 per cent solids with 3 pounds per ton of sub-bentonite type clay and 0.5 pound per ton sodium hydroxide (the weights being on a dry basis). It was found that this treatment removed all traces of the reagents and made the feldspar completely water-wettable.

Example V

A ceramic pulp composed of feldspar 30 per cent, clay 30 per cent, flint 30 per cent, and ball clay 10 per cent, was prepared, using flotation concentrated feldspar with the residual flotation reagents still contained on the particles of feldspar. This pulp on agitation and aeration had froth-forming properties to an extent to make it unworkable. This pulp then was treated with 3 pounds per ton (dry basis) bentonite and 0.25 pound per ton lime and agitated for two minutes with a propeller-type agitator. Upon removing the pulp from the agitator it was treated again with air and was found to be free from froth-forming tendencies, the pulp being found to be readily workable from a ceramic viewpoint.

In the foregoing examples, lime or caustic soda was used in connection with bentonite. As has been pointed out above, such alkaline reacting materials are found to be helpful as neutralizing agents for acidic constituents in froth-producing reagents, although in instances when such acidic constituents are absent, the presence of such alkaline materials is not necessary. Where such materials are employed, lime is found to be preferable to caustic soda as the neutralizing agent, it being more easily handled and being less corrosive to the equipment employed. It is found in practice that bentonite is the preferred deoiling material for the concentrates, its absorbent action for the froth-forming materials being substantially greater than that of the particles of the mineral concentrates being treated.

While from the foregoing it will be apparent that the preferred embodiment of the improved process employs bentonite as the froth-releasing material, the quantities thereof that are preferred will depend upon the particular type of concentrates being treated as well as the amount of froth-producing reagents associated therewith.

Accordingly, it will be understood that it is intended and desired to embrace within the scope of the invention such modifications and changes as may be necessary to adapt it to varying conditions and uses, as defined by the appended claims.

Having thus described my invention, what I desire protected by Letters Patent is as set forth in the following claims:

1. A process for removing amine flotation reagents from amine containing flotation froths of micaceous and feldspathic concentrates containing residual flotation reagents, which comprises adding bentonite to the said pulp of the micaceous and feldspathic concentrates for adsorbing the amine flotation reagents from the said concentrates, classifying the resulting treated concentrates and bentonite, and separating the resulting reagent-freed concentrates and liquid bearing mineral material and flotation reagents adsorbed thereon.

2. A process for removing amine containing flotation reagents from amine containing flotation froths of micaceous and feldspathic concentrates containing residual flotation reagents, which comprises adding to an amine containing pulp of micaceous and feldspathic concentrates an adsorbent bentonite clay for adsorbing the flotation reagents from the said concentrates, classifying the resulting treated concentrates and bentonite clay, and separating the resulting reagent-freed concentrates and liquid bearing the bentonite clay and flotation reagents adsorbed thereon.

3. In froth flotation concentration operations, the improvements which consist in treating an amine-containing pulp of micaceous and feldspathic concentrates containing residual amine-containing flotation reagents with bentonite for freeing the concentrates from the residual reagents, and agitating the bentonite and pulp until the amine-containing flotation reagents are separated from the concentrates.

4. In froth flotation concentration operations, the improvements which consist in treating an amine-containing pulp of silicate concentrates selected from the group consisting of mica and feldspar containing residual amine-containing flotation reagents with bentonite and an alkaline material for freeing the said silicate concentrates from the residual amine-containing reagents, and

agitating the pulp with the bentonite and alkaline material until acidic constituents in the reagents are neutralized and the reagents are separated from the concentrates.

5. In froth flotation concentration operations, the improvements which consist in treating a pulp of non-metallic silicate concentrates selected from the group consisting of mica and feldspar containing residual amine-containing flotation reagents with about 0.75 pound to about 3 pounds of adsorbent bentonite clay per ton of concentrates on a dry basis, agitating the pulp and bentonite until the said concentrates are free from the amine-containing flotation reagents, and separating the thus-treated concentrates from associated materials.

6. A process for removing residual amine-containing flotation reagents from froth flotation silicate concentrates selected from the group consisting of mica and feldspar, which comprises, agitating the concentrates as a water slurry with bentonite-type clay and an alkaline compound until the residual amine-containing reagents are separated from the concentrates, and recovering the thus-treated concentrates from associated materials.

7. A process for removing residual amine-containing reagents from froth flotation silicate concentrates, selected from the group consisting of mica and feldspar, which comprises agitating the said silicate concentrates as a water slurry with bentonite and lime until the residual amine-containing reagents are separated from the concentrates, and recovering the thus-treated concentrates from associated materials.

8. The process of de-oiling flotation micaceous and feldspathic pulps, which comprises conditioning the pulps as a water slurry by agitating the slurry with bentonite.

9. The process of de-oiling froth flotation silicate pulps selected from the group consisting of mica and feldspar obtained from amine-containing flotation reagents and mineral acid reagents, and which pulps contain residual amine-containing reagents, which comprises agitating the said pulps with bentonite and a water-soluble alkaline material for neutralizing the mineral acid reagents until the said pulp is freed from residual flotation reagents and the acid reagents therein are neutralized, and separating the thus-treated minerals from resulting associated materials.

10. The process of treating a ceramic slip which has froth forming properties resulting from the presence in the slip of amine-containing froth flotation mineral silicate concentrate selected from the group consisting of mica and feldspar and containing residual amine-containing froth forming reagents, which comprises agitating the slip with bentonite until froth-forming tendencies are removed from the slip, and recovering the thus-treated slip from associated materials.

11. In the treatment of froth flotation concentrates selected from the group consisting of mica and feldspar and containing residual amine-type froth-producing reagents, the improvements which consist in producing an aqueous slurry of the said concentrates, agitating the slurry with bentonite until the reagents are separated from the concentrates, and recovering the said concentrates free from associated materials.

12. The process for removing amine-containing flotation reagents from froth flotation silicate concentrates selected from the group consisting of mica and feldspar containing residual froth-forming amine-containing reagents which comprises adding bentonite to an aqueous pulp of the said concentrates and an alkaline compound in an amount sufficient to neutralize acidic constituents in the said residual reagents, agitating the bentonite and the pulp together until the residual reagents are separated from the concentrates, and recovering the resulting reagent free concentrates.

13. The process for removing flotation reagents from amine-containing froth flotation silicate concentrates selected from the group consisting of mica and feldspar containing residual froth forming reagents, which comprises adding bentonite to an aqueous pulp of the said concentrates and lime in an amount sufficient to neutralize acidic constituents in the said residual reagents, agitating the bentonite and the pulp together until the residual reagents are separated from the concentrates, and recovering the resulting free concentrates.

14. The process for removing amine-contain- flotation reagents from amine-containing froth flotation silicate concentrates selected from the group consisting of mica and feldspar containing residual froth forming reagents, which comprises adding bentonite to an aqueous pulp of the said concentrates and caustic soda in an amount sufficient to neutralize acidic constituents in the said residual reagents, agitating the adsorbent material and the pulp together until the residual reagents are separated from the concentrates, and recovering the resulting reagent-free concentrates.

15. The process for removing amine-containing flotation reagents from amine-containing froth flotation silicate concentrates selected from the group consisting of mica and feldspar containing residual amine-containing froth forming reagents, which comprises adding to an aqueous pulp of the said concentrates bentonite and caustic soda in an amount sufficient to neutralize acidic constituents in the said residual reagents, agitating the adsorbent material and the pulp together until the residual reagents are separated from the concentrates, and recovering the resulting reagent-free concentrates.

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