Aug. 8, 1939 J. M. McCLAVE 2,168,942

FLOTATION APPARATUS

Filed July 6, 1936

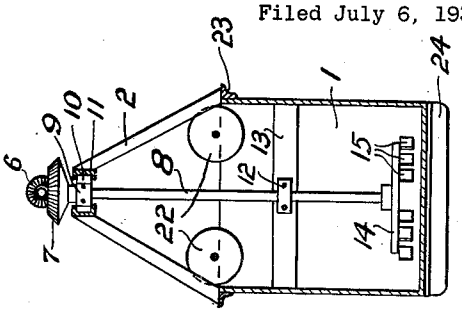


Fig. 2

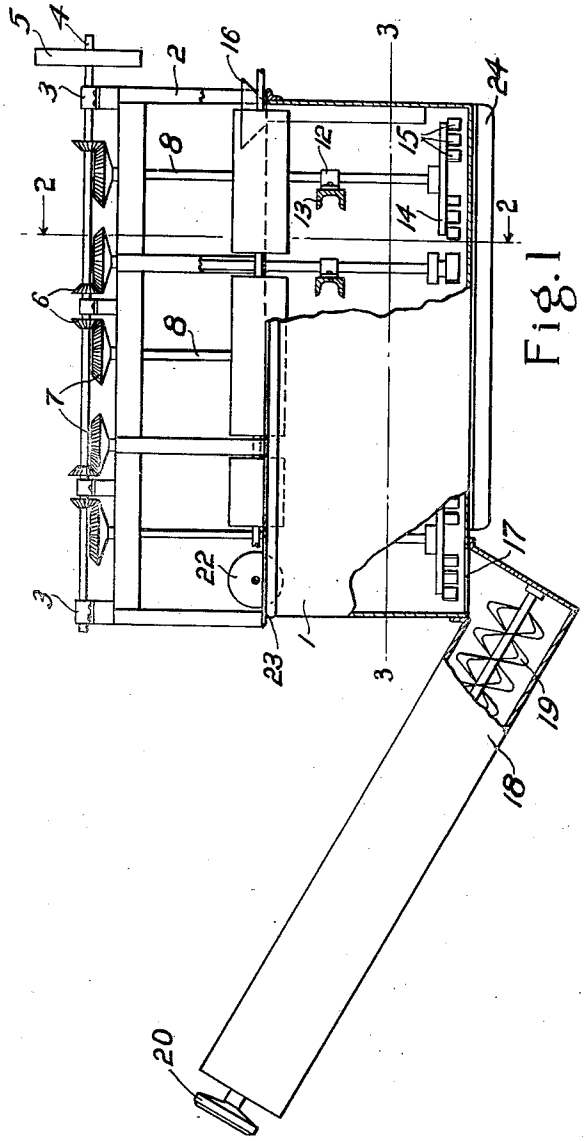


Fig. 1

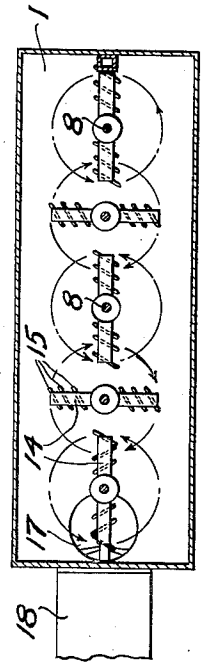


Fig. 3

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FLOTATION APPARATUS

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Application July 6, 1936, Serial No. 88,971
In Canada July 9, 1935

2 Claims. (Cl. 209—155)

This invention relates to apparatus for removing floatable material from ores, oil sands and the like.

In application Serial No. 739,610 there is disclosed a method and apparatus for separating minerals, hydrocarbons and the like from associated materials. The present invention relates to another form of apparatus for use in carrying out such flotation methods.

An object of the invention is to provide an efficient flotation cell which affords any desired amount of agitation of the material under treatment and yet maintains a quiet zone within which the separation of the floatable from the unfloatable material is effected, which ensures even distribution of the material in a thin layer as it progresses through the cell, and which, when used with a heating jacket as in separating oil from sands, permits more effective and uniform heating of the material to facilitate the liberation of the oil from the sand particles.

The invention will be described with reference to the accompanying drawing, in which—

Figure 1 is a side elevation partially broken away;

Figure 2 is a section on line 2—2 of Figure 1; and

Figure 3 is a plan view on line 3—3 of Figure 1.

In the drawing, 1 represents the flotation chamber, above which is centrally mounted by a frame 2 and journal members 3 a shaft 4 having a drive pulley 5 and carrying bevel gears 6 which mesh with corresponding gears 7 on the upper ends of vertical shafts 8 which are journalled in brackets 9 on supporting members 10 carried by brackets 11 or the like of the frame. Additional journalling brackets 12 and supporting members 13 may be provided intermediate the length of the shafts. On the lower end of the shafts 8 are rabble arms 14 having angularly disposed rabble blades 15.

A hopper 16 feeds material adjacent the bottom of the chamber and a bottom discharge outlet 17 is provided at the opposite end of the chamber. To the discharge outlet is connected an upwardly inclined conveyor tube 18 in which is arranged a conveyor 19, which may be of the helical screw type shown, a drag conveyor, a bucket elevator or the like. 20 represents drive means for the conveyor. Along the sides and, if desired, the discharge end of the chamber are slowly revolving drums or rollers 22 which may be driven by any suitable means, not shown. The side rollers are illustrated as being in sections but single rollers of the desired length may be employed. A scraper 23 may be provided for each roll. When used for treating oil sands or the like, a heating jacket 24 is provided on the bottom of the cell.

In operation the slurry or pulp to be treated is fed into the cell through the hopper 16. Air and flotation agent as required are incorporated in the pulp as it is fed into the hopper or otherwise, as desired. The water level in the cell is maintained at the point shown with the rollers 22 contacting the surface of the water. The inclination of the conveyor tube is such as to maintain the water level at the desired point. As the pulp is discharged from the lower end of the hopper the solids therein are gently agitated and conveyed in a more or less circular path by the angularly disposed rabble blades 15 while the inter-related movement of the rabble arms 14 carries the solids forward to the discharge outlet 17. The gentle agitation of the solids liberates the floatable particles which are carried upwardly through the quiescent body of water to the surface and the froth or foam with adhering oil or mineral matter is removed by the rollers 22. By the time the solids have reached the discharge end the repeated agitation thereof has caused the liberation of the oil or mineral particles and these have had ample opportunity of being picked up by the rising bubbles of air, so that an efficient separation is afforded. The solids then free or substantially free from floatable material are carried from the cell by the conveyor 19 and discharged.

In the treatment of oil sands, for which the cell is particularly well adapted, the steam jacket 24 applies heat to the pulp immediately adjacent the agitating zone and facilitates the quick release of the oil.

In the usual type of apparatus it is difficult and costly to maintain the desired temperature of the sand and oil at the moment of separation of the oil, partially at least because of the cold air entrained into the cell. It will be apparent that in the present arrangement the relative long travel of the sands in contact with the heated bottom greatly facilitates clean separation of oil from the sand.

It will be observed that alternate shafts carrying the rabble arms travel in opposite directions and that the angular disposition of the rabble blades gives the solid particles a definite and prolonged path of travel during which they are continuously gently agitated. The rabble blades on the last rabble are arranged to direct the clean material into the conveyor jacket.

Rotating paddles, paddle wheels, scrapers or other devices may be used in lieu of rollers for the removal of the froth from the cell and various other changes may be made within the scope of the invention defined in the following claims.

I claim:

1. A flotation cell having therein a body of water the major portion of which is maintained in a quiescent condition, comprising a chamber having a discharge outlet at the bottom, a feed inlet discharging adjacent the bottom, an upwardly inclined conveyor pipe connected to the outlet, vertical shafts projecting into the chamber, means to rotate each of said shafts, rabble arms on the lower end of each shaft adjacent the floor of the chamber and adapted to move in overlapping paths and angularly disposed blades on said arms to agitate solids in the chamber to form and release loaded bubbles which rise through said quiescent body of water and to propel the remaining solids from the feed end to the discharge end thereof.

2. A flotation cell as defined in claim 1 having means adjacent each side of the chamber to remove from the quiet surface of the body of water buoyant material separated from said solids.

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