R. GAHL.

FLOTATION ORE SEPARATOR.

APPLICATION FILED JAN. 31, 1916.

1,346,818. Patented July 20, 1920.

2 SHEETS—SHEET 2.

Fig. 9.

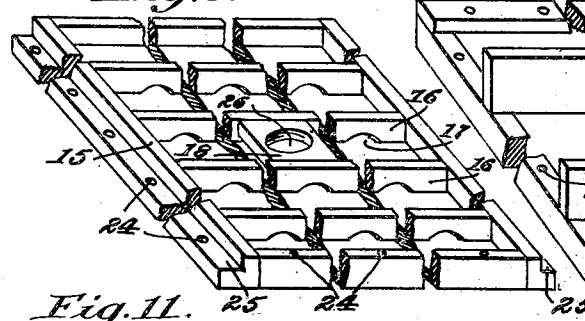



Fig. 10.

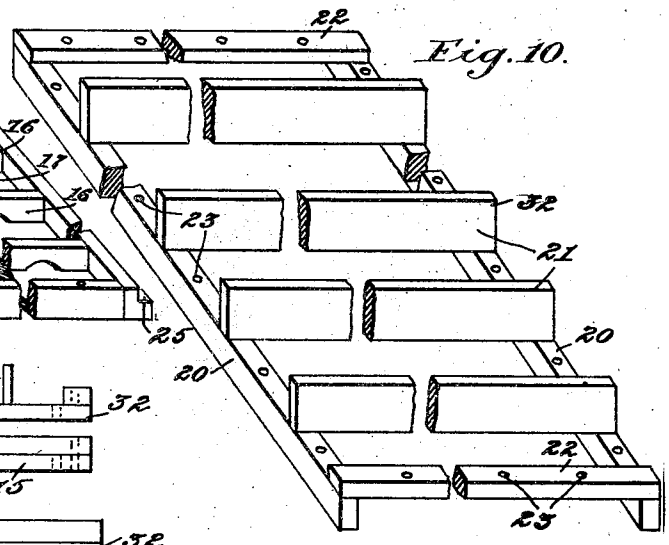



Fig. 11.

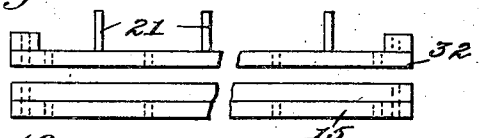



Fig. 12.

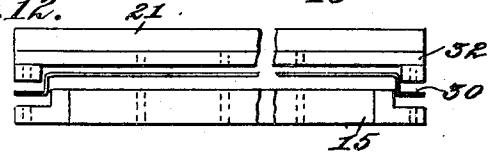



Fig. 13.

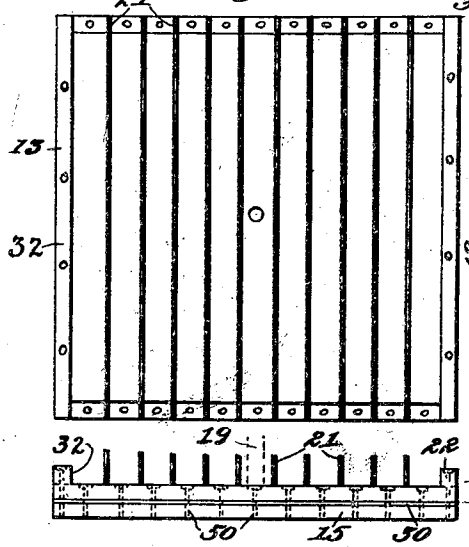



Fig. 15.

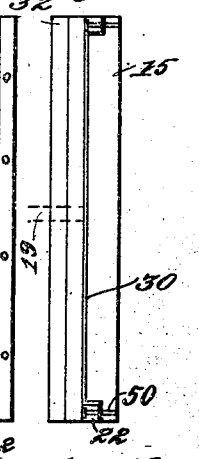



Fig. 14.

Fig. 16.

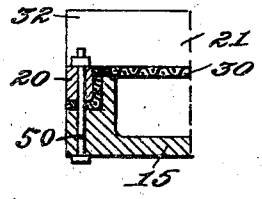



Fig. 20.

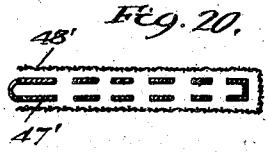



Fig. 21.

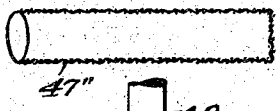



Fig. 18.

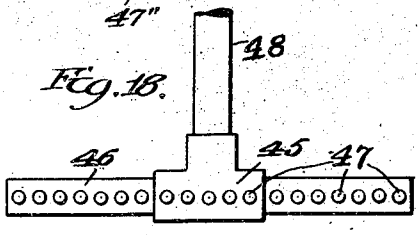
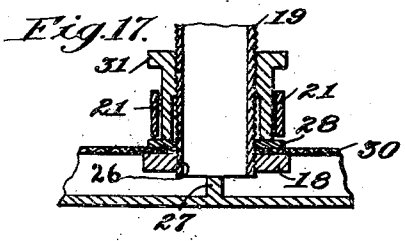



Fig. 17.




Inventor

Rudolf Gahl

by Byrnes Townsend & Brickenstein Att'ys.

R. GAHL.

FLOTATION ORE SEPARATOR.

APPLICATION FILED JAN. 31, 1916.

1,346,818.

Patented July 20, 1920.

2 SHEETS—SHEET 1.

Fig. 1.

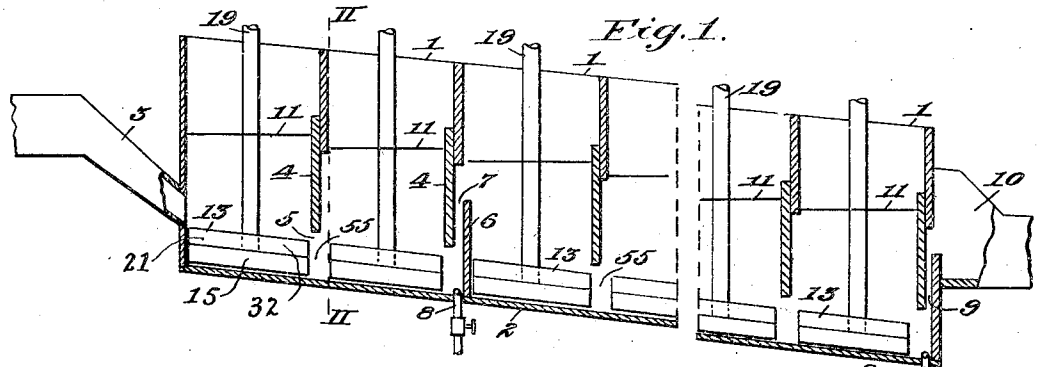



Fig. 8.

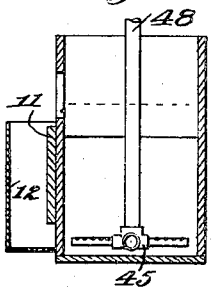



Fig. 2.

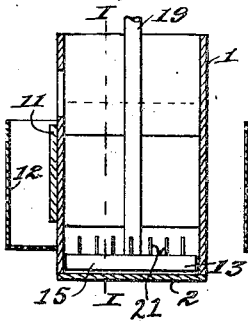



Fig. 4

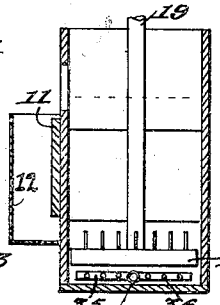



Fig. 6.

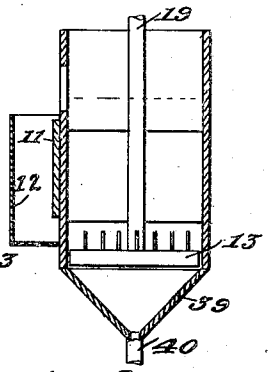



Fig. 5.

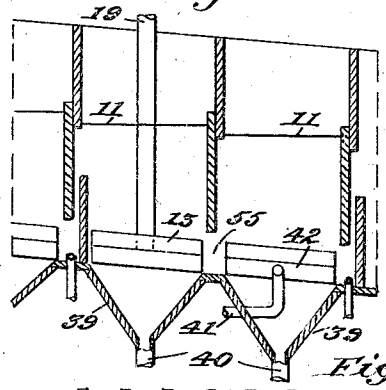



Fig. 3.

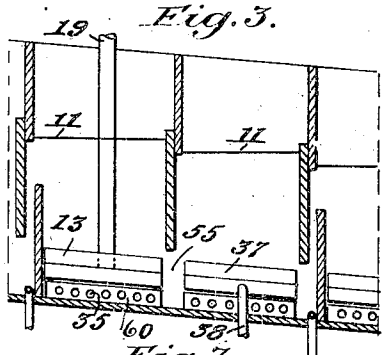



Fig. 7.

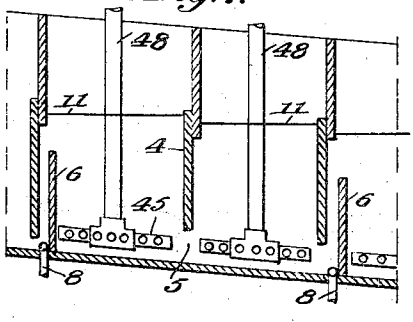
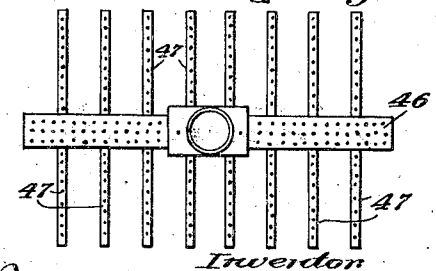



Fig. 19.




Inventor

Rudolf Gahl

by Byrnes Townsend & Brickenstein Attys.

# UNITED STATES PATENT OFFICE.

RUDOLF GAHL, OF MIAMI, ARIZONA, ASSIGNOR, BY MESNE ASSIGNMENTS, TO PNEUMATIC PROCESS FLOTATION COMPANY, OF NEW YORK, N. Y., A CORPORATION OF DELAWARE.

## FLOTATION ORE-SEPARATOR.

1,346,818. Specification of Letters Patent. **Patented July 20, 1920.**

Application filed January 31, 1916. Serial No. 75,343.

*To all whom it may concern:*

Be it known that I, RUDOLF GAHL, a citizen of the United States, residing at Miami, in the county of Gila and State of Arizona, have invented certain new and useful Improvements in Flotation Ore-Separators, of which the following is a specification.

This invention relates to flotation ore-separators, provided with a removable foraminous air-supply bottom or chamber.

In the accompanying drawings,—

Figure 1 is a broken view of a vertical longitudinal section on the line I—I of Fig. 2, showing one form of construction;

Fig. 2 is a vertical transverse section thereof, on the line II—II of Fig. 1;

Figs. 3 and 4 are views of vertical-longitudinal and -transverse sections of a modification;

Figs. 5 and 6 are views of vertical-longitudinal and -transverse sections of a further modification;

Figs. 7 and 8 are views of vertical-longitudinal and -transverse sections of another modification;

Figs. 9 and 10 are views, in perspective, of broken lower and upper parts, respectively, of the preferred type of removable bottom;

Figs. 11 and 12 are end and side views, respectively, of the removable bottom or chamber of Figs. 1 and 2, shown separated, with the air-supply pipe removed;

Figs. 13, 14, and 15 are plan, end, and side views of the assembled removable bottom of Figs. 1 and 2, showing a portion of the air-pipe;

Fig. 16 is a detail showing the method of securing the porous septum at the ends of the upper and lower sections of the removable bottom or chamber;

Fig. 17 is a detail showing the method of securing the air-supply pipe to the bottoms or chambers of Figs. 1 and 2, and also showing how the septum may be secured around the pipe; and

Figs. 18 and 19 are views of the air-supply manifold used in the modification shown in Figs. 7 and 8;

Figs. 20 and 21 illustrate different forms of foraminous pipes.

The flotation separator box or tank 1, generally rectangular in shape, is provided with a bottom 2 which may be horizontal, but is preferably sloping, as shown in Fig. 1. The tank is inserted in, or connected to, a launder 3, carrying water and ground ore pulp, or slimes, and entering the tank at a point below the concentrate overflow, the tank being ordinarily wider and deeper than the launder in order to reduce the velocity of the ore-flow. The several flotation compartments of the tank are separated by adjustable gates 4, each of which leaves a restricted opening or passage 5 for the discharge of the ore-pulp to the next compartment. At suitable intervals, or if desired between each compartment, is placed a baffle 6, providing a narrow channel 7 through which the ore discharges into the next compartment. This channel 7 is preferably of the width of the compartment, but it could as well be a pipe, or other duct, of suitable dimensions. The function of channel 7 is to impart a velocity to the stream of ore particles passing through, thereby thoroughly mixing them and preventing them from settling. At the bottom of each of the channels 7, there may be located a pipe 8, which delivers air to the pulp flowing through the passage 7, thereby stirring up the ore and water and preventing any accumulation of pulp in this passage. At the end of the flotation separator tank is a discharge passage 9, delivering tailings into the launder 10. This passage 9 may similarly be provided with an air supply pipe 8. The concentrates from the several separator compartments flow over the adjustable gates 11 into concentrate launder 12.

The removable air-chamber 13, shown in Figs. 1 and 2, is shown in detail in Figs. 9 to 15, inclusive. It consists of a subdivided box-like bottom-portion 15, (Fig. 9), containing partitions 16 having openings 17 which provide passages throughout the entire bottom for compressed air. A support 18 is provided with a threaded opening 26 into which an air-supply pipe 19 is secured (see Figs. 1, 2, and 17). The upper portion of the air-chamber consists of a grate or open frame (Fig. 10), made of side-ledges 20 upon which are secured grate-bars 21, and tie-bars 22. The grate-bars 21 are preferably of metal, and are as thin as per-

missible, and register with the partitions 16 to afford clamping surfaces for the septum 30. The side-ledges 20 and tie-bars 22 are provided with numerous bolt holes 23 which register with the bolt holes 24 in the bottom portion 15. The side ledges 20 nest in the recesses 25 in the sides of the bottom portion 15, the top and bottom portions being secured together by suitable bolts 50. A suitable septum 30, which may be a fabric such as canvas, having a great number of very small uniformly distributed pores, is bolted between the top and bottom portions, as shown in Figs. 12, 14 and 15. The air-supply pipe 19 (Fig. 17) passes through a hole in the canvas and is screwed into the threaded opening 26 in the support 18, against the brace 27. Upon the canvas 30 is placed a suitable washer 28, and against the washer is turned the lock-nut 31 making a tight joint.

In Figs. 3 and 4, a manifold consisting of a main supply pipe 60 having lateral branches 35, is placed in the flotation compartment below the removable air-chamber, and may be mechanically attached thereto, or separate, or built permanently in the flotation compartment. The several pipes 35 of the manifold are provided with numerous small holes 36, directed sideward and downward, see Fig. 4. The manifold may be supplied with a stirring fluid such as air or water under pressure, and is for the purpose of washing away any sands or ore particles which may have settled during the temporary removal of the air-chamber 13. The air or water may be supplied to the manifold in any suitable manner through pipe connections not shown.

In Fig. 3, the removable air-chamber 37 is shown supplied with compressed air through pipe 38 which may enter the side or bottom of the lower compartment.

In Figs. 5 and 6 the flotation compartments are provided with funnel-like bottoms 39, having air-pipes 40 secured therein. Upon replacing a temporarily removed air-chamber 13, air or water is supplied through pipe 40, thereby stirring and washing away any settlings, etc., that may have subsided. At 41 is shown an air-supply pipe leading into the removable air-chamber 42, in place of the vertical pipe 19, shown in Fig. 1.

In Figs. 7 and 8, the removable box-like air-chamber is replaced by the removable manifold 45, which also constitutes an air-chamber, consisting of a main horizontal pipe 46, (Figs. 18 and 19) from which project numerous cross-pipes 47; these cross-pipes may consist of foraminous metal pipes 47′ covered with canvas or similar material 48′, or they may consist of canvas tubes, or tubes 47″ of a similar foraminous material secured into the openings in the horizontal pipe 46. Pipe 46 is also foraminous, and may be made of canvas or similar material if desired. Vertical air-pipes 48 supply air to the manifold 45.

In operation, the ore-pulp or slimes, to which have been added the necessary quantity of oils, with suitable acids or other chemicals when desirable, is supplied to the flotation separator compartments through the launder 3. In the flotation compartments the ore-pulp is subjected to the action of streams of finely-divided and uniformly distributed air-bubbles from the removable air-chambers 13. The concentrates collect upon the upper surface of the pulp, from which they overflow into the launder 12 over the adjustable gate 11; the remaining ore-pulp or slimes pass under the partition 4 into the next compartment where the flotation-separation is repeated.

The air-supply to the air-chambers 13, 13 enters from above through pipes 19, Fig. 1, or at any other convenient place, as the side or bottom, through pipe 38, in Fig. 3, or pipe 41 in Fig. 5, and is distributed under the porous septum 30, from which it passes in a substantially uniformly distributed stream through the ore pulp. The admission of air through the top by means of pipe 19 is preferred, since it enables the removal of an air-chamber 13 without shutting down the separator. In use, the ore-pulp travels through the separator in the direction of the grate-bars 21, the latter not restricting its flow. Small accumulations of sands may occur in the spaces 55 between the air-chambers, 13, but this does not interfere with the operation of the separator.

I find by experience that one or even more of the porous bottoms may be removed (for instance, for the purpose of replacing the porous medium) without interfering with the operation of the machine. On account of the restricted area through which the pulp passes from compartment to compartment, the pulp current is strong at these points and does not permit a settling out of sands. When a porous bottom has been removed from a compartment, some sand may settle out on the bottom of such compartment, but does not interfere with the continued operation of the machine. Such an accumulation of sand would however prevent the porous bottom from being put back into place. It is for the purpose of removing any accumulated sand that I arrange for the blowing or washing out of such sand by means of the air or water introduced into the bottom of the compartment, before or while the foraminous bottom is being put back into position. In the form shown in Fig. 5, any accumulation of sand will occur within the inverted pyramids 39, and the air jets 40 arranged in the bottoms of these pyramids will be sufficient to remove the sand from the places on which the air bottoms rest.

It will thus be seen that my device is capable of continuous and uninterrupted operation and that provision is made for the ready removal and replacement of parts liable to wear while the device is in operation.

I claim:—

1. A flotation ore separator comprising a receptacle having an impervious bottom means for supplying ore to be treated to said receptacle, and means for removing concentrates therefrom, said receptacle having located near the bottoms thereof a series of independently removable foraminous air chambers having longitudinally extending upper surfaces, said air chambers being arranged for travel of substantially the whole of the pulp over the series.

2. A flotation separator as claimed in claim 1 in which the air chambers are provided with upwardly extending air supply pipes.

3. A flotation separator as claimed in claim 1 having means for introducing fluid directly beneath said air-chambers.

4. A flotation separator as claimed in claim 1 in which each air-chamber consists of a box-like compartment having a detachable porous cover as its active surface.

5. A flotation ore separator unit adapted for longitudinal pulp flow, having an air supply compartment provided with a porous cover having a smooth upper surface and held between the body of the compartment and a grating, the bars of the grating being arranged parallel to the flow of pulp.

6. A flotation ore separator comprising a receptacle having an impervious bottom, means for supplying ore to be treated to said receptacle, and means for removing concentrates therefrom, said receptacle having located near the bottom thereof a successive series of independently removable foraminous air-chambers having longitudinally extended upper surfaces provided with upwardly extending air-supply pipes, said air chambers being arranged for travel of substantially the whole of the pulp over the series, and means subdividing the receptacle into a series of communicating compartments.

In testimony whereof I affix my signature.

RUDOLF GAHL.