R. GAHL AND R. M. HASKELL.

ORE FLOTATION APPARATUS.

APPLICATION FILED JAN. 24, 1916.

1,343,123. **Patented June 8, 1920.**

Fig. 1.

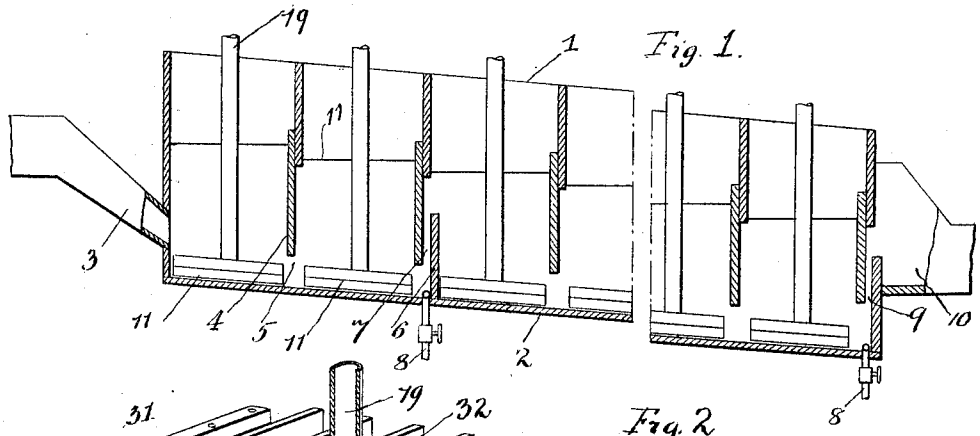


Fig. 2

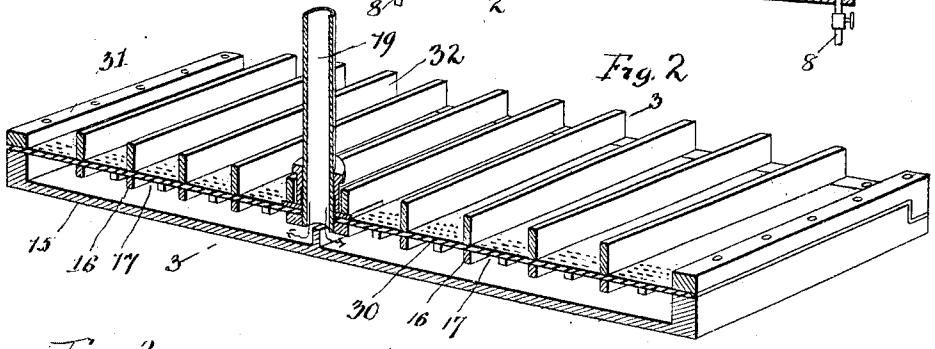


Fig. 3

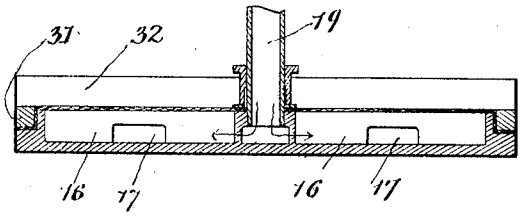


Fig. 4

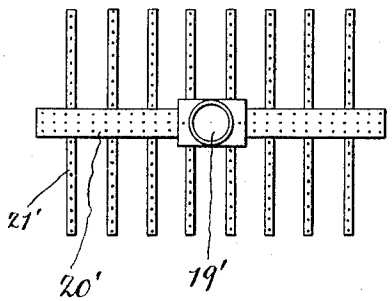


Fig. 5

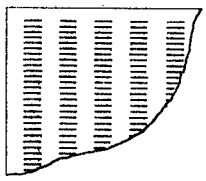


Fig. 6

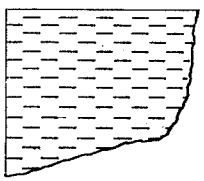


Fig. 8.

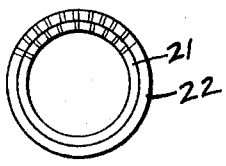
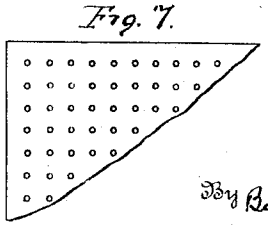


Fig. 7.



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UNITED STATES PATENT OFFICE.

RUDOLF GAHL, OF MIAMI, ARIZONA, AND ROBERT M. HASKELL, OF LAKE LINDEN, MICHIGAN; SAID GAHL ASSIGNOR, BY MESNE ASSIGNMENTS, OF HIS RIGHT TO PNEUMATIC PROCESS FLOTATION COMPANY, OF NEW YORK, N. Y., A CORPORATION OF DELAWARE.

ORE-FLOTATION APPARATUS.

1,343,123. Specification of Letters Patent. Patented June 8, 1920.

Application filed January 24, 1916. Serial No. 73,892.

To all whom it may concern:

Be it known that we, (1) RUDOLF GAHL and (2) ROBERT M. HASKELL, citizens of the United States, residing at (1) Miami, (2) Lake Linden, in the counties of (1) Gila, (2) Houghton, and States of (1) Arizona, (2) Michigan, have invented certain new and useful Improvements in Ore-Flotation Apparatus, of which the following is a specification.

This invention has for its object to provide a foraminous elastic medium or diaphragm to be used in connection with aeration devices used in ore flotation separators.

In the operation of flotation machines using a porous medium for the injection of air it is found, that the porous media have a tendency to clog or "blind," largely due to the fact that slime particles enter the air-channels in the medium and lodge therein. The action takes place with especial severity when it becomes necessary to shut off the air supply temporarily, while the ore-pulp is in the machine, as the buoyant action of the air bubbles which keeps slime particles away from the pores of the medium is missing in this case.

To prevent the choking, several remedies are applied in practice which are more or less effective. Such remedies are, for instance: temporary application of high-pressure air and frequent washing of the porous medium with water or chemicals. This may be done with the machine empty or full of pulp. When the machine is full a pipe or hose delivering water is generally stuck through the pulp and moved across the porous medium with a sweeping motion by an attendant. The water jet thus directed against the porous bottom sweeps it more or less clean.

If a flexible medium like canvas is used, frequent agitation of the same, for instance, with a stick, has proven useful.

None of these methods, however, avoid the drawback referred to radically.

We have found that it can be obviated entirely, if an elastic material like rubber is used.

If a sheet of rubber which is made porous, for instance in one of the ways described below, is substitutad for the porous media used heretofore, the small holes have little or no tendency to choke, even under the severest test above referred to, that of shutting off the air supply while the pulp is in the machine.

The cause for the difference in the behavior of the elastic medium is apparently that the air-pressure (which expands the medium materially) keeps the holes open, while they close automatically by the contraction taking place, when the air is shut off, thus preventing slime particles from settling therein.

A further advantage is that if some foreign particles happen to get into such holes accidentally they can easily be removed by applying a higher air pressure than normally with the object of expanding and cleaning the holes.

In the accompanying drawings,—

Figure 1 is a broken view of a vertical longitudinal section through one form of flotation separator;

Fig. 2 is a sectional perspective view of one form of air chamber;

Fig. 3 is a section on an irregular plane 3—3 of Fig. 2;

Fig. 4 shows a modification in which the air-chamber takes the form of a manifold;

Figs. 5, 6, and 7 are diagrams showing different forms and arrangements of openings in the elastic medium;

Fig. 8 shows a modification.

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 connected to a launder 3, carrying water and ground-ore, or slimes, and entering the tank at a point below the level of 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, which leave 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 narrow baffle 6, providing a narrow channel 7 through which the ore discharges into the next compartment. At the bottom of the channel 7

may be located a pipe 8 which delivers air or water 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 or water supply pipe 8. The concentrates from the several separator compartments flow over the gates 11 into a suitable concentrate launder, not shown.

In Fig. 2 is shown one form of air chamber consisting of a sub-divided box-like bottom portion 15 containing partitions 16, having openings 17 which provide passages throughout the entire bottom for compressed air. Extending over the partitions 16 is the perforated or slitted elastic septum 30, its edges being secured between the bottom portion 15 and a top portion 31 having grate-bars 32 registering with the partitions 16, these grate-bars being preferably of metal and as thin as permissible. Air under pressure is introduced through the pipe 19 passing through and secured to the perforated diaphragm in any suitable manner.

In Fig. 4 is shown a modification in which the pressure air is introduced through the pipe 19′, from which air is delivered into the trunk pipe 20′, to which are connected the manifold pipes 21′. The pipes 20′ and 21′ may be of perforated metal covered with the perforated elastic medium above referred to, or the pipes or some of them may themselves be made of this perforated elastic medium.

In Figs. 5 and 6 are shown two arrangements of slits in the elastic medium and in Fig. 7 is shown an arrangement in which the perforations are small holes. Fig. 8 shows a perforated tube 21″ of metal surrounded by a perforated tube 22″ of elastic material. If desired, tube 21″ may be also made of elastic material. Obviously other forms and arrangements of perforations may be used.

The elastic medium may be made in different ways. One method is to use thin sheets of elastic rubber, properly reinforced if necessary, and to perforate them with a great number of extremely fine needle holes. This method, however, is attended with the disadvantage that the thin rubber so perforated tears rather easily. It is preferable to use thicker sheet rubber, in which case the openings therethrough should be in the form of narrow slits as with moderate air pressures the very fine needle holes will not expand sufficiently to permit the passage of the amount of air required for the purpose in view. These slits open easily, the pressure necessary to open them depending on the distance between the partition supports, less pressure being required when the partitions and grate-bars are more widely separated. Instead of sheet rubber, there can be used the material called "rubber sponge". This material when made up in the form of sheets or tubes has also given good results as a flotation medium. Still another material of this character which has given good results in practice is a woven fabric containing rubber threads in one direction only.

In operation, the ore pulp or slimes, to which have been added the necessary quantity of oil with acid or other chemicals when desirable, is supplied to the flotation separator compartments and therein subjected to the action of the streams of finely divided air bubbles passing upwardly through the perforations in the elastic medium. The concentrates collect upon the upper surface of the pulp, from which they overflow into the concentrate launder.

We claim:—

1. In an ore flotation apparatus, a chamber having a wall made of elastic material and provided with fine openings therethrough and means for introducing fluid under pressure into said chamber.

2. In an ore flotation apparatus, a chamber having a wall made of elastic material and provided with fine slits therethrough and means for introducing fluid under pressure into said chamber.

3. In an ore flotation apparatus, a chamber having a wall made of elastic material and provided with fine openings therethrough, means for introducing fluid under pressure into said chamber, and a grating outside said elastic wall.

4. In an ore flotation apparatus, a chamber having a bottom portion provided with partitions having openings therethrough, a top portion having grate-bars extending from side to side and registering with said partitions, a septum made of elastic material and provided with fine openings therethrough, said septum being secured between the top and bottom portions, and means for introducing fluid under pressure into the space beneath said septum.

5. An ore flotation apparatus comprising a tank having means for producing a flow of pulp therethrough, said tank having at its lower portion a chamber having a wall made of elastic material and provided with fine openings therethrough and means for introducing fluid under pressure into said chamber.

In testimony whereof, we affix our signatures.

RUDOLF GAHL.
ROBERT M. HASKELL.