

L. G. ROWAND.  
 APPARATUS FOR SEPARATING ORE BY FLOTATION.  
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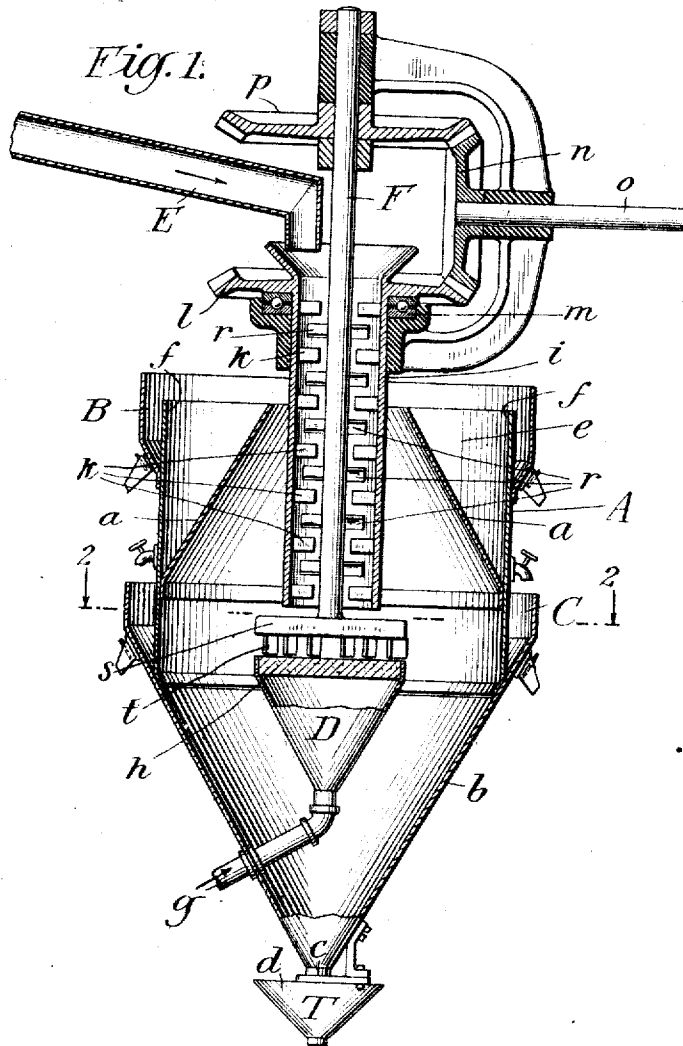
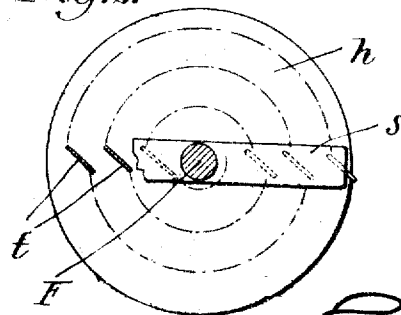


*Fig. 2.*



WITNESSES

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# UNITED STATES PATENT OFFICE.

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## APPARATUS FOR SEPARATING ORE BY FLOTATION.

1,312,754.

Specification of Letters Patent.

Patented Aug. 12, 1919.

Application filed April 9, 1914. Serial No. 830,683.

*To all whom it may concern:*

Be it known that I, LEWIS G. ROWAND, a citizen of the United States, residing in the borough of Brooklyn, county of Kings, State of New York, have invented certain new and useful Improvements in Apparatus for Separating Ore by Flotation; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to certain new and useful improvements in separating by flotation certain particles from a mixture containing them, as, for instance, the separation of particles of sulfids from the gangue with which they are associated.

The invention presents the characteristic feature of feeding the material to be separated into a body of water and into contact with a rising body of air or like aeriform fluid released below the surface of the water and which, in rising, comes in immediate contact with the particles of the mixture, whereupon the particles are disintegrated and those which are subject to flotation are disentangled from the rest and finally reach the surface of the water, where they are floated off to a suitable collecting receptacle forming a part of the apparatus.

In the accompanying drawing,—

Figure 1 represents a vertical sectional view of one form of apparatus adapted for the practice of the invention:

Fig. 2 represents a section thereof taken on the plane indicated by the line 2—2 of Fig. 1:

Similar letters of reference indicate similar parts throughout the several views.

Referring to the drawings,—A indicates a receptacle adapted to be supplied with a continuous body of water, so as to establish a constant overflow over the partition *a*, which has inwardly inclined walls so as to present the general appearance of the frustum of a cone. The receptacle A is further provided with a conical bottom *b* terminating in a discharge opening *c* which is pro-

vided with a cut-off gate *d*. Exterior to the frustum or inclined partition *a* is a chamber *e* which is provided at its bottom with a number of discharge openings for the discharge of "middlings" which, passing over the upper rim of the frustum *a* sink to the bottom of the chamber *e* before reaching the second overflow established by the edge *f* of the receptacle A, this second overflow serving for the separation of the "heads" of the flotation operation. The heads are received in the outer chamber B encircling the upper edge of the receptacle A and may be removed therefrom in any suitable way. So also, the "middlings" from the chamber *e* are preferably discharged into the annular chamber C from which they may be removed from time to time or continuously as desired.

Within the receptacle A and in the body of the water contained therein is located a chamber D, adapted to receive a body of air, gas, or other gaseous or aeriform fluid supplied under pressure through the conduit *g*. The water is usually kept at a temperature of about 60° F., above the temperature of the external air, and this may be effected in any suitable manner and may be brought about or assisted by preheating the air or gas or by mingling steam therewith. The top of the chamber D constitutes a distributor for the air, gas, gaseous or aeriform fluid, which, passing therethrough enters the body of water in a finely divided condition, over the entire upper surface of the top. The top may conveniently consist of a porous tile *h* having inter-communicating spaces, so that the air, gas, gaseous or aeriform fluid may readily find its way through these spaces and be discharged into the water above, and yet the spaces or pores of the tile will be too small to permit the infiltration of water from the receptacle A in any disturbing amount, into the chamber D.

It is characteristic of my invention that the material to be separated or concentrated shall be subjected to the intimate action of the rising air or gas bubbles as they are

given off from the top surface of the plate or tile *h*. This may conveniently be effected by supplying the material by means of any suitable conveyer, as, for instance, the feed chute *E* to a tube *i* extending downwardly into the body of the water and terminating in close proximity to the tile *h*.

To insure the breaking up or thorough mixing of the material during its descent through the tube *i* the central shaft *F* which is driven by the gears *p* and *n* through the power shaft *O*, may be provided in addition to the cross-head *s* with a series of paddles *r*. So also the tube *i* may be provided with a series of inwardly projecting radial baffles *k*, and, in some instances, it may be desirable to rotate the tube *i*. For that purpose, it may be provided with a gear *l* at its upper end, resting upon ball-bearings *m*, as shown, and driven from any suitable source of power, as, for instance, from the gear *n*, upon the power shaft *O*.

At the bottom of the shaft *F* is provided a cross-head *s* carrying a series of blades *t*, whose function is to gradually move outwardly those particles of the material which tend to remain upon the top surface of the tile *h* and to discharge the same off at the edge of the tile and into the body of water so that they will fall down into the hopper bottom, thus leaving the tile *h* constantly in condition for active service over its entire upper surface.

From the foregoing description, the mode of operation of the invention will be apparent; the material to be treated is first reduced to the appropriate degree of fineness familiar to flotation processes and is then mixed, as usual, with the customary flotation emulsion of water, and sulfuric acid and oil, or the like. It is then fed into the tube *i* and, in a disintegrated condition, is discharged from the lower end of the tube *i*, its down-flow being assisted, when the paddles *r* are used, by the configuration of said paddles which, as in a pug-mill, tend to force the material downwardly.

Upon its discharge from the lower end of the tube *i* it emerges into the main body portion of the water and immediately meets the uprising air or gas bubbles from the tile *h*. These air or gas bubbles attach themselves to the floatable particles and increase their buoyancy, at the same time disseminating them outwardly and upwardly in the body of water, and affording opportunity for the non-floatable particles to become disseminated and to drop through the water into the hopper bottom below. During this operation, the revolving blades *t* of the head *s* exercise their function of keeping the upper surface of the tile clear and uniformly active in the distribution of the air or gas bubbles.

The inward inclination of the walls of the conical frustum *a* tends to retard the upward movement of the particles, and, to a certain extent, opposes a barrier thereto, so that full opportunity is afforded for the particles constituting the tailings, to sink back through the body of water into the hopper bottom *b*. The floatable particles rise over the upper edge of the frustum *a*, and, as they proceed toward the overflow afforded by the upper edge of the receptacle *A*, the middlings drop to the bottom of the chamber *c*. The heads, as, for instance, the zinc blende, or similar material to be separated as heads are received in the chamber *B*. The heads, and the middlings, are recovered separately, and the tailings may be removed, from time to time or continuously, as desired, from the hopper bottom *b*.

It will, of course, be understood that the supply of water to the receptacle *A* is constantly maintained during the operation so as to obtain the desired overflow, and that the supply of air or gas to the chamber *D* is likewise appropriate to constantly renew and maintain the discharge of air bubbles from the tile.

What I claim is:

1. Flotation apparatus comprising a receptacle for water, a feed tube provided with pressure mechanism for forcing below the surface of the water and into the main body thereof finely divided ore mixed with flotation emulsion, a porous member below the discharge opening of the tube, means for forcing a multitude of air or gas bubbles through the porous member, and a barrier consisting of a hollow frustum of a cone interposed in the upward rise of the particles raised by the bubbles; substantially as described.

2. Flotation apparatus comprising the combination of a receptacle for water, a feed tube for discharging below the surface of the water and into the main body thereof finely divided ore mixed with flotation emulsion, a pressure chamber having a porous wall, said chamber being mounted within the receptacle below the lower discharge end of the tube and above the bottom of the receptacle and having its upper surface below and in the path of discharge of the tube, and means for forcing a multitude of air or gas bubbles through the porous tile; substantially as described.

3. Flotation apparatus comprising the combination of a receptacle for water, a feed tube for discharging below the surface of the water and into the main body thereof finely divided ore mixed with flotation emulsion, a porous member mounted within the receptacle below the lower discharge end of the tube, a pressure chamber of which said member forms the upper wall mounted

within the receptacle, said chamber being spaced from the walls thereof to permit gangue to pass downwardly in the receptacle around the chamber, and a discharge gate at the lower end of the receptacle; substantially as described.

4. Flotation apparatus comprising the combination of a receptacle for water, a feed tube for discharging below the surface of the water and into the main body thereof finely divided ore mixed with flotation emulsion, a porous member mounted within the receptacle below the lower discharge end of the tube and with its upper surface substantially transverse to the axis of the tube, a shaft passing through the tube, a scraper for the surface of said member mounted on the shaft, and means for rotating the shaft; substantially as described.

5. Flotation apparatus comprising the combination of a receptacle for water, a feed tube for discharging below the surface of the water and into the main body thereof finely divided ore mixed with flotation emulsion, a porous member mounted within the receptacle below the lower discharge end of the tube with its upper surface substantially transverse to the axis of the tube, a shaft extending within the tube, blades on the shaft, and means for rotating the shaft; substantially as described.

6. Flotation apparatus comprising the combination of a receptacle for water, a feed tube for discharging below the surface of the water and into the main body thereof finely divided ore mixed with flotation emulsion, a porous member mounted within the receptacle below the lower discharge end of the tube with its upper surface substantially transverse to the axis of the tube, a shaft extending through the tube, blades on the portion of the shaft lying within the tube, a scraper for the surface of said member mounted on the shaft, and means for rotating the shaft; substantially as described.

7. Flotation apparatus comprising the combination of a receptacle for water, a feed tube for discharging below the surface of the water and into the main body thereof finely divided ore mixed with flotation emulsion, a porous member mounted within the receptacle below the lower discharge end of the tube with its upper surface substantially transverse to the axis of the tube, and a plurality of baffles upon the interior surface of the tube; substantially as described.

8. Flotation apparatus comprising the combination of a receptacle for water, a feed tube for discharging below the surface of the water and into the main body thereof finely divided ore mixed with flotation emulsion, a porous member mounted within the receptacle below the lower dis-

charge end of the tube with its upper surface substantially transverse to the axis of the tube, a shaft extending within the tube, blades on the shaft, baffles on the interior of the tube, and means for rotating the shaft; substantially as described.

9. Flotation apparatus comprising a receptacle for water, a mixing and feeding tube for discharging below the surface of the water and into the main body thereof finely divided ore mixed with flotation emulsion, a porous member below the discharge opening of the tube, means for forcing a multitude of air or gas bubbles through the porous member, and a scraper for keeping the outer surface of the porous member in active condition; substantially as described.

10. Flotation apparatus comprising a receptacle for water, a feed tube for discharging below the surface of the water and into the main body thereof finely divided ore mixed with flotation emulsion, a porous member below the discharge opening of the tube, means for forcing a multitude of air or gas bubbles through the porous member, and a scraper for keeping the outer surface of the porous member in active condition, said scraper consisting of a shaft carrying a series of blades at its lower end so arranged as to force outwardly and over the edge of the porous member any material finding lodgment thereon; substantially as described.

11. Flotation apparatus comprising a receptacle for water, a feed tube for discharging below the surface of the water and into the main body thereof finely divided ore mixed with flotation emulsion, said tube being provided on its inner wall with a series of baffles, means for revolving the tube, a porous member below the discharge opening of the tube, and means for forcing a multitude of air or gas bubbles through the porous member; substantially as described.

12. Flotation apparatus comprising a receptacle for water, a feed tube for discharging below the surface of the water and into the main body thereof finely divided ore mixed with flotation emulsion, said tube being provided on its inner wall with a series of baffles, a rotary shaft having a series of radial blades located within the tube, means for rotating the tube and shaft in opposite directions, a porous member below the discharge opening of the tube, and means for forcing a multitude of air or gas bubbles through the porous member; substantially as described.

13. Flotation apparatus comprising a receptacle for containing a body of water, a feed tube for discharging below the surface of the water and into the main body thereof finely divided ore mixed with flota-

tion emulsion, means for supplying a multitude of disseminated air or gas bubbles to the water as it issues from the tube, an outlying frustum encompassing the tube, a middlings compartment outside of the frustum, and a heads compartment outside of the middlings compartment; substantially as described.

In testimony whereof I affix my signature, in presence of two witnesses.

LEWIS G. ROWAND.

Witnesses:

C. B. SCHROEDER,  
M. A. BELL.

It is hereby certified that in Letters Patent No. 1,312,754, granted August 12, 1919, upon the application of Lewis G. Rowand, of Brooklyn, New York, for an improvement in "Apparatus for Separating Ore by Flotation," errors appear in the printed specification requiring correction as follows: Page 2, line 108, claim 2, for the word "feed" read *mixing and feeding*; same page and claim, line 119, for the word "tile" read *wall*; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 30th day of September, A. D., 1919.

[SEAL.]

M. H. COULSTON,

*Acting Commissioner of Patents.*