

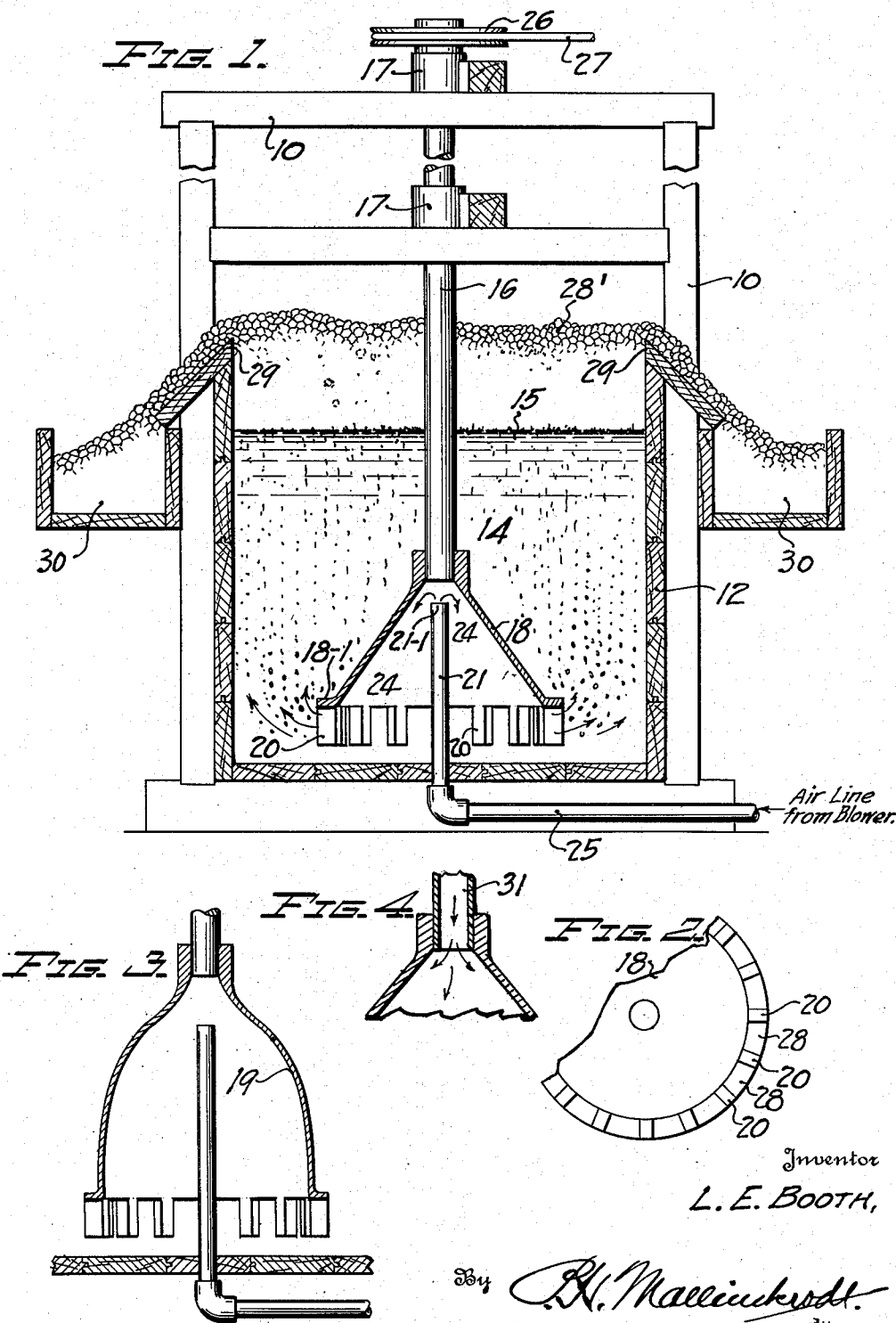
Sept. 22, 1936.

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2,055,065

AERATING MACHINE

Filed March 26, 1932



UNITED STATES PATENT OFFICE

2,055,065

AERATING MACHINE

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Application March 26, 1932, Serial No. 601,321

6 Claims. (Cl. 261—93)

This invention relates to an aerating machine, and the principal object of the invention is to provide an apparatus which shall be simple, efficient, and economical in construction and operation.

Since this invention finds extensive application in connection with the concentration of metalliferous ores by means of the flotation process, it becomes convenient to hereinafter describe the invention as specifically employed in the flotation of ores.

In aerating a liquid or semi-liquid, it is highly desirable that the liquid shall be impregnated with very finely divided particles of the gas, and that these particles shall be diffused throughout the liquid as uniformly as possible.

Since flotation pulp is a good example of a liquid or semi-liquid, and air is a good example of a gas, the use of this invention in flotation, may be taken as representative.

In the flotation process which employs certain frothing and conditioning agents, the diffusion of the gas particles uniformly through the liquid, is especially desirable. For high efficiency it is necessary that the froth shall consist of very fine bubbles.

In the present invention, this is accomplished by a hollow, tight-walled impeller having a substantially vertical axis around which the impeller is rotated at a proper speed. The impeller is preferably in the shape of a tight-walled cone having an open base, or it may be in the shape of an inverted bowl submerged in the liquid or pulp so as to sustain an appropriate air pressure within the impeller. In any event, the interior of the impeller is in free communication with the submerging liquid or pulp through the open basal plane of the impeller, thereby exposing a large area of liquid to the pressure-air. The impeller, further, is provided with agitating means along its basal wall portion so that the liquid around the impeller is thrown into suitable agitation when the impeller is running. Simultaneously, compressed air is admitted to the interior of the impeller and this causes an expulsion of pressure-air out from the impeller through the agitating means, and an immediate forcible entry of this air into the surrounding liquid or pulp at a point where the hydrostatic head is considerably in evidence. From extensive observations of experimental apparatus in glass housings constructed in accordance with what is set forth hereinafter, it appears that the aeration is caused by the compressed air which is divided by the agitating means and shot across what I choose to call the "discharge lip" of the impeller, the discharge lip being in close proximity to the agitating means. It further appears that the highly efficient aeration obtained, by means of this invention, is due

largely to the cutting or clipping action of the agitating means operative to separate the air streams, in transit, into a great multitude of minute sections or particles, which produce the aforementioned fine bubbles for flotation. Although depending lugs, outstanding from the impeller rim or discharge lip, are hereinafter shown and described as the preferred form of the agitating means, yet it is obvious that such means might be varied almost indefinitely.

Since the flotation process is well known, the details of its various practices need not be here recounted.

The features of this invention, for which the protection of Letters Patent is desired, are collectively grouped in the claims concluding this specification.

In the drawing,

Fig. 1 represents a cross section taken through a machine forming the apparatus of this invention;

Fig. 2, a fragmentary bottom plan of the impeller;

Fig. 3, a fragmentary axial section showing an impeller of another design; and

Fig. 4, a fragmentary axial section indicating another construction showing of the impeller and air inlet.

Referring to the drawing, the numeral 10 indicates a framework within which is disposed a housing 12 defining an aerating and/or agitating chamber 14 adapted to contain a body of pulp having for instance, the level 15. A vertically disposed shaft 16 driven by a grooved pulley 26 and a belt 27 or other suitable means, may be rotatably carried in bearings 17, which are supported by the framework 10.

Fixed on the lower portion of shaft 16 is an impeller which is preferably in the form of a conical bell 18. If desired, however, the bell, instead of being conical, may have other suitable forms, an instance being indicated at 19, Fig. 3. Bell 18 may have a rim 18-1 from which project downwardly a plurality of lugs or clipping element 20 which are spaced apart from one another circumferentially. Passing through the bottom of the housing and extending upwardly to a suitable point, preferably near the top of chamber 24, is a pipe 21 through which air under pressure is conducted into the chamber 24 defined within the cone. Thus the pipe 21 forms a nozzle having a discharge orifice 21-1. A pipe 25 is connected to the pipe 21 and extends to any suitable supply of air under pressure, such as a blower (not shown).

In operation, shaft 16 is rotated at the proper speed, and air under a suitable pressure is admitted to chamber 24. Due to the pressure in chamber 24, and to a certain degree to the influence of centrifugal force, air from chamber 24

is propelled outward through the spaces 28 between lugs or clipping elements 20, and this air issues from the impeller in substantially radial streams. Due to the rotation of the impeller, the circumferential travel of the impeller rim causes the lugs or clippers 20 to cut through the streams of air as they issue from the impeller, and to divide these streams into minute particles which are forcibly injected into the surrounding pulp or liquid. These finely divided particles rise vigorously through the pulp or liquid finally emerging at the level 15 in the form of very small bubbles, which combine with one another to product a froth 28'. This froth rises above overflow lips 29, and is conducted away through launders 30 in the usual manner. Characteristics of the impeller are, that it has airtight walls with an open mouth, submerged mouth down in a liquid, to form an enclosed chamber 20 which receives air under pressure.

Instead of bringing air under pressure, through a separate pipe, it may enter the impeller chamber through a hollow shaft 31, Fig. 4, upon which the impeller is fast, and which of course is rotatably disposed in suitable bearings, (not shown). The manner of conducting a gas into a hollow rotatable shaft is well known, so need not be here described.

It will be noted that in all cases, the air pressure under which the machine operates, depends upon the hydrostatic head above the highest point at which the impeller discharges air. The pressure at which air is supplied, may vary from one-half to three and one-half pounds per square inch, but excellent results have been obtained with pressure from three-fourths to one and one-half pounds per square inch.

Using the present invention in an actual test in free gold ore flotation, results were obtained as follows:

	Per- cent Au	Per- cent Ag	Percent of total	
			Au	Ag
Flotation concentrates.....	4.23	69.40	91.32	91.40
Flotation tailings.....	.04	.65	8.68	8.60
Heads.....	.419	6.87	100.00	100.00

The same ore with same reagent conditions but in a standard "pneumatic cell", gave:

Flotation concentrates.....	7.03	136.50	72.42	89.73
Flotation tailings.....	.12	.70	27.58	10.27
Heads.....	.416	6.53	100.00	100.00

Again, the same ore and reagent conditions, but in a "standard agitation" machine, gave:

Flotation concentrates.....	4.39	76.60	61.90	83.04
Flotation tailings.....	.19	1.10	38.10	16.96
Heads.....	.466	6.06	100.00	100.00

While a specific embodiment of my invention is herein shown and described, it is to be understood that various changes could be made therein without departing from the spirit and scope of the invention as defined in the claims.

Having fully described my invention, what I claim is:

1. An aerating machine, including in combination, a submerged bell rotatably disposed, said bell having an airtight wall structure with a discharge lip extending circumferentially of, and directly below the wall structure, agitating means on said bell in operative proximity to the discharge lip, and a pipe for the introduction of air leading into the chamber defined by said wall structure.

2. An aerating machine, including in combination, a rotatable bell disposed to discharge gas wholly along its basal circumference, a plurality of outstanding lugs spaced apart from one another around the basal circumference, a structure adapted to contain liquid in which said bell is submerged, means for rotating the submerged bell, and a conductor for gas under pressure leading into said bell.

3. An aerating machine, including in combination, a rotatable bell comprising a substantially airtight superstructure open circumferentially at the base thereof, a structure for containing liquid in which said bell is submerged, means for rotating the submerged bell, and a pipe disposed to conduct air under pressure into said bell, said bell having clipping means along its base operative to divide streams of pressure air into innumerable separate particles, said clipping means comprising bars spaced apart from one another circumferentially, said bars having substantial depth along surfaces transverse to the circumference of the base of said bell.

4. An aerating machine, including in combination, a rotatable bell having depending lugs spaced around the rim thereof, said lugs having faces of substantial depth transverse to the circumference of said rim, a structure for containing liquid in which said bell is submerged to a substantial depth, means for rotating the submerged bell, and a pipe disposed to conduct gas under pressure into said bell.

5. An aerating machine, including in combination, a rotatable bell having depending lugs spaced around the rim thereof, said lugs having faces of substantial depth transverse to the circumference of said rim, a structure adapted to contain liquid in which said bell is submerged, means for rotating the submerged bell, and means for conducting air under pressure into said bell.

6. An aerating machine, including in combination, a bell rotatably mounted, said bell having outstanding lugs spaced apart from one another around the rim of the bell, a structure adapted to contain liquid in which said bell is submerged, means for rotating the submerged bell, and means for conducting air under pressure into said bell, the body of liquid being sufficiently extensive around the basal rim of the bell so that substantially the maximum aerating and agitating effect of air and liquid discharged by the bell, shall be absorbed by said body of liquid.

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