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2,054,249

AERATING MACHINE

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2 Sheets-Sheet 1

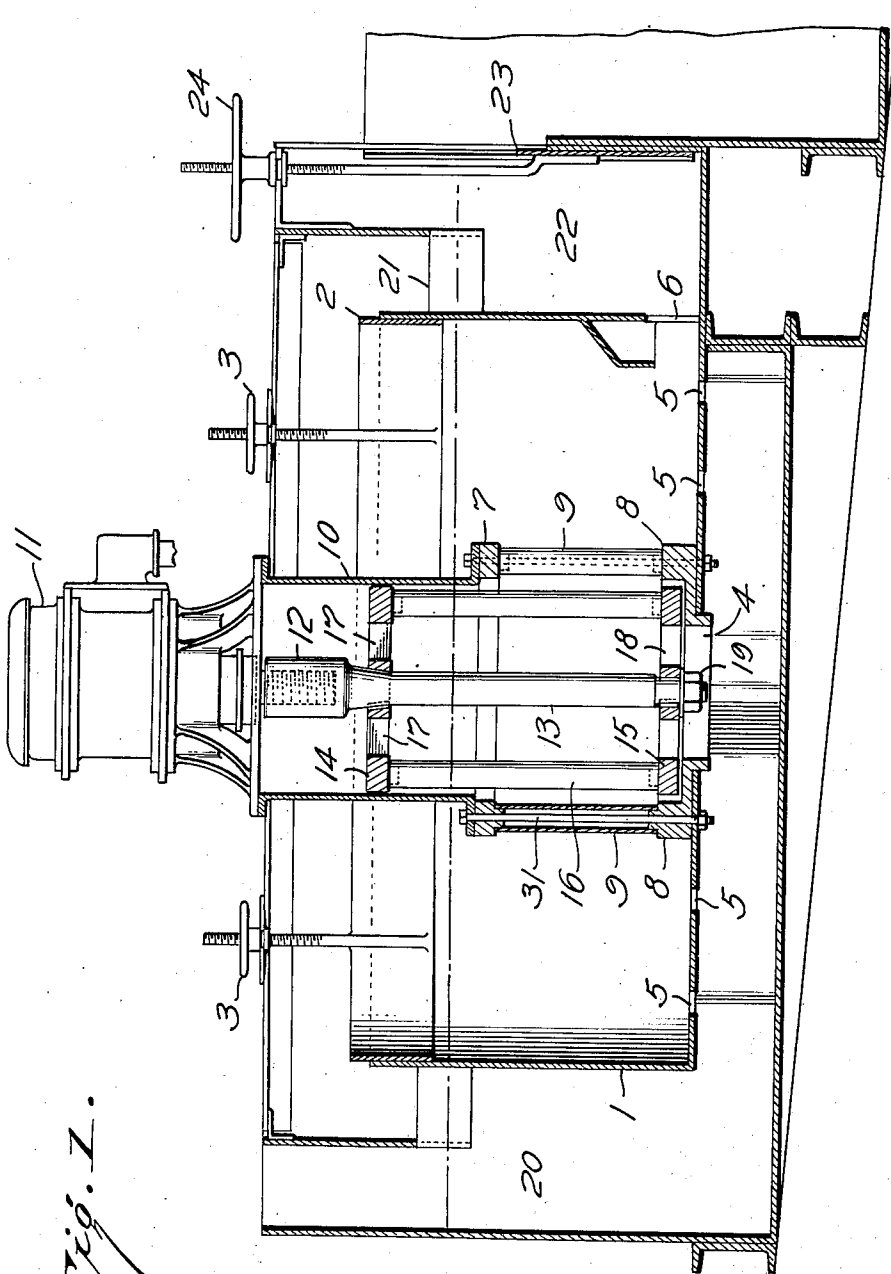


*Fig. 1.*

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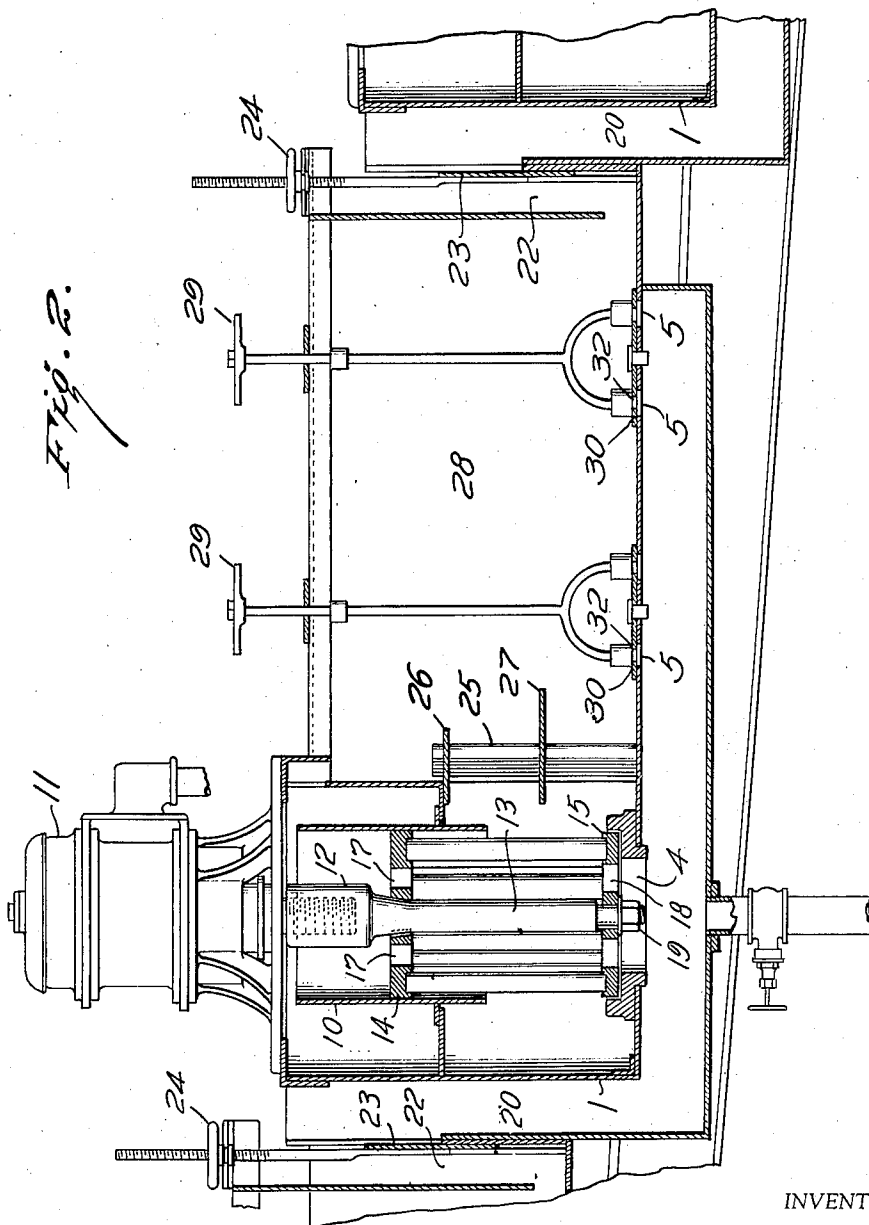
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## UNITED STATES PATENT OFFICE

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## AERATING MACHINE

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Application November 1, 1933, Serial No. 696,133  
In Great Britain November 4, 1932

6 Claims. (Cl. 209-169)

This invention relates to aerating machines, more particularly aerating machines for the flotation of ore pulp.

In my prior copending applications Serial No. 498,732, filed November 28, 1930 and Serial No. 584,673, filed January 4, 1932, I have described and claimed flotation machines in which the ore pulp is agitated by a mechanical agitator consisting of a squirrel cage rotor surrounded by a stator in the case of my earlier application, or by a grille in the case of my later application. The present invention relates to an improved aerating machine of the type shown in my prior applications above referred to. In those applications the rotor is of such height that when the pulp level is at its normal height and the machine is at rest, the rotor is below the level of the pulp and completely submerged. I have found that improved results and certain mechanical advantages are obtained by a rotor which is higher than the stator or grille and which extends above the pulp level. The use of a high rotor presents the advantage that since the upper portion of the rotor functions to suck in air an improved suction is obtained by the high rotor and the pulp, after aeration, is discharged through the lower stator in a very thoroughly aerated form. The structural and mechanical advantage obtained by a high rotor depends on the higher center of gravity of the rotor and shorter shaft connecting the rotor to its source of power. The shorter the shaft the stiffer it is and the less is the tendency for the rotor to whip. This is particularly advantageous with heavy pulps and large machines and permits a very firm support of the moving parts together with a minimum of vibration in operation. The high rotor while presenting the above advantages in operation, retains all of the features of my application above referred to. In other words, the advantages of high rotor construction are obtained without any sacrifice of the advantages inherent in the low rotor designs described and claimed in my earlier applications. It should be understood, therefore that the advantages claimed in my copending applications are equally applicable to the high rotor design.

The invention will be described in greater detail in conjunction with the drawings in which:

Fig. 1 is a vertical section through a round machine of the general design described and claimed in my copending application Serial No. 498,732 above referred to; and

Fig. 2 is a vertical section through an asymmetrical machine of the type described in my copending application Serial No. 584,673.

The machine illustrated in Fig. 1 is provided with a combined agitation and flotation chamber 1 containing an adjustable froth lip 2, adjusted by the threaded rods and hand wheels 3. The bottom of the chamber is provided with a central pulp inlet 4 and recirculation openings 5 and a tailings discharge opening 6 at one side of the chamber which is round in shape. In the center is the agitating means which consists of a stationary squirrel cage formed of an upper rim 7 and lower rim 8 joined by hollow round staves 9. On top of the stator is carried a cylindrical suction hood 10 which is bolted to the top of the stator by means of the bolts 31, running through the hollow staves and serving the additional functions of holding the stator together. The hood 10 supports an electric motor 11 provided with a threaded shaft which screws into the enlarged end 12 of the rotor shaft 13. To the shaft 13 is bolted a squirrel cage rotor which consists of an upper spider 14 and lower spider 15 joined with cylindrical staves 16 which fit on suitable lugs in the rims. The blades 17 and 18 of the spiders 14 and 15 are in the form of propeller blades so inclined as to suck air in from the top and pulp in from the bottom. The central hubs of the spiders are provided with openings through which the shaft 13 extends, the hub of the upper spider being suitably beveled to engage with a tapering portion of the shaft 13. The bolt 19 forces the rotor up on the shaft where it clamps tightly.

In operation pulp is introduced into the pulp space 20, flows under the chamber 1 and up through the central opening 14, being sucked by the rotation of the rotor which acts as a centrifugal pump. The pulp from the bottom and the air from the top are mixed and beaten by the rapidly rotating rotor and thrown out between the staves of the stationary cage or stator into the chamber 1 where the froth rises, overflowing the lip into the froth launder 21 and tailings are discharged through the opening 6 into the tailings compartment 22 whence they flow out over an adjustable tail gate 23 which is adjusted by the threaded shaft and hand wheel 24. In the drawings the discharge is shown as flowing into the pulp space of a succeeding machine in a battery. Of course each machine operates independently and can, if desired, be used alone.

As described in my copending applications above referred to, it is desirable to employ staves in the stationary cage of such a cross section as to cause the streams of agitated air and pulp

passing through them to first be compressed and then expanded. This action increases the efficiency of the aeration and provides for a finer and more uniform size of air bubble. While any cross section of stave which will result in a constriction, followed by expansion of the pulp passing between them, can be used, round staves which give very satisfactory results, present considerable economies in construction and are illustrated in the drawings. Other typical shapes are shown in my copending applications above referred to and may, of course, be used in the present invention. It is also, of course, possible to use staves which do not give the alternate compression and expansion effect such as for example rectangular staves with their flat faces opposite each other. The advantages of the high rotor and of course also the advantages of the highly efficient agitation achieved by squirrel cage rotor are retained without the additional mixing effect of the preferred type of stator stave. Such constructions are included in the invention in its broader aspects although in preferred modifications circular or similar shape staves are of advantage.

The machine shown in the drawings is made of sheet metal and tubular metal rotor and stator staves. This is the cheapest and for many purposes the best construction. However, if desired, the walls of the machine may be made of wood and it is advantageous where the pulp tends to be abrasive to provide the rotor and stator staves with some wear-resisting coating such as, for example, a coating of soft vulcanized rubber. This is also desirable where the pulp is corrosive in nature and might otherwise corrode the metal. The present invention, however, which is directed to the use of a high rotor is not concerned per se with any particular material of construction and any suitable materials may be used and are included in the invention.

Fig. 2 shows a somewhat modified form of machine, although the design of rotor is the same. Similar parts bear similar numbers. In the operation of the machine of Fig. 2, pulp enters through the pulp space 20, is sucked up by the rotor through the opening 4 and is discharged by the rotor but the flow can only take place to one side through the grille of staves 25 extending across the chamber from wall to wall. Preferably this grille is provided with baffles 26 and 27 to direct the stream of aerated pulp in a horizontal direction. The large extension of flotation chamber 28 permits a longer travel of the pulp and for some pulps this results in a better classification and correspondingly improved metallurgy per machine. The proportion of the pulp to be recirculated is determined by adjustment of the hand wheels 29 which turn plates 30 provided with openings 32 which register with openings 5 in the floor of the main frothing chamber. By suitable adjustment the proportion of pulp to be recirculated is adjusted for best results. A similar type of adjustment can be used in Fig. 1 by proportioning the size of the openings 5. It is, in general, an advantage of the machines of the present invention as well as those described in my copending applications, that the extremely low power consumption of the rotor permits recirculation of a considerable proportion of the pulp with correspondingly enhanced operation and improved metallurgy per machine. This is of importance where it is desired to obtain very complete separation as this can be effected in a smaller number of machines

of the present invention than is normally considered necessary with machines of the prior art. The high rotor with enhanced suction of air and also with improved rigidity of shaft further decreases the power required and increases the capacity of the machines with improved metallurgy. Thus the present invention permits even greater economy in power and efficiency in separation than was possible with the machines described in my prior specifications and renders the economical advantages over the prior art machines even greater. In addition to the greater efficiency in power utilization the life of the motor bearings is enhanced because the shorter shaft with higher center of gravity of the rotor so decreases vibration as to greatly lighten the load on these bearings with a correspondingly longer life and freedom from shutdowns due to bearing trouble.

The invention has been illustrated specifically in conjunction with machines using individual electric motors. I prefer this type of drive because of its simplicity and reliability. However, it should be understood that the invention is not limited to individual drives for each machine and on the contrary the machines may be driven from a shaft or from any other suitable source of power. The use of a shaft drive is illustrated in my earlier applications and is, of course, equally applicable to the improved machines of the present invention, the shorter rotor shaft and higher center of gravity decreasing the wear on the bearings with this type of drive in the same way as in the case of individual motors.

The spacing of the staves in the rotatable cage and in the stationary cage or grille may vary widely but where staves of a circular or other cross section forming a constricted throat, are used, it is desirable, although not essential, to space the staves sufficiently closely together so that the space between them at the most constricted point does not exceed twice the diameter of the stave. With spacings as close as this a remarkably effective aeration results.

What I claim is:

1. An aerating machine comprising a frothing chamber having a bottom, a liquid inlet opening in said bottom, a cylindrical vertical cage hung on a vertical shaft and rotatable about a vertical axis extending from close to said opening to above the liquid level, an outside cage or grille composed of vertical staves at least partly surrounding the cylindrical cage and the liquid inlet opening, the cylindrical cage having an upper portion extending above the liquid level in the frothing chamber when the machine is at rest whereby the rotation of the inner cage sucks liquid through the inlet and air through the upper portion and discharges aerated liquid between the staves of the outer cage.

2. An aerating machine comprising a frothing chamber having a bottom, a liquid inlet opening in said bottom, a cylindrical vertical cage hung on a vertical shaft and rotatable about a vertical axis extending from close to said opening to above the liquid level, an outside cage or grille composed of vertical staves completely surrounding the cylindrical cage and the liquid inlet opening, the cylindrical cage having an upper portion extending above the liquid level in the frothing chamber when the machine is at rest whereby the rotation of the inner cage sucks liquid through the inlet and air through the upper portion and discharge aerated liquid between the staves of the outer cage.

3. A machine according to claim 1 in which a standpipe extends upwardly from the stationary cage to a level above the highest liquid level in the machine and is open at its upper end to the atmosphere.

5 4. A machine according to claim 2 in which a standpipe extends upwardly from the stationary cage to a level above the highest liquid level in the machine and is open at its upper end to the atmosphere.

10 5. A machine according to claim 1 in which the froth chamber is provided with a double bottom constituting a liquid inlet and openings are provided in the floor of the froth chamber outside

of the stationary cage, permitting a portion of the liquid to flow from the frothing chamber back into the liquid inlet whereby a portion of the froth material is recirculated.

6. A machine according to claim 2 in which the froth chamber is provided with a double bottom constituting a liquid inlet and openings are provided in the floor of the froth chamber outside of the stationary cage, permitting a portion of the liquid to flow from the frothing chamber back into the liquid inlet whereby a portion of the frothed material is recirculated.

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