L. P. HILLS.

AIR LIFT FOR AGITATORS FOR ORE OR OTHER MATERIALS.

APPLICATION FILED AUG. 6, 1910.

994,679.

Patented June 6, 1911.

2 SHEETS—SHEET 1.

Fig. 1.

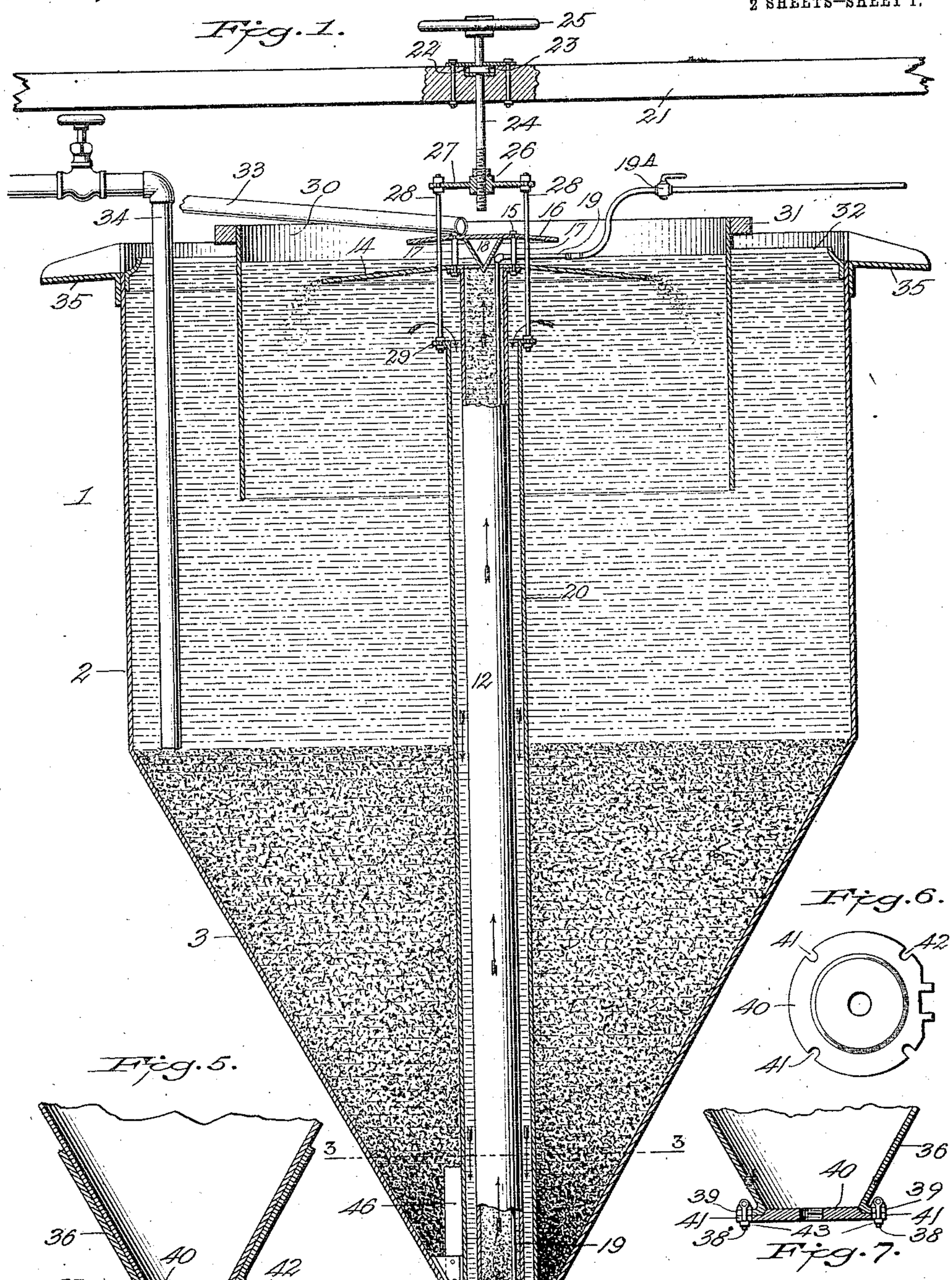

Fig. 6.

Fig. 5.

Fig. 7.

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2 SHEETS—SHEET 2.

Fig. 2.

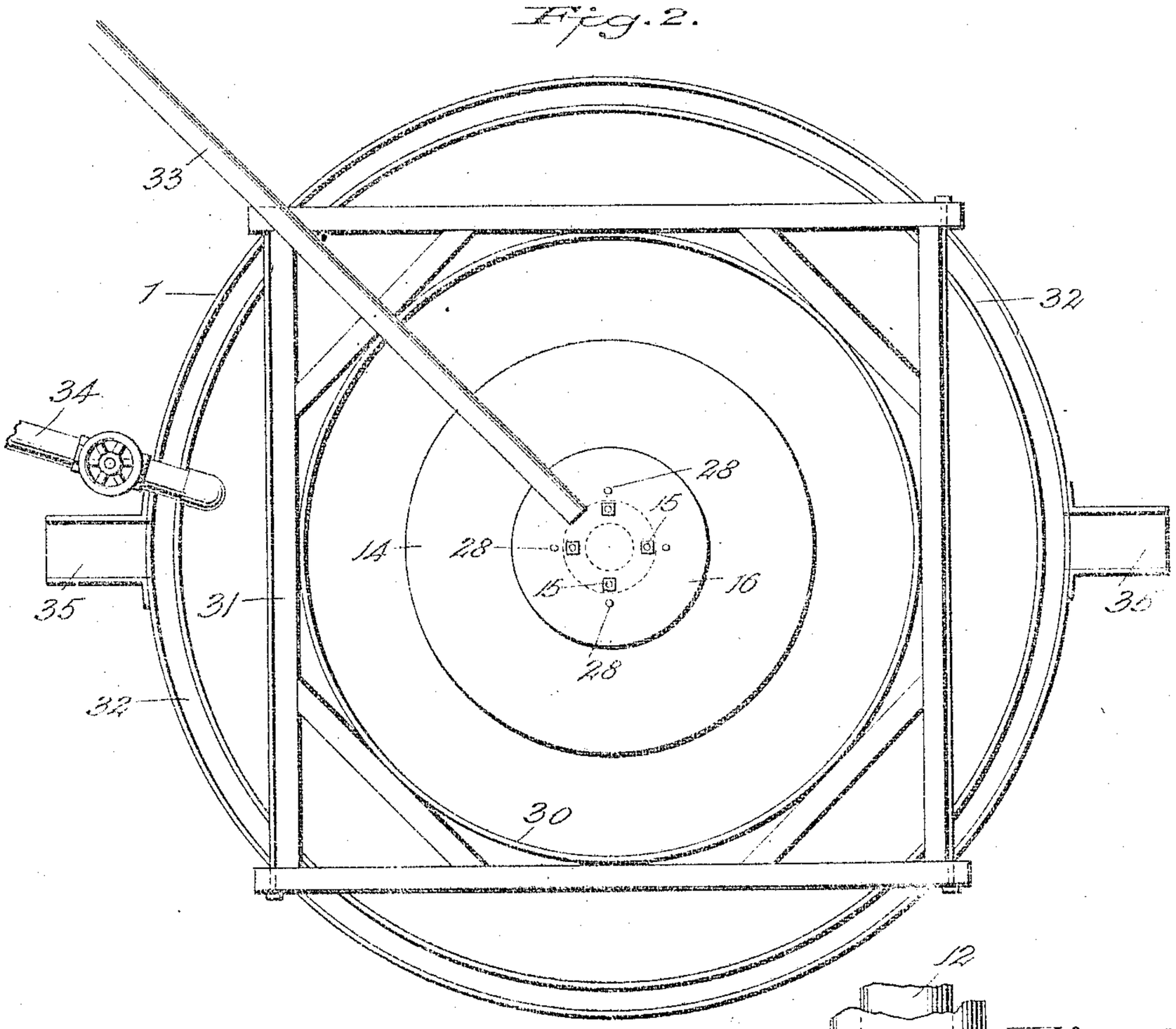


Fig. 3.

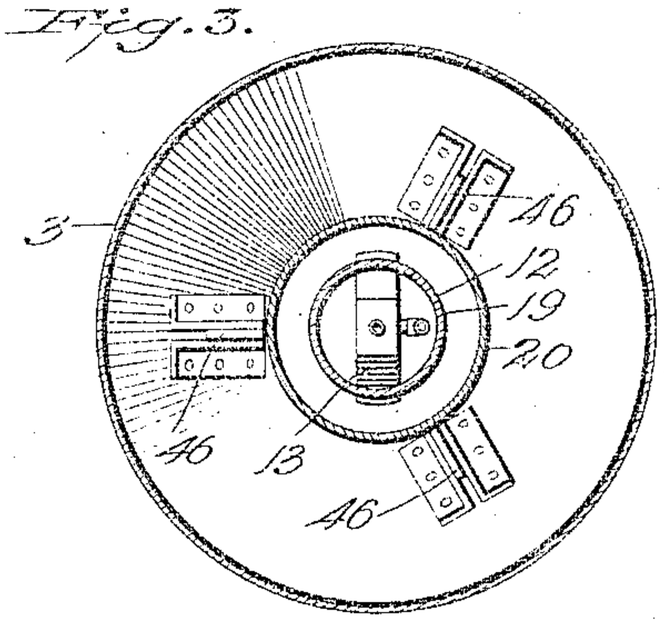
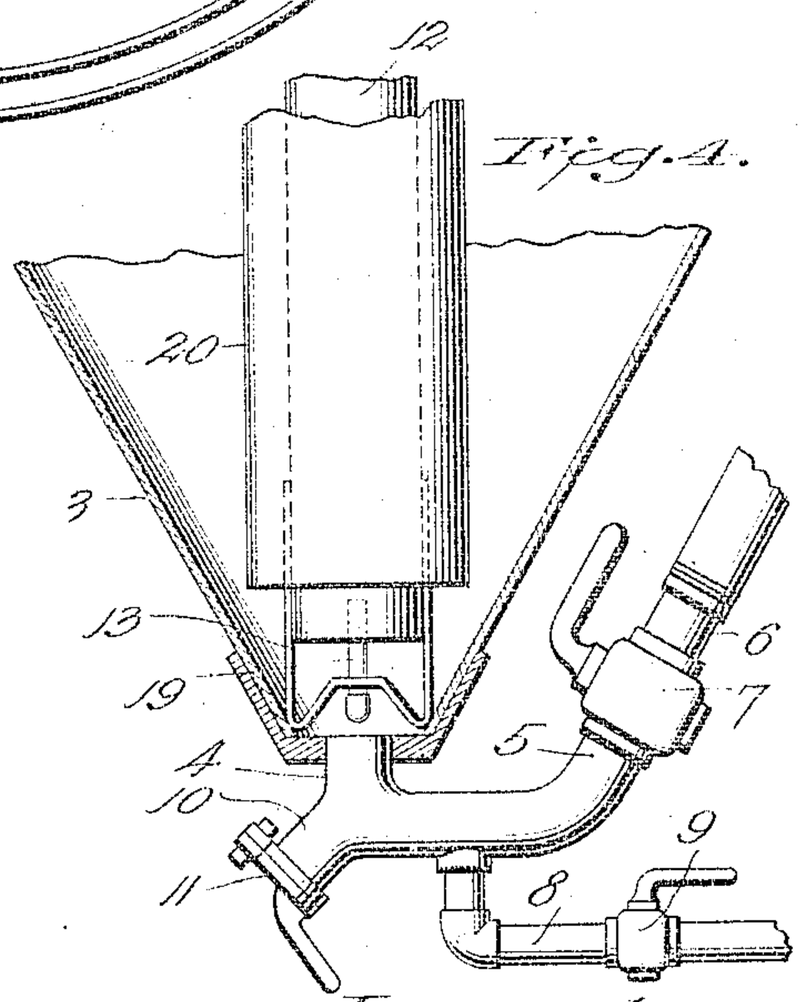


Fig. 4.



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UNITED STATES PATENT OFFICE.

LEON PAUL HILLS, OF TUOLUMNE, CALIFORNIA, ASSIGNOR OF ONE-FIFTH TO PHILIP M. McHUGH, OF GOLDEN, COLORADO, AND TWO-FIFTHS TO JULIUS F. THOMASSON, OF TUOLUMNE, CALIFORNIA.

AIR-LIFT FOR AGITATORS FOR ORE OR OTHER MATERIALS.

994,679. Specification of Letters Patent. Patented June 6, 1911.

Application filed August 6, 1910. Serial No. 575,944.

To all whom it may concern:

Be it known that I, LEON PAUL HILLS, a citizen of the United States of America, residing at Tuolumne, county of Tuolumne, and State of California, have invented a new and useful Improvement in Air-Lifts for Agitators for Ore or other Materials, of which the following is a specification.

My invention relates to improvements in air lifts for agitators for ore or other materials, and the objects of my invention are: First—to provide an air lift for agitators in which the air pipe is protected. Second—to provide an air lift for agitators having conical bottoms comprising a vertical pipe or column, and a vertically adjustable pipe surrounding the first pipe and spaced therefrom, said adjustable pipe being of less length than the inner pipe so that the solution in the agitator will flow over the top of the outer pipe and circulate downward between the two pipes and upward through the inner pipe, the outer pipe being adapted to be lowered so as to engage the conical bottom and thus shut out the pulp until after the circulation of the solution has been established, when the said pipe may be raised to permit the pulp to mingle with the circulating solution, pipes being employed for admitting air under pressure or water under pressure, or both, to the lower end of the inner pipe, guides being secured in the lower end of the agitating tank for steadying the movement of the outer pipe when the same is raised or lowered. I attain these objects by the mechanism illustrated in the accompanying drawings, in which:

Figure 1 is a vertical, central section of an ore pulp holding tank, containing a continuous pulp lifting and agitating air lift, embodying my invention. Fig. 2 is a plan view of the same. Fig. 3 is a horizontal, sectional view on the line 3—3 of Fig. 1 on a slightly enlarged scale. Fig. 4 is an enlarged, vertical, sectional view partly in side elevation, of the lower end of the agitator. Fig. 5 is a sectional view showing a modification of the lower end of the agitator. Fig. 6 is a plan view of the door for the said lower end; and Fig. 7 is a sectional view of the lower end of the agitator and door on the line of the pivoted retaining bolts for the said door.

Similar letters of reference refer to similar parts throughout the several views.

Referring to the drawings, the numeral 1 designates a tank adapted to hold pulp material such as finely pulverized ore and water or a chemical solution such as a cyanid solution and ore or a pulp formed of any chemical solution and finely ground or pulverized material. This tank preferably comprises a cylindrical portion 2 and a conical bottom portion 3, to the lower end of which a Y pipe fitting 4 is connected. One branch 5 of this fitting 4 is adapted to be connected to a pipe 6 that leads to a supply nected to a pipe 6 that leads to a supply of water under pressure. A valve 7 is inserted in the pipe 5. This branch pipe 5 is provided with a threaded inlet aperture, to which a pipe 8 is attached that leads to a supply of compressed air. This pipe 8 I term the auxiliary air supply pipe, and it is provided with a valve 9. The other branch 10 of the Y shaped pipe fitting forms a discharge pipe and outlet for discharging the pulp from the tank, and is provided with a valve 11. The two branches 5 and 10 of the fitting are controlled by their valves for admitting air or water or both when desired, or for discharging the pulp from the tank, as will be described more fully hereinafter.

In the center of the tank I place a pipe 12, which is positioned vertically therein with its lower end preferably resting on the inner surface of the conical bottom of the tank, although, if desired, it may be positioned at sufficient distance from the bottom to leave a space of sufficient area to permit the pulp to flow readily from all parts of the body of the tank into the bottom of the pipe. To the lower end of this pipe is secured a yoke shaped bracket 13, the lower portion of which engages the conical surface of the bottom of the tank and thus supports the pipe 12, as shown. The upper end of the pipe 12 is flanged, and a dished circular collar 14 having an axial hole of the same diameter of the bore of the pipe is secured upon the said flange, and is of a diameter to extend about half way to the surface of the tank. The collar is secured to the flange by bolts 15, which extend a suitable distance above the collar, and upon their upper ends

is secured a hood 16, which is preferably held at the required distance above the collar by sleeves or tubes 17 which surround the bolts 15 between the collar and hood. The hood is adapted tc prevent the pulp fed into the top of the tank from entering the pipe 12, as will be seen by reference to Fig. 1. A water deflecting inverted cone 18 is secured to the under side of the hood, which acts to deflect the pulp and solution circulating upward through the pipe 12 and spread it out over the collar, as will hereinafter appear. A compressed air conveying pipe 19 is extended down through one side of this air lift pipe 12 and then extends upward through a central hole in the yoke shaped bracket 13 and into the lower end of the air lift pipe 12 a slight distance.

Around the air lift pipe I place a surrounding pipe 20, which is enough larger in diameter than the air lift pipe to leave an annular space between the pipe 20 and the air pipe 12 of sufficient area to permit a volume of pulp or solution and pulp to flow through it to completely fill the air lift pipe under such operative pressure of compressed air as is used in the air lift pipe. This protective pipe extends from the bottom of the tank to within a short distance of the top of the air lift pipe, the thin pulp solution being adapted to flow over its top edge and through it to the lower entrance of the air lift pipe. This protective column is arranged to be vertically adjustable from a position in which its lower end is held tightly against the inside wall of the conical bottom portion of the tank to prevent the pulp from flowing under its edge into the bottom of the air lift pipe from the body of the tank, to any predetermined distance above the inside wall of the tank that will admit as litttle pulp as desired or as much as the full capacity of the air pipe will receive and air pressure will lift in an operative lifting feed movement. Any suitable means may be employed for supporting this protective pipe in adjusted positions, but I preferably employ the following means: Across the top of the tank, at a suitable distance above it, I place a beam 21, which is secured to the timber or other framework that supports the tank in a vertical position. I do not, however, illustrate the framework, as it does not form a part of my present invention. In the top of this beam is formed a bearing box 22, in which bears a collar 23, secured upon the upper portion of a threaded rod 24, which extends downwardly through a hole extending from the bottom through the beam 21. A hand wheel 25 is secured to the upper end of the threaded rod above the bearing box, and the lower end of the rod is threaded into the hub 26 of a plate 27, the outer peripheral edge portion of which is provided with apertures through which rods 28 depend, the upper ends of which are secured to the said plate by nuts, as shown. The lower ends of these rods are also bolted or are otherwise secured to a flange 29, which extends from the top of the protective pipe. The rods 28 extend loosely through apertures in the hood and in the collar; consequently, the bolts are held by passing through the hood and collar from rotary movement, while being permitted to move up and down as they and the pipe are raised and lowered by rotating the hand wheel. Consequently, the rotating of the hand wheel causes the plate 27 to screw up or down on the threaded rod, and thereby raises or lowers the protective pipe which is secured to the plate by the rods 28.

In the upper portion of the tank between the annular surface of the same and the collar 14 I place a cylindrical band 30. The upper end of the band is secured to a frame 31, which rests upon the top of the tank, and it extends a suitable distance below the upper end of the protective column or pipe, and it is positioned about two-thirds to three-quarters of the distance between the air lift pipe and the inside of the tank and concentrically with them. This band is termed a baffle, as its function is to prevent the heavy material that flows over the surface of the collar from flowing over against the sides of the tank and also to form a quiet zone for the lighter material of the pulp and the pulp solution to accumulate in. An overflow launder 32 is formed around the top edge of the tank, through which this lighter solution flows to a filter box or to other treatment.

A continuous supply of suitably pulverized ore or concentrates and a continuous supply of water, or a cyanid or other solution may be fed into the tank, the former through a launder 33 and the latter through a valved pipe 34, and fixed charges of any predetermined amount up to the full capacity of the tank may be treated. A charge comprises about one-half of the capacity of the tank of ore and one-half solution, and having filled the tank the operation of continuously circulating the pulp so as to hold the ore in suspension in the solution and thus permit the cyanid solution to take up the gold values therefrom is as follows: A supply of compressed air is admitted into the bottom of the air lift pipe by opening the valve 19A of pipe 19, the valve 11 in the discharge pipe being closed, and in order to start the pulp up in the air lift pipe, especially when the ore is a heavy ore, the protective column is let down until its lower end rests against the inside surface of the conical end of the tank, which shuts out from the lower end of the air lift pipe any pulp from the bottom portion of the tank, but the solution at the top portion which

carries the lighter particles of the ore in solution can flow into the top of the protective column and keeps it full, and the air lift pipe is also kept full of this lighter weight pulp, which is very largely clear solution, especially is it almost entirely solution when the air lift has been shut down and the ore in the solution has settled to the bottom of the tank in a body, which it very quickly does after the air lift is shut off, and it is easy to keep the ore in suspension when the settled body of ore has once been broken through to the clear solution at its top. My invention is especially adapted to start the solution and ore on its continuous upward and downward movement; consequently, when the air pressure is turned into the air lift pipe the solution that stands in the air lift pipe is raised up through it by the air pressure and flows out of its upper end upon the collar 14, over which it spreads and flows in a circular stream and runs off its circumferential edge and drops into the solution in the tank between the baffle and the air lift pipe. The baffle prevents its flowing to the side of the tank and preserves a quiet zone between itself and the tank for the clear solution to collect. The air jet from the air supply pipe is then drawing solution from the top portion of the tank over the top of the protective pipe, and the solution is kept running over the top of this protective pipe until the column of solution raised through the air lift pipe fills the air lift pipe full, when the operator raises the protective column slowly and a slight distance at a time by turning the hand wheel until the current of solution flowing down through the protective pipe and up through the air lift pipe draws in and picks up the solid settled ore little by little until enough has been fed up through the air lift pipe to make an opening through the top of the settled body of ore when the solution can flow through this opening to the bottom of the outside of the protective pipe and under its lower end into the air lift pipe after which the ore and solution are quickly mixed into a flowing pulp of even consistency. The protective pipe is then raised high enough to permit the ore pulp to flow continuously up through the air lift pipe and out over the collar and down through the pulp in the tank in a continuously flowing stream, which action is kept up until the cyanid or other chemical solution has extracted such of the gold in the ore as it will dissolve and take up, after which the air pressure is shut off, the solution is displaced or decanted, and the discharge valve is opened and the heavy pulp is run off through the discharge pipe and is conveyed to waste or to further treatment. When solution is fed automatically and continuously into the tank the clear solution that rises up between the baffle and the tank runs off continuously into the launder 32 through overflow spout 35.

The protective pipe 20 acts as a primer to the air lift pipe in getting a continuous flow of the solution moving through the air pressure lift first, and this flowing stream of solution sucks the settled ore in gradually until the settled ore and solution are thoroughly mixed, and are then moved together by the air lift, as I have found in practice that the air lift alone, no matter how strong, will not pick up a settled ore that has packed in the bottom of the conical tank without a stream of solution can be lifted first into which the settled ore will gradually feed, and my protective vertically adjustable pipe permits this to be done with positive assurance until the entire body of ore and solution will be circulating up through the air lift pipe and down through the pulp in a continuously flowing circular stream that thoroughly agitates the ore pulp.

When about to discharge pulp, should it be settled tightly or should it close the discharge pipe's entrance within the tank, the auxiliary air and water pressure may be employed to loosen it by opening the valves 7 and 9, which allows a pressure of air and water together to flow through the discharge pipe and drive the clogging pulp away, or, if desired, either the water or air can be used independent of one another, and, in addition, either the auxiliary air supply or the clear water or both can be used to assist in lifting the pulp through the air lift pipe.

In Figs. 5, 6 and 7 is illustrated a slight modification in the manner of closing the lower end of the tank. In this modification a conical casting 36 is secured to the lower end of the tank, which terminates in a flange 37, to which four-eye bolts 38 are pivotally secured, the bolts extending through recesses 39 in the circumferential edge of the flange. A door 40, having circumferential recesses 41 adapted to register with the recesses 39, is hinged to a lug 42 on the flange 37, and the bolts 38 also extend through the recesses 41 of the door. Nuts 43 are screwed on the ends of the bolts against the door and securely hold the same closed against the flange 37, and by removing the nuts and swinging the bolts out of the recesses 41 the door may be dropped to empty the tank of pulp. The door is provided with a valved outlet pipe 44, into which is tapped a pipe 45 for conveying air under pressure to the air lift.

Within the lower end of the tank are secured guide plates 46, which steady the lower end of the protective pipe 20 and maintain it in a position concentric with the pipe 12.

My invention is simple, practical, inexpensive to construct and can be applied to

agitating tanks at present in use in treating cyanid mills at present in operation.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In an air lift ore pulp solution agitating apparatus, the combination of the tank provided with valve controlled air inlet and discharge pipes in its bottom, a vertical air lift pipe in the center of said tank arranged to extend from adjacent the bottom of said tank close to the top of said tank, an air pipe extending into said air lift pipe and arranged at one end to be connected to a supply of air under pressure and having its opposite end extending up into the bottom of said air lift pipe a short distance, and a protective pipe surrounding said air lift pipe and spaced therefrom, said protective pipe being arranged to extend to a predetermined point below the top of said air lift pipe, a hood above the top of the air lift pipe, a circular dished collar on the top of said air lift pipe and extending therefrom a short distance, and means for raising said protective pipe from and lowering the same against the bottom of said tank.

2. In an air lift ore pulp solution agitating apparatus, the combination of a tank provided with a conical bottom having a valve controlled discharge pipe and a valve controlled auxiliary air inlet pipe, with an air lift pipe positioned vertically in the center of said tank and extending from adjacent to its bottom to near the top of the tank, an air supply pipe entering the said air lift pipe and having its discharge end extending a short distance up into said air lift pipe, a collar plate at the top of said air lift pipe arranged to receive the pulp solution discharging from said pipe, a circular partition within said tank at its top portion positioned at a predetermined position between the sides of said tank and said air lift pipe and a protective pipe surrounding said air lift pipe of enough larger diameter to permit sufficient pulp solution to flow down it to the bottom of said air lift pipe to fill said air lift pipe, said protective pipe being arranged to rest against the bottom of said tank and to extend up around said air lift pipe to a predetermined point below the top of said tank and above the lower edge of said circular partition, and means including a threaded rod for adjustably raising said protective pipe any desired predetermined distance above the bottom of said tank to admit pulp solution to flow under it to said air lift pipe.

3. In an air lift ore pulp agitating apparatus, the combination of a conical bottomed tank provided with a discharge outlet and with pipes leading to supplies of water and air under pressure, an air lift pipe in the center of said tank extending from close to said discharge pipe to near the top of said tank, having its upper end provided with a hood, a collar plate below said hood, a baffle in the top of said tank between the sides of said tank and said air lift pipe, an outer protective pipe surrounding said air lift pipe, said protective pipe being arranged to bear on the bottom of said tank around said air lift pipe and to extend upward around said air lift pipe to a predetermined distance below the top of said tank, a flange at the upper end of said protective pipe, a plurality of rods secured at their lower ends to said flange and extending loosely upward through apertures in said collar plate and hood, a plate having a threaded hub portion secured to the upper ends of said rods, a supporting beam extending across said tank above said threaded hub plate, a bearing box in said cross beam, a rod threaded to said hub plate at one end extending through and beyond and rotatably journaled in said bearing box, and a hand wheel secured to the upper end of said threaded rod, whereby said protective pipe is adjustably raised from the bottom of said tank or lowered against it to shut off the pulp from entering the lower end of said air lift pipe or to admit it to it in predetermined amounts up to its full pulp lifting capacity.

4. In an air lift pulp agitating apparatus for ore and other materials, the combination of a tank provided with a valve controlled discharge outlet, a protective pipe within said tank arranged to extend from a bearing positioned at its lower end against the bottom of the tank to near the top of said tank, means including a hand wheel for raising and adjustably setting said pipe at any desired predetermined distance above the bottom of said tank, an air lift pipe within said protective pipe extending from adjacent to the bottom of said tank through said protective pipe and above the same; an air pipe connected at one end to a supply of compressed air arranged to enter the bottom of said air lift pipe and to discharge compressed air upward through the same, and means including a pipe for introducing water under pressure into the bottom of said air lift pipe and into said tank.

5. In an air lift apparatus for agitating ore or other pulp, the combination of a conical bottomed tank with an air lift pipe and a protective pipe, said air lift pipe being supported with its bottom inlet-end adjacent to the bottom of the tank, an air supply pipe entering the lower end of said air lift pipe, means including a bracket at the end of said air lift pipe for supporting said air supply pipe, said air supply pipe being arranged to extend vertically upward into the center of the lower end of said air lift pipe for a short distance, said protective pipe

being arranged to be moved against the conical bottom of said tank to prevent pulp from flowing under its end to the lower end of said air lift pipe, and its top end being arranged to admit pulp to flow into it down to the lower end of said air lift pipe and adjustable means for raising said protective pipe to admit pulp under its lower end in any predetermined amount up to the lifting capacity of the supply of compressed air to said air supply pipe.

6. In an air lift for agitators as specified, the combination with a conical tank, of a vertically and centrally disposed air lift pipe therein of less length than the depth of the tank, a space being left between the lower end of said pipe and the bottom of the tank, a circular dished plate secured upon the top of the pipe having a central hole which registers with the bore of said pipe, a circular dished plate supported above the upper end of the pipe, a protective pipe surrounding the air lift pipe and spaced therefrom and means for raising and lowering said protective pipe, said pipe terminating below the upper end of the air lift pipe, guides for the lower end of the protective pipe, a discharge pipe for the tank and means for admitting air under pressure or air and water under pressure into the lower end of the air lift pipe.

7. In an air lift for agitators as specified, the combination with a conical tank having an outlet, an air lift pipe therein supported to leave a space between its lower end and the bottom of the tank and a protective pipe surrounding the air lift pipe and spaced therefrom, said protective pipe being of less length than the air lift pipe, of means for raising the protective pipe out of engagement with the bottom of the tank comprising a support, a bearing in the support, a threaded rod having a collar which rests in the bearing, said rod extending through the said bearing and support, a plate having a threaded hub through which said rod passes, rods connecting the said plate with the protective pipe and a hand wheel on the upper end of the threaded rod.

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

LEON PAUL HILLS.

Witnesses:
PAUL MORRIS,
J. F. THOMASSON.