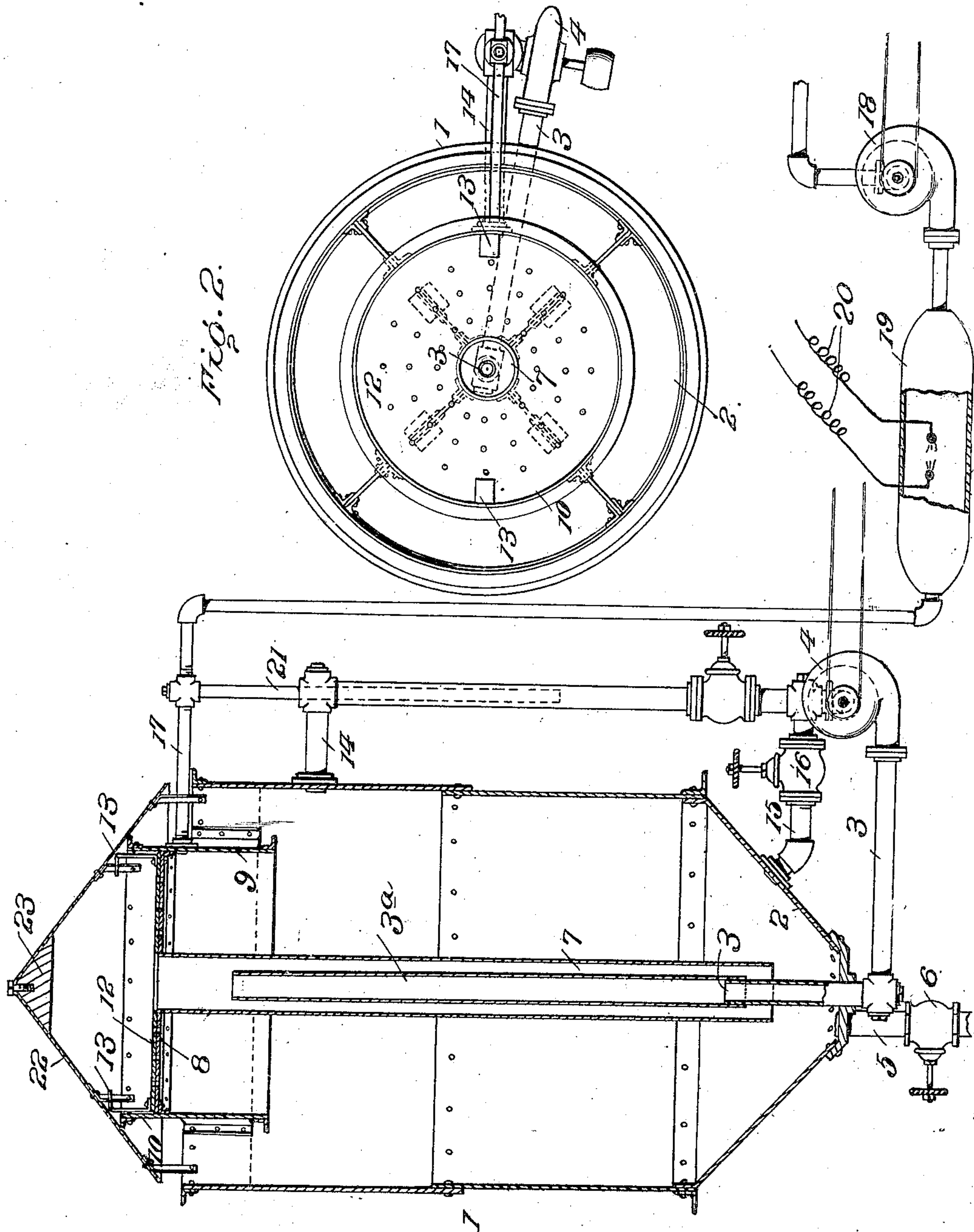


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F. J. CRANE.
TREATING ORES.
APPLICATION FILED AUG. 17, 1905.



Inventor

Francis J. Crane.

By,

J. P. McChesney

Attorney

Witnesses

John A. Murphy

UNITED STATES PATENT OFFICE.

FRANCIS J. CRANE, OF DENVER, COLORADO.

TREATING ORES.

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Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, FRANCIS J. CRANE, of Denver, in the county of Denver and State of Colorado, have invented certain new and useful Improvements in Treating Ores; 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.

The primary object of my invention is to provide simple and inexpensive means for oxidizing and desulfurizing refractory or smelting ores, as well as the so-called "fine-milling" or "oxidized" ores.

A further object is to enable the oxidizing of ores, especially tellurium ores, to be accomplished in less time and in a more thorough manner than has heretofore been possible.

A further object is to insure the pulverizing of refractory ores during the treatment thereof to effect oxidation.

In the cyaniding methods as heretofore practiced the oxidizing has been effected by aerating in large flat tanks, the solution being allowed to percolate. This requires constant agitation for quite a long period, so that the pulp will be exposed over and over again to the action of the air.

According to my invention the pulp is constantly exposed to the action of ozone, which is so thoroughly intermixed therewith as to insure the oxidation of the ores in a very short time, thus greatly increasing the output and lessening the cost of treatment. This I accomplish by forcing the solution of pulp, with cyanid added, to the upper portion of a tank, from whence it passes through an ozone-containing chamber, the solution being constantly taken off from and returned to the tank and in its passage entrains an additional supply of ozone, which by the action of the circulating-pump is thoroughly beaten into the pulp. When, however, the solution is being drawn off to be filtered, the circulation is kept up through a secondary take-off pipe leading from the tank at a point near its bottom. In treating refractory ores previously ground to pass through, say, one-eighth or one-quarter mesh pulverization may be effected by the impact of the discharge of the pump being directed against an arrester located above the ozone-containing chamber.

The invention will be hereinafter fully set forth, and particularly pointed out in the claims.

In the accompanying drawings, Figure 1 is a vertical sectional view of an apparatus constructed in accordance with my invention. Fig. 2 is a top plan view with the arrester omitted.

Referring to the drawings, 1 designates a tank having a conical bottom 2, into the vertex of which opens a return or feed pipe 3, leading from a centrifugal pump 4, which latter may be operated by any suitable means. A discharge-pipe 5 also leads from the bottom of the tank and is equipped with a valve 6. The feed-pipe 3 extends upwardly into the tank and is inclosed by a second larger pipe 7, which I term the "agitator-pipe." The length of the feed-pipe 3 depends upon the character of the ore being treated. The pipe 7 at its upper end extends a short distance above the top of tank 1, and to it is secured a perforated diaphragm 8, from which depends an open-bottom housing or chamber 9 concentric with pipe 7 and tank 1, a circular space being left between itself and the latter. The perforated diaphragm 8 forms the bottom of a discharge-receiving pan 10, and on said diaphragm is seated a second or false bottom 12, also formed with perforations designed to coincide with those of diaphragm 8. This false bottom has manipulating-handles 13, by which it may be turned axially for regulating the outlet from the pan—that is to say, by increasing or decreasing the flow through the perforations of diaphragm 8. This is necessary, since all solutions are not of the same consistency and in case of caking would clog the perforations and interfere with the flow. The false bottom may be rotated back and forth for the purpose of freeing any obstruction and can be readily removed when it is desired to clean diaphragm 8.

14 designates a take-off pipe leading from tank 1 near the top thereof, but at a point beneath ozone-chamber 9, such pipe opening through a vertical branch thereof into the receiving side of pump 4. A second take-off pipe 15, equipped with a valve 16, opens into tank 1 near the bottom thereof, which pipe is for the purpose of keeping the pump supplied when drawing off the solution for filtering through pipe 5. This prevents the pulp

from settling or caking before it is all drawn off. Except when necessary for this purpose valve 16 is kept closed.

17 designates an ozone-supply pipe opening into the ozone-chamber 9 and leading from an air-pump 18. Within the length of this pipe, preferably at a point near the pump 18, is a housing 19, wherein is located the terminals of sparker-coils 20, through which coils is passed a direct current generated by any suitable source. The air in its passage through the housing 19 is thoroughly charged with ozone and forced through pipe 17 into ozone-chamber 9; but a portion thereof is entrained by the solution passing through take-off pipe 14 through a branch pipe 21, leading from pipe 17 and depending some distance into the vertical branch of pipe 14. The ozone so drawn in with the pulp is thoroughly beaten thereinto as the latter is returned to the tank. Of course the ozone may be produced by other suitable means.

In connection with the treatment of certain refractory ores ground to an insufficient extent to insure oxidation I mount an arrester 22 above the discharge-receiving pan, such arrester being in the form of a cone secured to the tank and the pan by any suitable means. The feed-pipe 3 is preferably made telescopic or extensible, so that it will extend up to near the top of pipe 7, and the impact of the discharge against the cone will be so great that the ores will be thoroughly pulverized. To avoid undue wear, the cone, which is made of steel, is provided at its vertex with a solid block 23, against which the discharge will be directed. When, however, the ores do not require to be pulverized while being treated, the telescopic section 3^a of feed-pipe 3 may be removed, so that the ore will lag as it travels up through the agitator-pipe 7. This is important, since in treating soft or free-milling rock, lime-stone, &c., pulverization beyond a certain point would make filtering very difficult, and besides the action of the pump serves in itself to assist in pulverizing the ores to the necessary degree. The lagging within the agitating-pipe secures additional circulation of the entire pulp, and consequently greater admixing of the air and ozone, as well as less pulverization.

In practice the pulp is preferably made up of one part of finely-ground ore and two of water with the cyanid mixed therewith ready to act on the ores as soon as the latter are in condition to be extracted. The solution which is drawn off through pipe 14 flows into the feed-pump, entraining the ozone with it, and the mixture is then discharged through feed-pipe 3 up into agitator-pipe 7, through which it is forced onto the discharge-receiving pan 10 or is directed with great force against the arrester if the length of pipe 3 be increased by the addition of section 3^a. It will pass from the pan downwardly through

the ozone-chamber, thereby being further subjected to the action of ozone. This operation is continued until the extraction is complete, whereupon the solution is drawn off through pipe 5, pipe 15 being then opened up to prevent caking while the tank is being emptied. By this means I am enabled to treat tellurium or refractory as well as oxidized ores without the necessity of roasting, and the entire operation may be practiced in a very short time and with but little expense.

Although I have described the best means known to me for carrying out my invention, yet I do not restrict myself to the exact construction shown and described, since changes may be made without departing from the scope of my invention. For instance, tanks heretofore constructed with flat bottoms may be utilized, the ores and solution being taken off from the bottom and kept in an agitated state by slight discharges through pipes radiating from the feed-pipe at a point adjacent to such bottom.

I claim as my invention—

1. The herein - described apparatus for treating ores, comprising a tank, an ozone-chamber in the upper portion of such tank, and means for drawing off the solution from such tank and returning it thereto through the ozone-chamber.

2. The herein - described apparatus for treating ores, comprising a tank, an ozone-chamber in the upper portion of such tank, a pump, a pipe leading to such pump from such tank, a feed-pipe leading from the pump and opening into the tank, and an agitator-pipe leading from such feed-pipe to and above the ozone-chamber, the solution discharged from such agitator-pipe passing through the ozone-chamber in its return to the tank.

3. The herein - described apparatus for treating ores, comprising a tank, means for drawing the solution from such tank and returning it thereto, and means for supplying ozone to the tank at a point through which the solution must pass as it is being returned to such tank.

4. The herein - described apparatus for treating ores, comprising a tank, means for drawing the solution from the upper portion of such tank and returning it thereto at a still higher point, and means for supplying ozone to the solution as it is being drawn off from the tank, and also to the tank at a point intermediate the points at which the ozone is drawn off and returned to the tank such means forcing the ozone into the solution.

5. The herein - described apparatus for treating ores, comprising a tank, an ozone-chamber, an arrester located above said ozone-chamber, and means for drawing off the solution from such tank and discharging it against said arrester with sufficient impact to effect the pulverization of the ores, the latter then passing through said ozone-chamber.

6. The herein - described apparatus for treating ores, comprising a tank, an ozone-chamber, an arrester located above, said chamber, a pump, a pipe leading from the tank to such pump, and a return or feed pipe through which the ore and solution are discharged against said arrester before passing through said ozone-chamber.

7. The herein - described apparatus for treating ores, comprising a tank, an ozone-chamber in the upper portion of such tank, a pump, a pipe leading to such pump from the tank, a feed-pipe leading from the pump and opening into the tank, an agitator-pipe leading from such feed-pipe to and above the ozone-chamber, and a pan into which such agitator-pipe opens; said pan having a perforated bottom, the solution discharged from such agitator-pipe passing through such bottom and also through such ozone-chamber on its return to the tank.

8. The herein - described apparatus for treating ores, comprising a tank, an ozone-chamber in the upper portion of such tank, a pump, a pipe leading to such pump from the tank, a feed-pipe leading from the pump and opening into the tank, an agitator-pipe leading from such feed-pipe to and above the ozone-chamber, a pan into which such agitator-pipe opens, said pan having a perforated bottom, the solution discharged from such

agitator-pipe passing through such bottom and also through such ozone-chamber on its return to the tank, and a false perforated bottom fitted against said perforated bottom. 35

9. The herein - described apparatus for treating ores, comprising a tank, means for drawing the solution from such tank and returning it thereto, an ozone-chamber at the top of the tank through which the returned solution is caused to pass, and means for supplying ozone to such chamber and to the solution as it is drawn off from the tank. 40

10. The herein - described apparatus for treating ores, comprising a tank, an ozone-chamber at the top of the latter, a pump, a take-off pipe leading to such pump, a return or feed pipe leading from such pump to the tank, an ozone-chamber at the top of the tank through which the returned solution is caused to pass, an ozone-supply pipe opening into said ozone-chamber, a branch pipe leading from said ozone-supply pipe into said take-off pipe, and means for supplying ozone. 50

In testimony whereof I have signed this specification in the presence of two subscribing witnesses. 55

FRANCIS J. CRANE.

Witnesses:

T. B. STEARNS,
A. B. KENNEDY.