No. 837,560. PATENTED DEC. 4, 1906.

J. E. GREENAWALT.

CHLORIDIZING APPARATUS.

APPLICATION FILED MAR. 27, 1905.

2 SHEETS—SHEET 1.

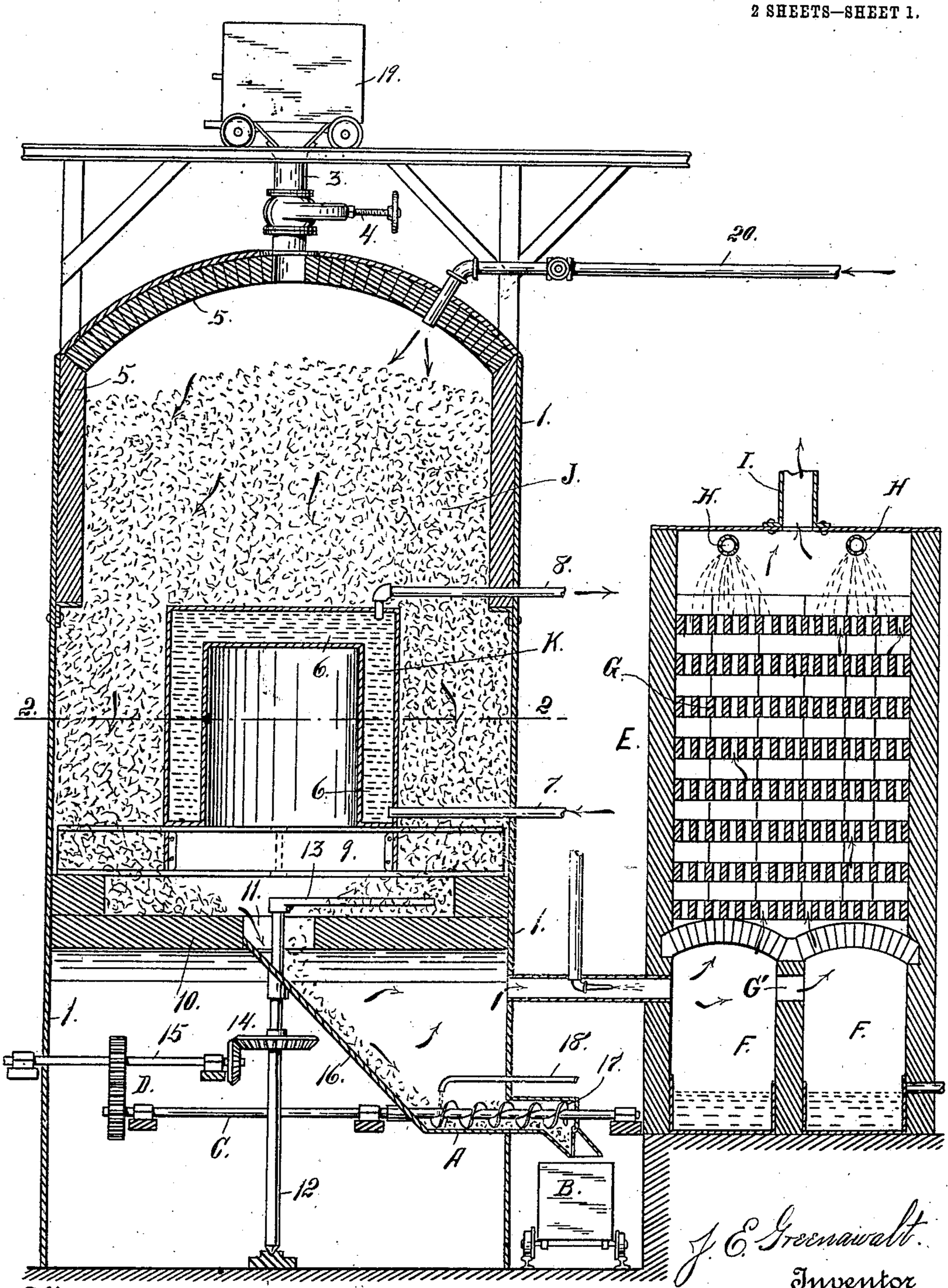

Fig. 1.

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2 SHEETS—SHEET 2.

Fig. 3.

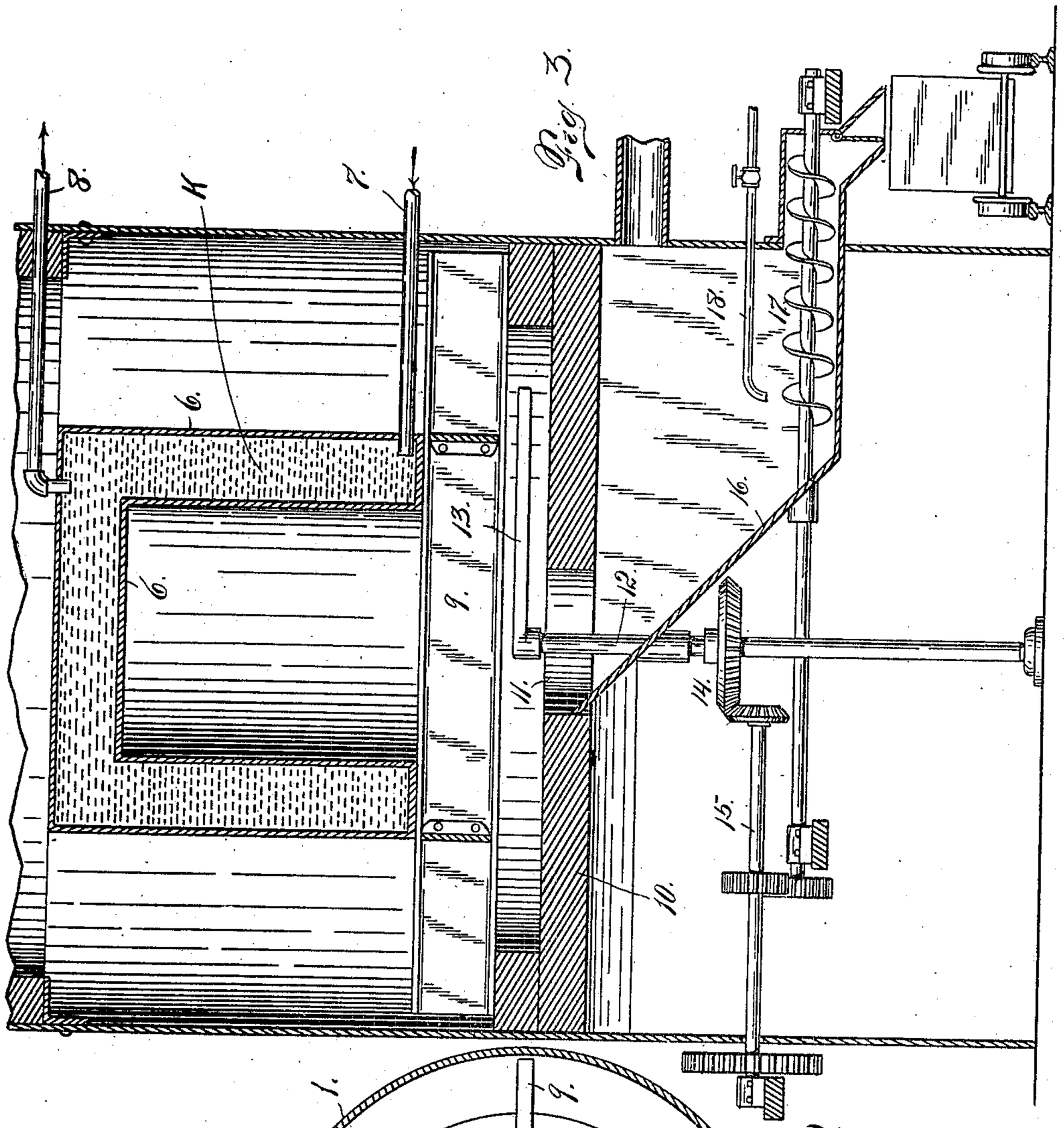
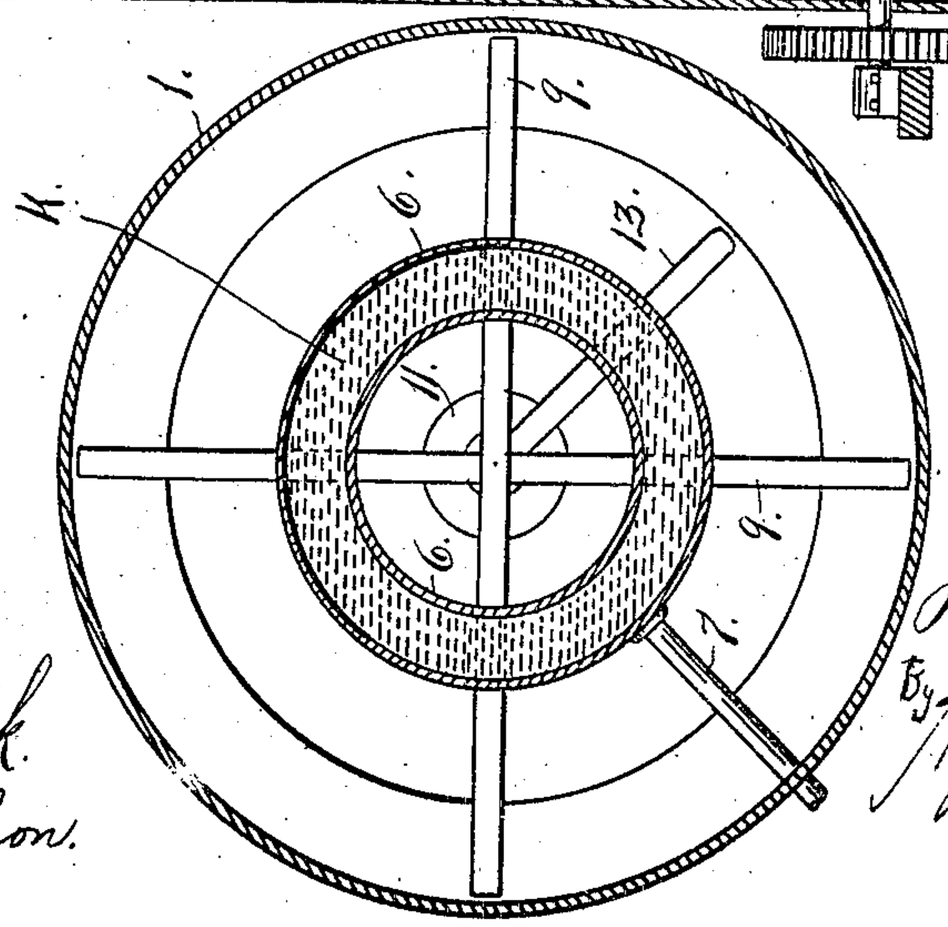


Fig. 2.



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CHLORIDIZING APPARATUS.

No. 837,560. Specification of Letters Patent. Patented Dec. 4, 1906.

Application filed March 27, 1905. Serial No. 252,108.

To all whom it may concern:

Be it known that I, JOHN E. GREENAWALT, a citizen of the United States, residing in the city and county of Denver and State of Colorado, have invented certain new and useful Improvements in Chloridizing Apparatus; and I do 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, reference being had to the accompanying drawings, and to the figures of reference marked thereon, which form a part of this specification.

My invention relates to improvements in apparatus for chloridizing ores; and its object is the treatment of ores when in a heated condition by the use of chlorin gas in such a manner as to prevent a loss resulting from the volatilization of the metallic values. In oxidizing roasting gold, silver, and copper ores perceptible losses of this character very rarely occur. If, however, salt (chlorid of sodium) is added to chloridize the silver, &c., a considerable loss generally occurs not only of the silver and copper, but also of the gold. When an ore is roasted with salt, the first chlorin released acts upon the baser elements in the ore, and it is only after free chlorin is released from the ore that the metals volatilize to any great extent. In carrying out the invention I add a small amount of salt, generally from one-half of one per cent. to one per cent. to the ore, either in the roasting-furnace or just before passing the ore into the chloridizing tank or chamber. In the chloridizing-tank the ore while hot is subjected to a stream of chlorin gas, which chloridizes the valuable metals, thus converting them into soluble chlorids.

My improved apparatus embraces a chloridizing-tank in the lower portion of which is located a cooling device, the tank having an escape-opening below the cooling device, means for stirring the ore, whereby it is gradually and continuously moved through the chloridizing-chamber, means for delivering a chloridizing-gas to the upper part of the chloridizing-chamber, whereby it is adapted to act on the ore while in a heated condition, and means for condensing any valuable fumes or gases which may have escaped from the chloridizing-chamber.

Having briefly outlined my improved construction, as well as the function it is intended to perform, I will proceed to describe the same in detail, reference being made to the accompanying drawings, in which is illustrated an embodiment thereof.

In the drawings, Figure 1 is a sectional view of the chloridizing-tank and condensing-chamber. Fig. 2 is a horizontal section of the chloridizing-tank, taken on the line 2 2, Fig. 1. Fig. 3 is an enlarged fragmentary section of the chloridizing-tank and the operating mechanism employed in connection therewith. In this view the upper part of the tank is broken away.

The same reference characters indicate the same parts in all the views.

The chloridizing-tank consists, preferably, of an outer shell 1, of sheet-steel, closed on top and connected with the pipe 3 through a gate-valve 4. The upper portion of the tank is lined with brick 5 in order to retain the heat of the ore until the chlorin gas has acted upon it. In the lower central portion of the tank is a cooling-chamber, whereby the ore is cooled and the volatile fumes from the upper portion of the ore condensed to a very great extent. This cooling device consists of a cylindrical water-tight shell 6, with a pipe 7 at the bottom for supplying the same with water and an escape-pipe 8 at the top for the discharge of the hot water and steam formed. The weight of the cooling-chamber and ore above it is supported by heavy steel I-beams 9. About fourteen inches below these beams is a horizontal floor 10, with a circular hole 11 in the center. Through this hole passes a vertical shaft 12, provided at its upper extremity with a projecting arm 13. This shaft, together with its arm, is given a rotary motion from a shaft 15 by means of the bevel-gears 14. The shaft 15 may be operated from any suitable source of power. An inclined partition 16, located below the opening 11, forms a chute to guide the ore into the screw conveyer 17, where it is properly moistened by water supplied by a pipe 18. The screw conveyer discharges the ore from a trough A into a receiving-car B. The conveyer-shaft C is connected in operative relation with the shaft 15 by means of gearing D.

In operation the hot ore is brought from the roasting-furnace by a car and discharged into the chloridizing-tank through a pipe 3, communicating with an opening in the top of the tank. The tank is first filled with ore and kept filled by supplying the red-hot ore at intervals of, say, every four hours; but it is constantly and continuously removed at the

bottom by the agitating or stirring arm 13. When the arm 13 is at rest, the angle with the floor 10 formed by the ore around the opening 11 is such that it remains at rest until the movement of the arm withdraws it and delivers it to the chute 16. In this way the ore body is constantly lowered without channeling and passes downwardly through the tank slowly and at the same rate that it is being withdrawn at the bottom. The chlorin or its equivalent is introduced through the pipe 20. When the valve 4 in the pipe 3 is closed, the entire upper portion of the tank is gas-tight, and a pressure of a few pounds is sufficient under most conditions to cause the gas to permeate the entire mass of hot ore and percolate downwardly through the ore in the chloridizing tank or chamber. In this manner the chlorin gas acts upon the hot ore, chloridizing the silver and the other chloridizable substances contained in the ore. However, before the inert gases that may be mixed with the chlorin or the surplus can escape from the tank they must percolate through the cooling zone or lower portion of the ore surrounding the water-cooled shell 6, where the temperature of the volatilized fumes is reduced sufficiently to cause precipitation to a considerable extent. The escaping gases and steam caused by moistening the ore in the screw conveyer are passed into the condensing-chamber E, whereby the remaining values contained in the gases are completely precipitated. While I prefer the use of chlorin gas generated electrolytically for this purpose, it is evident that hydrochloric acid or such other gas as sulfuric gas when the ore contains salt would answer the purpose. The presence of air in the gas-current also aids the chloridization of the ore. In order to make the chloridizing operation continuous, I have provided a vent or escape-passage for the unconsumed or inert gases.

The lower part of the condensing-chamber E is provided with compartments F, connected by a port G′. These chambers communicate with the upper part of the chamber, which is filled with checker-work G. Above this checker-work perforated pipes H are located and supply the chamber with the necessary water for condensing purposes. The waste gases which are not condensed in the chamber E escape at the top of the chamber through a conduit I.

In Fig. 1 of the drawings the ore in the chloridizing-tank is indicated and designated by the letter J. The arrows in this view indicate the passage of chlorin gas downwardly through the ore. The water in the cooling device 6 is designated in all the views by the letter K.

Having thus described my invention, what I claim is—

1. In chloridizing apparatus, the combination of a chloridizing-chamber, containing a chloridizing zone and a cooling zone, means for passing the ore from the chloridizing zone to the cooling zone and thence removing it from the chamber, and means introduci from the chamber, and means for introducing a chloridizing-gas into the chloridizing zone of the chamber.

2. In chloridizing apparatus, the combination of a chloridizing-chamber, means for passing the ore through the chamber, means for cooling the ore, means for passing a current of chloridizing-gas through the ore within the chamber and in the same direction as the travel of the ore.

3. In chloridizing apparatus, the combination of a chloridizing-chamber, a condensing-chamber, and means for passing a current of chloridizing-gas through the ore in the chloridizing-chamber, and means for conducting the fumes or gases remaining after the ore has left the chloridizing-chamber, into the condensing-chamber.

4. In a chloridizing apparatus, the combination of a chloridizing-chamber having a cooling zone, a condensing-chamber, means for introducing chloridizing-gas into the chloridizing-chamber, means for withdrawing the ore from the said chamber, and means for moistening the ore after it has left the chamber.

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

JOHN E. GREENAWALT.

Witnesses:
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A. J. O'BRIEN.