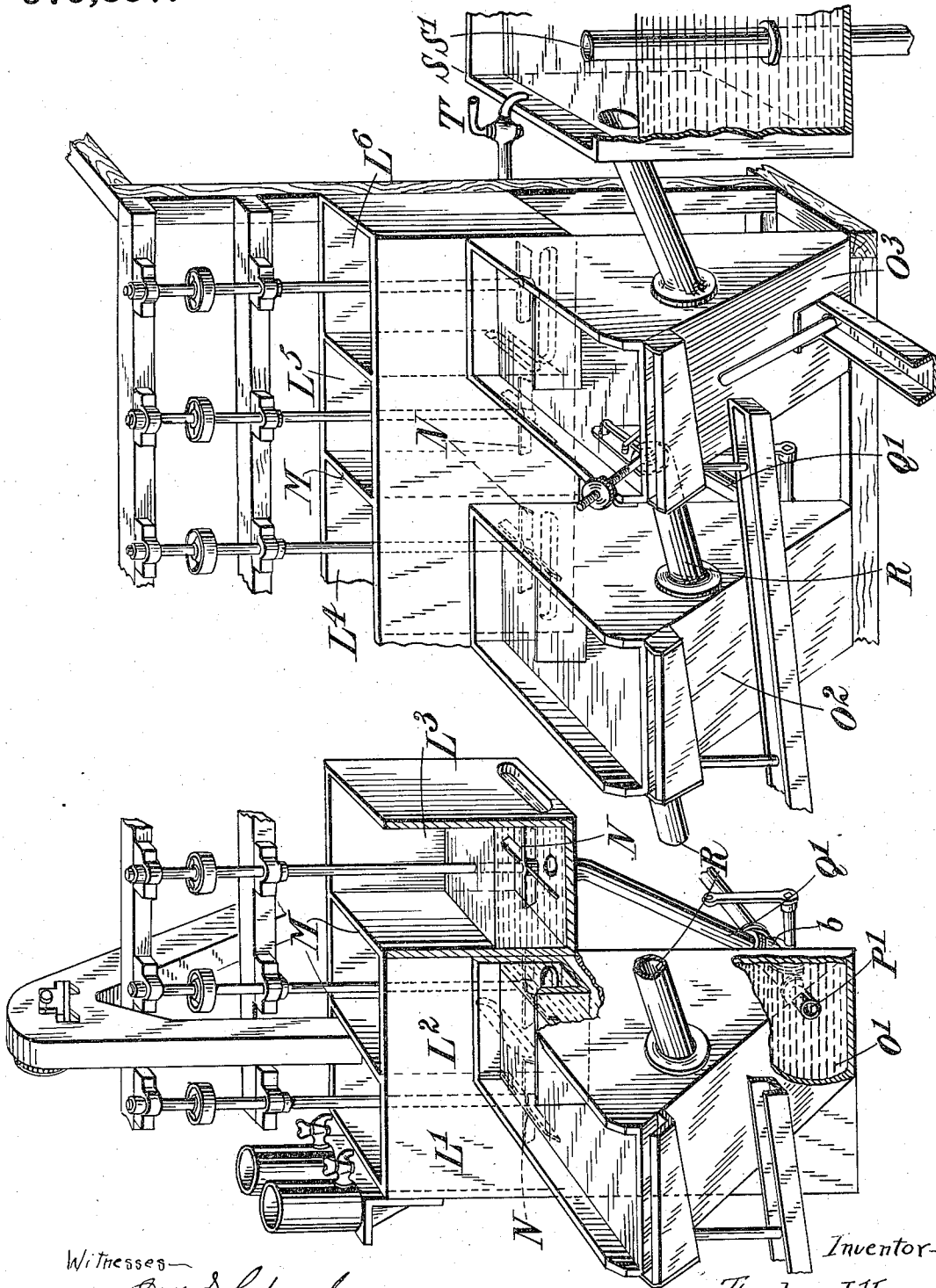


T. J. HOOVER.
 APPARATUS FOR ORE CONCENTRATION.
 APPLICATION FILED JULY 14, 1910.

979,857.

Patented Dec. 27, 1910.



Witnesses—

E. W. Shepard
W. J. Harner

By

Inventor—
Theodore J. Hoover
E. W. Shepard
 ATT'Y.

UNITED STATES PATENT OFFICE.

THEODORE JESSE HOOVER, OF LONDON, ENGLAND, ASSIGNOR TO THE MINERALS SEPARATION LIMITED, OF LONDON, ENGLAND.

APPARATUS FOR ORE CONCENTRATION.

979,857.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, THEODORE JESSE HOOVER, a citizen of the United States of America, residing at London, England, have
5 invented certain new and useful Improvements in Apparatus for Ore Concentration, of which the following is a specification.

This invention relates to improvements in apparatus for ore-concentration.

10 Several processes are known in which air is beaten into a liquid containing powdered ore in suspension, whereupon the bubbles of air attach themselves to certain particles which are thereby caused to float, while
15 other particles are not so floated.

The object of this invention is to improve the apparatus used in this type of process.

The invention will be best understood with reference to the accompanying drawing which is a diagrammatic illustration of
20 one form of apparatus.

Referring to the drawing several mixing vessels (say six) $L^1 L^2 L^3 L^4 L^5 L^6$ are placed side by side. These may conveniently
25 be large vats separated by partitions M . Where several vessels are connected together into a group the partitions have openings at the bottom so that the liquid may pass from one vessel to another. At the end of
30 each group however the partitions are complete. Each vessel is provided with a rotatable agitator or stirrer N which is conveniently in the form of several radial blades (curved or straight) radiating from the bot-
35 tom of a rotatable vertical shaft. Each agitator is carried by a vertical spindle rotated at a high speed by any convenient means.

Crushed ore or similar finely divided mineral is fed into the first vessel through any
40 convenient ore feeding device and water is also fed into the vessel.

A small proportion of acid, such as sulfuric acid may be introduced into the water, and a small proportion of one or more
45 other substances which enable metallic sulfids to be floated by air under the conditions specified may be introduced. The liquid containing ore in suspension is vigorously agitated in the vessels. On the lateral wall
50 of the mixing vessel, or of the last mixing vessel of the first group L^2 there is an outlet a at the bottom leading directly into a settling apparatus consisting conveniently of
55 a spitzkasten O^1 .

The spitzkasten is preferably constructed

as shown in the drawing but instead of being connected to the end of the mixing vessel it is connected at the side. The liquid and the sunken material pass out through an outlet
60 P^1 at the bottom of the spitzkasten and a conduit Q^1 connects said outlet with an orifice at the center of the bottom of the next succeeding mixing vessel L^3 . The rotating agitator therein performs the function
65 of a centrifugal pump and draws the liquid from the spitzkasten O^1 into said mixing vessel L^3 . A suitable valved air inlet b controlled by a lever is provided as a part of the conduit Q^1 for the purpose of supplying
70 the necessary air to the liquid after leaving the spitzkasten. The pulp may thus pass through a primary mixing apparatus $L^1 L^2$ thence through a spitzkasten O^1 into a secondary mixing apparatus $L^3 L^4$ thence into
75 a second spitzkasten O^2 and through a third mixing apparatus $L^5 L^6$ and a third spitzkasten O^3 . The spitzkasten should be all on one level. At a convenient point, say a few
80 inches below the level of water in the spitzkasten, the spitzkasten are connected together by conduits such as short pipes R . By this means the level of water in the spitzkasten is maintained the same so that
85 exactly the required amount of overflow is constantly maintained in each. The bulk of the circuit liquor passes away with the tailings from the bottom of the last spitzkasten.

In order to determine automatically the level of liquid in the spitzkasten, one of the
90 spitzkasten, conveniently the last, O^3 , is connected by a conduit as before with a vessel S of large area (the regulating vessel) placed alongside and filled with liquid, conveniently circuit liquor or water.

One convenient way of keeping a constant
95 level in the regulating vessel is to provide an overflow pipe S^1 the open top of which is at the desired level or a pipe can be so placed that it introduces water into the regulating
100 vessel whenever the level falls below the normal. The regulating vessel may simply be provided with a very small supply of water constantly running in through a tap T
105 at a rate arranged to give the necessary overflow in the spitzkasten or the regulating vessel S may have both an overflow pipe S^1 and an inlet of water through tap T .

Modifications may be made in the details of the invention provided always that the
110 spirit of the invention is not departed from.

What I claim as my invention and desire to secure by Letters Patent is:—

1. Apparatus for concentrating ores by gaseous flotation of certain mineral particles in liquid comprising in combination a mixing vessel, an agitator in the mixing vessel, a spitzkasten at the outlet of the mixing vessel, a secondary mixing vessel, a centrifugally acting agitator in said secondary mixing vessel and a connecting conduit between the tailings outlet of the spitzkasten and the zone of the suction influence of the centrifugally acting agitator of said secondary mixing vessel.
2. Apparatus for concentrating ores by gaseous flotation of certain mineral particles in liquid comprising a mixing vessel, an agitator in said mixing vessel, a spitzkasten at the outlet of said mixing vessel, a secondary mixing vessel, a connecting conduit between the tailings outlet of the spitzkasten and the center of the bottom of said secondary vessel and a centrifugally acting agitator in said secondary mixing vessel.
3. An apparatus for concentrating ores by gaseous flotation of certain mineral particles in liquid comprising in combination a plurality of mixing vessels connected as a group, an agitator in each of said mixing vessels, a spitzkasten at the outlet of said group of mixing vessels a plurality of secondary mixing vessels connected as a group, a centrifugally acting agitator in said secondary mixing vessel, and a connecting conduit between the spitzkasten and the zone of the suction influence of the centrifugally acting agitator.
4. An apparatus for concentrating ores by gaseous flotation of certain mineral particles in liquid comprising in combination a first mixing vessel, an agitator in the mixing vessel, a spitzkasten at the outlet of the mixing vessel, a secondary mixing vessel at substantially the same level as the first mixing vessel, a centrifugally acting agitator in said secondary mixing vessel, and a connecting conduit between the tailings outlet of the spitzkasten and the zone of the suction influence of the centrifugally acting agitator in the secondary mixing vessel.
5. An apparatus for concentrating ores by gaseous flotation of certain mineral particles in liquid comprising in combination a mixing vessel, a spitzkasten at the outlet of said mixing vessel, a secondary mixing vessel a centrifugally acting agitator therein, and a

connecting conduit between the tailings outlet of the spitzkasten and the zone of the suction influence of the centrifugally acting agitator in the secondary mixing vessel, said conduit being provided with an air inlet.

6. An apparatus for concentrating ores by gaseous flotation of certain mineral particles in liquid comprising in combination a series of mixing vessels, a centrifugally acting agitator in each, a series of spitzkasten placed respectively at the outlets from the mixing vessels and at the same level with one another, a conduit from the tailings outlet of each spitzkasten to the zone of the suction influence of the centrifugally acting agitator of the next succeeding mixing vessel, and a valve controlled air inlet in said connecting conduit.

7. Apparatus for concentrating ores by gaseous flotation of certain mineral particles in liquid, comprising in combination a series of mixing vessels, a centrifugally acting agitator in each, a series of spitzkasten placed respectively at the outlets from the mixing vessels and on the same level with one another, a conduit from the tailings outlet of each spitzkasten to the zone of the suction influence of the centrifugally acting agitator of the next succeeding mixing vessel and a connecting conduit near the top but under the liquid level between each pair of adjacent spitzkasten.

8. Apparatus for concentrating ores by gaseous flotation of certain mineral particles in liquid, comprising in combination a series of mixing vessels, a centrifugally acting agitator in each, a series of spitzkasten placed respectively at the outlets from the mixing vessels and on the same level with one another, a conduit from the tailings outlet of each spitzkasten to the zone of the suction influence of the centrifugally acting agitator of the next succeeding mixing vessel and a connecting conduit near the top but under the liquid level between each pair of adjacent spitzkasten, a vessel of relatively large area connected by a conduit with one of the spitzkasten and means for maintaining constant the level of the solution therein.

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

THEODORE JESSE HOOVER.

Witnesses:

H. D. JAMISON,
N. WILLIAMS.