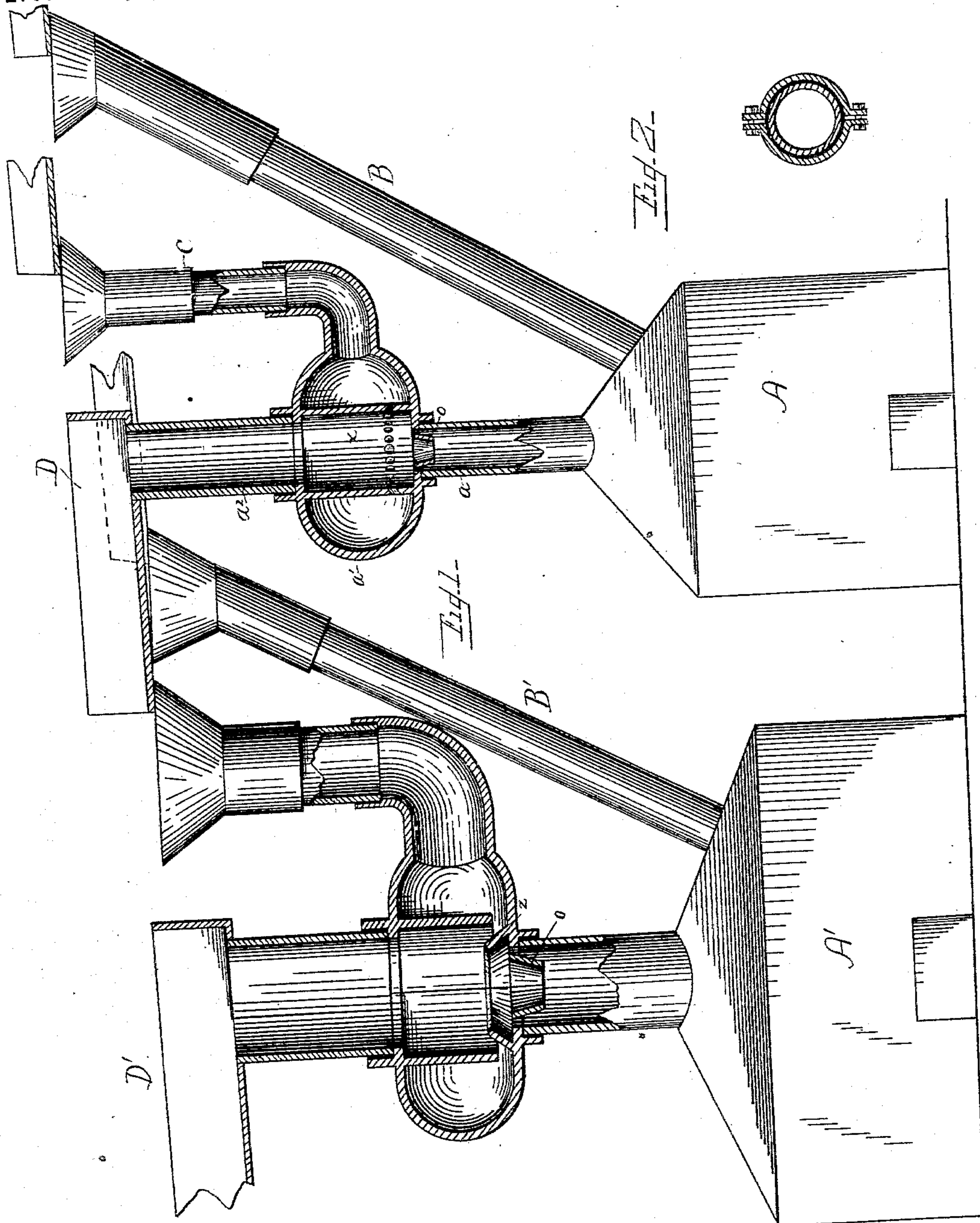


(No Model.)

F. A. HERRING.  
ORE CONCENTRATOR.

Patented Mar. 22, 1887.

No. 359,674.



Witnesses

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# UNITED STATES PATENT OFFICE.

FREDERICK AUGUSTUS HERRING, OF RENO, NEVADA.

## ORE-CONCENTRATOR.

SPECIFICATION forming part of Letters Patent No. 359,674, dated March 22, 1887.

Application filed December 2, 1886. Serial No. 220,448. (No model.)

*To all whom it may concern:*

Be it known that I, FREDERICK AUGUSTUS HERRING, a citizen of the United States, residing at Reno, in the county of Washoe and State of Nevada, have invented certain new and useful Improvements in Ore-Concentrators; 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.

My invention relates to improvements in ore-concentrators, or means for separating the metals and metallic compounds from their gangue.

The invention proceeds on the theory that there is no chemical union between quartz and the metals and the metallic compounds it contains, and the invention is intended to utilize natural forces in separating substances having different specific gravities.

In carrying out the purpose of my invention the ore is crushed or ground and a constant supply of water maintained, varying in quantity with the amount of work to be performed, the object being the separation of the metals and the metallic compounds from the barren quartz, sand, and other rock matter to obtain the metallic compounds for further treatment.

To this end my invention consists in the separation of the light and heavy constituents of the mineral by means hereinafter particularly described, and pointed out in the claims.

In the drawings, Figure 1 is an elevation, partly in section, of my improved apparatus. Fig. 2 is a sectional detail.

The apparatus as a whole consists in the combination of two concentrators of like construction, either of which may be used alone or in connection with the other.

I will first describe a single apparatus, and refer to that at the right of Fig. 1.

A is a closed tank or receptacle of any suitable dimensions and material. B is a water-conduit, C the pulp-conduit leading to the middle section of the stand-pipe, and D the waste trough or spout. The tank is provided with a stand-pipe,  $a$   $a'$   $a''$ . The part  $a$  in practice is about eighteen inches in length, and is preferably made of glass or other transparent

material, so that the operation within may be observed. The capacity of this part of the pipe should be about equal to that of the inlet-conduit B, through which clear water is admitted to the tank from a head somewhat above the top of the stand-pipe. The part  $a'$  is a bulb or enlargement about half as long as the parts  $a$  and  $a''$ , so that there may be slack water at this part of the pipe when the pulp is introduced through conduit C. The part  $a''$  is about the same length as the part  $a$ , and of a capacity about equal to that of the water-conduit B and the pulp-conduit C. The enlarged chamber or bulb portion  $a'$  provides for slack water, and thus gives time for the parts of the pulp to separate, the heavy portions sinking through the lower section,  $a$ , of the stand-pipe to the tank, and the slum and refuse passing upward through the upper section,  $a''$ , to the spout D.

To more perfectly accomplish my object of completely separating the waste from the mineral without carrying over or washing away any valuable ingredients, I have provided a perforated interior diaphragm or annular partition,  $x$ , within the bulb-section  $a'$ . By reason of this construction the momentum of the pulp is arrested by striking the exterior of said diaphragm and is given an impulse around the same, and passes through the perforations in its walls slowly against the column of water passing therethrough, thereby doing away with or obviating the downward impulse which the pulp would otherwise have, which downward impulse, if not arrested, would be sufficient to overcome the action of the upward currents of water and permit the pulp to fall into the tank. This arrangement also prevents the formation of eddies and tends to equalize the velocities of all parts of the upward current.

In order, also, to make the current of water uniform throughout the entire section of the part  $a$ , where it is delivered to the bulb  $a'$ , I introduce a slightly-conical tube or thimble,  $o$ , forming a deflector to retard the central part of the column and accelerate that part next the walls of the pipe.

The conduits B and C are provided with slip-joints and keys or set-screws, so that the height of the columns of water and pulp, or



either of them, may be regulated as occasion may require.

Instead of the perforations through the diaphragm, there may be an annular slit or opening below the bottom of said diaphragm, and there may be provided an upwardly-projecting lip or flange, *z*, as shown at the left of Fig. 1, in which case an upward impulse would be given to the pulp as it enters the chamber within the diaphragm. This form is especially adapted for the separation of the slums from sand.

The central section of the stand-pipe is preferably made of iron, cast in sections, as shown, and is bolted together through flanges, as shown in Fig. 2. Rubber packing may be used around the neck of the parts *a* and *a'* to seal the joints.

The single concentrator above described is all that is required for the separation of heavy minerals and metals from the barren sand; but where ore containing chlorides, carbonates, and other like combinations of the valuable metals is crushed or ground, much of the metal-bearing portion thereof is reduced to an impalpable powder. This portion of the mineral, when wet, is known as "slum," and is carried over with the sand from the primary concentrator as tailings. It is one of the objects of my invention to provide a convenient means of separating this slum from the sand at the same time and in a single operation with the separation of the heavy mineral therefrom. To accomplish this end I arrange what I term, for convenience, a "secondary separator," as shown at the left part of Fig. 1, into which the tailings from the primary separator are discharged. As the slum is lighter than the sand and is easily carried over with a slight current, the water-conduit *B'*, leading to tank *A'*, should be relatively smaller and have less elevation or head than the conduit *B*. The tank *A'* of the secondary separator should also be relatively larger than the tank *A*. The discharge-spout *D'* conducts the slum to a suitable reservoir, where it is allowed to settle, after which the water is drawn off and the residue collected and subjected to such treatment or reduction as may be required.

Obviously there should be two sets of tanks for continuous operation, so that the contents of one set may be removed while the other is accumulating.

By my combination of a pair of similar separators I am enabled to separate and secure both the heavy and light mineral constituents of bullion-bearing ore in a single operation or continuous process.

Having described my invention, what I claim is—

1. In an ore-concentrator, the combination of a vessel or tank, a water-conduit leading thereto, a pulp-conduit, a stand-pipe whose lower section is of about the capacity of the water-conduit, an upper section having a capacity about equal to both the water and pulp conduits, and an intermediate enlarged bulb or chamber for slack water, said pulp-conduit discharging into said enlarged section, as herein specified.

2. The combination, with the stand-pipe having an intermediate slack-water section, the annular interior diaphragm, and a feed-opening communicating with the interior of the same, of a tank, a water-conduit, and a pulp-conduit, the latter discharging into said slack-water section, as specified.

3. The combination, in an ore-concentrator, of the stand-pipe having an enlarged intermediate slack-water section, and the conical tubular deflector for equalizing the current of water at its entrance to said section, as specified.

4. The combination, with a stand-pipe having an enlarged intermediate slack-water section, an annular diaphragm within said section, and a lip for deflecting and distributing the pulp to give it an upward impulse as it enters the same, of a tank, a water-conduit, and a pulp-conduit discharging into said slack-water section, substantially as described.

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

FREDERICK AUGUSTUS HERRING.

Witnesses:

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