No. 623,230. Patented Apr. 18, 1899.

P. ARGALL.

ROTARY ORE COOLER.

(No Model.) (Application filed Nov. 1, 1898.)

3 Sheets—Sheet 1.

Fig. 1.

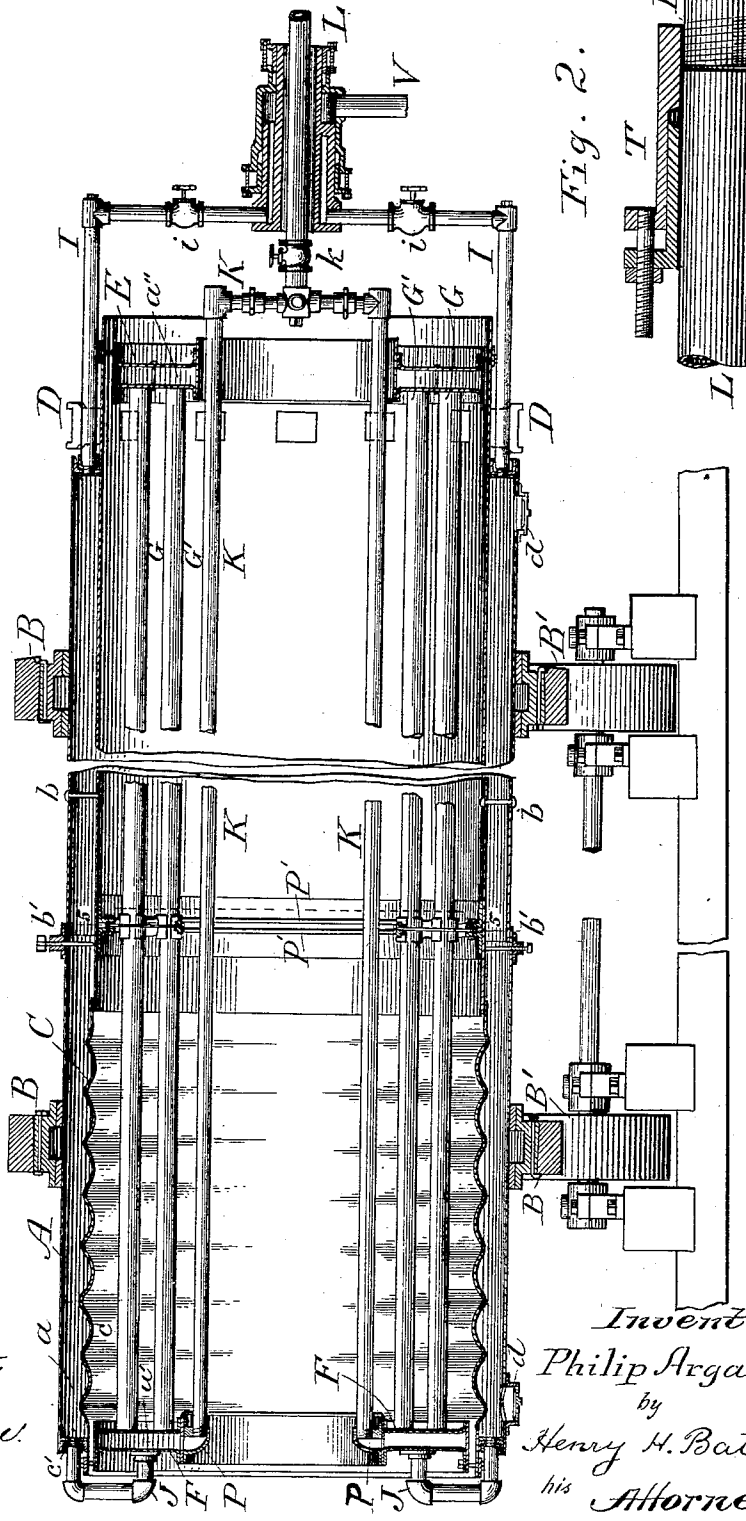


Fig. 2.

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Fig. 3.

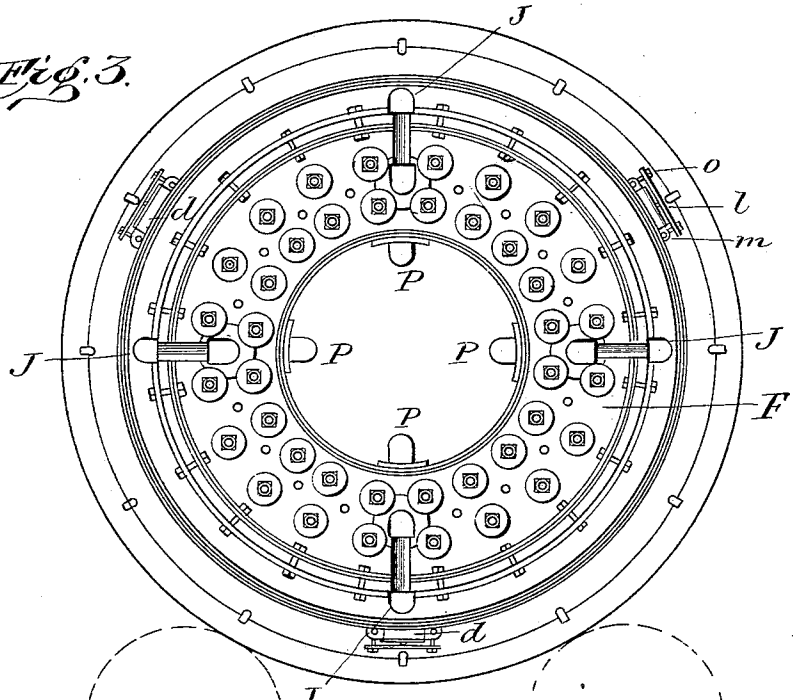
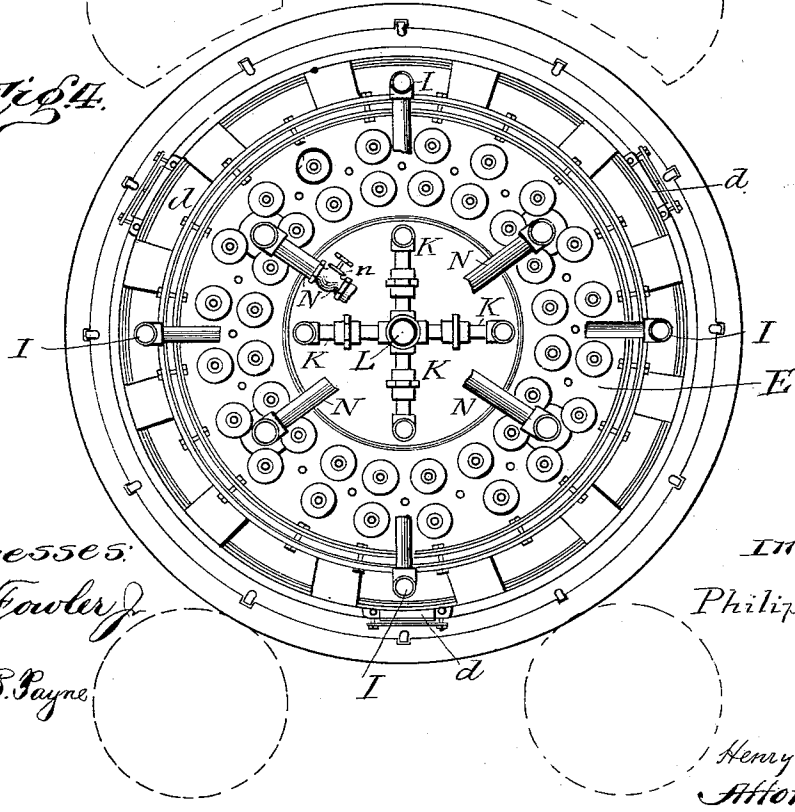


Fig. 4.



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Fig. 5.

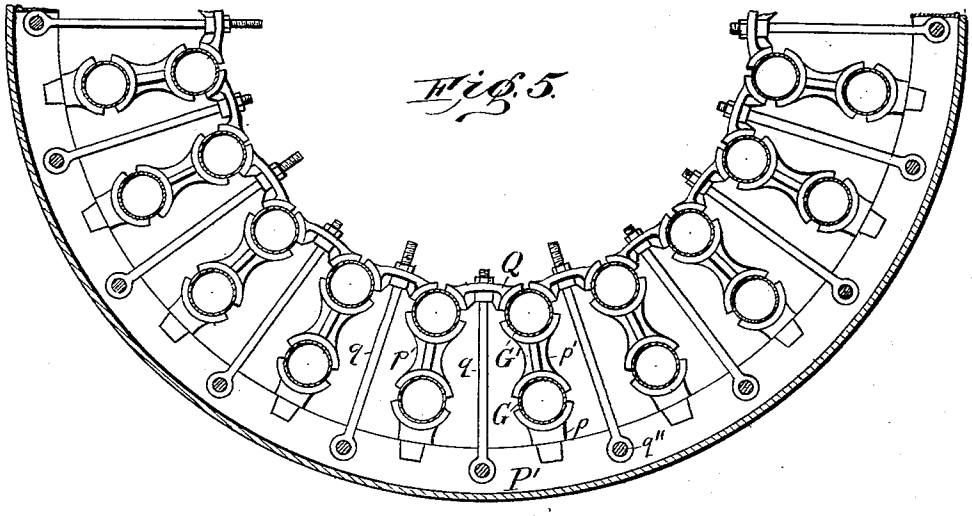


Fig. 6

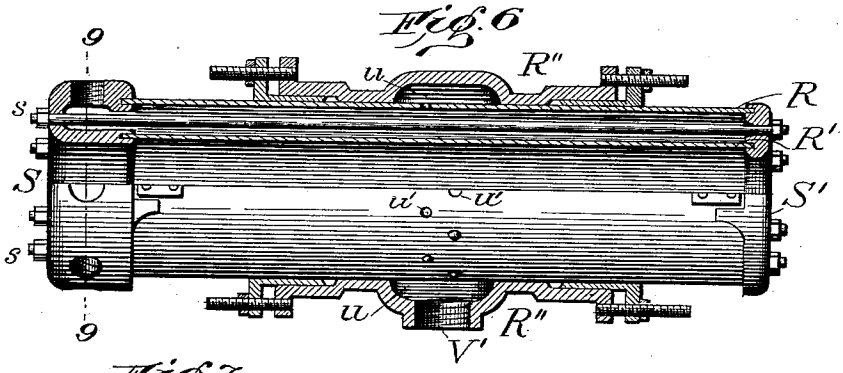


Fig. 7.

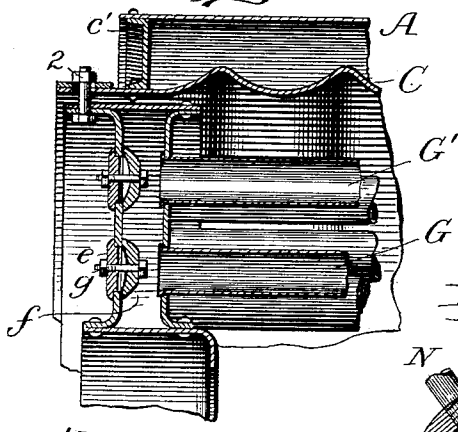


Fig. 8.

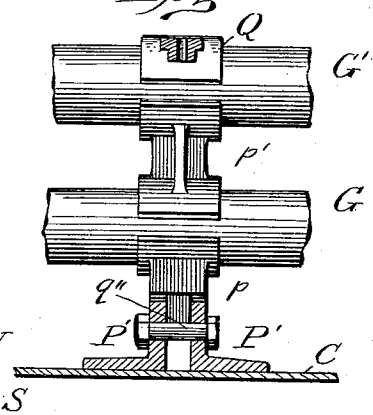
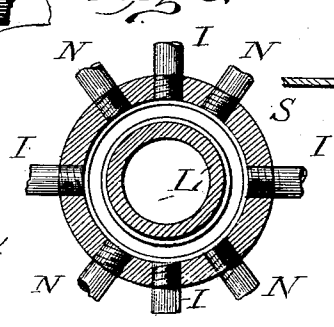


Fig. 9.



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UNITED STATES PATENT OFFICE.

PHILIP ARGALL, OF DENVER, COLORADO.

ROTARY ORE-COOLER.

SPECIFICATION forming part of Letters Patent No. 623,230, dated April 18, 1899.

Application filed November 1, 1898. Serial No. 695,245. (No model.)

To all whom it may concern:

Be it known that I, PHILIP ARGALL, a citizen of the United States, residing at Denver, in the county of Arapahoe and State of Colorado, have invented certain new and useful Improvements in Rotary Ore-Coolers; 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 the cooling of ores; and it consists of a cooling-machine whereby ores can be taken red-hot from the roasting-furnace and cooled down to ordinary temperature by one operation and in a few minutes of time. It is particularly useful in cyanid and chlorination works, where the crushed ore is roasted and has subsequently to be cooled down to normal temperature before being placed in the vats or barrels for chemical treatment. It can, however, be used for cooling any fine furnace product.

The method at present employed and in general use for cooling ore is to remove it from the furnaces in wheelbarrows, spread it out on a cooling-floor, turn it over by hand labor one or more times to expose all parts of it to the air, and finally sprinkle it with water. All this was costly, laborious, and time-consuming. My invention performs in a few minutes and in a thoroughly satisfactory manner that which heretofore required many hours for accomplishment on the cooling-floor and does away with the expensive and exhausting manual labor.

In the drawings forming a part of this specification, Figure 1 is a vertical central longitudinal section, with the middle portion broken away, of my rotary cooler. Fig. 2 is a longitudinal section of the stuffing-box and gland employed for connecting the stationary inlet and outlet pipes with the rotary portions with which they communicate. Fig. 3 is an end view of the feed end of the rotary cooling-cylinder. Fig. 4 is an end view of the discharge end of the rotary cooling-cylinder. Fig. 5 is a transverse section on line 5 5, Fig. 1, showing the method of supporting and staying the internal system of cooling-tubes. Fig. 6 is a longitudinal section of the distributer enlarged, shown at the right end of Fig. 1. Fig. 7 is an enlarged longitudinal section of a portion of the rotary cylinder, showing the mode of gaining access to the circulatory tubes for cleaning purposes. Fig. 8 is an enlarged detail view of a portion of the cylinder in longitudinal section, showing the mode of supporting the internal tubes. Fig. 9 is a transverse section on line 9 9 of Fig. 6, showing the distributing-pipes.

Like letters and numerals of reference indicate like parts on the several figures.

In Fig. 1 A is the outer cylindrical shell of the rotary cooler, made, preferably, of steel-plate, of a length from fifteen to forty feet and mounted by means of track-bands B upon rollers B' B', which rotate the cylinder through suitable connections with a source of power in the way well known for rotating tubular furnaces for roasting of ores.

C is an inner cylindrical shell, of similar material to the outer shell, secured to the latter at each end by annular flanged plates c', Figs. 1 and 7, and by an annular series of suitable stay-bolts b in the center and held stiffly in position at other points by bearing screw-studs b', running in threaded sockets secured to the outer shell, thus admitting of adjustment and not interfering with the longitudinal expansion and contraction of the inner shell C relatively to the outer shell. Said inner shell C terminates at the feed end of the cylinder in a corrugated tube c, the object of which is not only to increase the cooling-surface at this point, but also to provide for the considerable expansion and contraction at this point due to the impingement of the red-hot ore on the steel tubing.

The rotary cylinder is set at an angle of inclination from the level of about one foot in twelve to provide for the progressive travel of the ore, as in rotary roasting apparatus. It is provided with a series of discharge-outlets D around its circumference, near the discharge end, (at the right, Fig. 1,) similar to the discharge-openings shown in my Patent No. 612,185, dated October 11, 1898, for rotary tubular roasting apparatus. It is also furnished with mud-holes d d with removable lids or covers m, affording access to the space between shells A and C and outlet for any foreign substances accumulating therein.

The lids or covers are held in place by pivoted bolts and nuts *o o* and a holding-bar *l*. The rotary cylinder is also supplied with an annular hollow head E at the discharge end and a similar annular hollow head F at the feed end, Figs. 3 and 4, secured in place to the inner steel shell C, preferably by suspension-bolts *z*, as shown in Fig. 7, placed in elongated or oblong holes to allow for expansion of the tubes, and with an intervening space or loose fit sufficient to allow for expansion and contraction of the heads under the extreme variations of temperature. These heads may be made either of cast or wrought metal, but as herein shown they are made of boiler-plate. Between these heads is contained a double series of tubes G G', preferably of wrought metal, secured in the same at their extremities by expansion, as shown in Fig. 7, or in any other suitable manner. In Fig. 7 I have shown a means of gaining access to these tubes for cleaning purposes or repairs by means of hand-holes with removable covers, *e* being a circular cover for a circular opening in the head-plate opposite to the tube-opening, *f* being a yoke or spider within the head, and *g* being a headed screw-bolt and nut for firmly and detachably securing the said yoke and cover together.

I I are four pipes leading from the distributer to the space *a* between the steel shells A and C. These pipes are provided with valves *i i*. J J are four pipe connections at the feed end of the apparatus between the water-space *a* and the water-space *a'* in annular head F. K K are four pipes extending from the said annular water-space *a'* by way of hollow projections P lengthwise of the rotary cylinder to a common discharge or outlet pipe L at the discharge end of the apparatus, said pipes K K being connected to said discharge-pipe by suitable bends and unions or couplers. A valve *k* is provided in discharge-pipe L. N N are four pipes, leading also from the distributer to the annular space *a''* in annular head E, provided, like pipes I, with a means for turning on and off the water-supply, one of which means is shown at *n*, Fig. 4.

As the tubes or pipes G G' between the heads have to sustain a very considerable displacing pressure, they are secured in place by the means illustrated in Figs. 5 and 8. Two angle-irons P' P' are firmly riveted to the inner shell C at suitable intervals spaced about one inch apart. In this space saddles *p* are fixed between the angle-irons supporting the first or outer circle of tubes G. Upon these tubes rest a series of double saddles *p'*, which double saddles in turn support the inner series of tubes G'. The said inner series of tubes is held firmly in place by a series of intermediate caps Q, attached to suspension-bolts *q* by screw-nuts, as shown in Fig. 5, said suspension-bolts being anchored at the other end by an eye and transverse bolt *q''*, passing through the angle-irons P' P'.

The construction of the distributer, Figs. 6 and 9, is as follows: R R' are two tubes, preferably of wrought-iron, secured in head-castings S S', so as to inclose an annular water-space between and held in place by longitudinal bolts *s s*, lying in the water-space. The end casting next the cooler is tapped with eight holes for the reception of eight screw-threaded pipes I N, Figs. 6 and 9. The four pipes I connect with the annular water-space included between the two main shells A and C, as described above and shown in Figs. 1 and 4. The four pipes N connect with the hollow head E at the discharge end of the rotary cylinder, Fig. 4. Outside of this double distributer-tube R R' is a turned and fitted casting R'', closely embracing tube R and provided with a double stuffing-box and glands *r r'*. This outer casting R'' is stationary, while the inner double tube R R' rotates with the cooler and its system of tubing. Said casting R'' is tapped at V' for a stationary supply-pipe V and is recessed with an annular chamber *u*, communicating with said pipe V. Perforations *u'* through the wall of tube R admit the water to the annular space between tubes R R' and thence to pipes I N, radiating from hollow head S. The outlet or discharge pipe L passes centrally through the inner pipe R' of the distributer, with a considerable air-space or clearance surrounding it on all sides, as shown in Fig. 1. This discharge-pipe conveying hot water away from the cooler rotates with the system of pipes with which it is connected and is provided with a stuffing-box and gland T (shown in Fig. 2) to admit of such rotation. By this mode of discharge I am enabled to avoid obstructing the feed end of the cooler by an axial pipe, which is desirable in order to avoid conflict with the means for introducing the red-hot ore into the cooler when a chute is employed. The distributer also enables all the water regulation to be done at one place, and that at the cool end of the machine.

The mode of operation is as follows: The water is turned on at the right-hand end of the machine by means of the valves in the several distributing-pipes, the discharge-valve *k* is opened, and the machinery for rotation is set in motion. The water enters the distributer through pipe V, and thence flows through the four pipes I to the annular space *a* between the shells A and C, and also through the four pipes N to the annular space *a''* in annular head E. The water fills the annular space *a* and flows thence through pipes J into annular space *a'* in head F, and thence through hollow projections P through pipes K into discharge-pipe L. The water flowing into annular head E through pipes N passes into pipes G G', and the current flowing thence into annular head F meets and mingles with the current flowing through pipes J, where both join and pass together to the discharge-pipe L. The hot ore from the roasting-furnace has meantime been spouted into the feed

end of the rotary cylinder at the left hand and as the cylinder rotates it gradually advances along the steel cooling-surface and among the cooling-pipes G G′ toward the discharge-openings D, whereby its heat is rapidly abstracted, so that it reaches said discharge-openings at ordinary temperature. As it is very hot when arriving at the feed end the steel plates are subjected to an excessive temperature at that end and the water becomes heated to a like extent, so that when discharged it contains a large amount of heat, which may be utilized in various ways about the works, such as feeding boilers, heating rooms, &c. If water is not abundant, the residue is collected and cooled in suitable tanks for reuse.

I claim and desire to secure by Letters Patent—

1. In a rotary ore-cooler, a cylinder consisting of an outer and an inner shell inclosing an annular space between them, corrugations in said inner shell at the receiving end of said cylinder, closures at the ends of said annular space, means for rotating the cylinder, pipes connected with a source of water-supply connected to said annular space at the end farthest removed from the corrugations, and pipes connected with the said annular space at the end nearest the corrugations, leading to a main discharge-conduit through the interior of said cylinder, substantially as specified.

2. A rotary ore-cooler, consisting of a cylinder having inner and outer cylindrical shells, with an annular water-space between, means for rotating said cylinder, hollow heads within said inner shell and sustained thereby, longitudinal tubes between said hollow heads connecting the same, return-tubes communicating with one of said hollow heads and with a main discharge-pipe, and means for supplying water continuously to said annular space and to said hollow heads while the cylinder is in rotation, substantially as specified.

3. In a rotary ore-cooler, a cylinder consisting of shells A and C inclosing an annular space, hollow heads E and F within inner cylinder C, longitudinal tubes G and G′ connecting said hollow heads, return-pipes K, K, leading from hollow head F to a main discharge-outlet, means for supporting and rotating said cylinder, means for supplying water to said annular space and to said hollow heads, and means for discharging the water thereform while said cylinder is in rotation, substantially as specified.

4. In a rotary ore-cooler, a cylinder consisting of an outer and an inner shell inclosing an annular space between them, closures at the ends of said annular space, said inner shell projecting beyond the said annular space at the discharge end, annular corrugations in said inner shell at the receiving end, discharge-openings through the projecting portion of said inner shell at the discharge end, means for rotating said cylinder, means for supplying said annular space with water at one end, and means for discharging the water from said annular space connected with the other end thereof, substantially as specified.

5. In a rotary ore-cooler, a cylinder consisting of an outer shell and an inner shell, inclosing an annular space between them, hollow annular heads within said inner shell near the ends thereof, a double series of tubes extending longitudinally between said hollow heads, arranged in two concentric circles, and means for supporting said tubes against displacement, consisting of annular angle-irons secured to said inner shell, saddle-pieces p, double saddles p', intermediate caps Q, and suspension-bolts q anchored to said angle-irons, substantially as specified.

6. In a rotary ore-cooler, a cylinder consisting of an outer shell and an inner shell inclosing an annular space, annular closures c' at the ends of said annular space, and hollow heads E and F within said inner shell, said hollow heads loosely fitting said inner shell and anchored to the latter by bolts in elongated apertures to provide for longitudinal and lateral expansion, substantially as specified.

7. In a rotary ore-cooler, a cylinder consisting of an outer shell and an inner shell inclosing an annular space, closures c' at the ends of said annular space, hollow heads E and F within said inner shell, anchored to the latter, tubes G G′ extending between said hollow heads, openings in the outer plates of said hollow heads opposite said tubes, removable covers for said openings, yokes f, and screw-bolts g, whereby access is afforded to the interiors of said tubes, substantially as specified.

8. In a rotary ore-cooler, a cylinder consisting of an outer and an inner shell inclosing an annular space between them, closures at the ends of said annular space, means for rotating said cylinder, pipes for supplying water to said annular space at one end thereof, discharge-pipes for conveying the water away from said annular space connected with the other end thereof, a main central discharge-pipe with which said discharge-pipes are connected, and a distributer having a stationary part connected with a stationary main inlet-pipe and a revoluble part communicating with said supply-pipes, surrounding said main central discharge-pipe with an annular air-space between, substantially as specified.

9. In a rotary ore-cooler, a cylinder consisting of outer and inner shells inclosing an annular space, closures at the ends of said annular space, means for rotating said cylinder, hollow heads E and F within said inner shell, anchored to the latter, intermediate tubes extending between said hollow heads, means for supplying water to said annular space, means for supplying water to said hollow heads and intermediate tubing, and means for conveying water away from said

annular space and from said intermediate tubing, terminating in a main discharge-pipe, substantially as specified.

10. In a rotary ore-cooler having a water circulation, with supply and discharge pipes, and a main central discharge-pipe, a distributing means consisting of a revoluble member surrounding said main central discharge-pipe, with an annular air-space between, an annular chamber in said revoluble member, supply-pipes radiating from said annular chamber, a stationary member secured upon said revoluble member for a portion of its length, having an annular chamber therein, a stationary main supply-pipe connected with said stationary annular chamber, apertures in said revoluble chamber communicating with said stationary chamber, and packing means between said stationary member and said revoluble member, substantially as specified.

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

PHILIP ARGALL.

Witnesses:
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HENRY H. BATES.