No. 814,298. PATENTED MAR. 6, 1906.

F. KLEPETKO.

ROASTING FURNACE.

APPLICATION FILED NOV. 6, 1905.

2 SHEETS—SHEET 1.

FIG. 1.

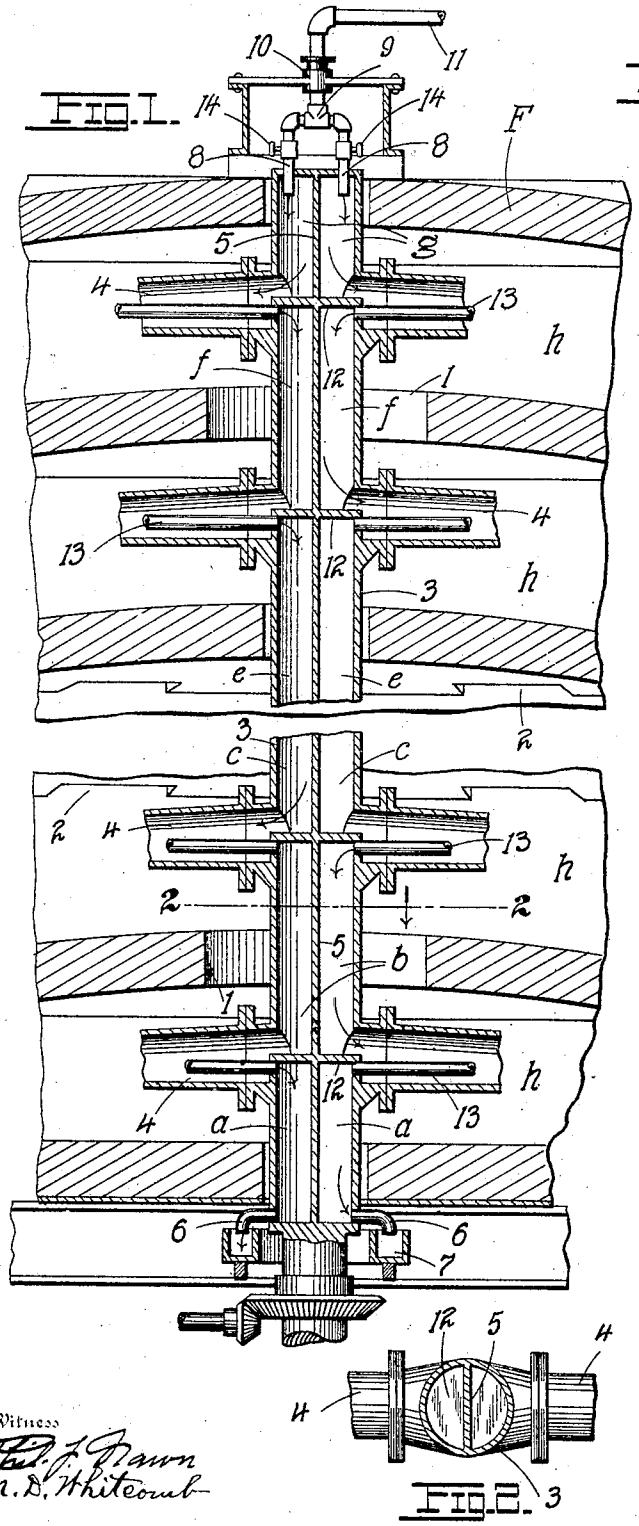
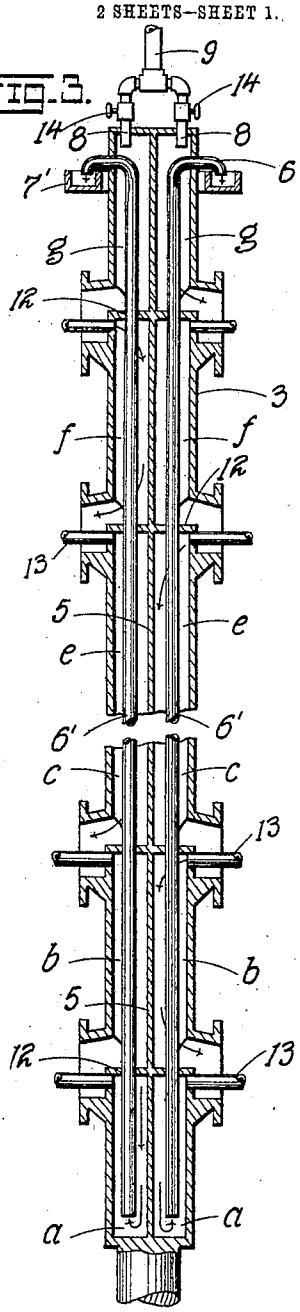


FIG. 2.

FIG. 3.



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2 SHEETS—SHEET 2.

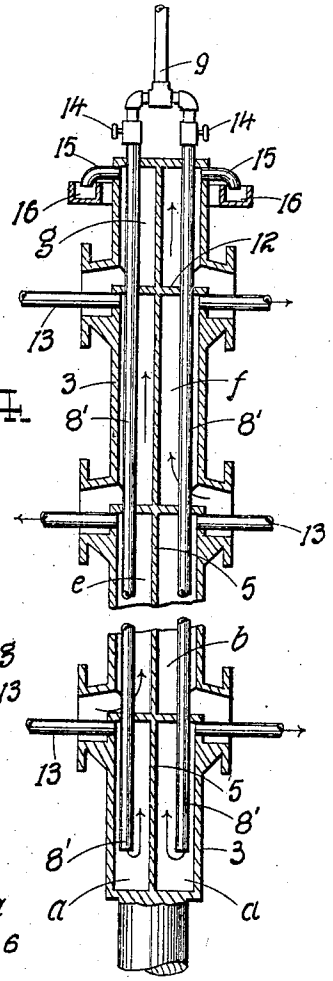

Fig. 4.

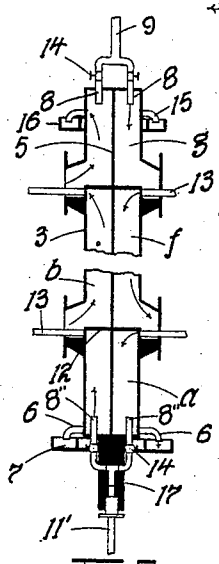

Fig. 9.

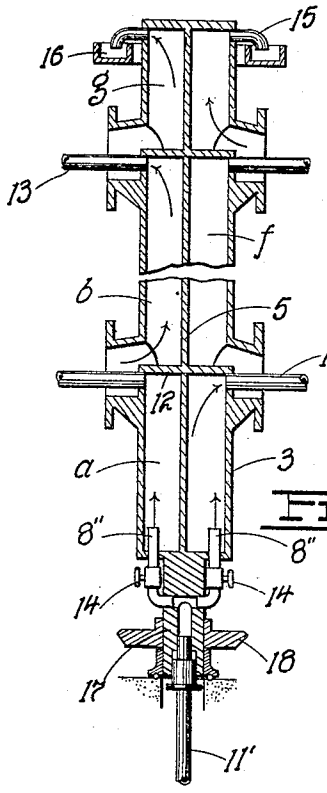

Fig. 5.

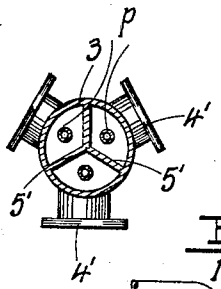

Fig. 6.

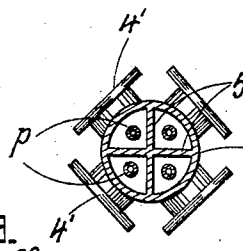

Fig. 7.

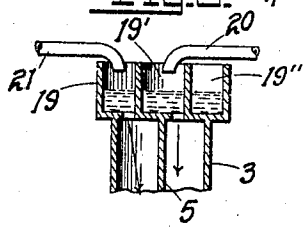

Fig. 8.

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ROASTING-FURNACE.

No. 814,298. Specification of Letters Patent. Patented March 6, 1906.

Application filed November 6, 1905. Serial No. 286,042.

To all whom it may concern:

Be it known that I, FRANK KLEPETKO, a citizen of the United States, residing at New York, in the county of New York and State of New York, have invented certain new and useful Improvements in Roasting-Furnaces, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part hereof.

My invention has relation to improvements in roasting-furnaces; and it consists in the novel construction and arrangement of parts more fully set forth in the specification and pointed out in the claims.

In the drawings, Figure 1 is a vertical central section of a conventional McDougall ore-roasting furnace, partly broken, showing a corresponding section of one of the forms of my improvement applied thereto. Fig. 2 is a horizontal section on line 2 2 of Fig. 1. Fig. 3 is a middle vertical section of the rabble-shaft, showing a modified form of circulation therefor. Fig. 4 is a similar section of the rabble-shaft with a second modification of circulation therefor. Fig. 5 is a similar section of the rabble-shaft, showing a third modification of a circulating system. Fig. 6 is a cross-section of a hollow shaft divided into three longitudinal conduits. Fig. 7 is a cross-section of a shaft having four longitudinal conduits. Fig. 8 is a vertical sectional detail showing a construction capable of feeding independent liquids to the conduits of the rabble-shaft, and Fig. 9 is a diagrammatic view of a combination of the constructions shown in Figs. 1 and 5 as applied to a single shaft.

The present invention is a qualification of the construction of the cooling apparatus shown and described in my pending application for Letters Patent for improvements in roasting-furnaces, Serial No. 223,539, filed September 6, 1904, the special object of the present improvement being to provide the hollow rabble-shaft with longitudinal division-walls or diaphragms dividing the passage of the shaft into two or more independent conduits for the circulation of independent currents of cooling medium, so that in the event of a leak or puncture of the walls of one of the conduits the remaining conduits may not be affected, thus obviating the necessity of an immediate shut-down of the furnace. The diaphragms referred to also permit of the introduction of cooling mediums from independent sources, so that water may be made to circulate through one or more of the conduits and air through the balance, or streams of water of different densities or specific gravities, and consequently of different specific heats, may be utilized.

The advantages of the present construction will be better apparent from a detailed description of the invention, which is as follows:

Referring for the present to Figs. 1 and 2 of the drawings, F represents the furnace, and *h* the several hearths in which the material is treated, the said material dropping from the upper hearth successively through the several hearths until it is delivered into the delivery-hopper, (not shown,) the hearths being provided, respectively, with the central and marginal openings 1 2 for the passage of the material. Passing through the hearths is the rotatable hollow rabble-shaft 3, from which radiate the series of hollow rabble-arms 4, extending into the several hearths and carrying rakes, (not shown,) all as fully understood in the art, the features described forming no part of my present invention.

Referring again to Figs. 1 and 2 of the drawings, 5 represents a longitudinal division-wall, diaphragm, or web dividing the passage-way of the shaft into independent conduits or sections, the latter being provided at the lower end with outlet taps or nozzles 6 6, which discharge into the annular trough 7, encompassing the base of the shaft. These independent conduits or divisions of the shaft are supplied with a cooling medium (water) through the branches 8 8, leading to a coupling 9, whose stem revolves in a stuffing-box 10, mounted on top of the furnace, the water being furnished from a stationary supply-pipe 11, leading to any source of supply. (Not shown.) The water entering the respective divisions or conduits of the shaft circulates through said conduits and is eventually discharged through the nozzles 6, as shown by the arrows in Fig. 1. The respective conduits of the hollow shaft are in the present instance each divided into a series of compartments or chambers *a b c d e f g* (and so on, depending on the number of hearths, the present shaft and furnace being broken, so as to omit compartment *d*) by means of the transversely-disposed division-walls or partitions 12, occupying a plane slightly

above the bottoms of the adjacent rabble-arms 4, each chamber having leading therefrom the distributing conduits or pipes 13, which extend into the hollow arms and discharge thereinto. The presence of the several partitions 12 constrains the currents on either side of the wall 5 to pass first through the arms 4 outwardly, thence through the distributing-pipes 13 inwardly into the compartments from which said distributing-pipes lead, the current flowing successively from one compartment (*g*, *f*, *e*, and so on) to the next compartment below it through the particular hollow arm and distributing-pipe, establishing communication between the two consecutive compartments until the last compartment is reached, when the water is discharged into the trough 7. Instead of discharging the water at the bottom of the shaft I may discharge it at the top of the shaft, withdrawing the water from the bottom compartments *a a* by means of discharge-pipes 6′ 6′, as shown in Fig. 3. These pipes 6′ 6′ extend the full length of the shaft through the several partitions 12, one pipe in each conduit on opposite sides of the wall 5, the upper ends of the pipes 6′ 6′ being passed through the shaft-wall and discharging into a trough 7′, encircling the top of the shaft. In other respects the circulation of the two independent water-currents is the same in Fig. 3 as in Fig. 1, as fully indicated by the arrows in Fig. 3. In the event it is desirable to shut off the supply to either conduit or division of the shaft under circumstances previously referred to or in the event of accident of any kind the same may be done by closing the valves 14, with which the feed-pipes or branches 8 are provided.

In the forms of my invention above described the water (or equivalent cooling medium) is discharged into the top of the rabble-shaft circulating downward; but I may introduce the water into the bottom of the shaft, whence it circulates upward through the several shaft-compartments, arms, and distributing-pipes, finally escaping at the top of the shaft, as fully shown in the modifications shown in Figs. 4 and 5. In Fig. 4 the feed-pipes 8′ (corresponding to the branches 8 extended) extend from the top of the shaft down into the bottom compartments *a a*, whence the water circulates upward through the distributing-pipes 13 into the first set of arms, thence inward into the next contiguous compartments *b b*, and so on, till finally discharged through the nozzles or taps 15 into the trough 16. In Fig. 5 the supply-pipe 11′ supplies the water to the branches 8″, leading from the hollow base 17 of the shaft, said base carrying the bevel-gear 18 of the shaft-driving mechanism, (not herein shown,) the said branches terminating in the bottom compartments *a a* and discharging directly thereinto. In the modification shown in Fig. 5 the circulation is the same as that of Fig. 4, the water flowing out of the top of the shaft through the taps 15 into the trough 16.

In all of the foregoing cases the water has been shown as circulating through the shaft from one end to the opposite end in the conduits or subdivisions formed by the wall 5; but it is apparent that the presence of the wall 5 makes it possible to combine in one structure the forms shown in Figs. 1 and 5, and if in such a combined structure the valve 14 of one branch 8 leading to the top of one conduit be opened and the valve 14 of the adjacent branch leading to the top of the adjacent conduit be closed and at the same time the valve 14 of one branch 8″ leading to the bottom of first conduit be closed and the valve 14 of the adjacent branch 8″ leading to the bottom of the second or adjacent conduit be opened (both ends of the shaft being provided with outlet-taps and troughs) it is apparent that it would be possible to direct and circulate a current through one conduit downward and through the other conduit upward, or vice versa, depending on which valves 14 were manipulated to effect such a result. We should then have two currents circulating in opposite directions through the shaft, the one independent of the other. This possibility growing out of the present construction is important, since we can thus introduce cold water at both ends of the shaft, each independent current cooling its own conduit or shaft-subdivision, Fig. 9.

Preferably one rabble-arm 4 extends from each conduit or shaft-subdivision into its corresponding hearth, and while in the main illustrations only one web or wall 5 is shown dividing the shaft into two independent non-communicating conduits the shaft may be subdivided into any number of such conduits. In Fig. 6 is shown a cross-section of a shaft 3 having three webs 5′ meeting at the center, dividing the original passage-way of the shaft into three conduits, each provided with a feed-pipe *p*, and in Fig. 7 is shown a cross-section of a shaft 3 having two webs 5″ intersecting each other at right angles and forming four conduits, also provided with feed-pipes *p*, in both cases the walls of the shaft being provided opposite each conduit with stub-arms 4′, to which the rabble-arms are generally secured.

Should it be desirable to introduce different liquids into the respective conduits of the shaft or liquids having different specific heats, this can be accomplished in some such way as illustrated in Fig. 8, in which the shaft is surmounted by a vessel 19, having an inner cylindrical compartment 19′ and an outer annular compartment 19″, the bottoms of which discharge into the respective conduits of the shaft, the compartment 19′ being supplied with liquid from pipe 20 and the compartment 19″ from pipe 21.

Considering the shaft as a unit or entirety, the water circulates vertically through it and through the hollow arms vertically in series and radially through the arms in series, and considering each conduit independently (and in view of the fact that only one arm extends from each conduit into its corresponding hearth) the circulation through each conduit and arms would be vertically and radially in series. In both cases, however, the circulating medium enters the shaft at one end, being abstracted therefrom at the opposite end. The points of inlet and final outlet may be at the same end, as shown in Fig. 3; but even in this case the point at which the liquid is abstracted or conducted out of the shaft is at the opposite end from the inlet.

Obviously the cooling apparatus here described is not necessarily restricted in its application to furnaces, but may be used in any art where available.

Having described my invention, what I claim is—

1. In a rabble apparatus, a hollow rabble-shaft having its passage-way divided into a series of conduits, and means for independently supplying each conduit with a suitable cooling medium substantially as set forth.

2. In a rabble apparatus, a hollow rabble-shaft having its passage-way divided into a series of contiguous non-communicating conduits, substantially as set forth.

3. In a rabble apparatus, a hollow rabble-shaft having its passage-way divided into a series of contiguous, independent conduits, and means for circulating a cooling medium through said conduits, substantially as set forth.

4. In a rabble apparatus, a hollow rotatable rabble-shaft having its passage-way divided into a series of contiguous, independent conduits, and means for circulating a cooling medium through said conduits, substantially as set forth.

5. In a rabble apparatus, a hollow rabble-shaft having its passage-way divided into a series of contiguous, independent conduits, and means for circulating independent cooling media through the several conduits, substantially as set forth.

6. In a rabble apparatus, a hollow rotatable rabble-shaft having its passage-way divided into a series of contiguous, independent conduits, and means for circulating independent cooling media through the several conduits, substantially as set forth.

7. In a rabble apparatus, a hollow rabble-shaft having its passage-way divided into a series of contiguous, independent conduits, means for circulating a cooling medium through the several conduits, and means for cutting off the flow of the circulating medium to any conduit, substantially as set forth.

8. In a rabble apparatus, a hollow rabble-shaft having its passage-way divided into a series of contiguous, independent conduits, and means for circulating cooling media through the several conduits simultaneously in different directions, substantially as set forth.

9. In a rabble apparatus, a hollow rabble-shaft having its passage-way divided into a series of contiguous, independent conduits, hollow rabble-arms communicating with said conduits, and means for circulation through the shaft and arms vertically in series, and through the arms radially in series, substantially as set forth.

10. In a rabble apparatus, a hollow rabble-shaft having its passage-way divided into a series of contiguous independent conduits, hollow rabble-arms communicating with said conduits, means for circulation through the shaft and arms vertically in series, and through the arms radially in series, means for introducing the cooling medium into any conduit at one end, and abstracting it from the same conduit at the opposite end, substantially as set forth.

11. In a rabble apparatus, a hollow rabble-shaft having its passage-way divided into a series of contiguous independent conduits, hollow rabble-arms communicating with said conduits, and means for circulation through each conduit and arms thereof vertically and radially in series, substantially as set forth.

12. In a rabble apparatus, a hollow rabble-shaft having its passage-way divided into a series of contiguous independent conduits, hollow rabble-arms leading from said conduits, means for circulation through each conduit and arms thereof vertically and radially in series and through the arms radially in series, substantially as set forth.

13. In a rabble apparatus, a hollow rabble-shaft having its passage-way divided into a series of contiguous, independent conduits, hollow arms leading from said conduits, means for circulation through the shaft and arms vertically in series, and through the arms radially in series, means for discharging the circulating medium into any of the conduits at one end thereof, and means for conducting the circulating medium out of the said conduits from the opposite end, substantially as set forth.

14. In a furnace having a plurality of hearths, a rotatable hollow shaft passing through the hearths and having its passage-way divided into a series of individual conduits, a series of hollow arms leading from said conduits into the several hearths, a series of chambers distributed throughout each conduit and communicating with the hollow arms, and means for feeding a cooling medium into the several conduits of the shaft and circulating the same through the shaft and arms, substantially as set forth.

15. In a furnace having a plurality of

hearths, a rotatable hollow shaft passing through the hearths and having its passageway divided into a series of individual conduits, a series of hollow arms leading from the conduits into the several hearths, a series of chambers distributed throughout each conduit and communicating with the hollow arms, and means for introducing a cooling medium into one end of any conduit and circulating the same through the several chambers of said conduit and the hollow arms leading therefrom, substantially as set forth.

16. In a furnace having a plurality of hearths, a rotatable hollow shaft passing through the hearths and having its passageway divided into a series of individual conduits, a series of hollow arms radiating from said conduits and extending into the several hearths, a series of chambers separated by transverse partitions distributed throughout each conduit, distributing-pipes leading from the respective chambers and opening into the adjacent arms, and a feed-pipe adapted to discharge a cooling medium into a chamber of each conduit, substantially as set forth.

17. In a rabble apparatus, a hollow shaft having a series of longitudinal conduits, and transverse partitions dividing the conduits into contiguous chambers or compartments, substantially as set forth.

18. In a rabble apparatus, a hollow shaft having a series of longitudinal conduits, transverse partitions dividing the conduits into contiguous chambers, and means for circulating a cooling medium through the chambers in either direction, substantially as set forth.

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

FRANK KLEPETKO.

Witnesses:
EMIL STAREK,
J. E. DEAKIN.