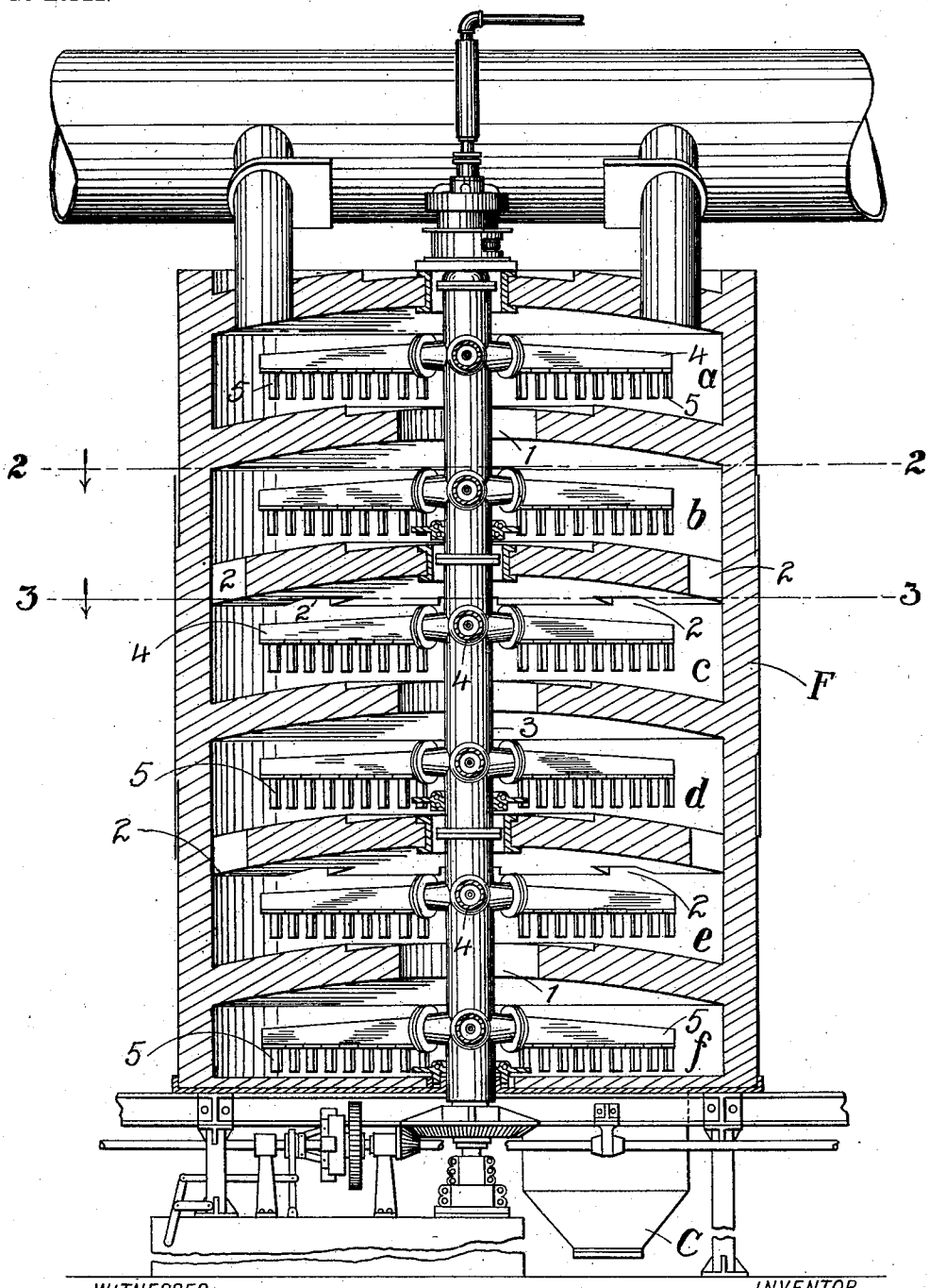
No. 744,359. PATENTED NOV. 17, 1903.

F. KLEPETKO.

ROASTING FURNACE.

APPLICATION FILED JUNE 29, 1903.

NO MODEL. 2 SHEETS—SHEET 1.



WITNESSES:

Fig. I.

INVENTOR

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BY

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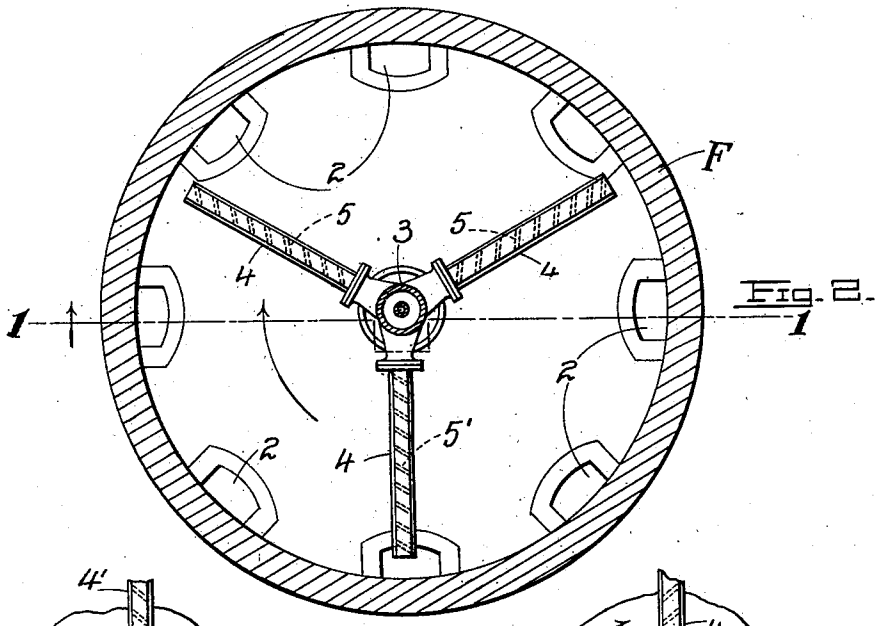


Fig. 2.

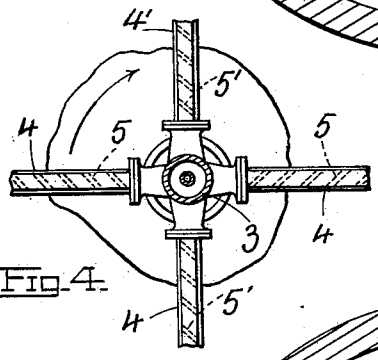


Fig. 4.

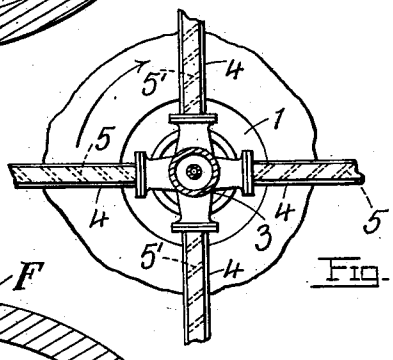


Fig. 5.

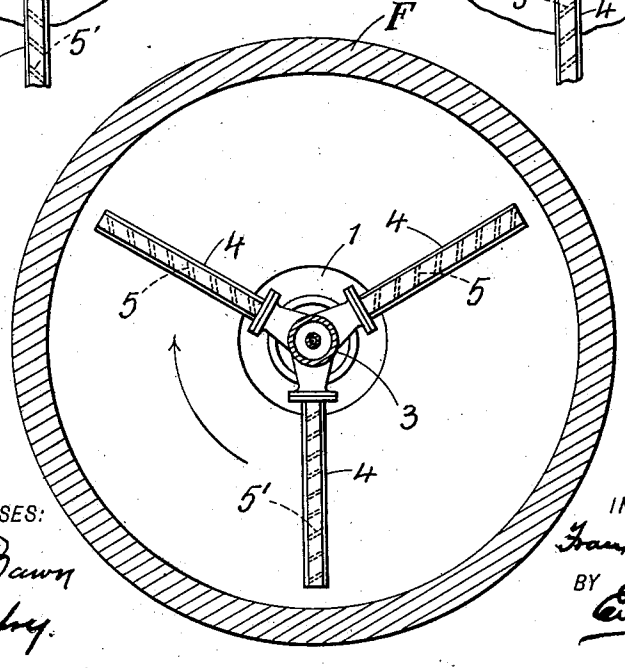


Fig. 3.

WITNESSES:

Hul. J. Dawn

G. L. Belfrey.

INVENTOR

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BY Emil Stoever

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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 744,359. Patented November 17, 1903.

UNITED STATES PATENT OFFICE.

FRANK KLEPETKO, OF NEW YORK, N. Y.

ROASTING-FURNACE.

SPECIFICATION forming part of Letters Patent No. 744,359, dated November 17, 1903.

Application filed June 29, 1903. Serial No. 163,621. (No model.)

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 middle vertical section taken on the broken line 1 1 of Fig. 2. Fig. 2 is a horizontal section on line 2 2 of Fig. 1, taken through the second hearth or that in which the ore is moved radially outward and discharged along the margin of the hearth. Fig. 3 is a horizontal section on line 3 3 of Fig. 1, taken through the third hearth or that in which the ore is moved radially inward and discharged at the center. Fig. 4 is a sectional detail of a modification of rabble-arms adapted for a hearth discharging at its outer margin, and Fig. 5 is a sectional detail of a modification of rabble-arms for a hearth discharging at its center.

The object of the present invention is to equip the prevailing or conventional type of McDougall ore-roasting furnace with rabble-arms in which the blades or rabbles are so disposed that for a given speed of the center shaft carrying the rabbles we may increase the length of time of roasting and also the stirring action of the rabbles or simply increase the stirring action for a given period of roasting.

While I do not wish to limit the application of the present invention to any special type of furnace, (it being applicable to all furnaces using rotating rabble-arms,) I have selected the type shown and described in United States Letters Patent No. 700,339, dated May 20, 1902, issued to myself and William J. Evans, for convenience of description. In the patent referred to there are two rake or rabble arms for each hearth, each arm having the rabble or blades disposed angularly to the length of the arm, such angular disposition determining the direction in which the ore shall be pushed along on the hearth for purposes of being discharged therefrom, for it is to be understood that the ore is pushed radially toward the center on one hearth, where it is discharged onto the next hearth below, and then it is pushed radially outward on such next hearth, where it discharges through marginal or peripheral openings onto a third hearth, and so on through the series of hearths. This, as is well known, is accomplished by disposing the blades at an oblique angle to the radial axis of the rabble-arms carrying the same, the blades for one hearth being disposed reversely or inclining in a direction opposite to those of the next adjacent hearth. It is to be borne in mind, too, that while the blades feed the ore from one hearth to the next hearth below in the series they serve to stir and agitate the ore as well. Now when it is required that an ore be roasted to a very low degree of sulfur content it is essential that it remain in the furnace for a lengthened period of time and that it be stirred very frequently in order to expose fresh surfaces thereof to the air. In the rectangular furnace where the ore is moved in the direction of the hearth—that is to say, in a straight path—the forward movement is obtained by setting the blades on the plows in such a way that the pushing effect laterally or sidewise on the ore due to the blades of one plow is offset by the pushing effect of the following plow—that is to say, the blades alternate in pushing the ore sidewise, first in one direction and then the other, (with the following plow,) the forward movement, however, being the same with each plow, as the ore is required to move forward. The time of the roasting of the ore on any hearth of this type of furnace can be lengthened only by slowing the speed of the plows or by putting in fewer of them. This would necessarily mean that in order to increase the roasting time the ore would have to be stirred less frequently, while, as a matter of fact, the opposite is desirable—viz., to increase the frequency of stirring while increasing the roasting time. In the McDougall type (or rotary type) of furnace this result can readily be effected, as will presently more fully appear. Assuming that (as in the patent above referred to) each hearth of the McDougall furnace be equipped

with one pair of rabble-arms, as the rabble-arms revolve the blades feed the ore radially outward or inward, as previously stated, (depending upon which hearth we are considering,) such radial feed resulting from the similar angular disposition of the blades along each arm of said pair. Suppose, however, we reverse the direction of the angular disposition of the blades of one arm of the pair, so that one set of blades will tend to feed the ore radially inward and the other set to feed the ore radially outward. Under those circumstances the radial-feed effect of the two arms would be neutralized and the ore would simply be pushed forward circularly along the hearth and never be discharged. In the rotary type of furnace, therefore, it is the radial feed which determines the length of time of discharge of the material, the circular feed (corresponding to the forward feed in the rectangular hearth) being entirely eliminated from the calculation, so that if in a hearth having one pair of neutralizing-arms we put in a third or odd arm having blades disposed at a suitable angle to the radial axis of such arm the third arm thus added will serve to feed the ore radially, (the direction depending on which hearth we are dealing with,) but only half as fast as did the first pair of arms before being neutralized by the reverse disposition of their respective blades; but while we thus increase the time of radial discharge of the ore fifty per cent. we likewise increase the stirring action fifty per cent., as we should have the stirring action of three arms against that of the two original. If we increase the number of arms to five, letting two pairs neutralize each other, thus getting the radial-discharge action of one arm only, we would double the roasting time and increase the stirring action one hundred and fifty per cent. A similar effect would result by a still further increase in the number of arms, though it might not be practical on account of congestion of iron-work at the center or hub of the cluster of arms. If we do not wish to increase the time of roasting, but simply wish to increase the stirring action, we could effect this by putting in four arms in a hearth and letting one pair neutralize each other, the two remaining arms tending to discharge the ore, Figs. 4 and 5. In that case the time would remain the same, as there would be only two arms effective for the radial discharge or feed of the ore, but the stirring action would be doubled, as there would be four arms instead of two. I prefer, however, an odd number of arms, for then not only the roasting time, but the stirring action, is increased. By reversing the angular disposition of the blades on one member of any pair of arms the radial feed of such pair is reduced to *nil*, leaving the effective work of radial feed to be done by such additional arm or arms as have no reversed counterpart in their blade equipments, the forward or circular advance of the ore being unaffected. It may also be desirable in roasting down to a very low percentage of sulfur that at certain periods of roasting more frequent stirring is required than at other periods. This could be effected by regulating the number of rabble-arms in the several hearths. For example, if on the top hearth we did not care to stir very much we could have only one arm of radial effective feed. In the next hearth we could (if we cared to increase the stirring action) have one arm for the effective radial feed and two arms whose blades were neutralized or arranged reverse one to the other. If we wished to increase the stirring action on the third hearth, we could put in five arms—one for the feed and two pairs of neutralized arms for the stirring. If on the next succeeding hearth we wished to reduce the stirring action, we could reduce the number to three arms, and, finally, on the fifth hearth we could reduce the number to a single arm, as is obvious. The foregoing will be apparent from the details, which may be described as follows:

Referring to the drawings, and particularly to Figs. 1 to 3, inclusive, F represents the furnace, and *a b c d e f* the several hearths in which the material is treated, the ore dropping from the upper hearth successively through the several hearths until it is delivered into the delivery-hopper C, the hearths being provided, respectively, with the central and marginal openings 1 2 for the passage of the material. Passing centrally through the hearths is the rotatable hollow shaft 3, from which radiate the series of hollow rabble-arms 4, extending into the several hearths and carrying rakes or blades by which the material is stirred and successively fed from one hearth to the hearth immediately beneath it, all as fully described in the patent aforesaid and as fully understood in the art. In the present case the blades 5 5 on two of the arms 4 are reversed in their angular disposition with respect to the lengths or radial axes of the arms, so that the tendency of one set of blades to push the ore radially outward is neutralized by the other set tending to push it radially inward, and the ore is therefore simply pushed along circularly and at the same time stirred and agitated by these blades. In the third or odd arm the blades 5′ are set at a suitable angle to advance the ore radially outward for such hearth as discharges through marginal openings, Fig. 2, or radially inward for such hearth as discharges through its central opening, Fig. 3. Assuming the rabble-arms to revolve in the direction indicated by the arrow in Fig. 2, it is apparent that the blades of the arms above the section-line 1 1 will neutralize one another, (since one set of blades tends to drive the ore radially inward and the other set radially outward,) leaving the odd or third arm to perform the effective feed outward. So in Fig. 3, the upper arms being neutralized, the

effective feed inward is accomplished by the blades 5′ of the odd arm. The odd number of arms here illustrated is three; but, as is obvious, this may be five, seven, or any odd number.

In Figs. 4 and 5 I have shown two pairs of arms, the blades 5 of one pair neutralizing one another and those, 5′, of the other pair being effective for the proper radial feed outward, Fig. 4, or inward, Fig. 5.

I do not, of course, wish to be limited to any particular details of construction, and while I preferably apply this principle to the style of rotary furnace shown in the patent aforesaid I may apply it to air-cooled furnaces of the rotary type or, in fact, any rotary furnace, whether its rabble-arms be provided with a cooling medium or not.

The mechanism by which rotation is imparted to the hollow shaft, while shown, is not specifically adverted to in the present description, as it forms no part of the present invention and, moreover, is the same as that shown in the patent aforesaid. So, too, other parts of the furnace are here shown, but not described, as they are either covered by the patented construction or are well known in the art, it being understood that the present invention is limited to the radial-feed disposition of the blades carried by or forming a part of the rabble-arms.

Having described my invention, what I claim is—

1. In a roasting-furnace having one or more hearths, one or more pair of rotatable radially-feeding rabble-arms for each hearth, and means carried by each pair for neutralizing the effective radial feed thereof in either direction, substantially as set forth.

2. In a roasting-furnace having one or more hearths, one or more pair of rotatable radially-feeding rabble-arms for each hearth, means carried by each pair for neutralizing the effective radial feed thereof in either direction, and additional rabble-arms provided with means for effectively feeding the material in such radial direction, substantially as set forth.

3. In a roasting-furnace having a plurality of hearths adapted to discharge alternately centrally and through marginal openings, a series of pairs of rabble-arms rotatable within the hearths about the vertical axis of the furnace, a series of angularly-disposed blades carried by the members of each pair of arms, but set reversely to one another whereby their effective radial feed is neutralized, and additional rabble-arms rotating conjointly with the first set of arms, and blades disposed on said additional rabbles for effectively feeding the material radially along the hearths, substantially as set forth.

4. In a roasting-furnace having a plurality of hearths, a series having an odd number of radially-feeding rabbles disposed in and rotatable in each hearth about the axis of the furnace, the even number of said rabbles having their radial feed neutralized, and the remaining rabble being effective in said radial feed, substantially as set forth.

5. In a roasting-furnace having a plurality of hearths discharging respectively through their center and through marginal openings, a central rotatable shaft passing through the several hearths, a series of radially-feeding rabble-arms extending from said shaft into the several hearths, the arms of each hearth being divided into a series whose effective feed of the ore radially is neutralized, and into additional series provided with means for effectively feeding the ore radially toward the proper discharge-opening in the hearth over which the arms operate, substantially as set forth.

6. In a rotary roasting-furnace having a series of stationary hearths, means for advancing the ore circularly in each hearth and stirring the same, and independent means for feeding or advancing the ore radially through the hearth, substantially as set forth.

7. In a rotary roasting-furnace having a plurality of stationary hearths, rabble-arms for advancing the ore in a path parallel to the peripheral walls of the furnace and simultaneously stirring the ore, and independent rabbles for feeding the ore radially through the hearths, substantially as set forth.

8. In a rotary roasting-furnace, having a plurality of hearths, rotatable rabble-arms extending into the several hearths from a common axis of rotation, blades disposed on a portion of said rabble-arms for advancing the ore around said axis and agitating the ore, and blades disposed on the balance of the rabble-arms for advancing the ore radially, the ore being discharged through suitable openings formed in the hearths when it has reached the limit of such radial advance, substantially as set forth.

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

FRANK KLEPETKO.

Witnesses:
CHAS. H. REPATH,
M. A. PESTANA.