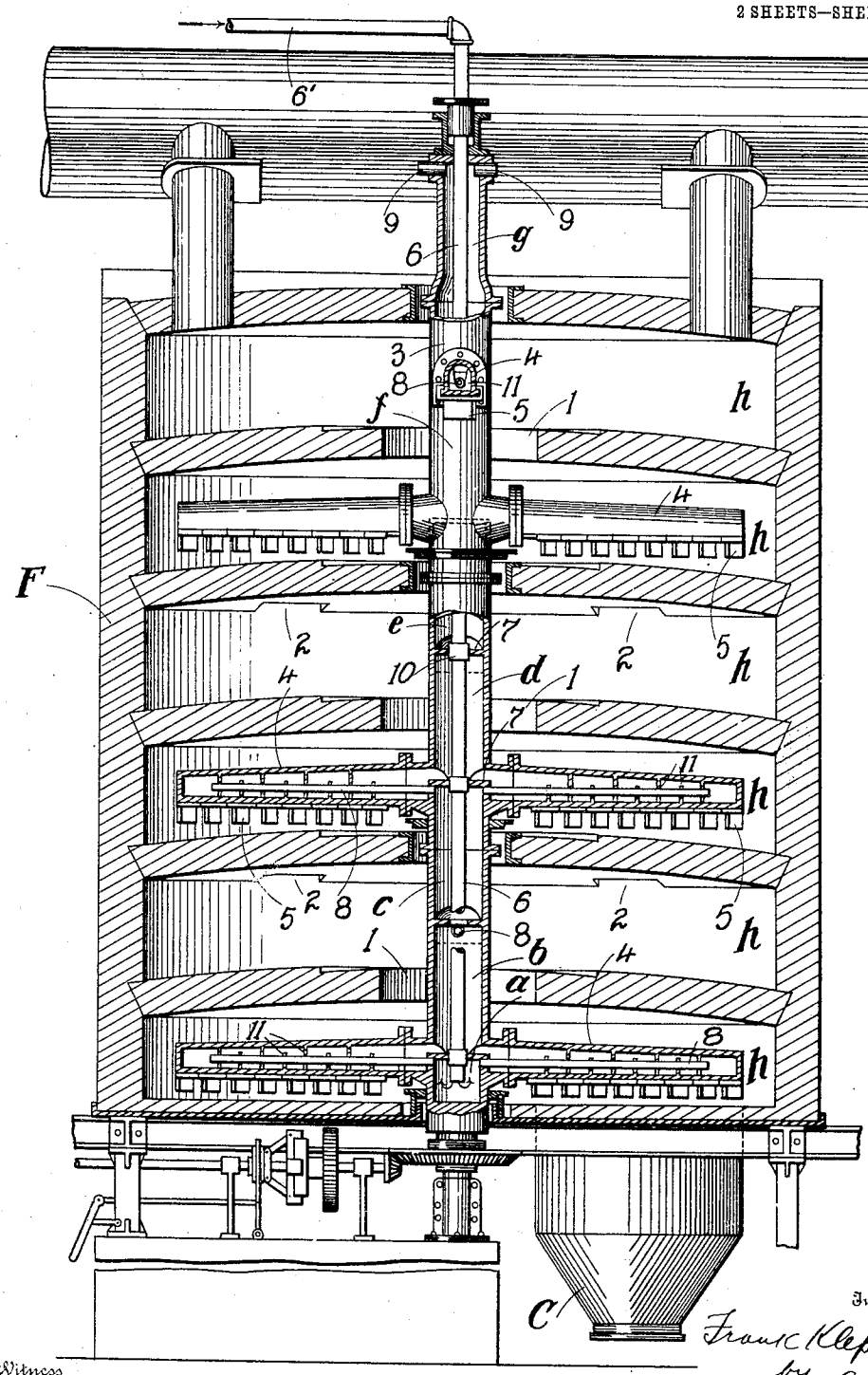
No. 779,717. PATENTED JAN. 10, 1905.

F. KLEPETKO.

ROASTING FURNACE.

APPLICATION FILED OCT. 3, 1904.

2 SHEETS—SHEET 1.



Witness
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FIG. 1.

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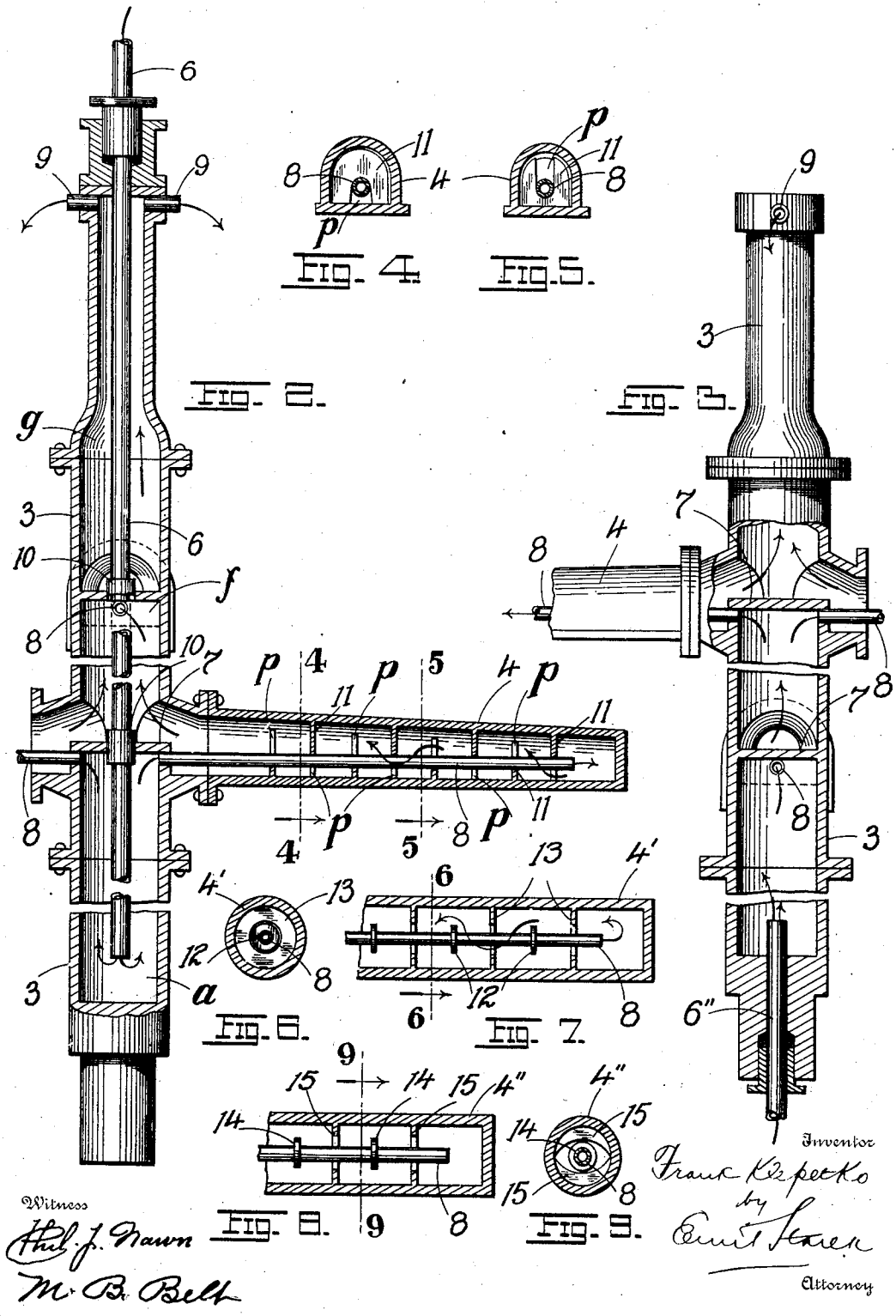

Fig. 2. Fig. 3. Fig. 4. Fig. 5. Fig. 6. Fig. 7. Fig. 8. Fig. 9.

No. 779,717. Patented January 10, 1905.

UNITED STATES PATENT OFFICE.

FRANK KLEPETKO, OF NEW YORK, N. Y.

ROASTING-FURNACE.

SPECIFICATION forming part of Letters Patent No. 779,717, dated January 10, 1905.

Application filed October 3, 1904. Serial No. 227,010.

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 arrangements 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, showing my invention applied thereto. Fig. 2 is an enlarged vertical section of the rabble-shaft and arms, showing the cooling mechanism applied thereto. Fig. 3 is a similar view showing, however, the feed-pipe entering and discharging at the bottom of the rabble-shaft. Fig. 4 is a transverse section on line 4 4 of Fig. 2. Fig. 5 is a transverse section on line 5 5 of Fig. 2. Fig. 6 is a transverse section on line 6 6 of Fig. 7. Fig. 7 is a sectional detail showing a modification in the deflecting-ribs of the rabble-arm. Fig. 8 is a sectional detail showing a still further modification in the deflecting-ribs, and Fig. 9 is a cross-section on line 9 9 of Fig. 8.

The present invention is an improvement in air-cooling devices for the McDougall type of ore-roasting furnace, being a qualification of the construction shown and described in my pending application, Serial No. 223,539, filed September 6, 1904, the pending case being more properly adapted for water as the cooling medium. The present arrangement is specially applicable in regions where water is scarce or not available and where air must be resorted to, though of course water might be used with advantage especially where a high degree of heat exists in the furnace. The structural qualifications above referred to consist in making proper provision for prolonging the contact of the circulating medium with the hollow rabble-arms through which the same must pass and in increasing the area of the surfaces encountered thereby with a view of utilizing to the best advantage the cooling influence of the current, advantage being taken of the conductive property of metal by which a temperature at one point is readily transmitted to another point. The details in which the present construction resembles that of the pending application will not be specifically dwelt upon, it being understood that such do not form the subject-matter of the present invention. Reviewing so much of the description of the furnace as may be essential to a better understanding of the invention, the latter may be described as follows:

Referring to 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 C, 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 arms 4, extending into the several hearths and carrying rakes 5, by which the material is successively fed from one hearth to the hearth immediately beneath it, all as fully understood in the art.

Referring again to the drawings, and more particularly to Figs. 1 to 5, inclusive, 6 represents an air-feed pipe (preferably stationary) which is located within the shaft, extending to a short distance from the closed bottom of the latter, the lower end of said feed-pipe being open and discharging into the shaft. The pipe receives its supply of air from an extension 6′, leading to any suitable blower. (Not shown.) The shaft is divided into a series of chambers *a b c d e f g*, the chambers being separated from one another by the transversely-disposed division-walls or partitions 7, occupying a plane slightly above the bottom of the adjacent rabble-arms 4, each chamber having leading therefrom the distributing conduits or pipes 8, which extend into the hollow arms 4 and discharge thereinto. Under this arrangement the air forced and discharged into the bottom chamber *a* passes

through the lower series of pipes 8 into the bottom rabble-arms, thence passing into the second chamber *b*, and from this through the next series of distributing-pipes and their corresponding rabble-arms, and so on till the current reaches the outlet-nozzles 9, where it discharges into the atmosphere. As seen from the foregoing, the feed-pipe 6 passes through the several partitions or division-walls 7, and in order that there shall be no leakage at these points a connecting-nipple 10 is placed around the pipe where it passes through the partition, said nipple being turned true and the partition drilled and reamed, making a practically air-tight joint. From the foregoing it will be apparent that the cooling medium must take the course indicated by the arrows and that a positive and even delivery of cool air will result throughout the entire system of rabble-arms. Each rabble-arm must receive its air-current from one chamber before it can deliver it to the next succeeding chamber of the shaft, and the circulation will thus be uniform and positive at all times. In this particular it will make no difference whether the current is introduced through the top or bottom so long as the remaining features of construction are not materially disturbed. Thus in Fig. 3 I have shown a modification in which the air is introduced through a pipe 6″, passing into the bottom of the shaft, the point of discharge into the chamber *a* being correspondingly the same as in the construction previously described. Like in my pending application above referred to, the feed-pipe may extend from bottom to top, discharging into the upper compartment or chamber *g*, or it may enter the upper chamber *g* from the top and terminate in said chamber; but these modifications being respectively illustrated and referred to in said pending application they are not shown herein. They are, however, mentioned in this connection, being that they are applicable to air as well as water. To prolong the contact of the cooling medium with the walls of the rabble-arms as much as possible and to increase the available surfaces of contact over which the air must pass to effect a cooling of the arms to the best advantage, I provide the inner opposite walls of the said arms with alternating series of deflecting ribs or walls 11, the free edges of the ribs being concave, whereby the concavities of the entire series of ribs form an opening for the free passage of the pipe 8. The ribs 11 are integral with the rabble-arms and not only increase the available contact-surface of the arm with the cooling medium, but deflecting the current as they do they retard its passage through the arm sufficiently to insure therefor a thorough contact for with surfaces, and hence more effectively cool the arm. The course of the air through the rabble-arms is indicated in the drawings, the currents taking a zigzag course, as shown by the arrows, the particular formation of the ribs leaving passages *p* between the inner wall of the arm and the concave edge of the rib.

It must be borne in mind that the deflecting-ribs 11, as shown in Figs. 1 to 5, inclusive, represent but one form of my invention, and various modifications may be devised which will produce the same results. Thus in Figs. 6 and 7 I have shown the pipe 8 provided with a series of disks or collars 12, alternating with a series of closed ribs or rings 13, formed on the inner wall of the rabble-arm 4′. In Figs. 8 and 9 I show a series of disks 14 alternating with a series of ribs 15 on the rabble-arm 4″, the ribs in each case, respectively, extending partially around the inner surface of the rabble-arm.

The air being forced (or drawn) through the shaft and rabble-arms in the manner indicated and having its period of contact therewith necessarily prolonged by the arrangement described and the surfaces of the contact being increased so as to provide more points from which the low temperature of the air can be communicated to the walls of the rabble-arms, it follows that a very effective cooling of the shaft and arms results, and where water is not available in suitable quantities an air-cooled furnace of the character here shown is fully as effective as a water-cooled furnace.

I may of course avail myself of any equivalent features of construction without in anywise affecting the nature or spirit of my invention.

I need not, of course, limit the application of the cooling feature to roasting-furnaces, as it may be applied to other furnaces or hearths as well. Neither do I wish to limit myself to the use of air as the gaseous cooling medium or to water as the liquid cooling medium, as other available media might be used.

Having described my invention, what I claim is—

1. In a furnace having one or more hearths, a hollow rabble-shaft and hollow arms therefor, and ribs formed on the inner surfaces of the rabble-arms, substantially as set forth.

2. In a furnace having a plurality of hearths, a rotatable hollow shaft passing through the hearths, a series of hollow arms radiating from said shaft and extending into the several hearths, a series of chambers distributed throughout the shaft and communicating with the hollow arms, means for permitting the circulation therethrough of a current of air, and a series of deflecting-ribs disposed along the inner surfaces of the hollow arms, substantially as set forth.

3. In a furnace having a plurality of hearths, a rotatable hollow shaft passing through the hearths, a series of hollow arms radiating from said shaft and extending into the several hearths, a series of chambers distributed throughout the shaft, air-conduits leading

from the respective chambers and opening into the adjacent series of hollow arms, and a series of deflecting-ribs formed along the inner surfaces of the hollow arms in the path of the current traversing said arms, substantially as set forth.

4. In a furnace having a plurality of hearths, a rotatable hollow shaft passing through the hearths, a series of hollow arms radiating from said shaft and extending into the several hearths, a series of chambers distributed throughout the shaft, air-conduits leading from the respective chambers and opening into the adjacent series of hollow arms, a feed-pipe for delivering air into the shaft, and a series of deflecting-ribs formed along the inner surfaces of the hollow arms in the path of the current traversing the arms, substantially as set forth.

5. In a furnace having a plurality of hearths, a rotatable hollow shaft passing through the hearths, a series of hollow arms radiating from said shaft and extending into the several hearths, a series of chambers distributed throughout the shaft, air-conduits leading from the respective chambers and opening into the adjacent series of hollow arms, and a series of deflecting-ribs formed on the adjacent surfaces of the hollow arms and conduits respectively, in the path of the current traversing said hollow arms, substantially as set forth.

6. In an air-cooling apparatus for furnaces, a hollow rabble-arm having a series of alternating oppositely-disposed ribs provided with concave edges, forming a clear passage for the insertion of a distributing-pipe, substantially as set forth.

7. In a furnace having a plurality of hearths, a rotatable hollow shaft passing through the hearths, a series of hollow arms radiating from said shaft and extending into the several hearths, a series of chambers distributed throughout the shaft, air-conduits leading from the respective chambers and opening into the adjacent series of hollow arms, and a series of deflecting-ribs formed on the adjacent surfaces of the hollow arms and conduits respectively, the ribs on the arms alternating with those of the conduits, substantially as set forth.

8. In a furnace having one or more hearths, a rotatable hollow shaft passing through the hearths, hollow arms radiating from said shaft and extending into the several hearths, chambers distributed throughout the shaft and communicating with the hollow arms, means for permitting circulation therethrough of a current of cooling medium, and a series of deflecting-ribs disposed in the path of the currents traversing said arms, substantially as set forth.

9. In a furnace having a plurality of hearths, a rotatable hollow shaft passing through the hearths, a series of hollow arms radiating from said shaft and extending into the several hearths, a series of chambers distributed throughout the shaft, air-conduits leading from the respective chambers and opening into the adjacent series of hollow arms, and a series of deflecting-ribs disposed in the path of the currents traversing said arms, substantially as set forth.

10. In a furnace having one or more hearths, a hollow rabble-shaft and hollow arms therefor, conduits for directing a current of air from the shaft into the hollow arms, and deflecting-ribs disposed in the path of the currents traversing said arms, substantially as set forth.

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

FRANK KLEPETKO.

Witnesses:

EMIL STAREK,

M. B. BELT.