No. 799,063. PATENTED SEPT. 12, 1905.

F. KLEPETKO.

ROASTING FURNACE.

APPLICATION FILED MAR. 15, 1905.

2 SHEETS—SHEET 1.

Fig. 1.

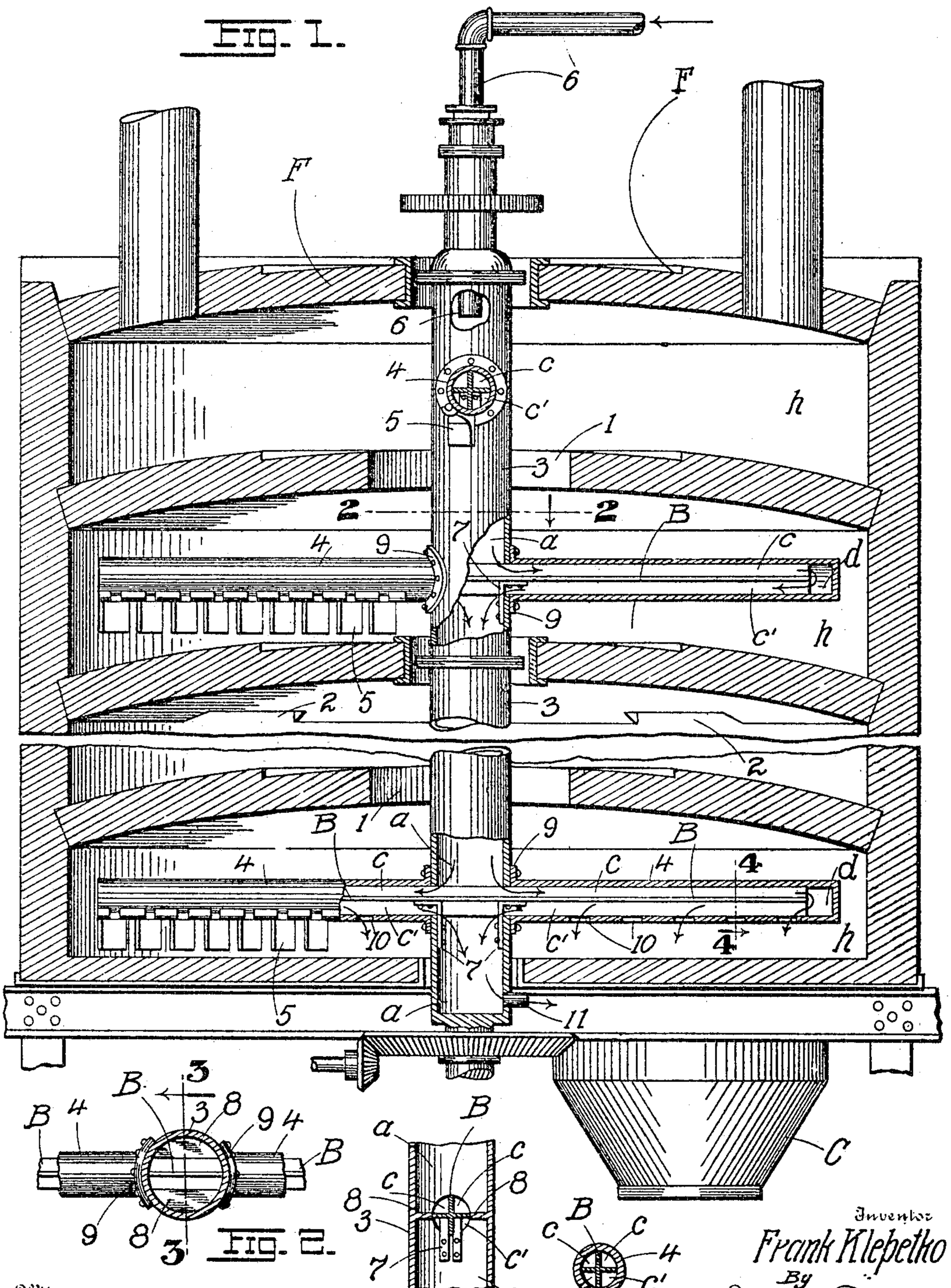

Fig. 2.

Fig. 3.

Fig. 4.

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2 SHEETS—SHEET 2.

Fig. 7.

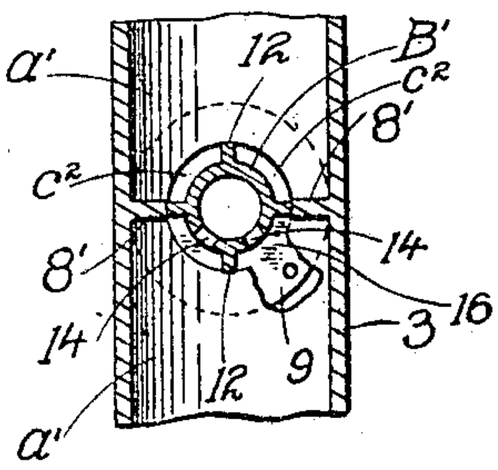

Fig. 8.

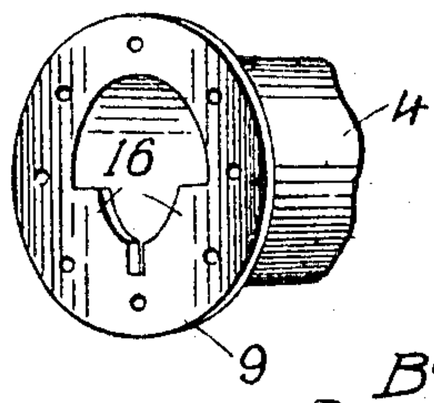

Fig. 9.

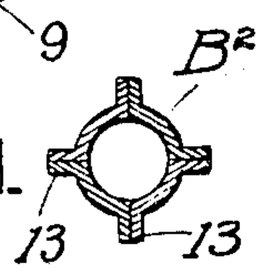

Fig. 5.

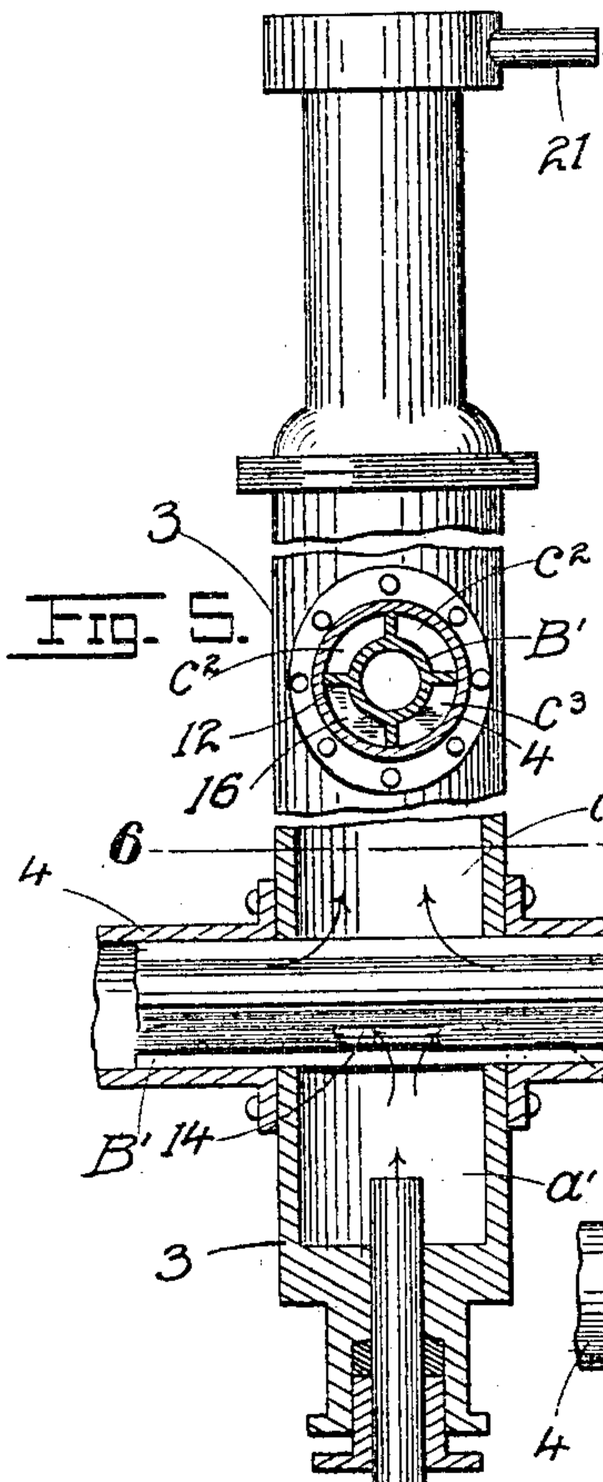

Fig. 10.

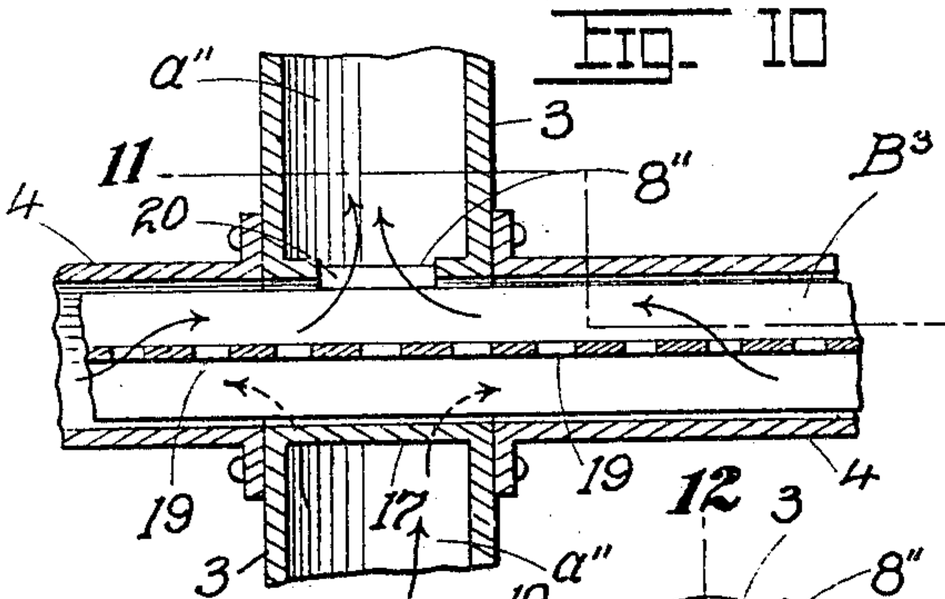

Fig. 12.

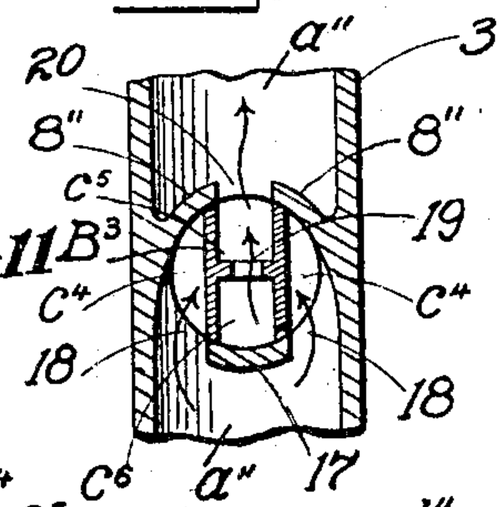

Fig. 11.

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UNITED STATES PATENT OFFICE.

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ROASTING-FURNACE.

No. 799,063. Specification of Letters Patent. Patented Sept. 12, 1905.

Application filed March 15, 1905. Serial No. 250,271.

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 of a conventional McDougall ore-roasting furnace broken at the middle, showing one of the forms of my invention applied thereto. Fig. 2 is a horizontal sectional detail on line 2 2 of Fig. 1. Fig. 3 is a vertical middle section on line 3 3 of Fig. 2. Fig. 4 is a vertical section on line 4 4 of Fig. 1. Fig. 5 is a combined section and elevation of a broken rabble-shaft and rabble-arm, showing the application thereto of a modified form of my invention. Fig. 6 is a horizontal section on line 6 6 of Fig. 5. Fig. 7 is a vertical section on line 7 7 of Fig. 6. Fig. 8 is a perspective of the base of the rabble-arm. Fig. 9 is a cross-section of another modification of structural member for supporting the rabble-arm. Fig. 10 is a vertical section on line 10 10 of Fig. 11, showing a further modification of my invention. Fig. 11 is a horizontal section on broken line 11 11 of Fig. 10, and Fig. 12 is a vertical cross-section on line 12 12 of Fig. 11.

The present invention has relation to the rabble shaft and arms of the conventional McDougall ore-roasting furnace, being specially directed to the means for cooling these parts and to mechanical details which will insure a rigid and durable construction both for the shaft and the rabble-arms, the object being to produce a construction which will not only direct the cooling medium positively and with certainty against those portions which it is essential shall be kept cool, but which shall possess mechanical advantages the virtues of which will be manifest from a detailed description of the invention, which is as follows:

Referring to the drawings, and particularly to Figs. 1 to 4, inclusive, F represents the furnace, which may be composed of any convenient number of superposed hearths *h*, in which the material is treated, the ore dropping from the upper hearth successively through the several hearths until it is delivered to and discharged from the discharge-spout 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 (preferably) air-cooled rabble-shaft 3, from which radiate the series of hollow rabble-arms 4, extending into the several hearths and carrying rakes or blades 5, by which the material is stirred and successively fed from one hearth to the hearth immediately beneath it, all as well understood in the art. As stated above, the shaft and rabble-arms are preferably air-cooled, the air entering the shaft (in the form shown in Fig. 1) from above through a supply-pipe 6, leading to any suitable blower or fan. (Not shown.) To prevent the arms from sagging under their own weight as a result of the heat to which they are exposed, to insure a thorough cooling of the same, and to insure a positive circulation of the cooling medium through the several arms and shaft, I secure said arms to the rabble-shaft and qualify the construction of the latter in a manner more particularly described as follows: Passed transversely through the walls of the shaft in each hearth is a structural member B, which may be of any conventional cross-section, that shown in Figs. 1, 2, 3, 4 being that of four webs radiating from a common axis in planes at right angles to one another, though, as subsequently to be seen, said cross-section may be that of a **T**, **Z**, channel bar, **I**-beam, or any combination of these or circular with peripheral ribs, depending on the specific paths which it is desirable that the cooling medium shall traverse. Said member is secured to the shaft-walls by angle-plates 7 or any other mechanical manner. Formed at intervals along the inner walls of the shaft 3, on each side of the axis thereof, are ribs 8, which, with the horizontal contiguous webs of the member B, form partitions which divide the shaft into a series of compartments *a*,

communication between which is only possible through the hollow arms 4, which connect each pair of contiguous compartments. Whether the cooling medium is forced from the top downward through the shaft, as shown in Fig. 1, or in the reverse direction, as subsequently to be seen, the currents pass through one compartment *a*, encountering the partition or division wall separating said compartment from the next adjacent one, being obliged when forced from top downward to traverse the hollow arms outwardly through the upper pair of conduits *c*, formed between the horizontal and the upper vertical web of the member B, thence inwardly through the lower pair of conduits *c'*, formed between the horizontal webs and lower vertical web into the next adjacent compartment *a*, and so on. The path of the current as described is possible, since the lengths of the members B projecting beyond the walls of the shaft are somewhat shorter than the arms 4 which they support, thus leaving a space *d*, from which the current is free to circulate, as indicated. The arms 4 are passed over the projecting portions of the structural members, the basal flanges 9 thereof being secured to the walls of the shaft. Thus the projecting portions of the structural members B serve as supports for the hollow rabble-arms 4, the latter being readily removable and interchangeable. The structural member being of a cross-section which insures rigidity therefore does not sag, and hence preserves the arms and their rakes against undue deterioration. At the same time it serves to form with the inner walls of the arms suitable conduits for the passage and circulation of the cooling medium, and with the adjunctive formations 8 of the shaft divides the latter into a series of distinct compartments, which insure positive direction to the course of the cooling medium. In Fig. 1 I have shown the lower set of arms provided with openings 10 to permit a portion of the air to enter the lower hearth and supply oxygen to the combustible constituents thereof where the nature of the ore may demand it, though the bulk of the air may escape through the nozzle 11 at the bottom of the shaft.

As stated above, the circulation of the cooling medium may be from top to bottom or from bottom to top, and in Fig. 5 I have shown an upward circulation in connection with a modified form of structural member B', the latter being in the form of a pipe provided with longitudinal peripheral ribs 12, disposed in planes preferably at right angles to one another. These ribs may be welded or riveted to the pipe, or they may result from joining a series of flanged sections B^2, as shown in the modification in Fig. 9, the flanges 13 forming the ribs of the pipe resulting from the union of the sections. As in the form described in connection with Figs. 1, 2, 3, 4, so in the present instance the shaft is provided with a series of ribs or formations 8', which, together with the wall of the pipe B' and the adjacent horizontal ribs 12, serve to divide the shaft into a series of compartments *a'*, which communicate with one another through the hollow arms 4. In the modification here referred to, however, the course of the cooling medium is first through the pipe B', thence through the spaces between the pipe and arms and ribs, as shown by the arrows, the course here indicated being made possible by virtue of the following construction: Formed in the wall of the pipe B' within the shaft 3 on either side of the lower rib 12 are elongated slots or passages 14, through which the cooling medium of one compartment *a'* must first pass, thus entering the pipe B'. As the medium leaves the pipe it enters the space *d'*, whence it passes through the several conduits c^2 c^3, formed between the ribs and the adjacent walls of the pipe and arm respectively. In order that the air circulating through the lower pair of conduits c^3 may escape and mingle with that in the upper pair c^2 and eventually pass to the next compartment *a'*, those portions of the horizontal ribs 12 confined within the arm 4 have suitable sections removed and their continuity broken by a series of open spaces 15, through which the lower currents may freely pass and join those flowing through the upper pair of conduits. In order that no part of the current entering the pipe through the slots 14 may directly enter the arm 4 from the shaft 3 through the opening formed in the shaft for the reception of the member B', I cover up the lower half of the annular opening left between the pipe and shaft and the horizontal ribs and lower rib 12, respectively, by flanges 16, formed, preferably, on the arm 4. The upper half of said annular opening is left open, so that the cooling medium is compelled to take the course outlined therefor above.

As previously stated, the cross-section of the structural member may be of any approved design, so long as it insures the formation of air spaces or conduits between it and the walls of the rabble-arms for the circulation of the cooling medium. In Figs. 10, 11, 12 I have shown a structural member B^3, whose cross-section is that of an **H**. In that case the shaft is provided with lateral formations or ribs 8'' and a transverse partition 17, disposed relatively below said ribs to complete the division-wall between two consecutive compartments *a''* of the shaft. The partition 17 supports the lower edges of the flanges of the **H**-beam, and the free

edges of the ribs 8″ engage the adjacent upper edges of said flanges. The circulating medium is thus compelled as it leaves one compartment *a″* of the shaft to pass through the spaces 18 on either side of the partition 17, thence outwardly through the outer pair of conduits c^4, formed between the vertical flanges of the member B^3 and the walls of the arm 4, thence after entering the space *d″* inwardly through the inner pair of conduits c^5 c^6, between the walls of the arm and between the flanges and central web of the said member, the web being provided with a series of openings 19 to allow the currents in the lower inner conduit c^6 to mingle with those in the upper conduit c^5, when the combined currents eventually escape through the space 20, formed between the flanges within the shaft, into the next contiguous compartment *a″*. The upper end of the shaft is provided with an escape-nozzle 21, from which the heated air is discharged, a pipe 6′ supplying air thereto from the bottom.

While the formations 8 (8′ 8″,) which, together with the structural member, serve to complete the division-wall separating any two contiguous compartments *a* (*a′ a″*) of the shaft, are preferably formed or cast with the shaft-walls, they may of course be secured to the structural member after the latter has been inserted into the shaft; but of course this arrangement would be mechanically inferior to that outlined above.

The invention here outlined is susceptible of many modifications, as is obvious, and I have here shown only a few examples of the structural members that might be improvised and employed to carry out my invention. Naturally I do not wish to limit myself to the details here shown, as they may be modified considerably without affecting the nature or spirit of my invention.

I do not wish to be limited to the use of air as the cooling medium nor to an ore-roasting furnace as the specific furnace in which the invention may be practiced.

While the partitions which divide the shaft into a series of contiguous compartments structurally form part of the members B, as a matter of economy and mechanical convenience the invention broadly and generically contemplates any division-wall which may be the full equivalent of that herein shown.

Having described my invention, what I claim is—

1. In a furnace, a suitable hollow rabble-shaft, structural members passed through the walls thereof, hollow rabble-arms passed over the projecting portions of the structural members and forming suitable conduits therewith, and suitable formations located within the shaft and conjointly forming, with the structural members, partition-walls dividing the shaft into a series of compartments which communicate with one another through the hollow arms, substantially as set forth.

2. In a furnace, a suitable hollow rabble-shaft, structural members passed through the walls thereof, hollow arms passed over the projecting portions of the structural members and forming conduits therewith, suitable rib formations carried by the inner walls of the shaft and conjointly forming, with the structural members, partition-walls dividing the shaft into a series of contiguous compartments which communicate with one another through the hollow arms, substantially as set forth.

3. In a furnace, a hollow rabble-shaft, structural members penetrating the walls thereof, and formations within the shaft jointly forming with the adjacent portions of the structural members partition-walls which divide the shaft into a series of contiguous compartments, substantially as set forth.

4. In a furnace, a rabble-shaft, a series of structural members supported thereby and radiating therefrom, and hollow arms passed over and supported longitudinally along said members, and forming circulating-conduits therewith around said structural members, substantially as set forth.

5. In a furnace, a hollow rabble-shaft divided into a series of contiguous compartments, structural members radiating from said shaft, hollow arms passed over said members and forming circulating-conduits therewith, said arms establishing communication between two consecutive compartments through the conduits aforesaid, substantially as set forth.

6. In a furnace, a hollow rabble-shaft, structural members radiating from the axis of the shaft outwardly through the walls thereof, suitable formations conjointly forming, with the adjacent portions of the members, partition-walls dividing the shaft into a series of contiguous compartments, hollow arms passed over the projecting portions of said members and forming conduits therewith, said arms establishing communication between two consecutive compartments through the conduits aforesaid, substantially as set forth.

7. In a furnace, a hollow rabble-shaft divided into a series of contiguous compartments, structural members radiating from the shaft and forming portions of the division-walls between the compartments, and suitable complementary formations located within the shaft for completing said division-walls, substantially as set forth.

8. In a furnace, a hollow rabble-shaft di-

vided into a series of contiguous compartments, structural members radiating from the shaft and forming portions of the division-walls between the compartments, suitable complementary formations located within the shaft for completing said division-walls, hollow arms passed over said members and forming conduits therewith, said arms establishing communication between two consecutive compartments through the conduits aforesaid, substantially as set forth.

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

FRANK KLEPETKO.

Witnesses:
CHARLES V. DREW,
M. A. PESTANA.