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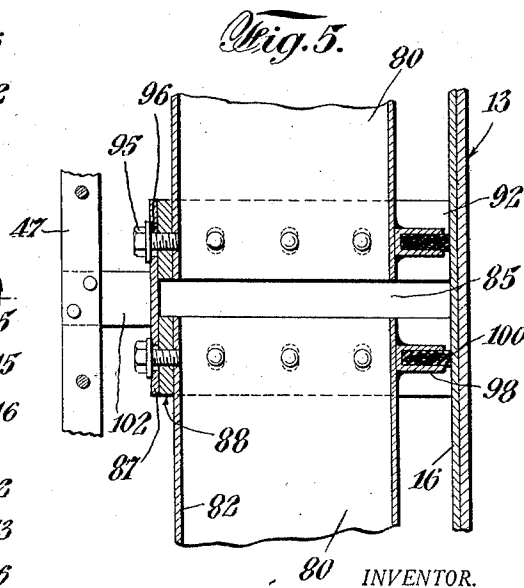
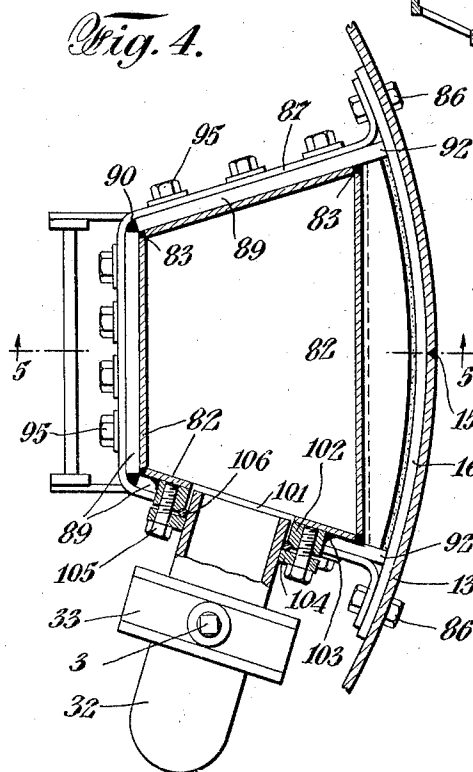
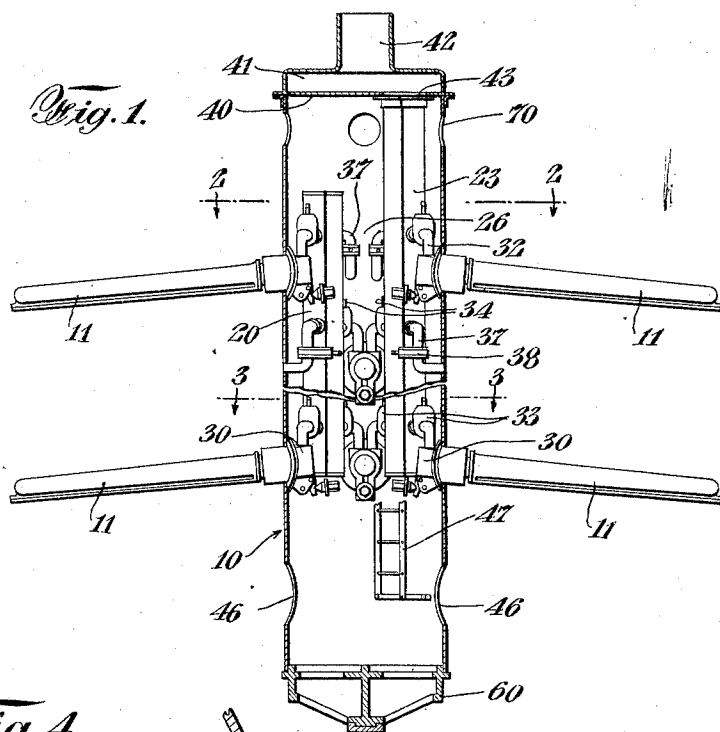
E. HALSE

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ROASTING FURNACE CONSTRUCTION

Filed Jan. 7, 1928

3 Sheets-Sheet 1



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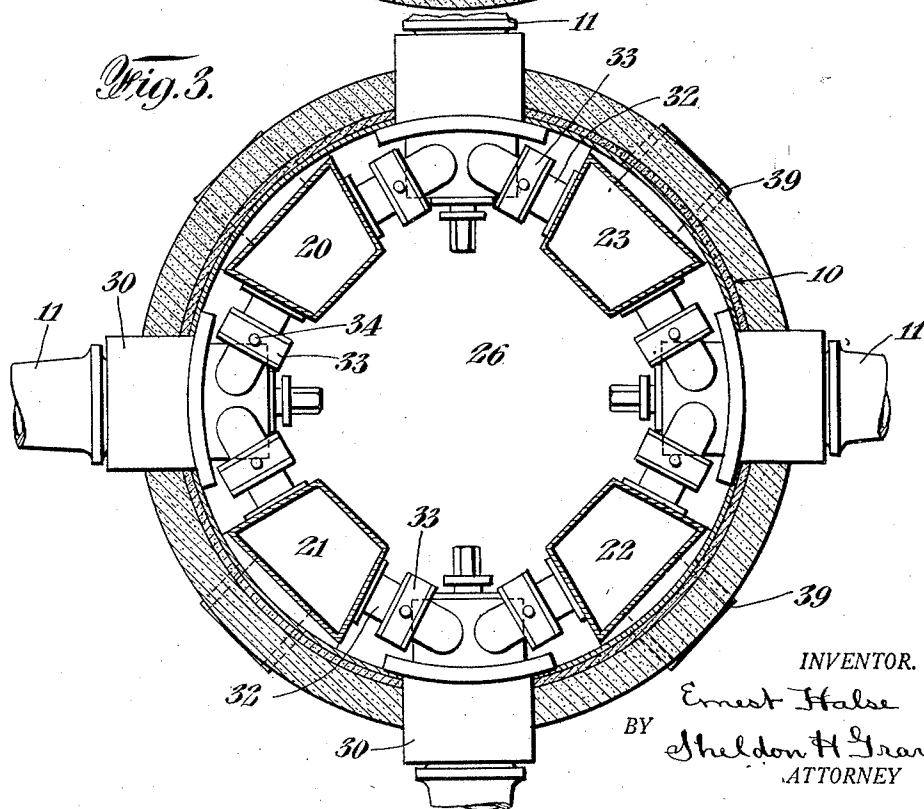
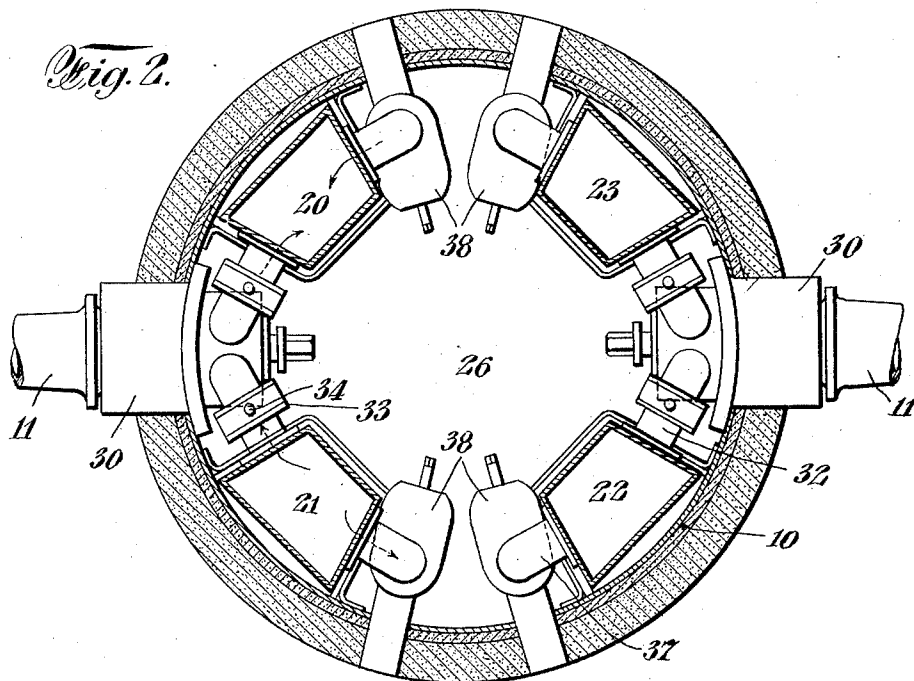
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ROASTING FURNACE CONSTRUCTION

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3 Sheets-Sheet 2



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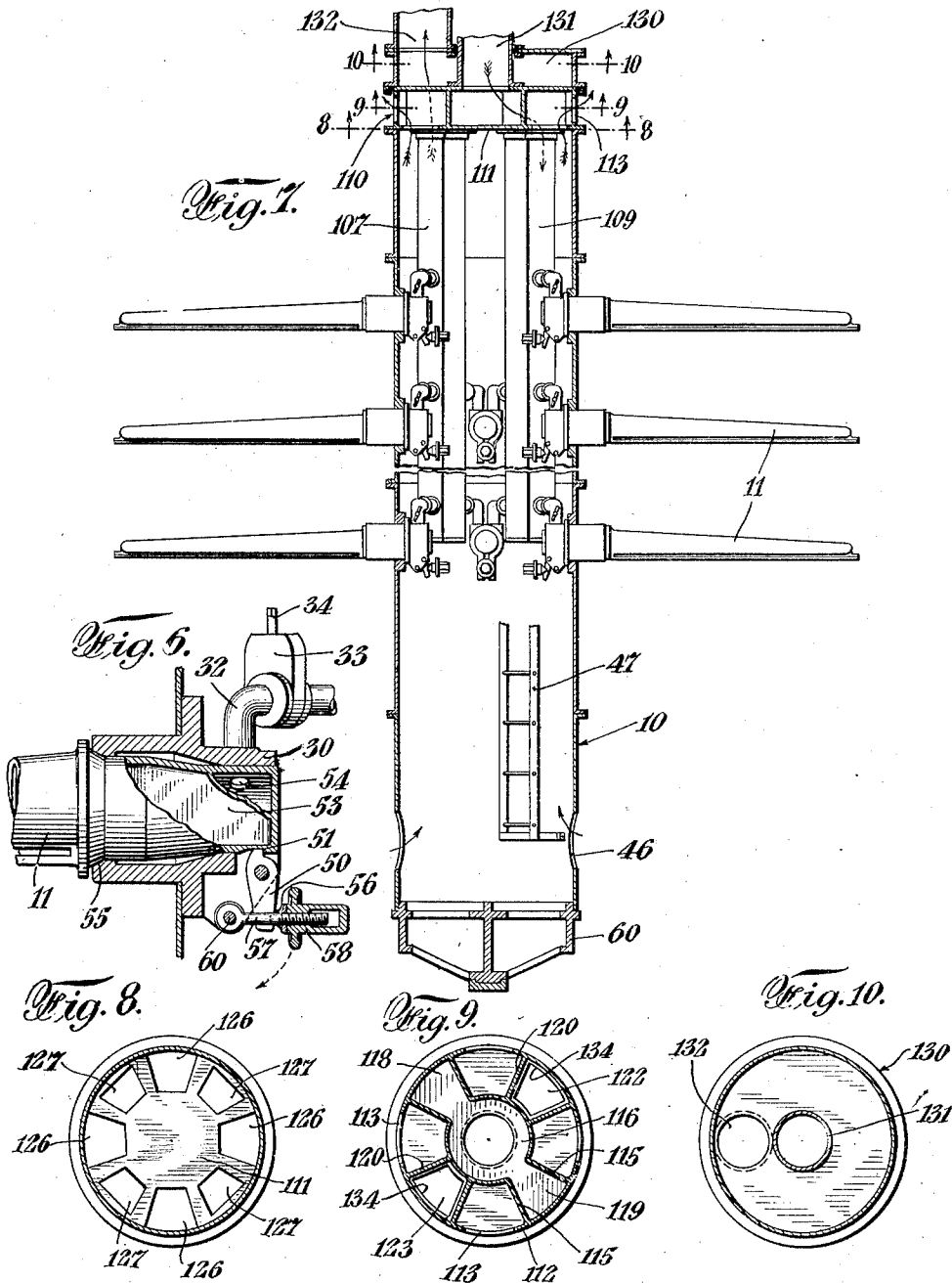
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ROASTING FURNACE CONSTRUCTION

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3 Sheets-Sheet 3



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ROASTING-FURNACE CONSTRUCTION

Application filed January 7, 1928. Serial No. 245,080.

This invention relates generally to roasting furnaces or similar apparatus formed with superposed hearths for carrying ore or similar material to be treated and in which means is provided for stirring the material and moving it over the hearths. Such means usually consists of a vertical rotating shaft having a plurality of arms which extend over the hearths and are provided with plow or rabblers that project downward into the material and serve to stir and move the material as the shaft rotates.

In means of this character, heretofore employed, it has been the practice to provide for the circulation of cooling medium, such as air, through the shaft and arms, and for this purpose communicating passages have been provided in the shaft and arms whereby the cooling medium may be introduced into the shaft and caused to flow through the shaft and arms. Passages in the shaft have also been employed in introducing air into the furnace to assist in the combustion or oxidation of the material on the hearths.

One object of the present invention is to provide a shaft construction of this character, embodying an improved means for the circulation of air therethrough. A further object is to provide a rabble-arm-supporting shaft with an improved arrangement of passages therein. A still further object is to provide a construction of this character with an improved means for controlling the flow of air to the various parts of the furnace. A further object is to provide a rabble arm-supporting shaft with an improved means for the circulation of air through rabble arms and for the supply of air from the shaft to the interior of the furnace, and to provide, in addition, a means whereby the flow of air through the arms and into the furnace may be controlled as desired.

In the embodiment of the invention herein disclosed, the central shaft is formed of a hollow casing, inside of which are constructed a series of ducts that extend longitudinally of the shaft. The ducts are spaced from one another and are located near the wall of the casing, and the rabble arms are secured to the casing at points between the

ducts. The rabble arms are formed with interior circulating passages, having inlet and outlet openings at their inner ends, and these openings communicate respectively with adjacent ducts at opposite sides of the arm by means of branch pipes which are located in the spaces between adjacent ducts. Certain of the ducts are supplied with air from outside the furnace and the remaining ducts receive air which is discharged from the rabble arm; the arrangement being such that successive ducts of the series are alternately supply and discharge ducts for the arms. Thus a rabble arm located between two ducts is supplied with air from one duct and this air, after passing through the arm, is discharged into the other duct. The ducts which extend longitudinally of the shaft are each connected to a plurality of rabble arms; the duct thus forming a manifold for supplying air to, or receiving air from, a plurality of arms.

In case it is desired to supply air to the interior of the furnace, branch pipes are provided which extend from the duct through the shaft casing into the furnace. By this means the interior of the furnace may be supplied with cool air directly from the supply ducts, or with heated air from the discharge ducts; the air from the discharge ducts being preheated by its passage through the arms.

For the purpose of controlling the flow of air through the arms and into the interior of the furnace, the branch pipes, above referred to, are provided with valves. By employing valves in the individual branch pipes, it is possible to control the flow of air through one or more arms independently of the flow through other arms and also to control the flow of air into one or more hearths independently of the flow into other hearths. The control valves in the case of larger shafts are operated from inside the shaft; the arrangement of ducts near the wall of the shaft being such as to leave a central space of sufficient size, inside the shaft, to permit the operator to enter the shaft.

The particular arrangement of the manifold ducts and the branch pipes between ad-

3 jacent ducts results in a great economy of space inside the shaft. Thus, in a shaft of moderate diameter, a relatively large number of pipe connections may be employed and at the same time ample working space provided inside the shaft.

10 A further object of my invention is to provide an improved construction of the ducts in the shaft and also an improved means for supporting and securing the ducts to the shaft casing. A further object of my invention is to provide a construction of this character which is strong and durable and which will not warp or otherwise be injuriously affected when subjected to the intense heat of the furnace.

15 Other objects and advantages of my invention will appear from the following description taken in connection with the accompanying drawings wherein:

20 Figure 1 is a fragmentary vertical sectional view of a furnace shaft embodying one form of my invention and showing a number of rabble arms carried by the shaft,

25 Figure 2 is an enlarged horizontal sectional view taken on the line 2-2 of Figure 1 and showing an arrangement of rabble arms and discharge nozzles for one of the hearths.

30 Figure 3 is a sectional view similar to Figure 2, but taken on the line 3-3 in Figure 1,

35 Figure 4 is an enlarged detail horizontal sectional view showing one form of construction of manifold duct and means for supporting the duct from the shaft casing,

Figure 5 is a sectional view taken on the line 5-5 of Figure 4,

40 Figure 6 is a detail view showing a means for removably securing a rabble arm to the shaft,

Figure 7 is a view similar to Figure 1, but showing a modified form of my invention, and

45 Figures 8, 9 and 10 are horizontal sectional views taken respectively on the lines 8-8, 9-9 and 10-10 of Figure 7 and showing a structure at the upper end of the shaft for providing communication between the supply and discharge ducts and the outside of the shaft and also providing communication between the outside and the interior of the shaft for ventilating the shaft.

50 Referring to Figure 1, 10 represents a central furnace shaft carrying rabble arms 11. Shaft 10 comprises a metal casing 13 which ordinarily will be formed of cylindrical sections bolted together at their ends in a manner well known in the art. In larger shafts it is customary to form each section of a number of curved metal plates which are welded or otherwise suitably joined at their edges; the seams thus formed being reinforced by 55 curved straps or plates which are riveted to

the adjacent plates of the sections. At 15 in Figure 4 is indicated a seam between adjacent plates of a shaft section, and at 16 is shown a strap which reinforces the seam.

70 Mounted inside the shaft casing, are a series of manifold ducts or conduits of which four, 20, 21, 22 and 23 are shown in Figures 2 and 3. These ducts which extend longitudinally of the shaft are located near the shaft casing. In the form of invention shown in the drawing, the ducts taper inwardly from the casing wall and terminate in a flattened inner face which is spaced some distance from the axis of the shaft, thus leaving a relatively large central space 26 inside the shaft. Between adjacent ducts of the series are rabble arm holding sockets 30 which project outwardly through the casing 13 and are adapted to receive and removably secure, or lock, to the shaft 10 the rabble arms 11. 85

The shaft shown in Figures 1 to 3 has four lower rabble arms, equally spaced around the shaft, and designed to operate in the lowest hearth of the furnace. Above the lower arms are pairs of arms at different elevations, each pair being designed to operate in a different hearth. Figure 3 shows the arrangement of rabble arms for the lowest hearth and Figure 2 the arrangement of arms for the topmost hearth of the furnace. The arms in hearths above the lowest hearth are secured to the shaft at opposite points as shown in Figure 2; the arms in successive hearths being at right angles to one another. 90

Pipes 32, each communicating at one end with a duct and at the other end with the interior of socket 30, form a means for the supply of cooling fluid to the arms and the discharge of fluid from the arms. Two of the ducts, namely, ducts 21 and 23, are supply ducts, and the remaining ducts, 20 and 22, are discharge ducts. It will be seen by reference to Figures 2 and 3 that the arm sockets are located between a supply duct at one side of the socket and a discharge duct at the other side of the socket. The interior of the socket is in communication with both the adjacent supply duct and the adjacent discharge duct by means of branch pipes 32. As shown in Figure 6, the rabble arm is formed of a hollow casing having a vertical partition 53 therein which divides the interior of the casing into two passages. These passages are in communication with one another near the outer end of the arm. Openings 54 in the rabble arm casing at opposite sides of the partition communicate through similar openings in a socket 30 with the pipes 32. It will be thus seen that air from a supply conduit passes through a pipe 32 to the interior of the arm and thence through the arm and through the other pipe 32 to the discharge conduit. For the purpose of controlling the flow of cooling medium to the arms, the branch pipes 32 are provided with valves 33, 100 105 110 115 120 125 130

having operating stems 34 which may be actuated from the interior of the shaft.

Provision is made also for the supply of air to the interior of the furnace from both the supply and discharge ducts. For this purpose branch pipes 37 are provided, which are located between adjacent ducts and which are in communication at one end with the interior of a duct through the side walls of the duct. Pipes 37 extend at their other ends through the shaft casing 13 and form outlets or nozzles for discharging air into the furnace hearths. To supply air to the lowermost hearth, short straight pipes 39 are provided, which extend outwardly from the lower ends of the ducts through the shaft casing as shown in Figure 3.

Valves 38 are provided in the branch pipes 37 to control the discharge of air from the ducts into the interior of the furnace. Valves 33 and 38 are shown conventionally in Figures 1 to 4 as gate valves. Valves used for a similar purpose in the form of invention shown in Figure 7 are shown conventionally as butterfly valves.

The ducts 21 and 23, in the form of invention shown in Figure 1, are supplied with air through the top of the shaft 10. A partition 40 extending across the shaft near its upper end forms with the top of the shaft a supply chamber 41 which is in communication at its top with a central passage 42 extending upwardly from the top of the shaft and leading to a source of air supply, such as a fan or blower. Chamber 41 communicates through openings 43 in partition 40 with supply conduits 21 and 23 respectively. Air from the source is supplied to the passage 42, from whence it flows through the manifold intake chamber 41 through openings 43 into the supply ducts 21 and 23. Part of the air flows from supply ducts 21 and 23 through branch pipes 37 and pipes 39 into the interior of the furnace and the remainder flows through the branch pipes 32 through the rabble arms to the discharge ducts 20 and 22 through which it is delivered to the interior of the furnace through pipes 37 and 39.

For the purpose of permitting access to all parts of the interior of the shaft 10, the shaft is formed near its bottom with manholes 46, and a ladder 47 extends upwardly in the shaft from the manhole. By this means a workman may enter the shaft to make inspection or repairs or operate the valves.

Means is also provided whereby the rabble arms may be connected or disconnected from the shaft from the interior of the shaft. This means is shown in Figure 6 wherein 50 represents a pawl pivoted to the holding socket 30 and adapted to engage a shoulder 51 formed near the inner end of the rabble arm 11, and force the arm inwardly against the socket seat 55. The pawl 50 is engaged by a bearing block 56 which is movable along an eye

bolt 57 and is adapted to be forced against the pawl by a hand wheel 58 which is screw-threaded on the outer end of the eye bolt 57. Eye bolt 57 is pivotally connected at 60 to the socket 30. To disconnect the rabble arm from the socket, the hand wheel is unscrewed along the eye bolt 57; this operation releasing the bearing block 56 from the pawl 50 and permitting the eye bolt to swing downwardly in the direction indicated by the arrow in Figure 6. This frees the pawl 50 from the shoulder 51 and permits the rabble arm 11 to be pulled out of its socket.

Suitable means is provided for ventilating the interior of the shaft so that a workman may enter the shaft while the furnace is in operation. Ventilating air enters the shaft through the manholes 46 or through openings in the shaft driving gear 60 and this air leaves the shaft through openings in the top, such as the openings 70 shown in Figure 1. If desired, a fan may be provided for maintaining a forced draft through a shaft.

In Figures 4 and 5 I have shown one preferred form of duct construction. This duct comprises sections 80 formed of flat metal plates 82, welded together along their edges as indicated at 83. The duct sections are supported in alignment with one another with adjacent ends spaced some distance apart as indicated at 85 in Figure 5. The space between adjacent ends of the duct sections is bridged by a strap 87 which embraces the adjacent ends and is bolted to the shaft casing as indicated at 86. Interposed between the strap 87 and the wall of the duct section and welded to the wall is a strap or member 88 formed of flat bars 89, welded together at their ends as indicated at 90. The two bars 89 at opposite sides of the duct extend beyond the outer wall of the duct into contact with the shaft casing as indicated at 92. Bolts 95 which extend through vertically elongated openings 96 in strap 87 and are screw-threaded into the bars 89 and the sides 82 of the duct serve to secure the members 87 to the ends of the duct sections, at the same time permitting a limited relative movement between the end of the duct section and the member 87. Member 88 is employed between the strap 87 and end of the duct section so as to provide sufficient thickness of metal for tapping. Welded to the outer face of the outer plate 82 of the duct section and extending across the plate 82 are U-shaped bars 98 which serve to hold sealing strips 100 formed of asbestos or similar material. The strips 100 project outwardly from the members 98 into contact with the casing 13. It will be seen that strap 87 and strips 100 cooperate to form a seal between the interior of the duct, at the adjacent ends of the duct sections, and the remainder of the space inside the shaft, and at the same time relative movement between the duct section and the casing 13 is

permitted. In this manner allowance is made for unequal expansion and contraction of these parts.

In the construction shown in Figures 4 and 5, the member 87 is formed with projecting lugs 102 which are secured to and serve to support the ladder 47.

In Figure 4 is shown one form of joint connection such as may be used between a branch pipe and duct. The wall of the duct is formed with an opening 101 around which is an annular plate of flange 102 welded at 103 to the wall. The branch pipe extends into the bushing, and a flange 104 surrounding the pipe is bolted to the plate 102, as indicated at 105. A packing ring 106 of asbestos or other suitable material located between the pipe and plate serves to maintain a tight joint between the pipe and duct.

In the shaft construction shown in Figures 7 to 10 four ducts are employed of which two, 107 and 109, are shown in Figure 7. Duct 109 and the duct opposite thereto (not shown) are supply ducts, and duct 107 and the opposite duct are discharge ducts. All of the ducts extend to the top of the shaft and means is provided for supplying air through the top of the shaft to the supply ducts and for discharging air through the top of the shaft from the discharge ducts. This means comprises a horizontal manifold 110 which is secured to and rotatable with the shaft 10. Manifold 110 comprises a bottom plate 111 and a vertical side wall 112 formed with equally spaced openings 113. Extending inwardly from the side wall 112 are partitions 115 which form a relatively large central chamber 116, having lateral extensions 118 and 119 as shown in Figure 9. Also extending inwardly from the wall 112 are partitions 120 which join the partitions 115 and form two oppositely located, relatively small chambers 122 and 123. The bottom plate 111 is formed with four openings 126 which communicate with the space inside the shaft. These openings together with the openings 113 in the walls 112 permit air, supplied to the shaft for ventilation, to pass upwardly into the manifold and thence outwardly through openings 113.

The bottom plate 111 is also formed with four equally spaced openings 127, two of which communicate upwardly with chambers 122 and 123, respectively, of the manifold and communicate downwardly with the discharge ducts in the shaft. The remaining two openings 127 communicate with the central chamber 116 through the lateral extensions respectively 118 and 119 and these openings 127 also communicate with the supply ducts. A pipe 131 communicates with the central chamber 116 of the manifold 110 and forms a passage for supplying air to the chamber 116 and thence through openings 127 to the supply ducts.

Above the manifold 110 is a stationary casing 130 which is open at its bottom and is formed at its top with a central opening through which pipe 131 passes. The casing 130 is also formed at its top with a discharge passage 132 through which air, discharged from the discharge ducts, passes; this air entering the casing 130 through openings 134 in the top of the manifold 110. It will be understood that in actual practice suitable sealing means will be employed between the top of the rotating manifold 110 and the bottom of the stationary casing 130, so as to prevent leakage of air between the walls of the manifold and casing.

Other forms of the generic invention above described are disclosed in my co-pending application, Serial Number 236,030 filed November 28, 1927.

It will be understood that the embodiments of my invention herein disclosed are merely illustrative, and various changes may be made without departing from the spirit and scope of the invention as set forth in the following claims.

I claim:

1. A roasting furnace shaft adapted to carry rabble arms, said shaft comprising an outer casing; a plurality of manifolds in said shaft and extending longitudinally thereof, said manifolds being spaced apart and located near the periphery of said shaft, said manifolds comprising plates extending inwardly from the casing and connected together at their inner edges at points a substantial distance from the axis of the shaft and thus leaving a central space in said casing, means located between adjacent manifolds and accessible for operation from the interior of said shaft for removably securing rabble arms to said shaft and pipes connecting said means and manifolds for supplying cooling medium to the interiors of said arms.

2. A roasting furnace shaft adapted to carry rabble arms, said shaft comprising an outer casing, a plurality of manifolds in said shaft and extending longitudinally thereof, said manifolds being spaced apart and located near the periphery of said shaft, said manifolds being formed of plates extending inwardly from the casing and connecting plates forming the inner walls of the manifolds, said connecting plates being located a substantial distance from the axis of the shaft and thus leaving a central space in said casing, means located between adjacent manifolds and accessible for operation from the interior of said shaft for removably securing rabble arms to said shaft, pipes connecting said means and manifolds for supplying cooling medium to the interiors of said arms and valves in said pipes for controlling the flow of medium of said arms, said valves being accessible for operation from the interior of said shaft.

3. A roasting furnace shaft adapted to carry rabble arms, said shaft comprising an outer casing, a plurality of manifolds in said shaft and extending longitudinally thereof, said manifolds being spaced apart and located near the periphery of said shaft, said manifolds being formed of plates extending inwardly from the casing and connecting plates forming the inner walls of the manifolds, said connecting plates being located a substantial distance from the axis of the shaft and thus leaving a central space in said casing, means located between adjacent manifolds and accessible for operation from the interior of said shaft for removably securing rabble arms to said shaft, pipes connecting said means and manifolds for supplying cooling medium to the interiors of said arms, other pipes communicating with said manifolds and extending through said casing for supplying air to the interior of said furnace.
4. A central shaft for roasting furnaces comprising an outer casing, a plurality of ducts located in said casing and extending longitudinally thereof, said ducts being formed of aligned sections, means for securing said sections to said casing, said means permitting relative movement between adjacent sections of said ducts and between the duct sections and said casing.
5. A central shaft for roasting furnaces, comprising an outer casing, a plurality of ducts located in said casing and extending longitudinally thereof, said ducts being formed of aligned sections spaced apart at their adjacent edges, means for securing said sections to said casing and permitting relative movement between said sections and casing, said means comprising straps secured to said casing, each of said straps embracing adjacent ends of adjacent sections and bridging the space between said adjacent ends and means connecting, and permitting relative movement between said straps and sections.
6. A central shaft for roasting furnaces, comprising an outer casing, a plurality of ducts located in said casing and extending longitudinally thereof, said ducts being formed of aligned sections spaced from said casing and spaced from one another at their adjacent ends, means for securing said sections to said casing and permitting relative movement between said sections and casing, said means comprising straps secured to said casing, each of said straps embracing adjacent ends of adjacent sections and bridging the space between said adjacent ends, means connecting, and permitting relative movement between, said straps and sections, and sealing means between said adjacent ends and casing, said sealing means permitting relative movement between said sections and casing.
7. A central shaft for roasting furnaces comprising an outer metal casing having in the space inside and adjacent the wall of said casing a plurality of inwardly tapering longitudinal ducts formed of metal plates joined together, connections communicating with said ducts and located in the spaces between adjacent ducts and means extending through the casing and forming communications between said connections and points external to said casing.
8. A central shaft for roasting furnaces comprising an outer casing, a plurality of spaced longitudinally extending manifold ducts inside said casing, the inner sides of said ducts being flattened and spaced a substantial distance from the axis of said casing, thereby leaving a relatively large unobstructed space in said casing, rabble arms carried by said casing and connections located in the spaces between adjacent manifolds and forming communications between the interior of the manifolds and arms.
9. A central shaft for roasting furnaces comprising an outer casing, a plurality of spaced longitudinally extending ducts inside said casing, said ducts occupying substantially one-third or more of the peripheral area of said casing, walls of said ducts being formed by plates which are formed and arranged to leave between said ducts an axial space in said casing; rabble arms in said casing and connections between adjacent ducts for forming communication between ducts and arms.
- Signed at Bethlehem, in the county of Northampton and State of Pennsylvania, this 29th day of December, A. D. 1927.
- ERNEST HALSE.