J. B. F. HERRESHOFF.

FURNACE FOR ROASTING ORES.

APPLICATION FILED AUG. 11, 1910.

1,066,110.

Patented July 1, 1913.

3 SHEETS—SHEET 1.

Fig. 1.

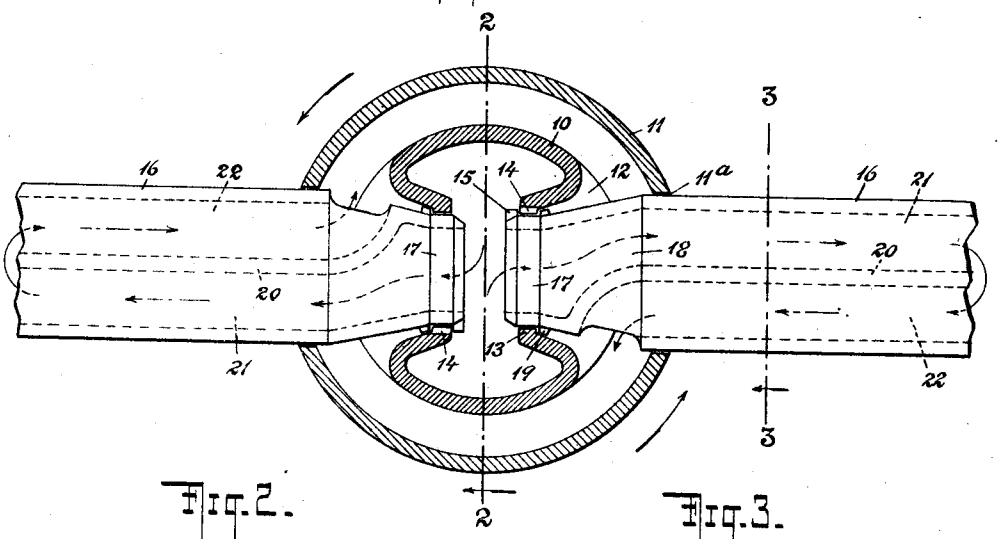


Fig. 2.

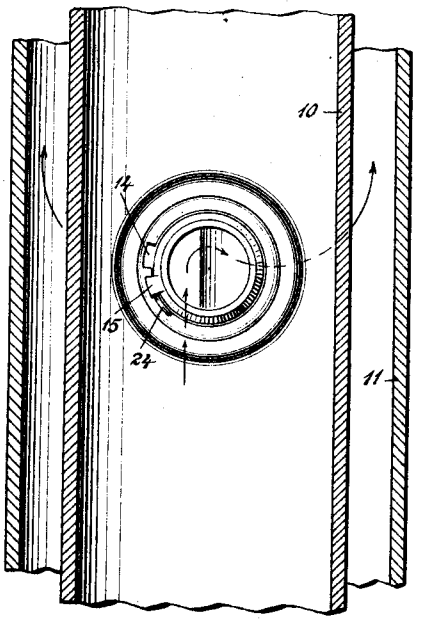
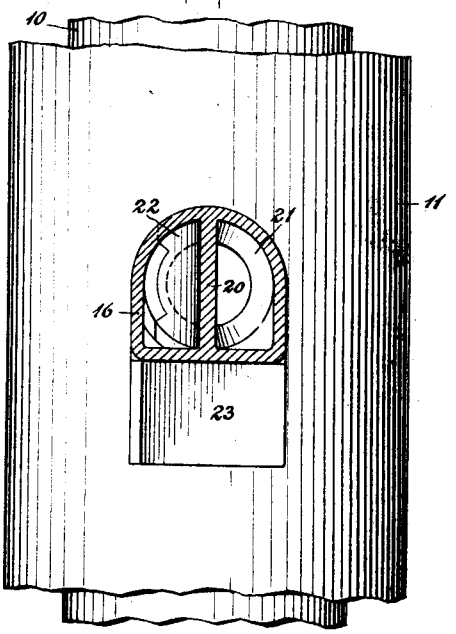


Fig. 3.



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3 SHEETS—SHEET 2.

Fig. 4.

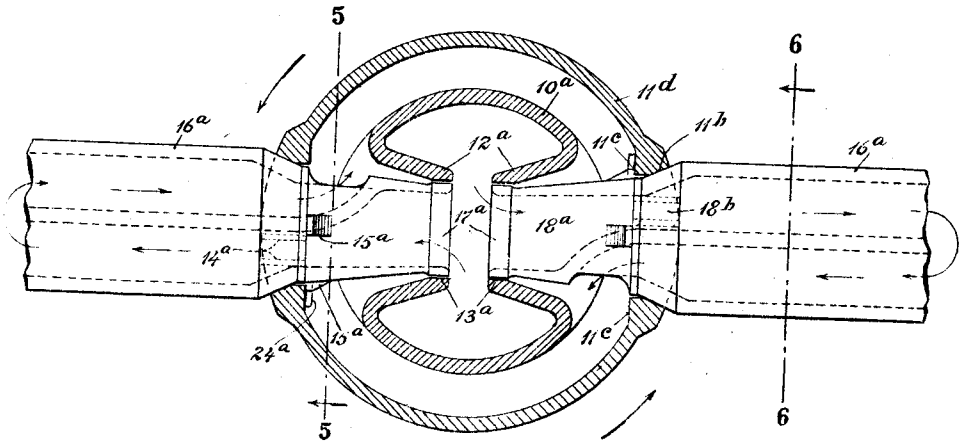


Fig. 5.

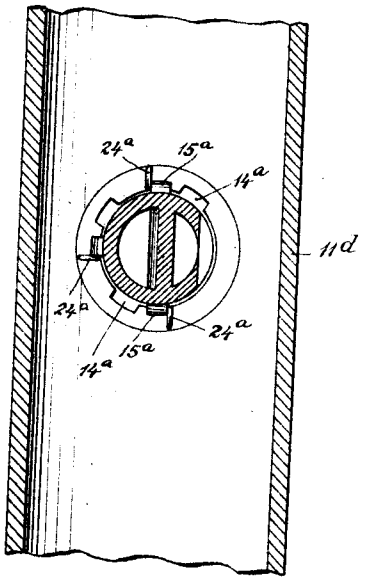
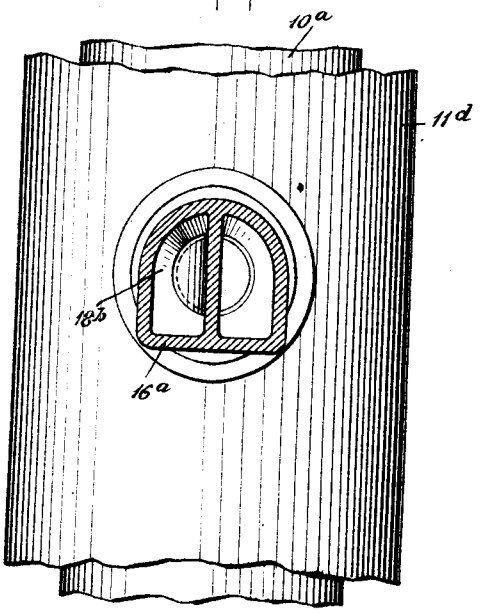


Fig. 6.



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3 SHEETS—SHEET 3.

Fig. 7.

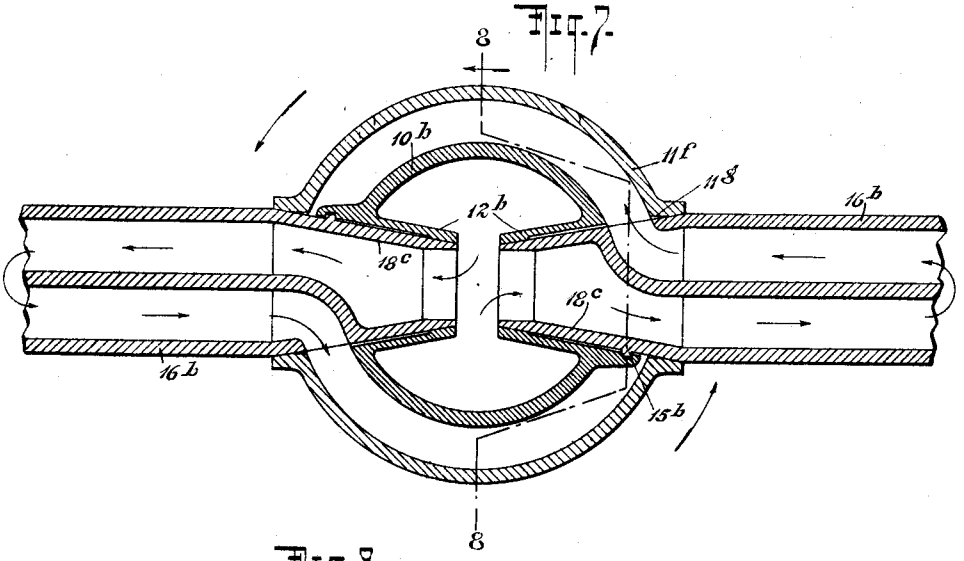
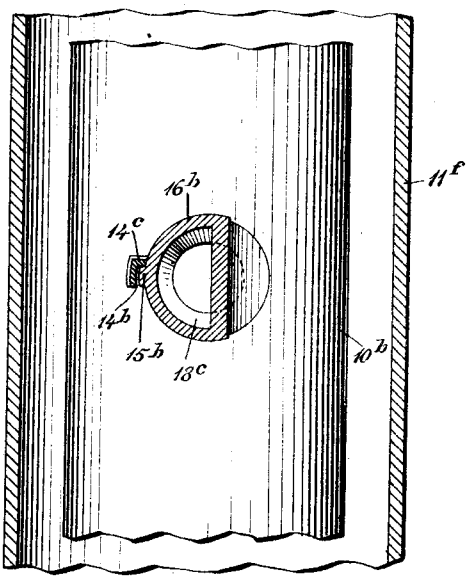


Fig. 8.



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UNITED STATES PATENT OFFICE.

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FURNACE FOR ROASTING ORES.

1,066,110. Specification of Letters Patent. Patented July 1, 1913.

Application filed August 11, 1910. Serial No. 576,667.

To all whom it may concern:

Be it known that I, JOHN B. F. HERRESHOFF, a citizen of the United States, and resident of the borough of Manhattan, city, county, and State of New York, have invented certain new and useful Improvements in Furnaces for Roasting Ores, of which the following is a specification.

My invention relates to ore roasting furnaces of the kind disclosed in my pending application Serial No. 508,598, filed July 20, 1909, and has for its object to improve the construction of the rabble arms thereof and the means for fastening said arms in position in the furnace.

The particular object of my invention is to so construct the rabble arms and coöperating parts of the furnace that said arms may be individually and quickly removed from the furnace and as quickly and easily replaced in position therein.

The present constructions are improvements of the structure shown in my previous United States Patent No. 616,926, issued January 3, 1899, and are particularly adapted for use in connection with furnaces in which air or other gas is used as a cooling medium.

My invention will be fully described hereinafter and the features of novelty will be pointed out in the appended claims.

Reference is to be had to the accompanying drawings in which—

Figure 1 is a horizontal section through the usual shaft and sleeve at a point above one pair of rabble arms: Fig. 2 is a vertical section thereof on the line 2—2 of Fig. 1; Fig. 3 is a cross-section on the line 3—3 of Fig. 1; Fig. 4 is a view similar to Fig. 1 of another form of my invention; Figs. 5 and 6 are sectional views thereof respectively on the lines 5—5 and 6—6 of Fig. 4; Fig. 7 is a view similar to Figs. 1 and 4 of still another form of my improvement and Fig. 8 is a sectional view thereof on the line 8—8 of Fig. 7.

In Figs. 1, 2 and 3 of the drawings 10 represents the customary hollow vertical shaft which extends centrally of the furnace and is closed at its upper end while its lower open end is connected with a source of air supply as a blower or other suitable device. A sleeve 11 also of any ordinary construction surrounds said shaft and is rigidly connected therewith, its lower end being closed and its upper open end extending to a point outside of the furnace. The said shaft and sleeve are given a rotary motion through the medium of suitable gearing for instance of the kind disclosed in my application Serial No. 508,598 above referred to. In this form of my invention the shaft 10 is provided at spaced intervals throughout its length with diametrically opposite sockets 12 the walls of which converge toward the axis of the shaft. These sockets 12 which communicate with the interior of the shaft are preferably formed by bending the shaft material inward as shown in Fig. 1 and are provided adjacent to their inner edges with cylindrical bearing surfaces 13. Each socket 12 is further formed with a recess 14 located at a suitable point on each of the surfaces 13 and extending parallel therewith and at substantially right angles to the axis of the shaft. These recesses 14 each serve to permit of the passage of a projection 15 carried by each rabble arm 16 at the extreme inner end thereof which projections engage the inner wall of said sockets and prevent lengthwise movement of the rabble arms in an outward direction when said arms have been brought to an operative position. Each rabble arm 16 is formed with a cylindrical bearing surface 17 adapted to coöperate with and engage a bearing surface 13 and is further provided with a tapering portion 18 merging into the main body of said arm. Lugs 19 are located at preferably diametrically opposite points on said arm adjacent to the bearing surface 17 and are arranged to engage the outer portions of the bearing surfaces 13 to prevent lengthwise movement of the rabble arms in an inward direction. In other words the projection 15 and lugs 19 are located at opposite sides of the bearing surface 17 of each arm and engage opposite surfaces of the bearing portion 13 of each socket when the arms are in proper position in the furnace and thus maintain each arm against any movement in the direction of its length. It is to be understood that the individual rabble arms each extend through openings 11ª located in the sleeve 11 at points in registry with the sockets 12. Each rabble arm

16 is also divided internally by a partition 20 into two lengthwise channels 21 and 22, which communicate with each other adjacent to the outer ends of the rabble arms. The inner end of the channel 21 connects with the interior of the shaft 10 while the inner end of the channel 22 communicates with the interior of the sleeve 11. Each rabble arm is further provided with the usual downwardly extending projections or teeth 23 for manipulating the ore it being understood that said projections are inclined alternately to the left and to the right in adjacent arms so as to alternately force the ore inward and outward on the several floors of the furnace in the well known way.

In operation air or other cooling gas is applied to the interior of the shaft 10 by the blower or similar device and travels upwardly through said shaft and through the various channels 21 of the rabble arms to the channels 22 thereof and finally escapes through the sleeve 11. In its pasage the air or other gas cools the shaft and the rabble arms and prevents same from becoming overheated. The air is introduced into the shaft 10 under a slightly greater pressure than the pressure inside of the furnace so that any slight leakage which may occur at the points of connection of the arms and the sleeve and shaft will be into the furnace and not from the furnace into the sleeve or shaft. The hot air or gases of the furnace are thus prevented from entering the sleeve and shaft and heating the cooling medium and thus tending to destroy its usefulness.

If it is desired for any reason to remove one or more rabble arms, the same may be accomplished in the following manner: The arm which it is intended to disconnect is given a rotary movement about its axis until the projection 15 is in registry with the recess 14 whereupon by a linear movement in the direction of the length of the arm, said arm may be readily withdrawn from its socket 12 and through the opening 11^a which registers therewith. To return or replace the arm or a substitute in operative position the tapered end 18 thereof is inserted through the opening 11^a and the projection 15 again brought into registry with the recess 14. After this has been accomplished the arm is given a further inward movement to cause the projection 15 to pass through the recess after which the arm is given a rotary movement about its axis in a direction opposite to that in which it is rotated to remove said arm. This rotary locking movement of the arm is limited by means of a stop 24 fixed on the inside surface of each socket at a proper point and adapted to contact with the projection 15 as clearly indicated in Fig. 2. The recesses 14, projection 15 and stops 24 are so located relatively to each other that when the arm is brought to its final position the teeth or projections 23 will stand upright in proper working position. The inward movement of each rabble arm is limited by means of the lugs 19 which abut against the outside surface of the bearing portion 13. During the rotary movement of the arms in either direction the portions 13 and the surface of the openings 11^a serve as bearings to render this rotary movement of the arms readily possible.

In the form of construction shown in Figs. 4, 5 and 6 the shaft 10^a is provided with sockets 12^a similar to the sockets 12 shown in Figs. 1, 2 and 3 and having bearing surfaces 13^a similar to the bearing surfaces 13 arranged to coöperate with bearing surfaces 17^a one of which is located at the inner end of each rabble arm 16^a in the same manner as shown in Fig. 1. Each arm in addition to having a tapered portion 18^a corresponding to the portion 18 of Fig. 1 is provided with an additional inclined portion 18^b adapted to engage the similarly inclined surface 11^b of the openings 11^c which correspond to the openings 11^a of Fig. 1. In this instance instead of having a recess on the sockets adjacent to the bearing portion as in Fig. 1 two or more recesses 14^a are provided in the sleeve 11^d adjacent to the periphery of the openings 11^c for the accommodation of two or more projections 15^a located on the tapered portion 18^a of the arm 16^a. When the arms are in operative position these projections 15^a abut against straight inner faces 11^e. Stops 24^a similar to the stops 24 are provided on said faces 11^e for the purpose of limiting the rotary movement of each arm in one direction. Otherwise the general construction and operation of this form of my invention may be the same as in the structure illustrated in Figs. 1, 2 and 3. To remove an arm in this form the said arm is rotated until the projections 15^a register with the recesses 14^a after which the said arm may be taken out by a simple lengthwise movement thereof. To replace the arm or its substitute in position the inner end thereof is first passed through the respective opening 11^c, the projections 15^a being brought into registry with the recesses 14^a, and then moved inwardly so as to cause the projections 15^a to pass through the coöperating recesses 14^a and the bearing surface 17^a to engage the bearing surface 13^a. This inward movement of the arm is limited through the medium of the inclined surface 11^b. After the arm has been moved fully inward it is given a rotary movement to cause the projection 15^a to be moved out of registry with the recesses 14^a and to engage the stops 24^a in which condition the arm is in operative position. Thus lengthwise movement of the arm in an outward direction is prevented by the projections 15^a and in an

inward direction by the inclined portion 18^b, the arm being therefore securely locked in position. In this case the arm is journaled on the bearing surface 13^a and inclined surface 11^b during a rotation in either direction.

Referring now to the form of my invention disclosed in Figs. 7 and 8 the shaft 10^b is provided at spaced intervals throughout its length with inwardly extending and tapered sockets 12^b and the sleeve 11^f is formed with openings 11^g opposite said sockets the walls of which or a portion thereof are arranged at the same angle as the walls of the registering socket to form a continuation thereof. In this instance the inner ends of the rabble arms 16^b are simply tapered as at 18^c to fit into the openings 11^g and sockets 12^b as clearly illustrated in Fig. 7. To lock the arms in position, each arm is provided with a projection 15^b adapted to enter a recess 14^b formed in an extension 14^c forming part of the shaft 10^b and having its one end closed as indicated at 14^d to engage the projections 15^b and limit the rotary movement of the arms 16^b in one direction. The projections 15^b are located on that portion of the tapered end of each arm which is of sufficiently small diameter to permit the projection to pass through the opening 11^g, so that the use of recesses as 14 and 14^a is obviated. Otherwise this form of arm may be the same as in the two previous forms of my device. To remove an arm of this latter construction it is simply rotated in a direction to remove the projection 15^b from the recess 14^b and then withdrawn. To replace the arm, the tapered end thereof is passed through the opening 11^g and into the socket 12^b with the projection 15^b out of registry with the extension 14^c, the inward movement of the arm being limited by the engagement of the inclined walls of the socket and opening respectively with the tapered portion of the arm. After the arm has been moved inward as far as possible it is given a partial rotation to bring the projection 15^b into the recess 14^b and against the closed end thereof. In this condition the arm is in operative position and is held against outward lengthwise movement by the coöperation of the projection 15^b and lateral wall of the recess 14^b.

It is to be understood that in all the forms of my invention the stops for limiting the rotary movement of each arm in one direction are so placed relatively to the inclination of the teeth or projections 23 that the pressure of the ore against these teeth as the furnace is in operation will be in a direction to lock the arms, that is to force the several projections against the coöperating stops and not away from them.

In all the forms of my invention the sleeve forms a fulcrum as it were for the arms and the shaft or the sockets thereof a means for retaining the arms against tilting downward and side strain. Each individual arm may be instantly and quickly removed and as easily and quickly replaced or a new arm substituted as desired. Repairs may thus be made without necessitating the shutting down of the furnace for any longer period of time than it takes to effect an interchange of arms. The various fastening means while very simple are also extremely efficient and readily permit the expansion and contraction of the material of which the parts are made and due to differences or variations in temperature.

By constructing the rabble arms in such a manner that two spaced portions thereof only are in engagement with the walls of the apertures and sockets, and the portion intermediate of said spaced portions is free from said walls and out of contact therewith, the coöperating engaging surfaces of the tubes and the rabble arms are considerably reduced. The danger of the arms becoming stuck or clogged in the apertures and sockets is thus obviated, as the frictional contact between said arms and tubes is reduced to a minimum, without decreasing the efficiency of the structure.

Various changes in the different forms shown and described may be made within the scope of the claims without departing from the spirit of my invention.

I claim:

1. In an ore-roasting furnace, two upright tubes connected together and arranged one within the other with an annular space between them, each of said tubes being provided with apertures in registry with each other, a rabble arm extending through the aperture in one tube into the aperture of the other tube, a relatively narrow bearing surface on said rabble arm adjacent to its inner end arranged to engage said inner tube, another relatively narrow bearing surface on said rabble arm at a distance from the first and arranged to engage the outer tube, the arm between said bearing surfaces being free from said tubes and fastening means on said arm for detachably engaging one of said tubes.

2. In an ore-roasting furnace, two upright tubes connected together and arranged one within the other with an annular space between them, one of said tubes being provided with an inwardly extending socket and the other tube having an opening in registry with said socket, one of said tubes being further provided with a recess, a rabble arm extending through said opening into said socket, a relatively narrow surface on said arm arranged to engage the inner surface of said socket, another relatively narrow bearing surface on said arm at a distance from the first arranged to engage the surface of said opening, the arm between said bearing surfaces being free from said socket and

a projection on said arm arranged to pass through said recess and engage the inside face of one of said tubes.

3. In an ore-roasting furnace, two upright tubes connected together and arranged one within the other with an annular space between them, each of said tubes being provided with apertures in registry with each other, a rabble arm extending through the aperture in one tube into the aperture of the other tube, a relatively narrow bearing surface on said rabble arm adjacent to its inner end arranged to engage said inner tube, another relatively narrow bearing surface on said rabble arm at a distance from the first and arranged to engage the outer tube, the arm between said bearing surfaces being free from said tubes, means on said arm arranged to detachably engage one of said tubes to prevent lengthwise movement of said arm in one direction and additional means on said arm arranged to engage one of said tubes to prevent lengthwise movement of the arm in the opposite direction.

4. In an ore-roasting furnace, two upright tubes connected together and arranged one within the other with an annular space between them, one of said tubes being provided with an inwardly tapered socket and the other tube having an opening in registry therewith, a rabble arm having a tapered end portion extending through said opening and into said socket, a bearing surface on said arm adjacent to the end of its tapered portion adapted to engage the inner surface of said socket, another bearing surface on said arm at substantially the beginning of its tapered portion adapted to engage the surface of said opening, the tapered end portion of said arm between said bearing surfaces being free from the surface of said socket and fastening means on said arm for detachably engaging one of said tubes.

In testimony whereof, I have hereunto set my hand in the presence of two subscribing witnesses.

JOHN B. F. HERRESHOFF.

Witnesses:
JOHN A. KEHLENBECK,
H. H. LOCKWOOD.