

N^o 6372



A.D. 1913

(Under International Convention.)

Date claimed for Patent under Patents and Designs Act, 1907, being date of first Foreign Application (in the United States), } 12th Apr., 1912

Date of Application (in the United Kingdom), 14th Mar., 1913

At the expiration of twelve months from the date of the first Foreign Application, the provision of Section 91 (3) (a) of the Patents and Designs Act, 1907, as to inspection of Specification, became operative

Accepted, 30th Oct., 1913

COMPLETE SPECIFICATION.

Improvements in Roasting Furnaces.

I, JOHN BROWN FRANCIS HERRSHOFF (Chemist), of 25, Broad Street, City of New York, County and State of New York, United States of America, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

My invention relates to roasting furnaces and particularly to furnaces for roasting ores and of the type described in the Specification of Letters Patent No. 22,022 of 1910.

One of the objects of the present invention is to increase the life and efficiency of a furnace of the kind referred to, by so constructing the central rotating member and the rabble-arm members that, especially at their points of connection, they may be maintained at a lower temperature than heretofore.

Another object of the invention is to provide connecting means between the central member and the arm-members, which shall be protected from the intense heat of the furnace and at the same time be easy of access for removing and attaching the arm-members.

A further object is to provide, for the purpose of uniting abutting members in the rotary system constituted by the central rotatable member and rabble-arms, jointing means which may be insulated from the heat of the furnace by a suitable heat-insulating medium.

Other objects of my invention will be pointed out or will otherwise appear in the following description of the particular embodiment of the invention which is shown in the accompanying drawings, wherein

Fig. 1 shows in side elevation a portion of the central rotatable member of a furnace of the type mentioned, with rabble-arms attached thereto;

Fig. 2 is a plan view of the mechanism shown in Fig. 1;

Fig. 3 is an elevation of a portion of the central member with the rabble arm removed;

Fig. 4 is a view similar to Fig. 3, with the rabble-arm attached and broken off near the attaching flange;

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Fig. 5 shows, in vertical section on line 5—5 of Fig. 6, a portion of the central member and attached rabble-arms;

Fig. 6 is a section of the central member on the line 6—6 of Fig. 5, the rabble-arms appearing in plan view;

Fig. 7 is a perspective view of the flanged portion of a rabble-arm; 5

Fig. 8 is a detail view showing the upper surface of the attaching flange of one of the central member sections; and

Fig. 9 is a view similar to Fig. 8, but showing the lower surface of the cooperating attaching flange.

It will be understood that the furnace to which my invention is applicable 10 comprises a series of superimposed hearths which support the ore or other material to be treated. The hearths are provided with apertures for the passage of ore and of evolved gases alternately near the centre and the periphery thereof, and are further provided with central openings through which extends a central member rotatably supported above and below the hearths in suitable bearings. 15

Attached to this member above the hearths are rabble-devices comprising rabble-arms equipped in the usual manner with rabbles, which are adapted to extend into the ore to be treated and, usually, are angularly disposed so that, upon the rotation of the central member, the rabbles above each hearth move the ore thereon gradually toward the opening in said hearth, through which opening 20 it falls upon the next lower hearth.

The central rotatable member shown in the drawings comprises a shaft 1, surrounded by a concentric sleeve 2. The shaft and sleeve may be of integral construction and held in separated, concentric relation by strengthening ribs 3. At the point of attachment of each rabble arm, the wall of the sleeve extends 25 inwardly so as to form a recess or pocket 4 from the innermost wall 5 of which extends outwardly a substantially semi-circular flange 6. The flange 6 is provided with slots 7 for the reception of bolts 8 the heads of which are adapted to be positioned in suitable pockets in the flange between the slots therein and the inner wall 5. These pockets extend outwardly in the direction of the 30 slots 7 to the periphery of the flange 6 (as particularly shown by the dotted lines in Fig. 3) and are so shaped internally that the bolt heads are held from turning. The flange 6 is provided with a central vertical partition 9 which, together with the walls of the flange on one side of said partition, extends to the shaft 1 to form a passage 10 to connect the shaft with the recess 4. The oppo- 35 site side of the flange is formed into a passage 11 to establish communication between the interior of the sleeve 2 and the recess. The walls of the recess 4 are strengthened by means of lugs 12 within the sleeve 2.

Each rabble-arm 13 is provided at its inner end with a substantially semi-circular flange 14 and with a central vertical partition 15 extending from the 40 inner end to a point near the outer end, the partition 15 forming an inlet passage 16 and an outlet passage 17 in communication with each other near the outer end of the arm. The rabble-arms are secured by means of the bolts 8 to the flanges 6 of the sleeve 2 so that the passages 16 and 17 of the arms are in communication with the passages 10 and 11 respectively of the central member, 45 the partition 15 abutting against the partition 9. In this position the flange of each arm is situated entirely within the recess 4.

The flange 14 of each arm is provided with slots 18 (Figure 7) which extend to the periphery of the flange in a generally upward direction similarly to the 50 corresponding slots 7 in the flange of the central rotatable member. These slots 7 and 18 are of sufficient width to accommodate the shanks of the bolts and are angularly disposed in a generally upward direction so that the bolts may be easily removed into and out of position and furthermore so that an insulating material may be readily applied to them.

The outer face of each flange 14 is provided with a plurality of recesses each 55 substantially concentric with the axis of a bolt 8 when positioned at the bottom of its slot, and of suitable size to receive a nut for the bolt and a suitable tool

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for turning the nut. When tightened into place, the nut is adapted to seat upon the bottom 20 of the recess and is in effect imbedded within the flange. A portion of the longitudinal wall of the recess is undercut as at 21.

5 The central rotatable member is preferably made in sections, as shown in Fig. 5, and these sections are provided with terminal external flanges 22 and 23 through which fastening means extend to secure the sections together. The fastening means preferably comprise bolts 8¹ cooperating with the flanges, the bolt-nuts being inserted into pockets formed by the flange and abutting wall 5¹ on one section and the heads in recesses in the other section. The wall 5¹ is
10 similar in function to the wall 5 and the recesses may be similar to the recesses in the flange 14, previously described. The pockets extend laterally of the bolt and the recesses longitudinally thereof.

In the operation of the furnace, the central member and the rabble-arms and associated parts are subjected to an intense heat under which the various means
15 for connecting parts together are apt to be destroyed. A circulation of cooling fluid, preferably air, is maintained for the purpose of cooling these parts. The air is first caused to traverse the shaft 1 from which it passes, in the case of each arm, successively through the passage 10, 16, 17 and 11 into the sleeve 2, whence it is withdrawn. The circulation may obviously be caused either by
20 a suction or a pressure device.

The central member and its associated rabble-arms are preferably rotated in practice in the direction shown by the arrow in Fig. 6. Owing to the resistance to turning offered by the material treated, the rabble arm flanges 14 are pressed with great force against the flanges 6 in the neighbourhood of the passages 11
25 and 17 and there is a corresponding tendency to pull these flanges apart on the opposite side of the partitions 9, that is, in the neighbourhood of the passages 10 and 16. The conduction of heat from the hearths to the interior of the sleeve 2 is facilitated on the first-mentioned side because of the intimate contact thus produced between the flanges. On the opposite side, however, the conduction
30 is obviously less perfect, but this side is nevertheless maintained at a proper low temperature by conducting the cold air from the shaft 1 directly by means of the passage 10 to the point at which the flanges tend to draw apart. This location of the inlet and outlet passages 10 and 11 respectively, with regard to the direction of rotation of the central member forms an important feature of my
35 invention.

The point of connection of the arms and the central member is situated within the recess 4, the walls of which are materially cooled because their inner surfaces are continually bathed by the air flowing in the sleeve 2. This air manifestly is at a very low temperature relatively to that of the atmosphere
40 outside of the sleeve. The connecting means is further protected by a suitable insulating material 24 (Fig. 1) which, on account of the structure described, may be packed around the bolts, the bolt heads and nuts. The undercut portions 21 of the flange 14 obviously prevent the packing from being displaced. If desired, the packing may be inserted so as completely to fill the recesses 4.
45 As a packing, asbestos or other poor conductor of heat may be used. In some cases it may not be necessary to insert an insulating material by hand, but the ore dust which accumulates in the furnace may serve as such insulating material. The inclination of the bolt slots is such that descending dust will readily fill them and the bolt head and nut recesses, and be held therein. The undercut
50 portions 21 furthermore, as will be seen, especially by an inspection of Fig. 6, are such that an increased area for collecting dust is presented.

The cooling of the various furnace parts at the points of connection thereof is further enhanced by making the bolt flanges of relatively large dimensions. The fastening bolts are thus relatively small and are in effect imbedded in a
55 large mass of metal through which the heat is readily conducted into contact with the cooling fluid. The flanges, moreover are forced into intimate contact

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with each other without packing or other separating medium and are preferably made integral with the furnace parts to which they are attached, so that the best possible conducting path is produced between relatively hot and relatively cool portions of the furnace.

The insulating material is obviously applicable to the connecting means for the sections of the central member in the same manner as for the connecting means described above. 5

The connection between the rabble arms and the central member being all within the recesses 4, it is obvious that the sections of said member may be readily removed through the central openings in the hearths without interference by said connections. 10

Instead of the bolts shown, it will be understood that any other suitable securing means may be used. Furthermore, when I speak of a bolt-head in the claims, I mean to refer to either the permanent integral head at one end of the bolt or to the movable head, or nut, at the other end thereof. 15

Having now particularly described and ascertained the nature of the said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. In a roasting furnace, the combination of a central rotatable member provided with a recess, a rabble-arm extending into said recess, and means within the recess and accessible from the exterior of said member for securing said arm to said member. 20

2. In a roasting furnace, the combination of a central rotatable member provided with a recess, the inner wall of said recess being provided with an outwardly-extending flange, a flanged rabble-arm extending into said recess and abutting against said first mentioned flange, and means co-operating with said flanges for securing said arm to said member. 25

3. In a roasting furnace, the combination of a central member comprising a hollow shaft and a sleeve surrounding said shaft and spaced therefrom, said member being provided with a recess and separate passages establishing communication between the recess and the shaft and sleeve respectively, a rabble-arm provided with channels in communication with said passages at the inner end of the arm and in communication with each other near the outer end of the arm, and means within the recess for securing said rabble-arm to said central member. 30 35

4. In a roasting furnace comprising a rotary system constituted by a central rotatable member provided with rabble-arms, the employment of jointing means for uniting abutting members in the rotary system, consisting in the combination of flanges on the respective members, a bolt co-operating with said flanges to secure said members together, each flange having a recess for the reception of the head or nut on the corresponding end of the bolt, and heat-insulating material in said recesses for protecting the head and nut of the bolt. 40

5. In jointing means as and for the purpose specified in Claim 4, the combination of a recess in the one flange for the reception of the head or nut at the corresponding end of a bolt and extending longitudinally of the bolt, a recess in the other flange for the reception of the nut or head at the corresponding end of the same bolt and extending laterally of the bolt, and heat-insulating material in said recesses for protecting the head and nut of the bolt. 45

6. In jointing means as and for the purpose specified in Claim 4, the combination of a member provided with a flange adapted to give passage to a bolt, and also with a wall spaced apart from said flange, a member abutting against the first-mentioned member and having a flange provided with a recess for the reception of the head or nut of said bolt, a bolt uniting the respective flanges so that its head or nut rests in the space between the flange and wall of the one member whilst its nut or head rests in the recess in the flange of the other 50 55

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member, and heat-insulating material in said space and in said recess to cover the head and nut of the bolt.

7. In a roasting furnace, the combination of a central rotatable member provided with a flange and a wall separated from said flange, a rabble-arm member abutting against said first-mentioned member and provided with a flange having a recess, a bolt co-operating with said flanges to secure said members together, and heat-insulating material in the space between said wall and said first-mentioned flange and in the recess in said second-mentioned flange, for covering and protecting the heads of said bolt from heat.

8. In a roasting furnace, the combination of a central rotatable member provided with a slotted flange and a wall separated from said flange, a rabble-arm abutting against said central member and provided with a flange having a recess and a slot in alignment with the slot of said first-mentioned flange, a bolt seated in said slots and securing said member and said arm together, and insulating material in the space between said wall and said first-mentioned flange, in said slots, and in said recess, for covering and protecting said bolt from heat.

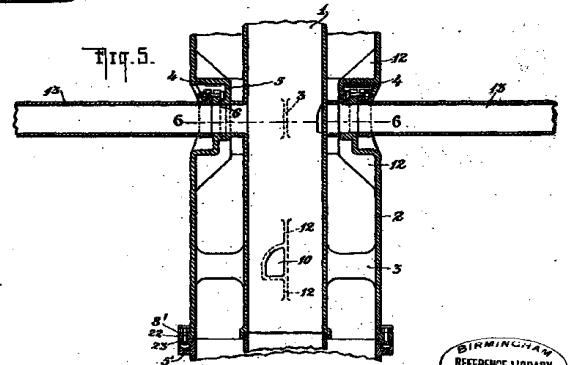
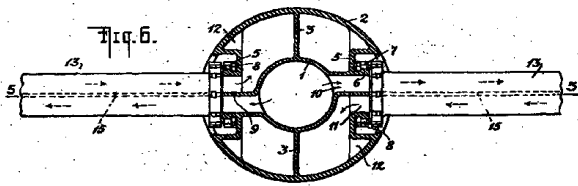
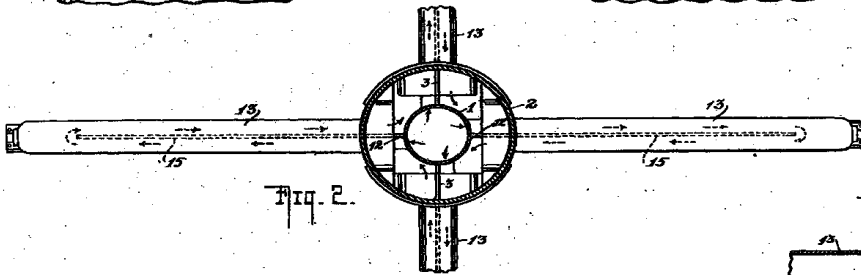
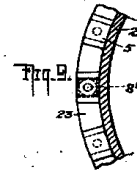
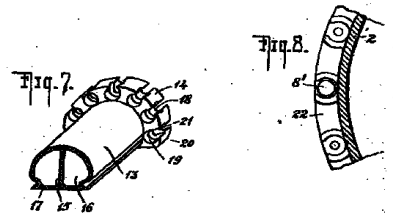
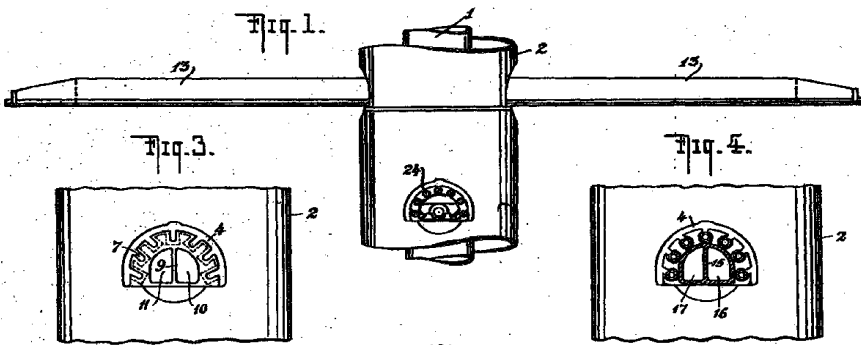
9. In a roasting furnace wherein a rabble-arm is secured by means of a joint to a central rotatable member comprising a hollow shaft, and a sleeve surrounding said shaft at a distance, the interior of the hollow shaft and the approximately annular space which separates the shafts and sleeve being connected respectively with the inlet and outlet for the cooling medium, whilst the rabble-arm has longitudinal passages which on the one hand communicate with one another near the outer end of the rabble-arm, and, on the other hand, communicate at their respective inner ends with the interior of the hollow shaft and with said annular space, the arrangement whereby the communications between the rabble-arm passages and the hollow shaft and annular space respectively pass through said joint towards those sides of the rabble-arms which, during rotation, are respectively subjected to tensile and compressive strains due to the resistance offered by the material being roasted, substantially as and for the purpose set forth.

10. A roasting furnace of the kind referred to, constructed substantially as hereinbefore described with reference to the accompanying drawings for the purpose set forth.

Dated this 14th March, 1913.

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Fig. 1.

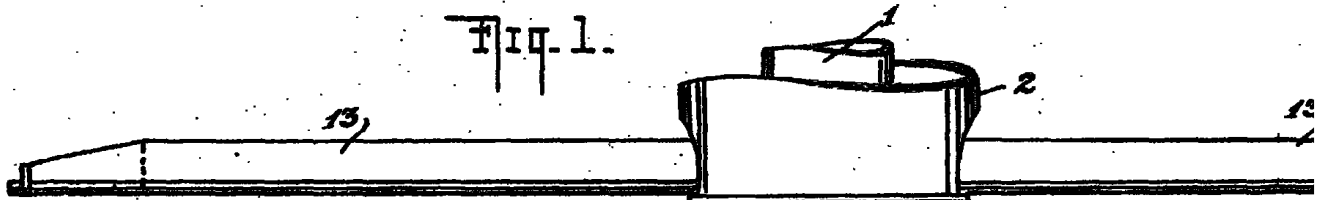


Fig. 3.

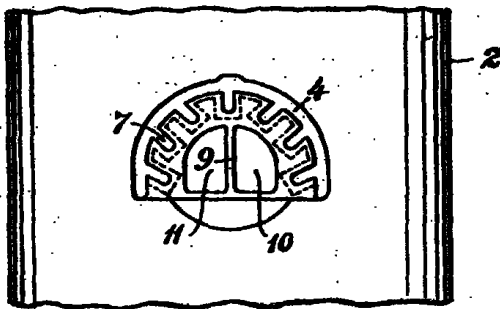


Fig. 2.

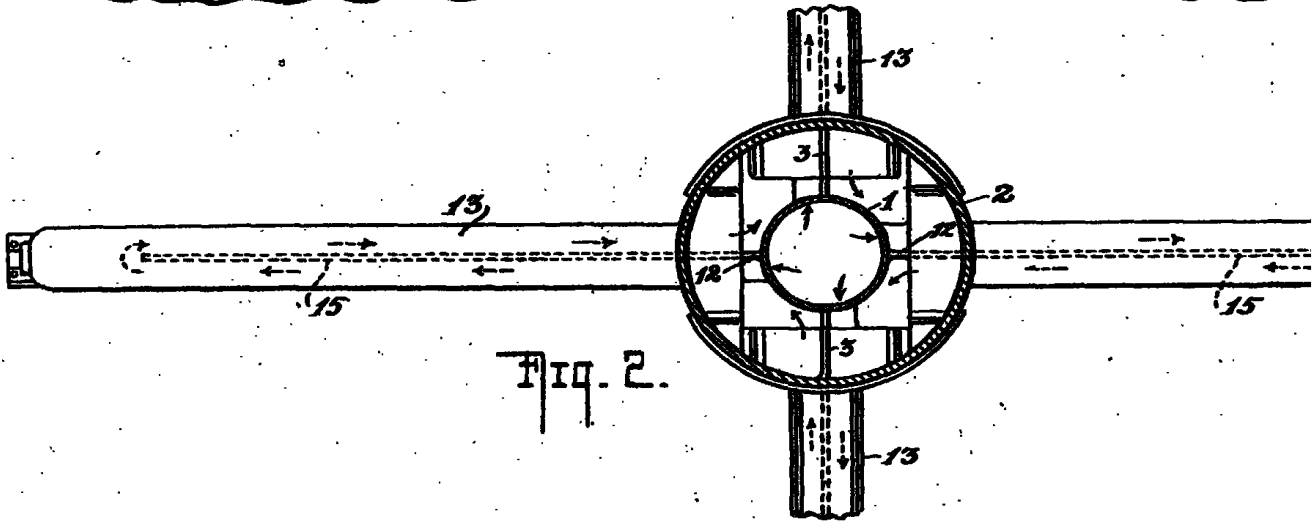
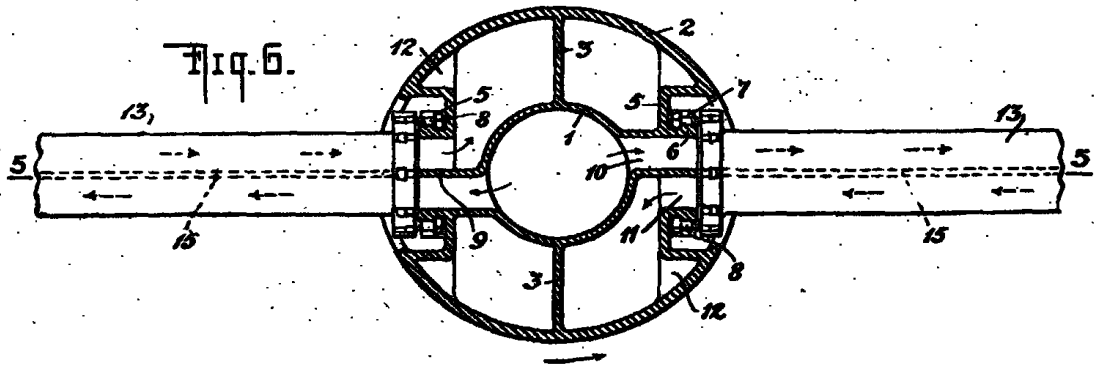


Fig. 6.



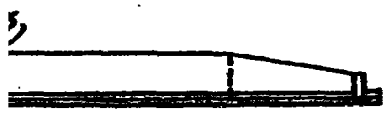


Fig. 4.

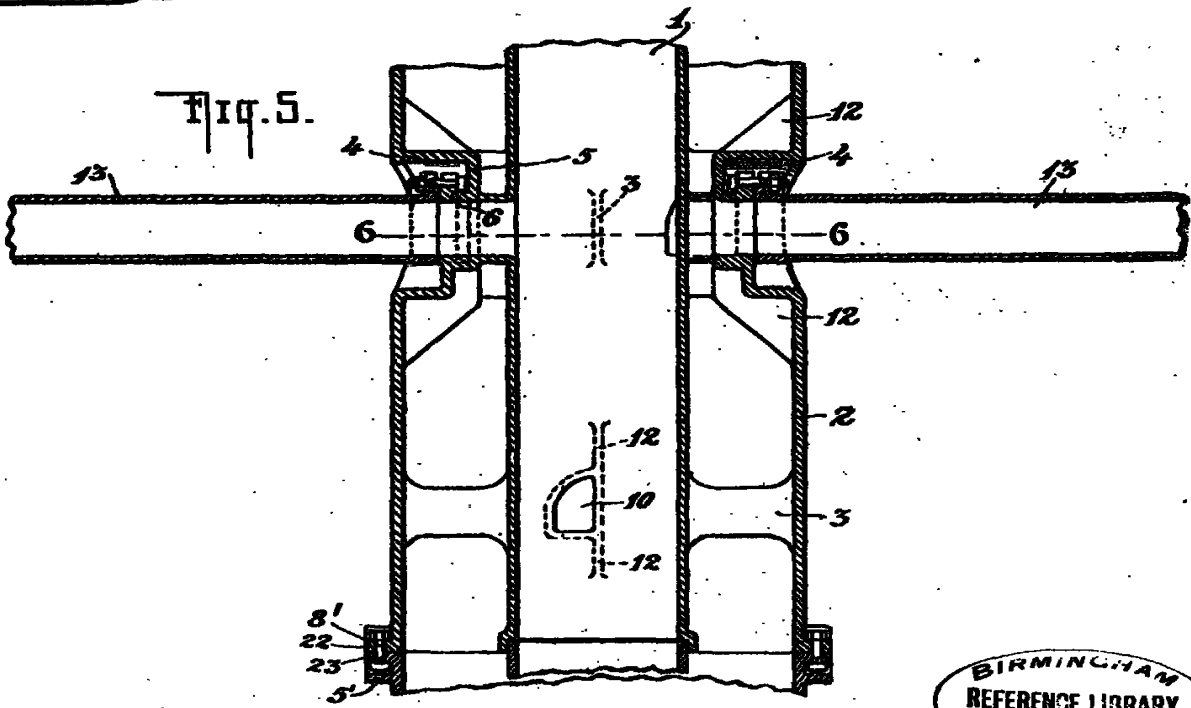
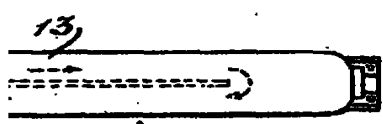
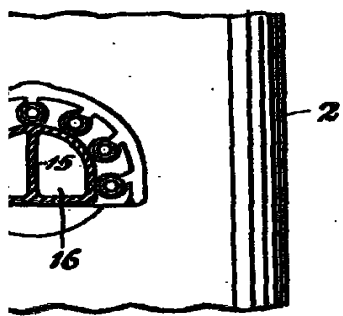


Fig. 5.

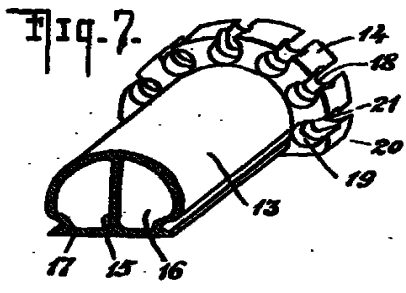


Fig. 7.

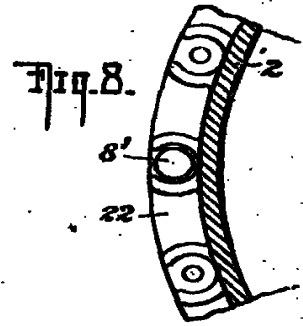


Fig. 8.

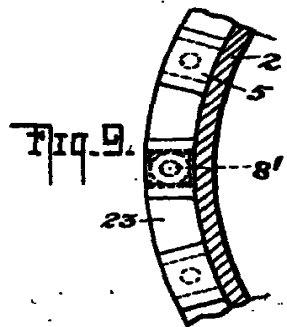


Fig. 9.

