No. 786,599. PATENTED APR. 4, 1905.

C. H. REPATH & F. E. MARCY.

ROASTING FURNACE.

APPLICATION FILED MAY 25, 1904.

3 SHEETS—SHEET 1.

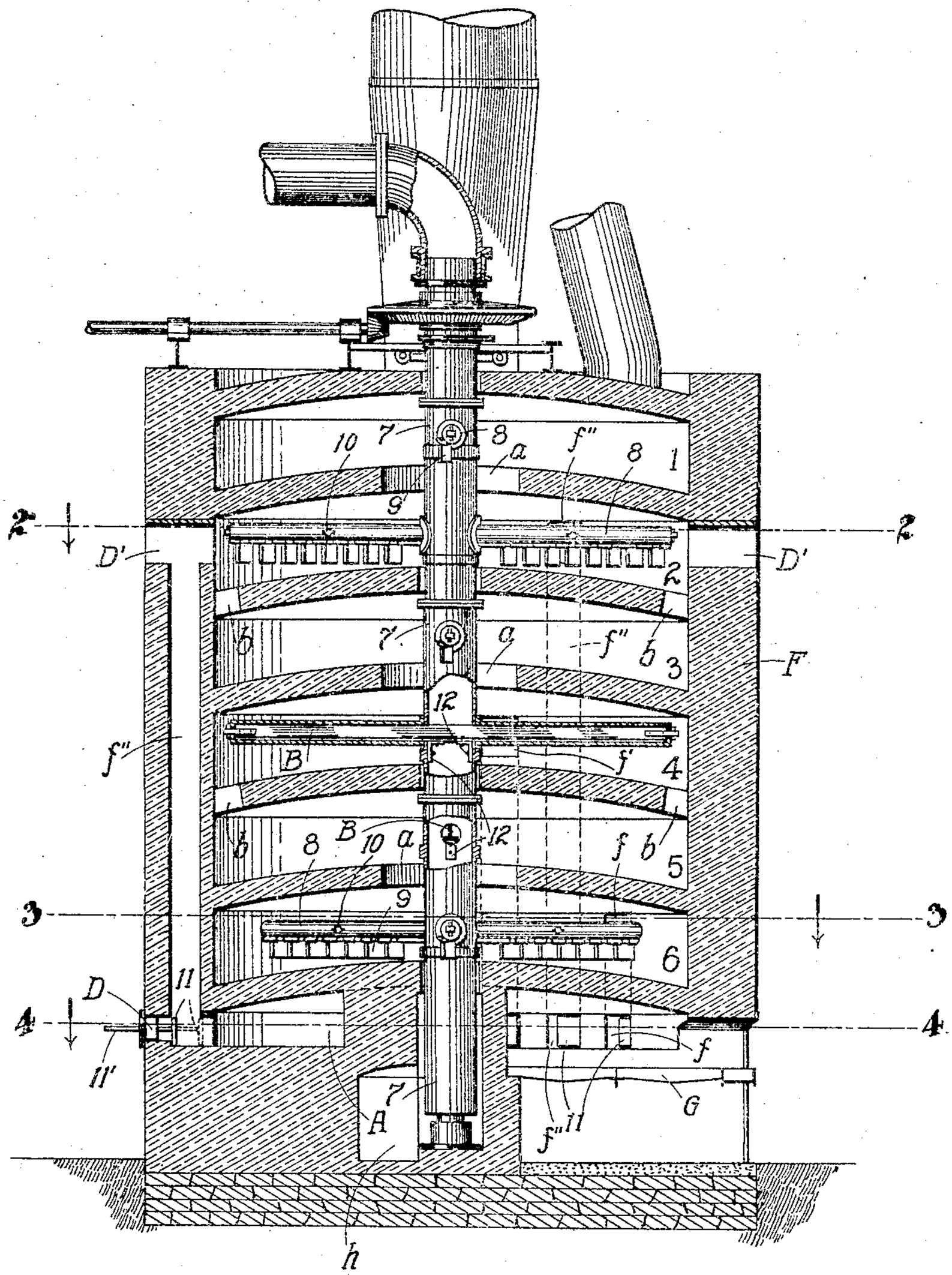

FIG. 1.

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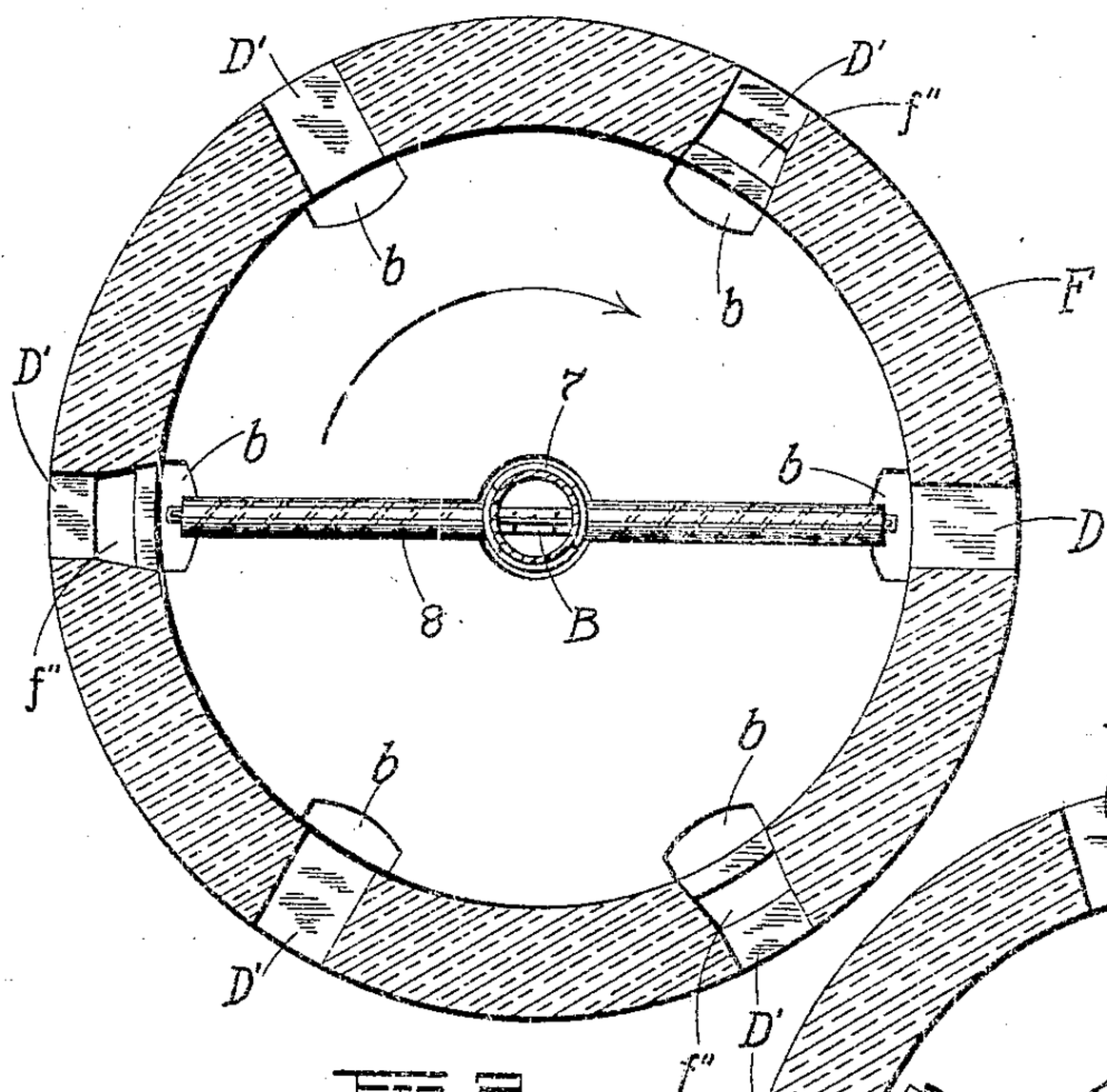

Fig. 2.

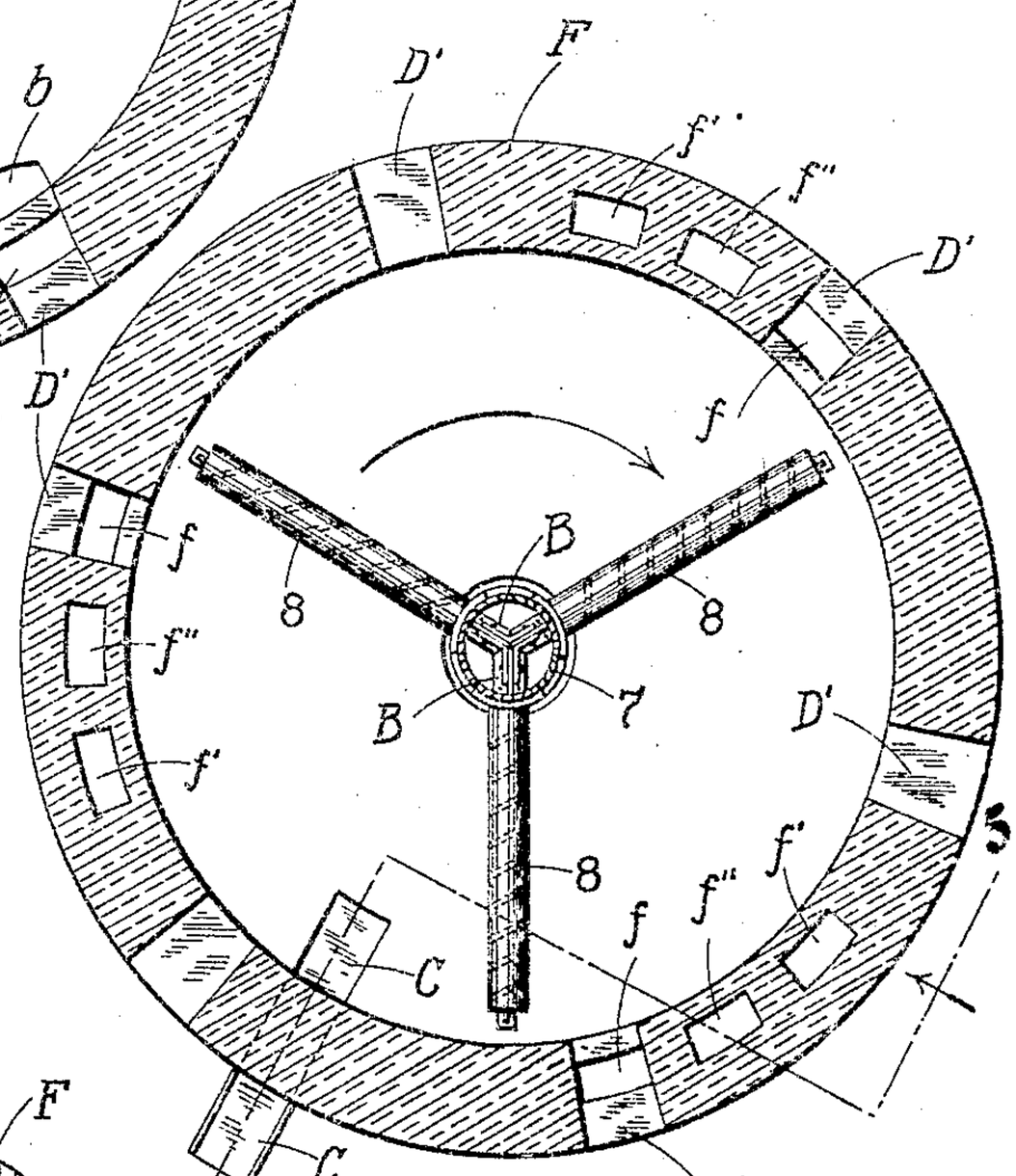

Fig. 3.

Fig. 5.

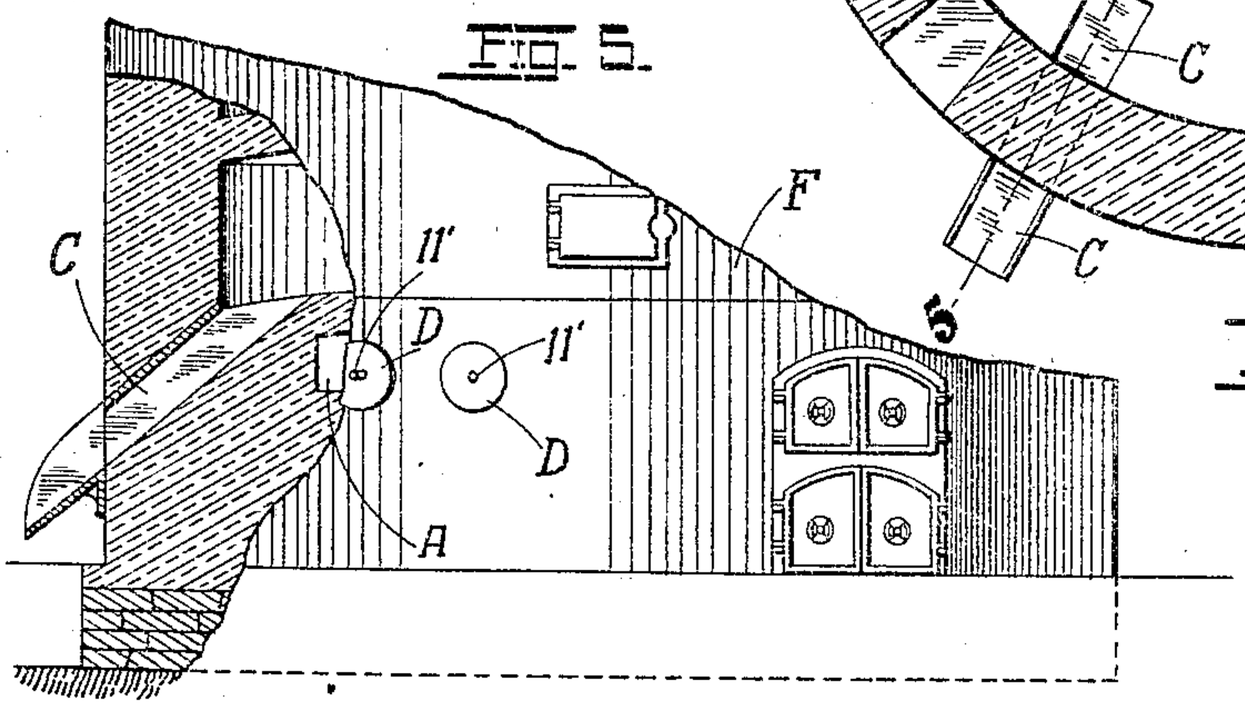

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PHOTO-LITHOGRAPHED BY JACKETT & WILHELMS, LITHO. & PTG. CO. NEW YORK.

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3 SHEETS—SHEET 3.

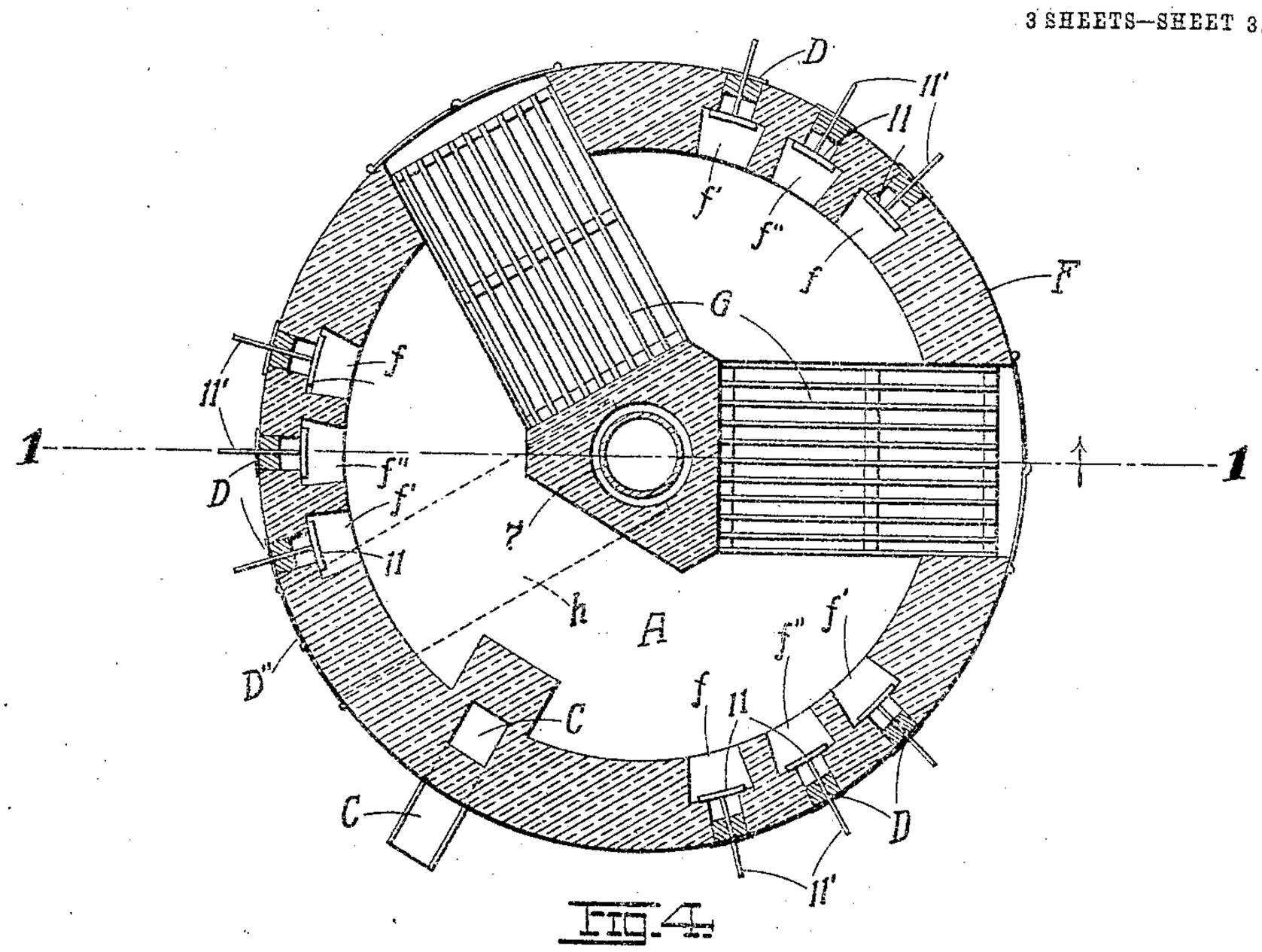

FIG. 4.

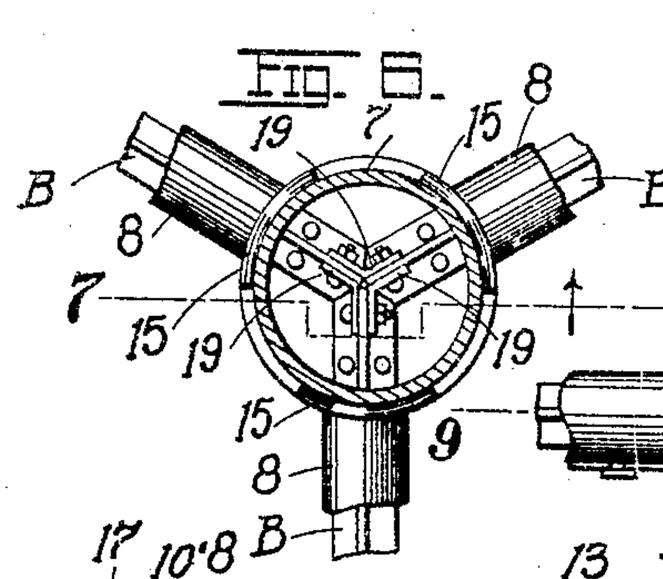

FIG. 6.

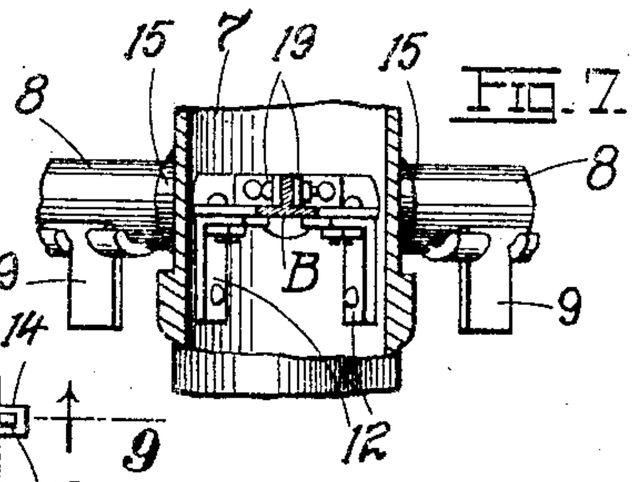

FIG. 7.

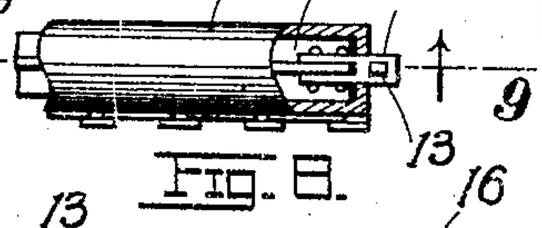

FIG. 8.

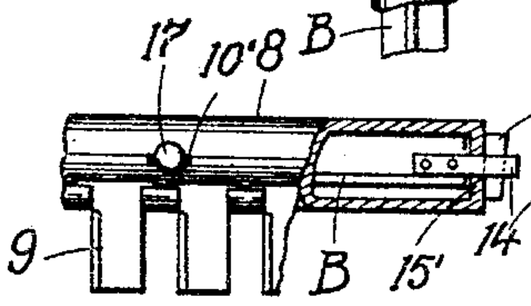

FIG. 9.

FIG. 10.

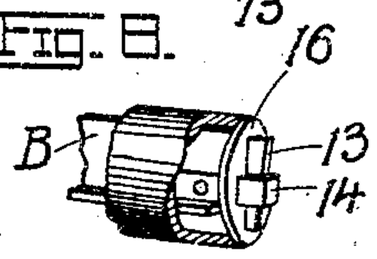

FIG. 11.

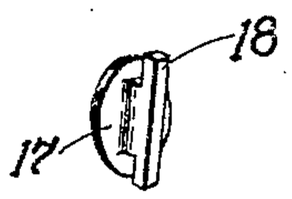

FIG. 12.

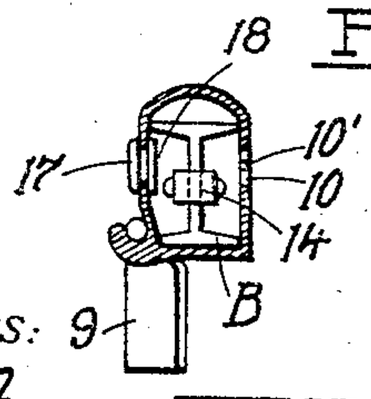

FIG. 13.

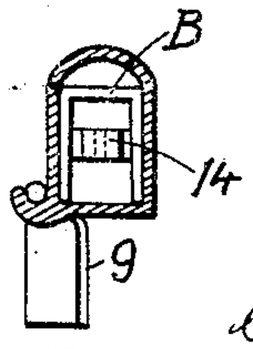

FIG. 14.

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No. 786,599. Patented April 4, 1905

UNITED STATES PATENT OFFICE.

CHARLES H. REPATH AND FRANK E. MARCY, OF NEW YORK, N. Y., ASSIGNORS TO FRANK KLEPETKO, OF NEW YORK, N. Y.

ROASTING-FURNACE.

SPECIFICATION forming part of Letters Patent No. 786,599, dated April 4, 1905.

Application filed May 25, 1904. Serial No. 209,763.

To all whom it may concern:

Be it known that we, CHARLES H. REPATH and FRANK E. MARCY, citizens 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.

Our 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 on line 1 1 of Fig. 4. Fig. 2 is a horizontal section on line 2 2 of Fig. 1. Fig. 3 is a horizontal section on line 3 3 of Fig. 1. Fig. 4 is a horizontal section on line 4 4 of Fig. 1. Fig. 5 is a vertical section on the broken line 5 5 of Fig. 3. Fig. 6 is an enlarged cross-sectional detail on line 3 3 of Fig. 1, showing the meeting ends of the three rabble-arm supporting members within the stirring-shaft. Fig. 7 is a vertical section on line 7 7 of Fig. 6. Fig. 8 is a top plan of the outer end of the rabble-arm. Fig. 9 is a vertical section on line 9 9 of Fig. 8. Fig. 10 is an end view of the arm. Fig. 11 is a perspective showing a modified method of closing the outer end of the rabble-arm. Fig. 12 is a perspective detail of the plug for closing the discharge-orifice of the rabble-arm. Fig. 13 is a cross-section showing an **I**-beam structural member, and Fig. 14 is a cross-section showing a channel-bar structural member.

The object of our invention is to qualify the general construction of the conventional form of McDougall or turret type of furnace as to make the same eminently adapted for the roasting of ores low in sulfur—such as telluride and similar ores, in which the percentage of sulfur is frequently too low to subserve the purpose of a fuel and to which the heat for roasting purposes must be supplied from without. Of course with ores of this description no attempt is made to save the SO_2 gases, these, together with the products of combustion emanating from the combustion-chamber which supplies the heat, escaping through the stack leading from the furnace.

In practicing our invention special provision is made for the economic distribution of the heat, thereby saving fuel and proportionately increasing the capacity and saving over reverberatory or straight-line furnaces.

A further object is to provide a method for cooling the rabble-arms and stirring-shaft by means of air, the air thus utilized for cooling purposes being made available, if desirable, for purposes of supplying oxygen to the charge on any hearth, so that the air fulfils a double purpose. The air supplied to the charge is conveyed thereto through the rabble-arms, though it must not be supposed that this arrangement is to be confined to the treatment of the character of ores above referred to, for the same may be applied in the roasting of any ore where the admission of oxygen to the charge is necessary or desirable. The present invention is therefore directed to the specific distribution of fire-boxes and flues relatively to the hearths of the conventional McDougall type of roasting-furnace, to the controllable distribution of the heat products among the several hearths, to the manner of cooling the rabble-arms and shaft, to the manner of admitting variable quantities of air to the several hearths, and to such other details whose advantages will readily become apparent from a detailed description of the invention, which is as follows:

Referring to the drawings, F represents the furnace, which in the present instance is composed of six superimposed hearths 1, 2, 3, 4, 5, and 6, respectively, 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 *a b* for the passage of the material. Passing centrally through the hearths is the rotatable (preferably) air-cooled stirring-shaft 7, from which radiate the series of hollow rabble-arms 8, extending into the

several hearths and carrying rakes or blades 9, 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. The sixth hearth is fitted with three rabble-arms, which increase the stirring by fifty per cent., at the same time giving the roasting ore a greater travel along the path of the rakes rather than toward the outer edges of the hearth. The calcines are taken out on one side of the furnace in a similar way that the calcines in the standard McDougall drop into a hopper on one side of the hearth. The air for cooling the shaft and arms is taken in at the top of the central shaft either by natural or forced draft from where it passes into the arms, and from there it may be discharged into the hearths through the air-openings 10, so that the air answers the twofold purpose of cooling and furnishing oxygen to the charge. The shaft and arms may be designed large enough to supply the total amount of air for the oxidation of the ore, said amount being of course complementary to that furnished by the combustion-chamber located under the sixth hearth, and which will presently be referred to. It is further proposed to make the arms of such size that they will have a capacity sufficient to furnish a large amount of air for any one hearth—in other words, to be able to supply the greatest amount of air when the oxidation or burning takes place the most rapidly. This will be accomplished by making the arms of ample size and then regulating the size or number of openings or orifices 10, as subsequently to be more fully explained.

In the present furnace under the sixth hearth (counting from the top) there is disposed a fire-chamber A, having two coal-fire grates G G, the heat from which is of course used in the roasting process. The grates are of the ordinary stationary-boiler type, consisting of cast-iron bars; but instead the shaking-grate may be substituted, if desired. It will be noticed that the combustion-chamber A extends under the entire sixth hearth, the gases therefrom being carried out and up through nine separate flues f f' f'', respectively extending to hearths 6, 4, and 2, so that each of these hearths is supplied with three hot-gas flues set one hundred and twenty degrees apart. These flues have a capacity of one and one-half times that of their normal capacity, the normal capacity meaning one-third of the total gas arising from the combustion of one thousand pounds of coal per hour, so that by the aid of dampers 11 a large proportion of hot gases can be applied to any one of the three hearths. To illustrate, we could apply fifty per cent. of the hot gas to No. 6 hearth, thirty-five per cent. to No. 4, and fifteen per cent. to No. 2, or vice versa, or any other combination, depending, of course, upon the actual conditions. The dampers are preferably in the form of plates having round rods 11′ secured to the center thereof. The rod passes through the circular door D, and by pushing the rod in and out it closes or opens the flue, thus acting as a damper. In this particular furnace no attempt is made to apply heat directly to hearths 1 3 5, as they get their heat from the hearths below. We could of course apply the heat to each hearth; but that is not necessary. There are six doors D′ on each hearth, and on hearths 6, 4, and 2 three of the doors lead into the hot-gas flue, so that, if necessary, atmospheric oxygen may be admitted with the hot gas. The driving machinery for the stirring-shaft and rabble-arms is mounted on top of the furnace in order to be readily accessible for oiling and adjustment. The bearings at the bottom of the shaft are reached through a manhole h, closed by door D″, and as the shaft is cooled there is no danger from the heat, even if it is in proximity to the combustion-chamber.

As stated above, the shaft and rabble-arms are air-cooled, the air entering into the shaft from above. To prevent the arms from sagging under their own weight as a result of the heat to which they are exposed, we secure said arms to the stirring-shaft 7 by a method which we will now proceed to describe. Passed transversely through the walls of the shaft in each hearth is a structural steel member B, which may be either a T-bar, I-beam, or angle-bar, said member being secured to the shaft-walls by means of angle-plates 12. The projecting portions of this structural member B thus serve as supporting members for the interchangeable hollow arms 8, the latter being simply slipped over the supporting members B and their ends keyed by a wedge or key 13, the latter being passed through the terminal loop 14 of a reinforcing-strap riveted to the web of the supporting member. It is apparent that after the key is driven up the supporting member B will be in tension and the hollow rabble-arm 8 in compression, the several arms thus becoming rigid members which bear with their basal flanges 15 against the correspondingly-curved peripheral walls of the shaft, and are thus held against the turning which might otherwise result from the twisting movement of the rakes. The hollow arm when slipped over the structural member rests on it the entire length, causing the load to be uniformly distributed. The outer end of the arm may be formed with an inner closing-flange 15′, as shown in the section of the arm, or a separate closing-plate 16 may be interposed between the end of the arm and key, as shown on the modification in Fig. 11. The orifices 10, (preferably located on the sides,) which admit the air through the arms into the charge, may when desired be closed by a plug 17, the latter being provided with an inner diametrically-disposed rib 18, which may be turned into alinement with the opposite re-

cesses 10′ of the orifice to properly insert the plug, after which by giving the plug a turn of ninety degrees, so as to bring the ends of the rib out of alinement with the recesses the plug becomes locked in position. Of course it is removed by a reversal of these operations. The member B is protected from the direct effects of the heat of the furnace, and the rabble-arm being readily replaceable while the furnace is in operation and still hot it is apparent that a decided advantage flows from this construction. With such a construction the capacity of the furnace should not be limited any more than the water-cooled furnace. For the sixth hearth, which contains three rabble-arms, the connection between the structural members B and the stirring-shaft must be somewhat qualified, for the three members must meet at the axis of the shaft. In that case the separate members are secured together by plates 19, bolted to the webs thereof, and in addition they are secured to the shaft by angles 12, as heretofore explained.

Such features of construction as may be shown, but not herein specifically referred to, are either well known in the art or covered by prior patents or other pending applications. It is further to be understood that we do not wish to be limited to the precise details of construction here shown, as these may in a measure be departed from without in any wise affecting the nature or spirit of our invention.

Having described our invention, what we claim is—

1. In a furnace having a plurality of superposed hearths, a fire-chamber located beneath the bottom hearth of the series, and independent flues leading from said fire-chamber to one or more of said hearths, substantially as set forth.

2. In a furnace having a plurality of superposed hearths, a fire-chamber located beneath the bottom hearth of the series, and independent flues located within the walls of the furnace leading from said fire-chamber to a series of said hearths, substantially as set forth.

3. In a furnace having a plurality of superposed hearths, a fire-chamber located within the compass of the peripheral walls of the furnace beneath the bottom hearth of the series, and independent flues located within the walls of the furnace leading from said fire-chamber to a series of said hearths, substantially as set forth.

4. In a furnace having a plurality of superposed hearths, a fire-chamber located beneath the bottom hearth of the series, independent flues leading from said chamber to a series of said hearths, and controlling-dampers for the respective flues, substantially as set forth.

5. In a furnace having a plurality of superposed hearths, a fire-chamber located beneath the bottom hearth of the series, independent flues leading from said chamber to a series of said hearths, controlling-dampers for the respective flues, and means for admitting atmospheric air to the respective hearths, substantially as set forth.

6. In a furnace having a plurality of superposed hearths, a fire-chamber located beneath the bottom hearth, independent flues leading from said chamber to a series of said hearths, a central hollow stirring-shaft passing through the hearths, and hollow arms radiating from said shaft and extending into the several hearths, the arms being provided with openings for delivering atmospheric air into the hearths during the roasting operation, substantially as set forth.

In testimony whereof we affix our signatures in presence of two witnesses.

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FRANK E. MARCY.

Witnesses:
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