No. 793,816. PATENTED JULY 4, 1905.

A. M. BEAM.

ORE TREATING FURNACE.

APPLICATION FILED DEC. 15, 1903. RENEWED NOV. 19, 1904.

5 SHEETS—SHEET 1.

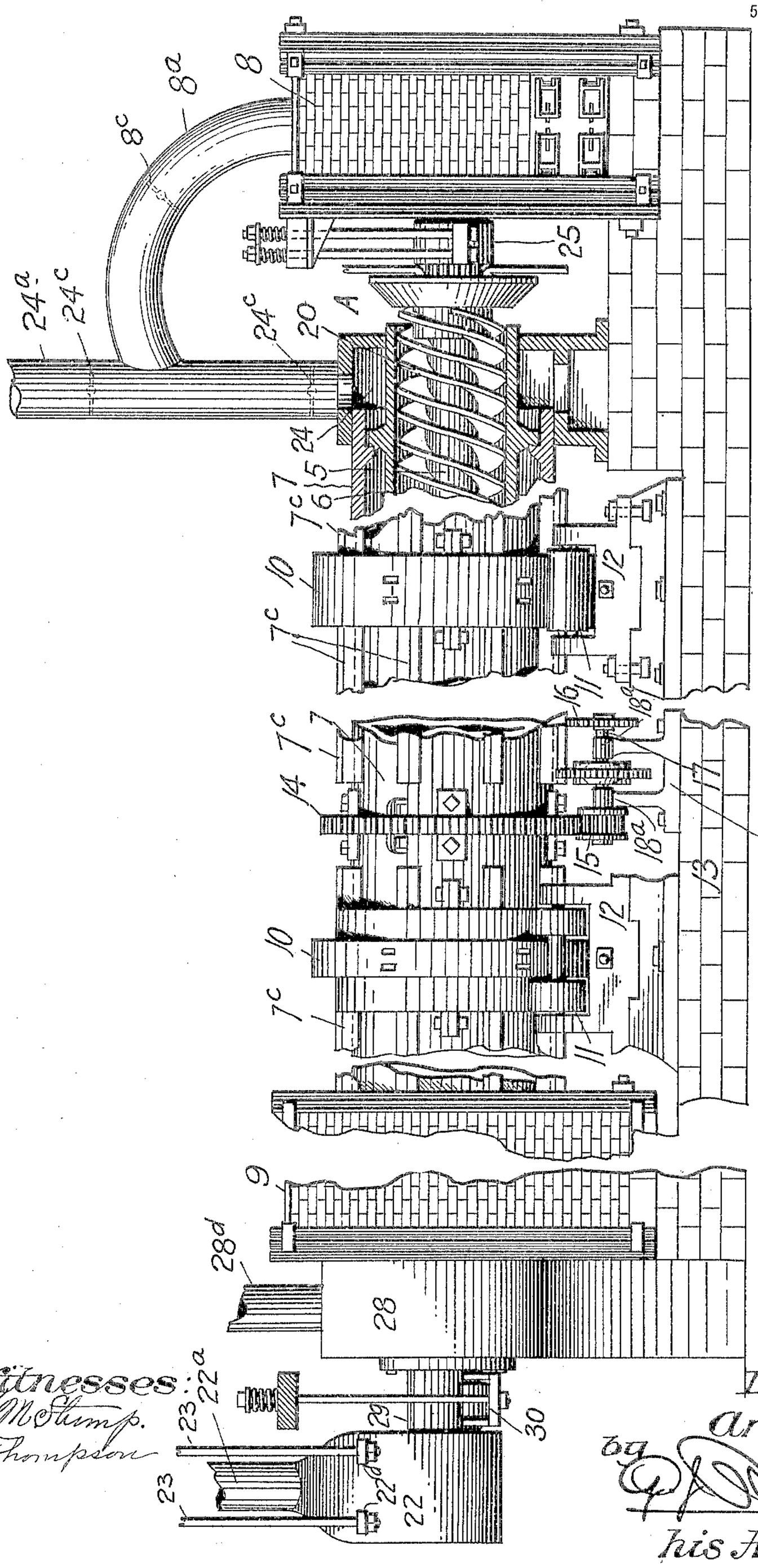

FIG. 1.

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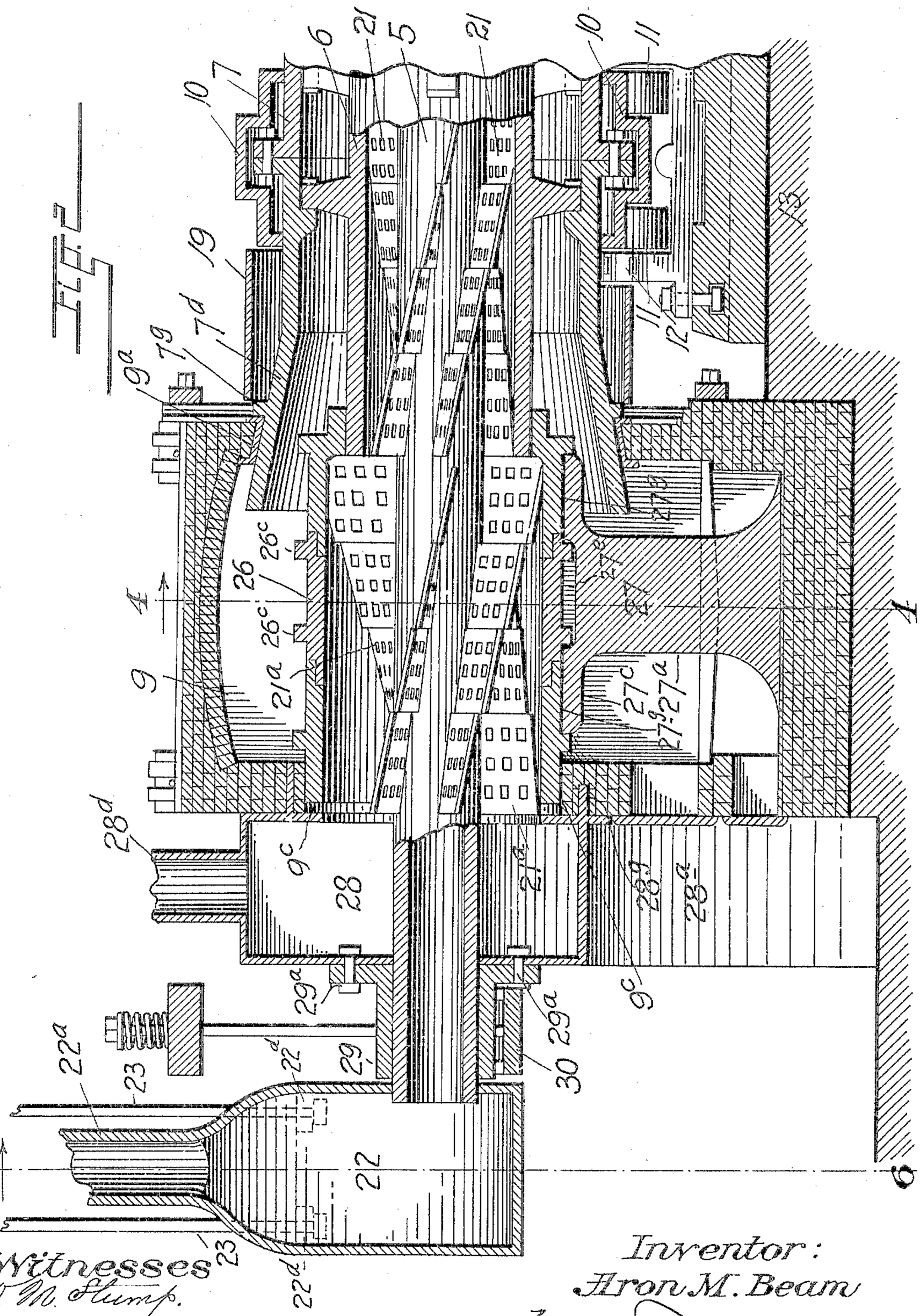
5 SHEETS—SHEET 2.

FIG. 2.



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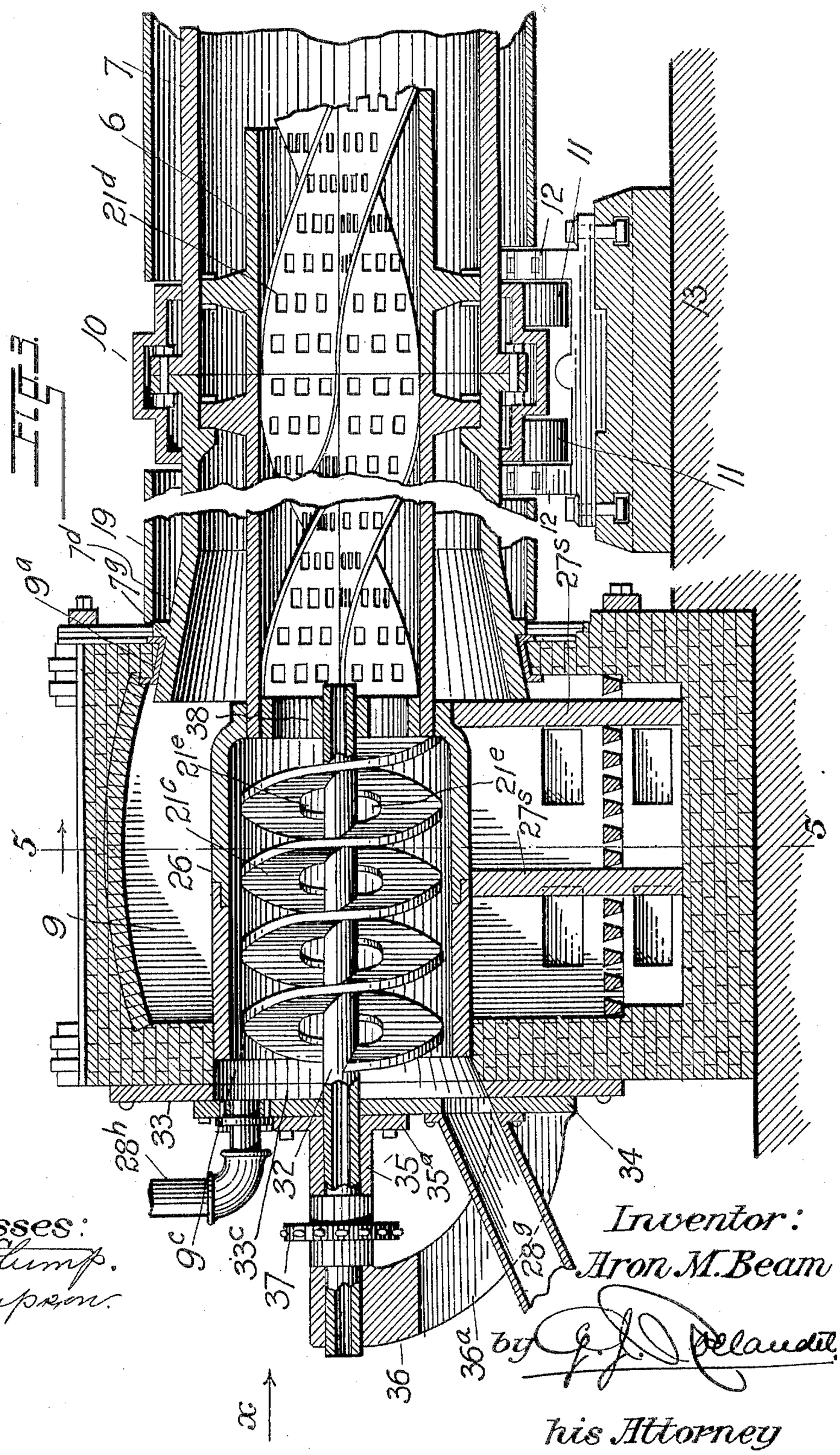
5 SHEETS—SHEET 3.

FIG. 3.



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5 SHEETS—SHEET 4.

FIG. 4.

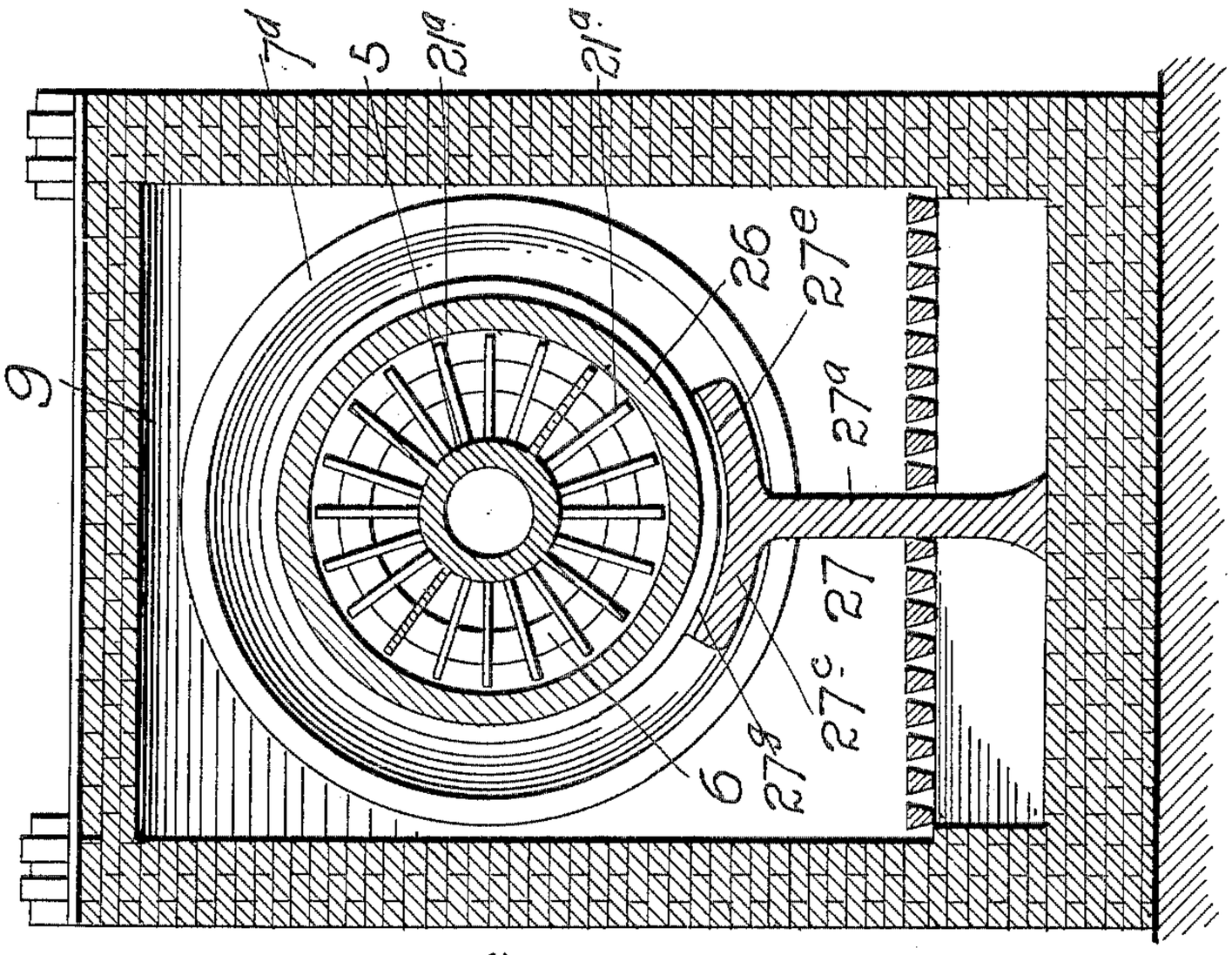
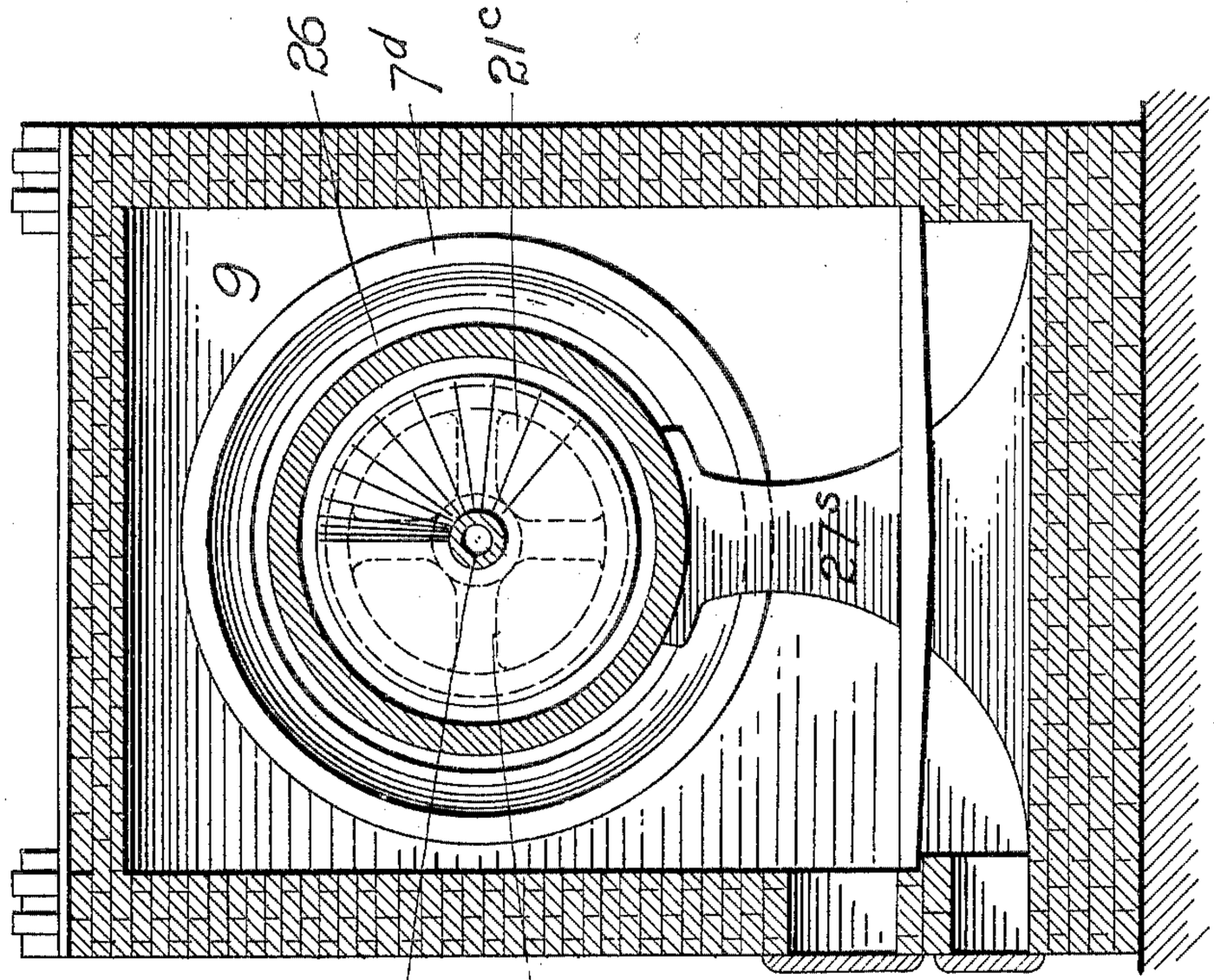


FIG. 5.



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No. 793,816. PATENTED JULY 4, 1905.

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ORE TREATING FURNACE.

APPLICATION FILED DEC. 15, 1903. RENEWED NOV. 19, 1904.

5 SHEETS—SHEET 5.

FIG. 7.

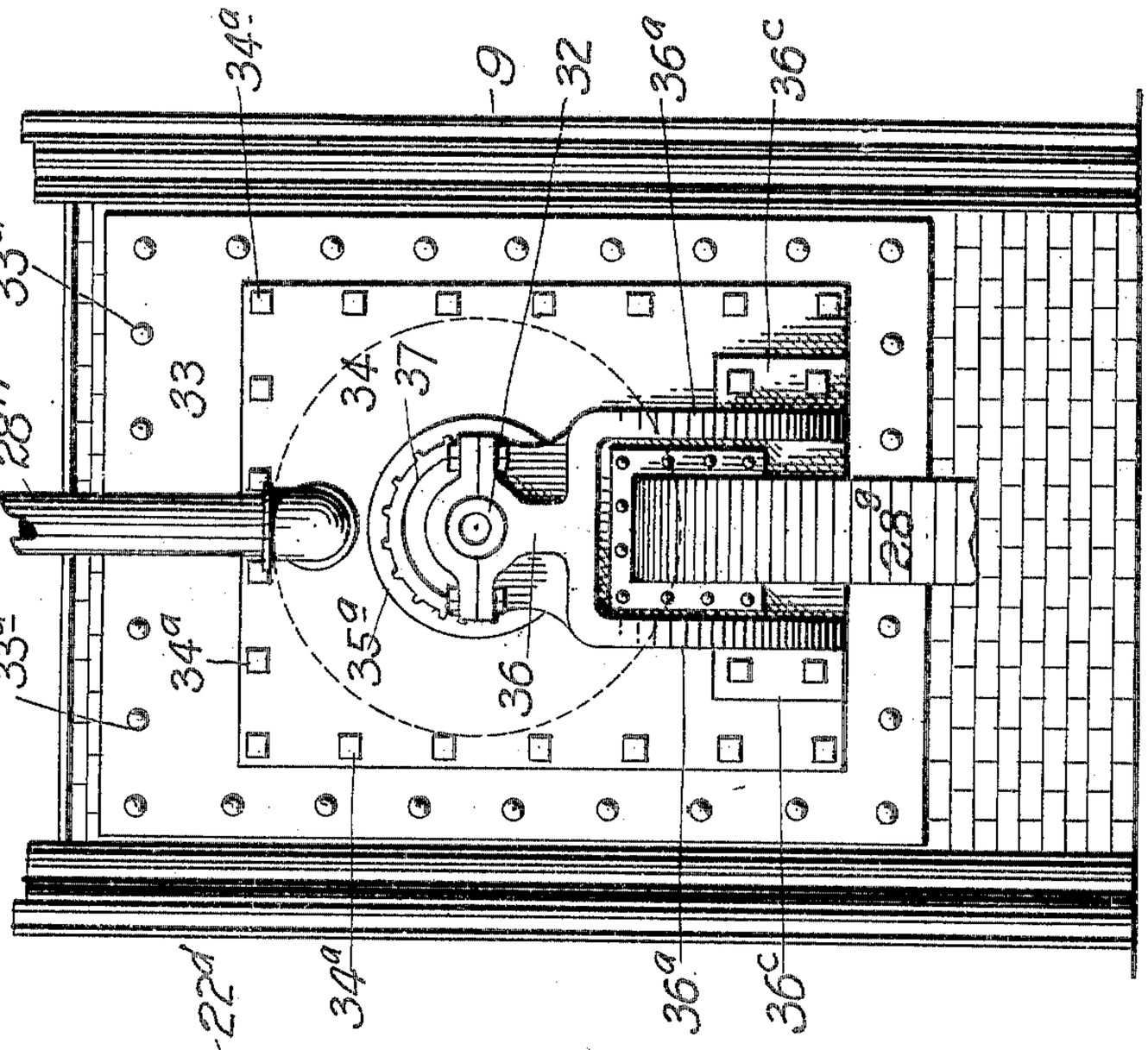
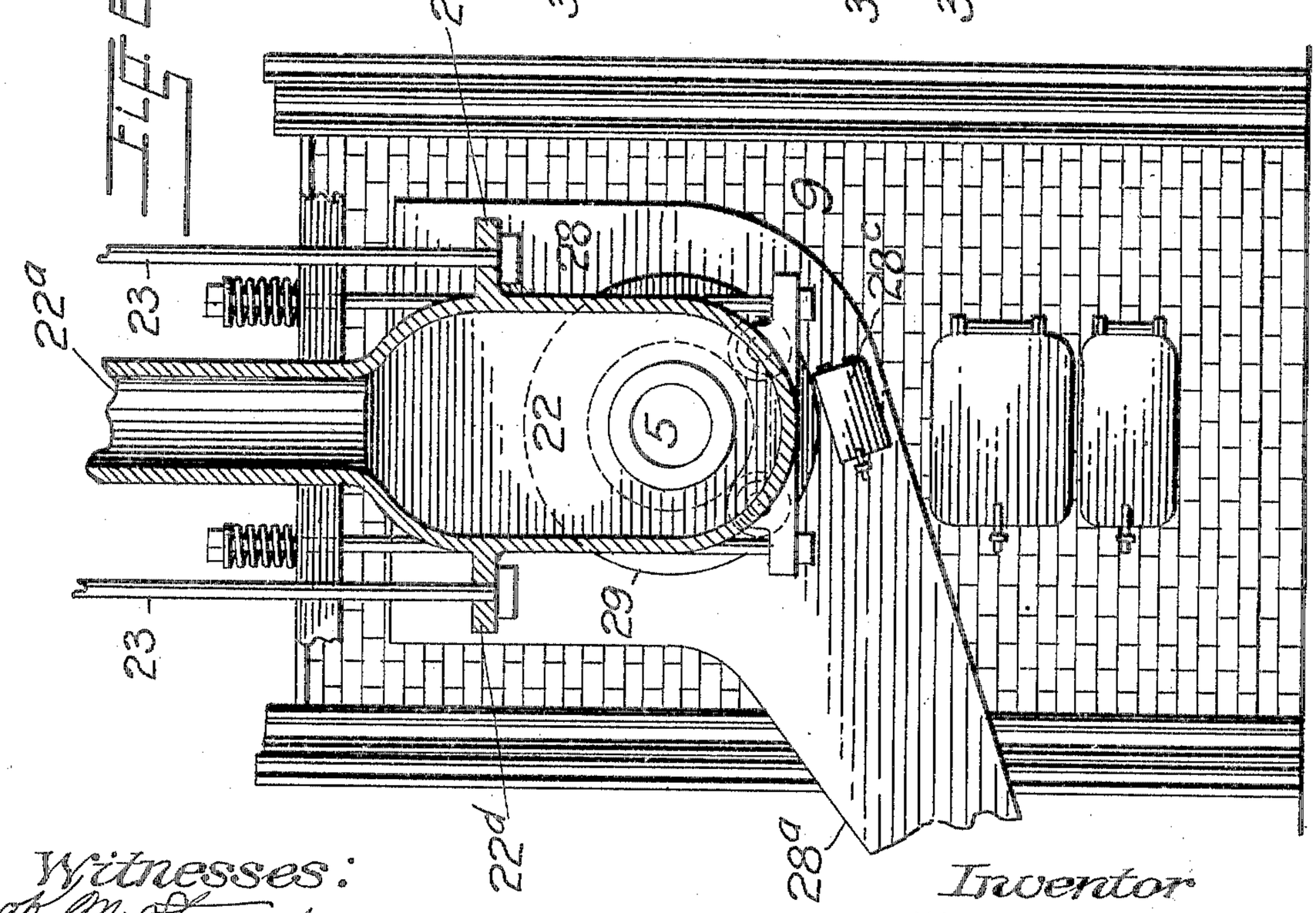


FIG. 6.



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No. 793,816. Patented July 4, 1905.

UNITED STATES PATENT OFFICE.

ARON M. BEAM, OF DENVER, COLORADO.

ORE-TREATING FURNACE.

SPECIFICATION forming part of Letters Patent No. 793,816, dated July 4, 1905.

Application filed December 15, 1903. Renewed November 19, 1904. Serial No. 233,426.

To all whom it may concern:

Be it known that I, ARON M. BEAM, a citizen of the United States, residing at Denver, in the county of Denver and State of Colorado, have invented certain new and useful Improvements in Ore-Treating Furnaces, of which the following is a specification.

My invention relates to improvements in ore-treating furnaces, and more especially in that kind of furnaces in which the ore is fed into and made to travel through a rotating cylinder which is subjected to the products of combustion arising from one or more suitably-located fire-boxes or combustion-chambers. I particularly refer to the furnaces described in United States Patent No. 745,765, granted to me December 1, 1903, in which the products of combustion arising from the grate in a combustion-chamber pass around an ore-cylinder on their way to the stack, and Serial No. 163,573, filed June 29, 1903, and allowed November 17, 1903, (not yet issued at the present time,) in which the products of combustion pass from two combustion-chambers through and around an ore-cylinder on their way to one or more smoke chambers and stacks.

The objects of the improvements described in this specification are, first, to increase the lasting qualities of that portion of my device which, being located inside the fire-box, is subjected to the direct heat of the fire; second, to make it possible to increase the temperature in the combustion-chambers where the ore is being roasted, thereby increasing the capacity of the device, as well as perfecting the results of the process; third, to simplify the construction of the discharge end of my furnace in comparison with the means described in the above-mentioned patents. To these ends I make use of the mechanism illustrated in the accompanying drawings, in which--

Figure 1 represents a side elevation of the device in which two cylindrical flues are employed in heating the ore passing through the ore-chamber. The feed end of the device has been shown in section, while intermediate parts have been broken away for lack of room. The outside casing is omitted. Fig. 2 is an enlarged section through the discharge end of the same; Fig. 3, an enlarged section through the discharge end of the device, showing its construction when but one combustion-flue is used in conjunction with the ore-cylinder, the inner flue in this case being omitted; Fig. 4, a section taken along the line 4 4, Fig. 2, looking in the direction of the arrow; Fig. 5, a section taken along line 5 5, Fig. 3, looking in the direction of the arrow; Fig. 6, a section taken along line 6 6, Fig. 2, looking in the direction of the arrow; and Fig. 7, an end elevation of the device looking in the direction of arrow *x*, Fig. 3.

Similar reference characters refer to similar parts throughout the various views.

The furnace, as illustrated in Figs. 1, 2, 4, and 6, is composed of three concentric cylinders 5, 6, and 7, the outer and middle one of which are detachably secured together, so as to rotate in unison, while the central cylinder is connected to the middle one by a series of integral partitions. The space between the middle cylinder 6 and the central cylinder 5 forms the ore-chamber through which the ore travels while being roasted, while the central cylinder 5 and the annular space between the middle cylinder 6 and the outer cylinder 7 form the flues through which the products of combustion pass from the combustion-chambers to the stacks. The heat necessary for roasting the ores traveling through ore-cylinder 6 is generated in two combustion-chambers 8 and 9, located at either end of the horizontally-located cylinders, one of said furnaces, 9, being connected with the outer flue-cylinder 7, while the other, 8, is connected with the central flue-cylinder 5. The cylinders are composed of several adjoining sections, which are secured together to form one whole, said arrangement facilitating shipment and enabling me to increase and decrease the length, and consequently the capacity, of the furnace without materially having to alter the construction of the entire structure. Secured around the outer cylinder are two or more tread-rings 10, which engage rollers 11, which support the furnace during its rotating movement. Rollers 11 are located on each side of the tread-rings and are mounted in suitable bearings 12, which are secured to the foundation 13 of the device. The furnace

may be rotated by any suitable means, but preferably by means of a gear-wheel 14, secured around the outer cylinder and into which meshes a pinion 15, which receives its movement from a sprocket-wheel 16, mounted on the same shaft 17 with the pinion and rotated by means of a chain, which may extend to any suitable source of power. Shaft 17 is mounted in boxes 18^a on a bed-plate 18, which is secured to the foundation 13.

In order to retain the heat in the cylinder, the constant loss of which would greatly decrease the efficiency of my furnace, I surround them with a casing 19, made, preferably, of Russian iron and secured, by means of small screw-bolts, to ribs 7^c, which being equidistantly located around cylinder 7 are formed integral therewith for strengthening purposes. At the points where the tread-rings and the gearing are located the casing is omitted. The ore is fed into the annular ore-space between the central and the middle cylinders at a point A and is fed into the cylinder toward the discharge end by means of a screw conveyer 20, which connects the central and middle cylinder, being integral with both. Conveyer 20, winding through the ore-space for a limited distance, is succeeded by a series of helicoidally-arranged perforated partitions 21, each of which is placed a slight distance below the preceding one, so that the ore may drop from one to the other through the apertures, thus being thoroughly rabbled while traveling from the feed end to the discharge end of the furnace. Partitions 21, like the helicoidal partition 20 at the feed end, are integral with the central and middle cylinders, winding through the ore-space between the two. The central cylinder 5, extending at the feed end of the furnace beyond the middle cylinder 6, terminates inside the combustion-chamber 8. Its other extremity at the discharge end of the furnace also extends beyond the middle cylinder and terminates in a smoke-chamber 22, provided with a stack 22^a. Smoke-box 22, which surrounds the extremity of cylinder 5, is suspended from any suitable framework by means of rods 23, secured to lugs 22^d, which form part of the box. The outer flue-cylinder 7 terminates at the feed end of the furnace in a smoke-chamber 24. The middle cylinder 6 extends farther through the outer wall of said smoke-chamber, terminating at a point outside and in close proximity to said wall, while the central cylinder 5, as stated heretofore, extends still farther and terminates in the combustion-chamber 8. The end of cylinder 5 projecting beyond the mouth of cylinder 6, between said cylinder and the combustion-chamber, is supported by means of a roller-bearing 25, which is flexibly connected with the wall of the combustion-chamber.

Smoke-chamber 24 is provided at its top with a stack 24^a, having suitably-located dampers 24^c, and connected with combustion-chamber 8 by means of a pipe 8^a, also provided with a damper 8^c, the object being to enable the operator by proper manipulation of the dampers to direct the smoke and gases from the combustion-chamber into the stack or to prevent the smoke from smoke-chamber 24 from passing through the stack, as may be desired. The opposite extremity of the outer flue-cylinder 7 at the discharge end of the furnace is provided with an integral outwardly-flaring bell-shaped mouthpiece 7^d, which enters into and terminates in the combustion-chamber 9, the hole in the wall of said chamber through which the mouthpiece passes having been provided with a metal lining 9^a. To prevent further inward movement of the end of flue 7, same is provided with an integral ring 7^g, which rests against the outside surface of the wall of chamber 9. The bell-shaped mouthpiece of cylinder 7 greatly aids in allowing the gases, smoke, and flames which arise from the grates in the combustion-chamber 9 to quickly enter the cylinder. Located inside combustion-chamber 9 and concentric to cylinder 5, which on its way to smoke-chamber 22 passes through the combustion-chamber, is a cylinder 26, one end of which rests inside a cylindrical opening 9^e in the wall of the chamber 9, while its other extremity enters into and terminates in the bell-shaped mouth 7^d of cylinder 7 at a point which is approximately in line with the outer surface of the wall of the combustion-chamber.

Cylinder 26, which is made of fire-clay or other non-combustible material, is preferably composed of a plurality of sections which are halved into each other by sockets and tenons. Its free or innermost extremity has been reduced diametrically to correspond with the outside diameter of cylinder 6, which projects into and terminates in cylinder 26. Cylinder 26 is supported by a standard 27, which is erected on the floor of the cumbustion-chamber and which, being also made of fire-clay, is composed of a vertical wall 27^a, cemented or otherwise firmly secured to the floor of the combustion-chamber, and which supports a segmentally-shaped top plate 27^c, which being integral with the upright extends on both sides thereof and conforms with the outside circumference of cylinder 26. It is essential that cylinder 6 should project inside of the fire-clay cylinder for but a short distance, not exceeding the thickness of the wall of the combustion-chamber, so that at no time it will be subjected to the direct heat arising from the fire in the combustion-chamber. A recess 27^e, cut in the upper surface of plate 27^c and extending along its entire width, divides said surface into two contacting surfaces 27^g, which engage the outer surface of cylinder 26 when the latter is in place. Four rings 26^c, which are formed integral to and around cylinder 26, are located one on each side of

the contacting surfaces 27^g to prevent longitudinal movement of the cylinder. The part of cylinder 5 extending through the fire-clay cylinder 6 has been provided with a series of helicoidally-arranged perforated wings 21^a, similar in form and arrangement to the partitions 21, which connect cylinders 5 and 6, length of said wings being such in relation to the inside diameter of cylinder 26 that when cylinder 5 is made to revolve they will move in close proximity to the inner periphery of the cylinder. The ore passing out of ore-cylinder 6 into cylinder 26 travels through the latter, impelled by the revolving helicoidal wings 21^a toward the opening 9^c in the wall of the combustion-chamber, through which it drops into a discharge-chamber 28, which adjoining the wall of the combustion-chamber extends around the discharge-openings 9. Discharge-chamber 28 terminates into a downwardly-extending chute 28^a and is supported by means of a flanged step 28^g, which projects into the wall of the combustion-chamber. A door 28^c may be utilized for the taking of samples, while a stack 28^d at the top of the discharge-chamber provides an outlet for the fumes and gases which enter with the roasted ore. Central flue-cylinder 5, extending beyond the combustion-chamber, passes through discharge-hood 28 and is supported at a point in between chamber 28 and the smoke-box 22, inside of which cylinder 5 terminates, by a flanged cylindrical bearing 29, which is secured to the side of the discharge-chamber by means of rivets or bolts 29^a. The cylindrical portion of bearing 29 is furthermore supported by a roller-bearing 30, which is flexibly suspended from any suitable support.

Figs. 3, 5, and 7 illustrate the simpler form of my furnace, in which the central flue-cylinder is omitted. The partitions 21, which in the furnace hereinabove described connecting the inner and middle cylinders, are in the modified form replaced by continuous perforated spiral partitions 21^d, which extend through the ore-cylinder. There being no central flue-cylinder, the combustion-chamber 8, as well as the smoke-chamber 22, are naturally omitted, while a discharge-chute 28^g and a pipe 28^h are substituted for the discharge-chamber 28, with chute 28^a and stack 28^d, used in the double-flue furnace. The absence of the rotating central cylinder inside the fire-proof cylinder makes it essential that other means be provided to take the place of the helicoidally-arranged wings 21^a, which in the double-flue furnace conduct the ore through the cylinder toward the discharge-opening. To this end I have provided a shaft 32, which passing through the center of cylinder 26 bears a conveyer 21^c, composed of a single or double screw blade which extends the entire length of the cylinder. To prevent accumulation of heat in the screw, same is provided with a number of apertures 21^e. The outer extremities of the shaft having been placed in bearings, same may be rotated by any suitable means independent from the rotating furnace. Placed against the outside of the combustion-chamber and surrounding the discharge-opening 9^c is a metal plate 33, secured to the wall of the chamber by means of bolts or rivets 33^a, and provided with an opening 33^c, corresponding to the discharge-opening 9^c. Opening 33^c in plate 33 is covered by means of a second plate 34, which is secured to the first-mentioned plate by means of bolts 34^a and which in addition to the above-mentioned discharge-chute 28^g and fume-outlet pipe 28^h carries bearings 35 and 36 for the support of shaft 32. This arrangement enables me to gain admission to cylinder 26 at any time by loosening bolts 34^a and removing plate 34, together with discharge-chute, fume-outlet, bearings, and conveyer. Bearing 35 is cylindrical in shape and is provided with a flange 35^a, by means of which it is fastened to plate 34. The outside bearing 36 is supported by a forked bracket 36^a, the legs of which are curved toward the plate 33 and straddle the discharge-chute 28^g. They are provided with flanges 36^c, with which the bracket is secured to the plate. Located in between the two bearings 35 and 36 is a sprocket-wheel 37, which is secured around shaft 32. A chain leading from any convenient source of power and engaging the sprocket-wheel affords means for rotating the conveyer-shaft 32 in its bearings. The inner extremity of shaft 32 is supported in a bearing 38, consisting of two concentric rings connected by two or more radial arms, the outer one of said rings fitting and secured in the orifice of the ore-cylinder 6, while the inner ring fits around shaft 32. Shaft 32 is hollow and preferably composed of a piece of gas-pipe to which the screw conveyer is secured, which enables me to blow oxygen into the ore-space whenever it is desired by connecting the end of shaft 32, projecting beyond bearing 36 with a conveniently-located air compressor or blower. The air or steam being forced through the ore-chamber has a tendency to lift the ore as it drops spray-like through the apertures in the partitions, thus surrounding every particle and furnishing the oxygen necessary for oxidizing and roasting the ores.

It will be observed that in the furnace illustrated in Fig. 3 the standard 27, which in the first-described form runs lengthwise of the cylinder, has been replaced by two independent supports 27^s, running crosswise of the cylinder. The grate-bars, which in the double-flue furnace ran parallel with the axis of the cylinder, run in the single-flue furnace at right angles to the same, and the location of the fire and ash doors has been changed accordingly. This arrangement, although in principle the same as the arrangement shown

in Fig. 2, is made necessary on account of the difference in construction of the two furnaces, the location of the plates 33 and 34 being, as will be seen, obstructive to the location of the fire and ash doors at that side of the furnace. The same construction, however, may be employed in double-flue cylinder-furnaces, if so desired.

Having thus explained the construction of my invention, its operation will be readily understood. In the first-described form of furnace the ore is roasted by the products of combustion passing from the combustion-chambers through the central and outer flue-cylinders, the former of which passes through the ore-chamber, while the latter surrounds it, the three cylinders being rotated by means of the gear-driving mechanism. The ore is fed into the ore-cylinder from a suitably-located ore-hopper at the point A, as heretofore described, and by means of conveying-screw 20 is conveyed to the perforated partitions 21, which on account of their helicoidal arrangement compel the ore to slowly travel to the end of the ore-cylinder, where it drops into the stationary fireproof cylinder 26, through which it is conveyed, by means of the helicoidally-arranged wings on the inner flue-cylinder, to the discharge-chamber 28, and from where, through the discharge-chute 28[a], it falls into the ore-cars or other suitable receptacles.

The operation of the furnace built according to the simplified manner illustrated in Fig. 3 is practically the same as is just explained, the principal difference being that the products of combustion do not pass through the ore-chamber, but only around the same and that the conveyer which carries the ore through the fireproof cylinder is rotated independently from the rotating furnace.

In the furnaces described in the beforementioned patents the great difficulty was encountered that the portion of the ore-cylinder which extends into the combustion-chamber and in consequence subjected to the direct heat from the furnace would in a very short time be destroyed, no matter of what kind of metal it was constructed and even when the temperature in the furnace remained moderate throughout the operation.

By employing an independent non-combustible stationary conduit to convey the ore through the combustion-chamber to the discharge-chute I not only have done away with the constant and costly repairing and replacing of destroyed and consumed portions of the ore-cylinder and adjacent parts, but I have made it possible to run my furnace at a heat three times as great as could be used in the old construction, where the maximum heat never was allowed to exceed 400°, while in the new construction I can run it up to 1,200° without doing serious damage to exposed parts.

Having thus described my invention, what I claim is—

1. In an ore-treating furnace, a rotary flue-cylinder, one end of which connects with a smoke-stack, while its other extremity projects into a combustion-chamber, a stationary conduit extending through said combustion-chamber, an ore-cylinder concentrically located inside and attached to said rotary flue-cylinder, its extremity extending into and being covered by said stationary conduit, suitable means for feeding ore into and through said ore-cylinder into said conduit and means for conveying the ore through said conduit, substantially as described.

2. In an ore-treating furnace, a rotary flue-cylinder connected at one end with a smoke-stack, while its opposite extremity terminates inside a combustion-chamber, a stationary conduit extending through said combustion-chamber in concentric relation to said flue-cylinder, one of its ends extending into a discharge-opening in the wall of said combustion-chamber, an ore-cylinder concentrically located inside and attached to said rotary flue-cylinder its extremity extending into and being covered by said conduit, suitable means for feeding ore into and through said ore-cylinder and means for conveying the ore through said conduit, substantially as described.

3. In an ore-treating furnace, a rotary flue-cylinder connected at one end with a smoke-stack, while its opposite extremity terminates inside a combustion-chamber, a stationary conduit made of refractory material and composed of a plurality of sections extending through said combustion-chamber in concentric relation to said flue-cylinder, one of its ends extending into a discharge-opening in the wall of said combustion-chamber, suitable means for supporting said conduit, an ore-cylinder, concentrically located inside and attached to said rotary flue-cylinder its end extending into and being covered by said conduit, a discharge-chamber surrounding the discharge-opening in said combustion-chamber, suitable means for feeding ore into and through said ore-cylinder and means for conveying the ore through said conduit into said discharge-chamber, substantially as described.

4. In an ore-treating furnace, a rotary flue-cylinder connected with a stack at one end, and having a bell-shaped extension projecting into a combustion-chamber, a conduit made of non-combustible material extending through said combustion-chamber, and communicating with an ore-receptacle, standards erected in said combustion-chamber, supporting said conduit, an ore-cylinder concentrically located inside and attached to said flue-cylinder and terminating inside said conduit, means for preventing longitudinal movement of said conduit, suitable means for feeding

ore into and through said ore-cylinder and means for conveying the ore through said conduit and into said ore-receptacle, substantially as described.

5. In an ore-treating furnace a rotary flue-cylinder connected with a stack at one end, its opposite extremity projecting into a combustion-chamber, a stationary conduit composed of a plurality of sections extending through said combustion-chamber, one end extending into a discharge-opening in the wall of said combustion-chamber, one or more standards made of non-combustible material, erected in said combustion-chamber, supporting said conduit, projections on the sections of said conduit, engaging said standards, an ore-cylinder concentrically located inside and attached to said flue-cylinder and extending into said conduit, means for conveying ore through said ore-cylinder and into said conduit and means for conveying the ore through said conduit, substantially as described.

6. In an ore-treating furnace, a rotary flue-cylinder, connected with a stack at one end, its other extremity extending into a combustion-chamber, a circular, stationary conduit, extending through said combustion-chamber in concentric relation to said flue-cylinder, one end of said conduit extending into a discharge-opening in the side of the combustion-chamber, suitable means for supporting said conduit, an ore-cylinder concentrically located inside and attached to said flue-cylinder and projecting into said stationary conduit, means for conveying the ore through said ore-cylinder and into said conduit, a second flue-cylinder concentrically located inside and attached to said ore-cylinder and extending through said conduit, its ends projecting into a second combustion-chamber and into a smoke-chamber and suitable means for conveying the ore through said conduit, substantially as described.

7. In an ore-treating furnace a rotary flue-cylinder, connected with a stack at one end, its other extremity extending into a combustion-chamber, a circular, stationary conduit, extending through said combustion-chamber in concentric relation to said flue-cylinder, one end of said conduit extending into a discharge-opening in the side of the combustion-chamber, suitable means for supporting said conduit, an ore-cylinder, concentrically located inside and attached to said flue-cylinder and projecting into said stationary conduit, means for conveying the ore through said ore-cylinder and into said conduit, a second flue-cylinder concentrically located inside and attached to said ore-cylinder and extending through said conduit, its ends projecting into a second combustion-chamber and into a smoke-chamber, and a series of helicoidally-arranged wings secured to the portion of said central cylinder extending through said conduit, substantially as described.

8. In an ore-treating furnace, a horizontal, rotary flue-cylinder connected with a stack at one end, its opposite extremity projecting through the wall of and into a combustion-chamber, provided with a discharge-opening in its opposite side, a circular conduit composed of a plurality of sections, made of non-combustible material projecting into said discharge-opening and extending into the combustion-chamber, an ore-cylinder concentrically located inside and attached to said flue-cylinder, communicating with said conduit, suitable means for supporting said conduit, means for conveying the ore through said ore-cylinder into said conduit, a discharge-chamber adjacent to said combustion-chamber and surrounding said discharge-opening, a second flue-cylinder concentrically located inside and connected with said ore-cylinder, one of the ends of said central flue-cylinder being connected with a combustion-chamber, while its other extremity, passing through said conduit and through said discharge-chamber, terminates in a suspended, stack-supporting smoke-chamber, means for supporting said central flue-cylinder, means for conveying the ore through the ore-cylinder into the non-combustible conduit and means on said central flue-cylinder for conveying the ore through said conduit into the discharge-chamber, substantially as described.

9. In an ore-treating furnace, a horizontal rotary flue-cylinder, connected at one end with a stack and having a bell-shaped extremity projecting into a combustion-chamber, a circular conduit made of non-combustible material, extending through said combustion-chamber in concentric relation to said flue-cylinder, one end of said conduit projecting into a discharge-opening in the side of said combustion-chamber, said conduit being composed of a plurality of sections detachably secured together, one or more standards erected in said combustion-chamber, supporting said conduit, rings on said conduit engaging said standards, a discharge-chamber, secured adjacent to the wall of the combustion-chamber, surrounding the discharge-opening, said discharge-chamber having a fume-outlet, discharge-chute and sampling-door, a second flue-cylinder, concentrically located inside and attached to said ore-cylinder, one end of said central flue-cylinder communicating with a combustion-chamber, its other end projecting through said non-combustible conduit and through said discharge-chamber and terminating inside a suspended smoke-chamber, a bearing attached to said discharge-chamber, supporting the central flue-cylinder, a second bearing supporting said first bearing, suitable means for conveying the ore through the ore-cylinder into the conduit, and helicoidally-arranged perforated wings on the part of said central flue-cylinder extending through said conduit, substantially as described.

10. In an ore-treating furnace, a rotary flue-cylinder, connected at one end with a stack, its other extremity projecting into a combustion-chamber, a stationary conduit extending through said combustion-chamber and communicating with a discharge-chute and with a fume-outlet on the outside of said combustion-chamber, suitable means for supporting said conduit, an ore-cylinder concentrically located inside and attached to said flue-cylinder its extremity terminating inside and being covered by the adjacent end of the conduit, suitable means for conveying the ore through said ore-cylinder into the conduit and means for conveying the ore through said conduit into said discharge-chute, substantially as described.

11. In an ore-treating furnace, a rotary flue-cylinder, connected at one end with a stack, its other extremity projecting into a combustion-chamber, a stationary conduit extending through said combustion-chamber and communicating with a discharge-chute and with a fume-outlet on the outside of said combustion-chamber, suitable means for supporting said conduit, an ore-cylinder concentrically located inside and attached to said flue-cylinder its end extending into and being covered by the adjacent end of the conduit, suitable means for conveying the ore through said ore-cylinder into the conduit, a screw conveyer located inside said conduit and suitable means for rotating said conveyer, substantially as described.

12. In an ore-treating furnace, a rotary flue-cylinder, connected at one end with a stack, its other extremity projecting into a combustion-chamber, a conduit extending through said combustion-chamber and communicating with a discharge-chute and with a fume-outlet on the outside of said combustion-chamber, suitable means for supporting said conduit, an ore-cylinder concentrically located inside and attached to said flue-cylinder, suitable means for conveying the ore through said ore-cylinder into the conduit, a hollow shaft extending through said conduit, its ends being supported in bearings inside and outside said combustion-chamber, a perforated screw conveyer mounted on said shaft and suitable means for rotating said shaft, substantially as described.

13. In an ore-treating furnace, a rotary flue-cylinder connected at one end to a stack, its other extremity being bell-shaped and extending into a combustion-chamber, having a discharge-opening in the wall opposite the mouth of said flue-cylinder, a circular conduit extending inside said combustion-chamber in concentric relation to said flue-cylinder, one end of said conduit extending inside said discharge-opening, a suitable plate secured to said combustion-chamber, in front of said opening, a discharge-chute and a fume-outlet mounted on and opening into said plate, an ore-cylinder concentrically located inside and attached to said flue-cylinder and terminating inside said conduit, a shaft extending through said conduit and supported in suitable bearings located inside said conduit and outside said combustion-chamber, a screw conveyer mounted on said shaft, suitable means for rotating said shaft and means for supporting said conduit, substantially as described.

14. In an ore-treating furnace, a rotary flue-cylinder connected with a stack at one end, its opposite extremity being bell-shaped and projecting into a combustion-chamber, a circular conduit extending through said combustion-chamber in concentric relation to said flue-cylinder and projecting into a discharge-opening in the wall of said combustion-chamber, a plate secured to the outside of said wall and surrounding said discharge-opening, a second plate detachably secured to the first-mentioned plate and provided with a discharge-chute and fume-outlet, standards, erected in said combustion-chamber, supporting said conduit, an ore-cylinder concentrically located inside and attached to said flue-cylinder, and communicating with said conduit, means for conveying ore through said ore-cylinder into said conduit, a bearing located in the mouth of said ore-cylinder, one or more bearings, secured to the detachable plate on the outside of the combustion-chamber, a hollow shaft mounted in said bearings, a perforated screw conveyer mounted on said shaft, and suitable means for rotating said shaft, substantially as described.

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

ARON M. BEAM.

Witnesses:
K. M. STUMP,
J. THOMPSON.