H. A. MacCLYMENT.

FURNACE.

APPLICATION FILED MAR. 2, 1907.

955,340.

Patented Apr. 19, 1910.

4 SHEETS—SHEET 1.

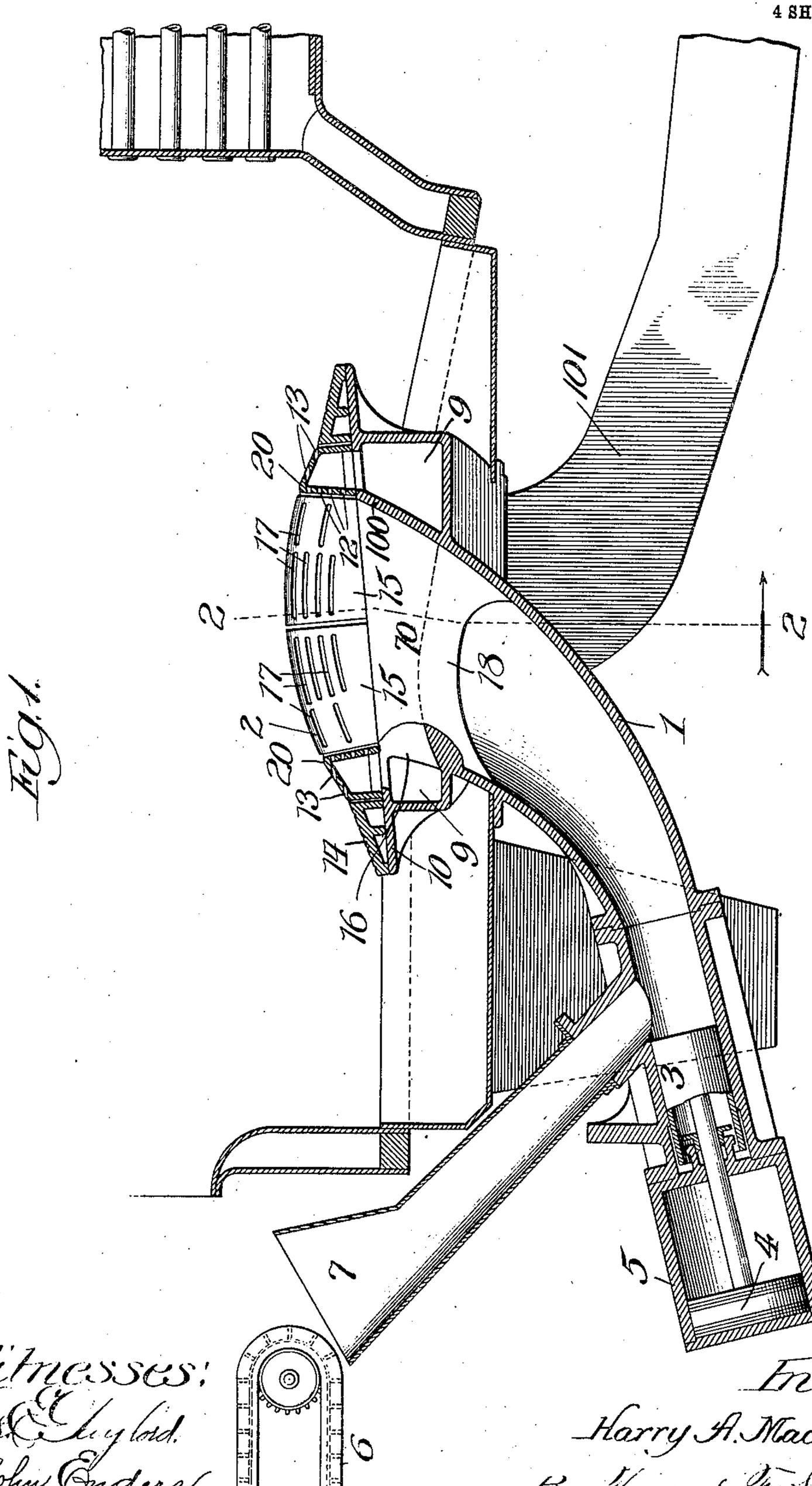

Fig. 1.

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4 SHEETS—SHEET 2.

Fig. 2.

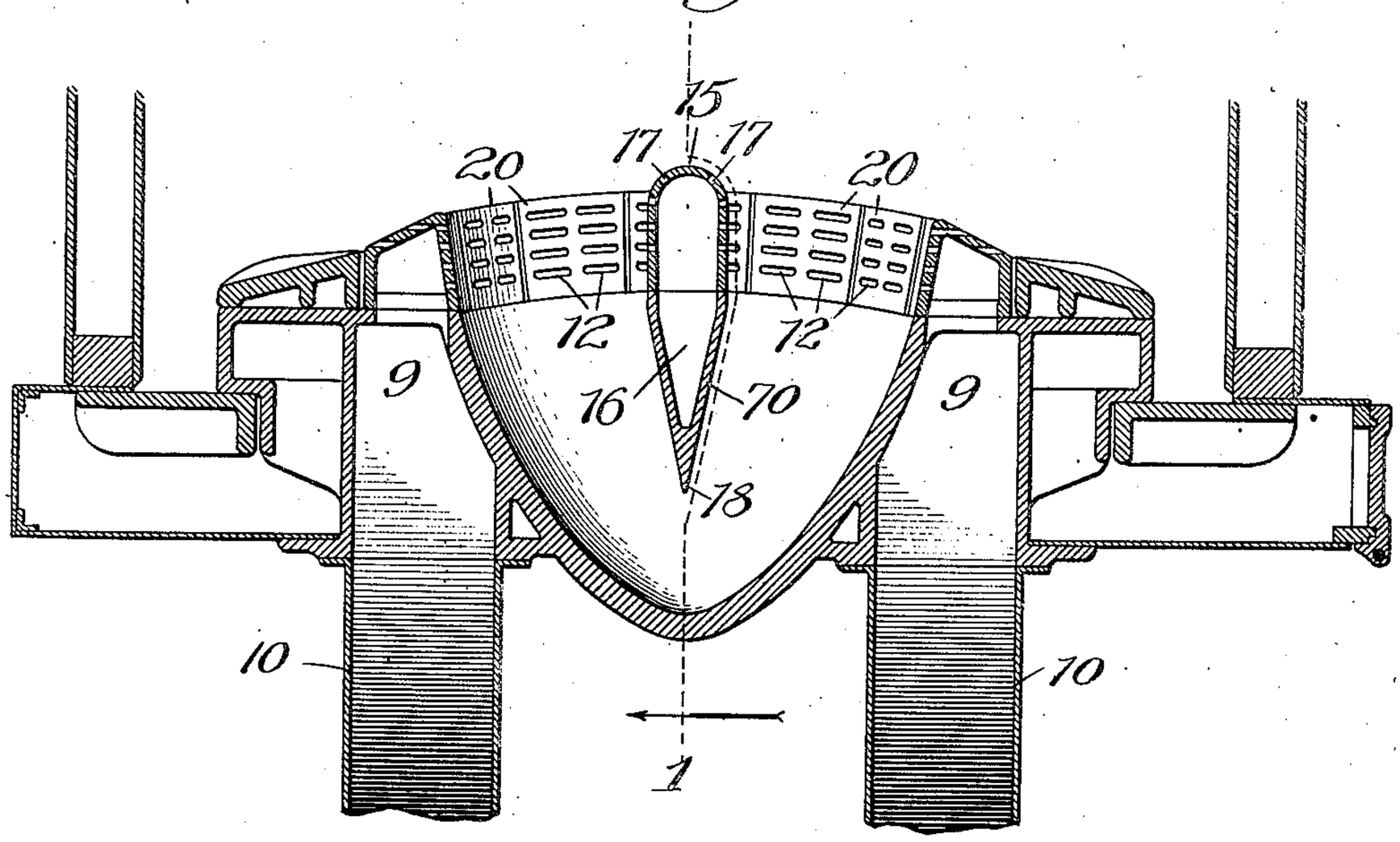


Fig. 3.

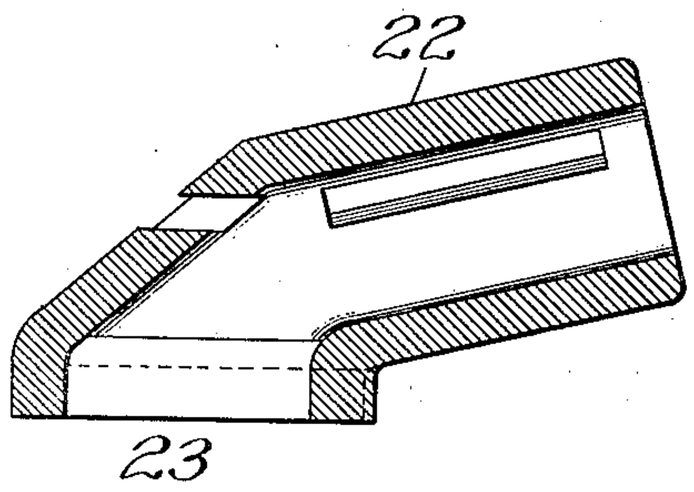
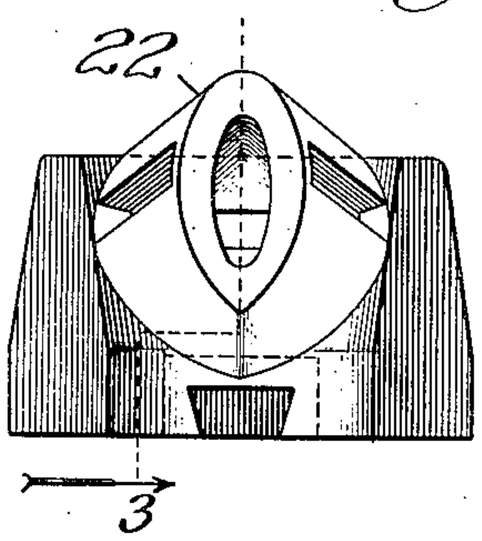


Fig. 4.



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4 SHEETS—SHEET 3.

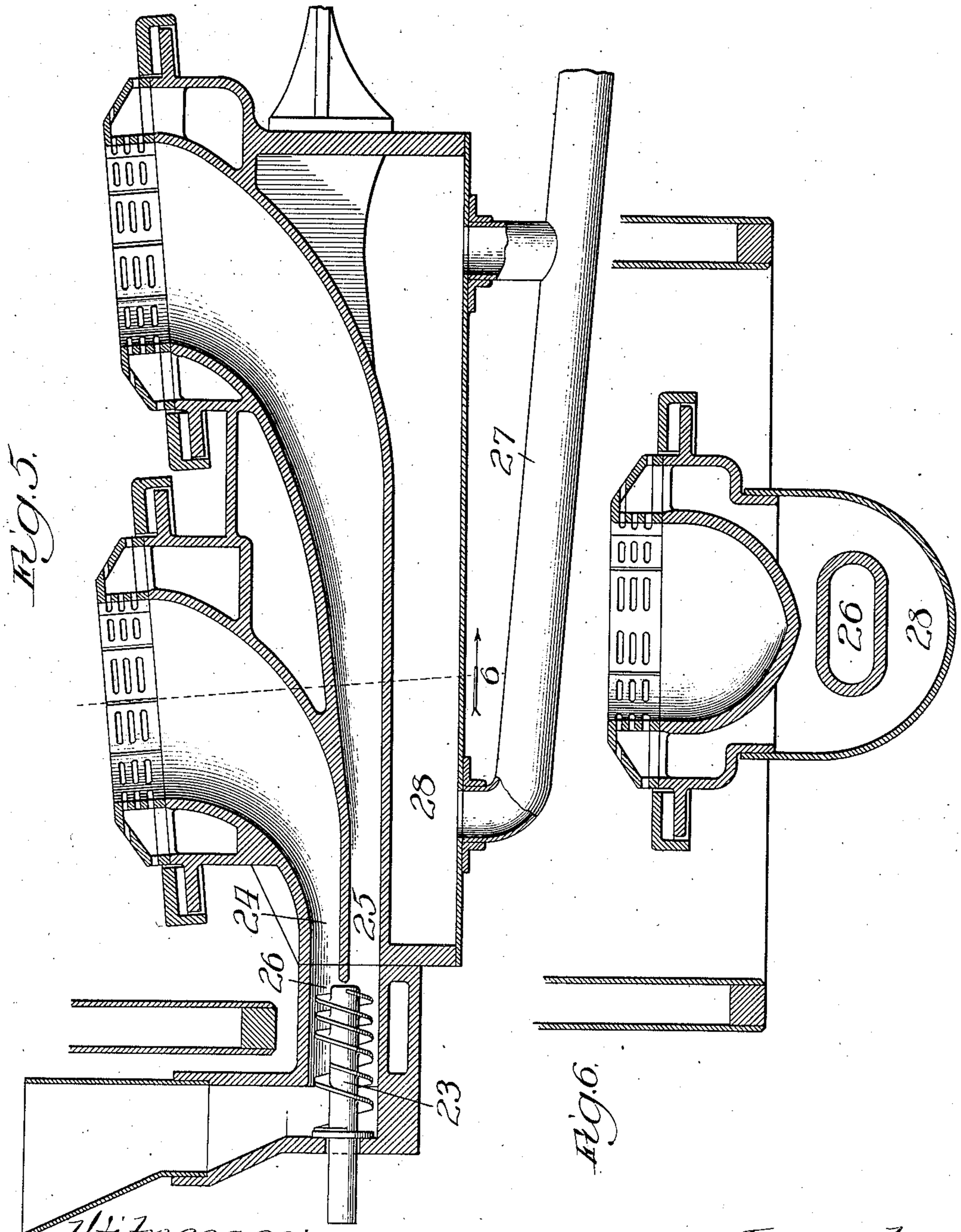

Fig. 5.

Fig. 6.

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4 SHEETS—SHEET 4.

Fig. 7.

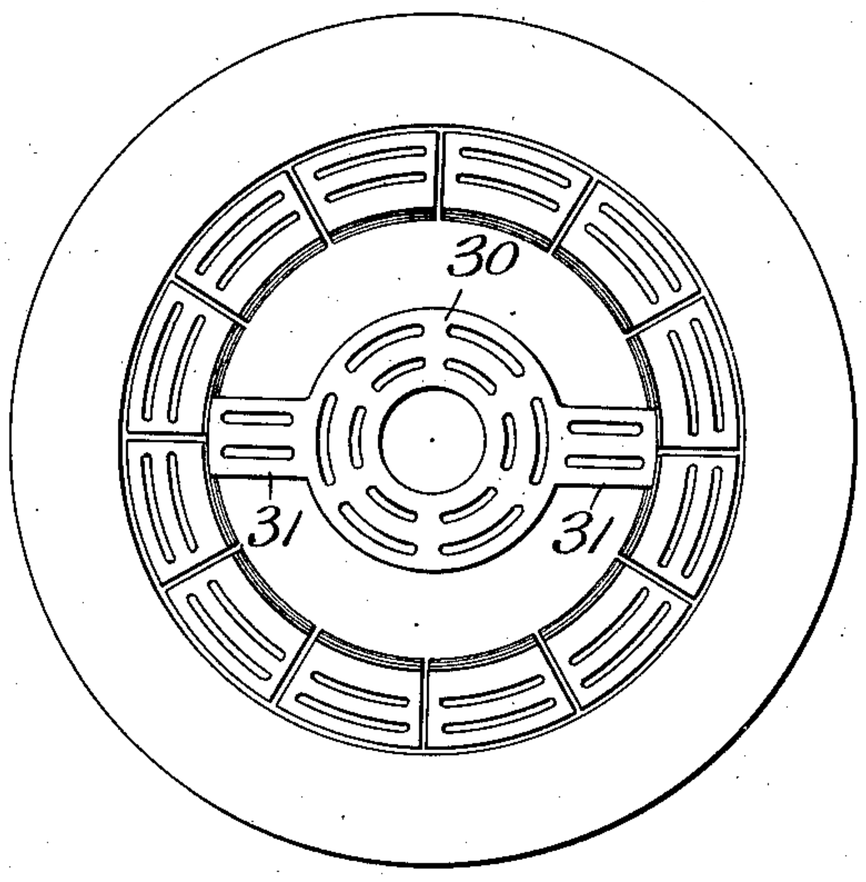


Fig. 8.

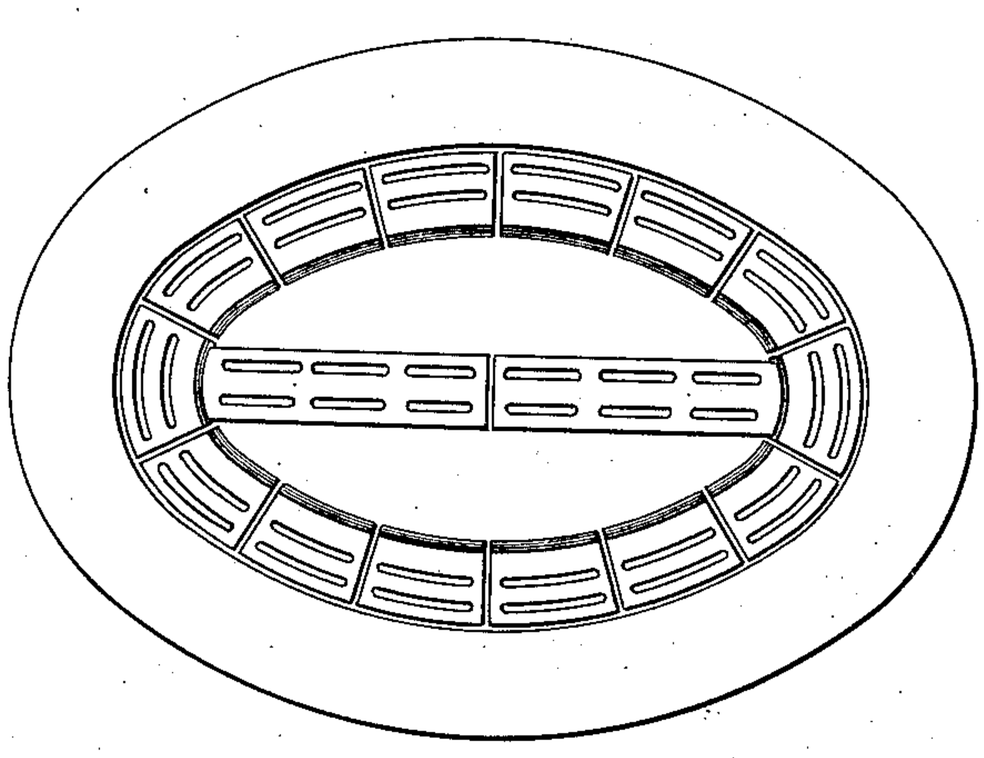
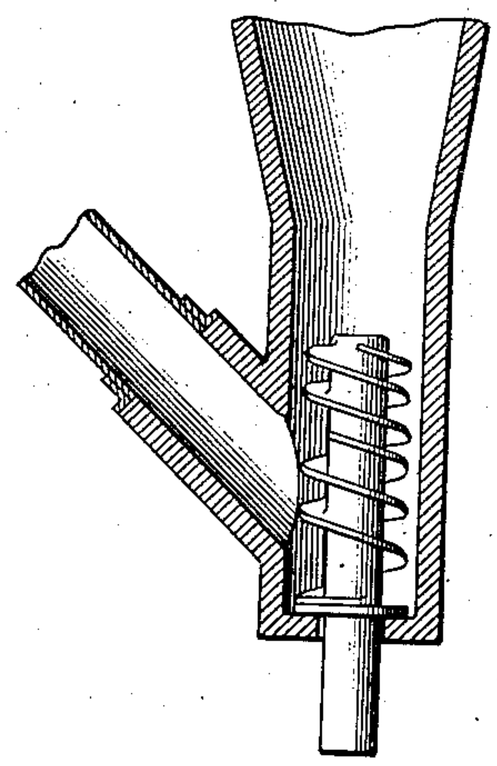


Fig. 9.



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UNITED STATES PATENT OFFICE.

HARRY A. MacCLYMENT, OF BURLINGTON, IOWA.

FURNACE.

955,340. Specification of Letters Patent. **Patented Apr. 19, 1910.**

Application filed March 2, 1907. Serial No. 360,149.

To all whom it may concern:

Be it known that I, HARRY A. MacCLYMENT, a citizen of the United States, residing at Burlington, in the county of Des Moines and State of Iowa, have invented certain new and useful Improvements in Furnaces, of which the following is a specification.

The object of my invention is to provide an improved under feed stoker and an improved burner for coal or other fuel, the parts being so arranged that the burner may either be surrounded by grate bars of the usual type or may be surrounded by an open space connecting directly with the ash pit, and to obtain an unlimited amount of active burning area, fully supplied with necessary air, fed from one fuel feeding source, this being obtained by two or more burners relatively small or one or more burners relatively large but with air distributing means as here described.

In my companion application Serial No. 293,774 filed on or about December 29, 1905, I show and claim means for feeding coal to isolated parts of a fire box of ordinary construction in which the coal is burned upon the usual grate bars. In the apparatus herein described and claimed I concentrate the combustion at the points where the fuel is supplied to the fire box, *i. e.*, instead of feeding the coal from below and spreading it on the grate bars to be consumed thereon in the usual manner, I provide individual burners for the fuel, said burners being located at the outlets of the fuel supply passages, and provide means for supplying sufficient air to the burners to insure the complete combustion of the fuel. I may equip fire boxes with one or more of such burners and may vary the size and form of the burners to meet the requirements of the use to which they are put. While in some cases I may surround the burners with grate bars, the combustion even in such cases will be limited almost completely to the burners, the grate bars being designed merely to retain any unconsumed or partially consumed fuel which may overflow from the burner.

The precise nature of my invention will more fully appear from the following specification in which I describe a specific embodiment of my invention.

In the drawings—Figure 1 is a vertical sectional view of the fire-box of a locomotive embodying one form of my invention. Fig. 2 is a sectional elevation on the line 2 of Fig. 1. Fig. 3 is a sectional elevation of a modified form of twyer, the section being taken on the line 3 of Fig. 4. Fig. 4 is a front elevation of the structure shown in Fig. 3. Fig. 5 is a sectional elevation of a fire-box provided with two burners constructed in accordance with my invention and provided with my improved screw forcer for feeding coal thereto. Fig. 6 is a transverse sectional elevation on the line 6 of Fig. 5, looking in the direction of the arrow. Fig. 7 is a plan view of a burner constructed in accordance with my invention, but embodying a modified form of twyer. Fig. 8 is a plan view of a burner similar to that illustrated in Figs. 1 and 2, but oval or elliptical in cross section instead of circular. Fig. 9 is a sectional elevation of a structure embodying a screw forcer designed to be used in connection with my improved burner or in connection with a fire-box of other construction.

In the structure shown in Fig. 1, the numeral 1 designates a fuel supply pipe terminating at its upper end in a burner designated generally by the numeral 2. The pipe 1 is provided with a plunger 3 or other suitable means such as a screw forcer for forcing the fuel upward. I have shown the plunger 3 connected to a piston 4 operating in the cylinder 5, but have not shown the specific means for conveying steam to said piston, as such means form no part of my invention. Fuel is supplied to the pipe 1 by the conveyer 6, designed to carry coal from the tender and deposit it in the hopper 7, whence it falls by gravity to the pipe 1. I have found in practice that the power necessary to force fuel through a pipe increases rapidly with the curvature of the pipe. Instead, therefore, of curving the pipe 1 to an extent sufficient to make its upper end vertical, I have adopted other means for securing an even distribution of coal around the outlet of said pipe. It has heretofore been considered necessary in order to secure an even distribution of the fuel to deliver the same from a substantially vertical pipe. I have found, however, that the uneven distribution which would ordinarily result from delivering the fuel from a pipe inclined at its upper end—as shown in the drawing—may be counteracted by cutting the upper end of the pipe at an incline. If the upper

end of the pipe shown in Fig. 1 terminated in a horizontal plane, a larger amount of coal would be delivered on the side marked 100 than upon the opposite side. I have found, however, that by carrying the side 100 upward to a point higher than the opposite side, this defect may be remedied and an even distribution of fuel secured throughout the periphery of the burner. By this construction I obtain the advantages of even distribution heretofore thought to be obtainable only by continuing the curve in the pipe 1 sufficiently to give its upper end a vertical direction. This construction results in a great saving of power, as the fuel is easily forced around the comparatively slight curvature of the pipe 1 when constructed according to my invention. It is understood that as the delivery pipe 1 approaches the vertical in its direction the slope of the distributing ring and outlet is lessened until as shown in Fig. 9 the design is essentially vertical and the slope *nil*. In operation the coal falling in front of the plunger 3 is compacted by the action thereof, and being forced forward gradually expands and conforms to the shape of the pipe 1. By this action the coal is formed into a semi-solid mass and is bodily moved forward by each stroke of the plunger. Therefore when the proper distribution is obtained by properly proportioning the parts there can be no uncertainty in the feeding action of the mechanism. In order to secure a sufficient air supply to insure the perfect combustion of the fuel, I surround the upper end of the pipe 1 with an annular air duct 9 open on the upper side and communicating at its lower side with the pipe 101 which leads from a suitable source of compressed air. The pipe 1 is constructed with a circular flange 10 extending outwardly from the outer wall of the air duct 9. Upon the upper end of the pipe 1 and spanning the annular opening in the air duct 9 are a circular series of twyer castings 20, 20. The interior of these castings communicates with the air duct 9 and the compressed air received therefrom escapes through the perforations 12, 13, part of which are directed inwardly and part outwardly. Resting upon the flange 10 is a circular protecting ring 14 designed to receive the fuel as it overflows from the top of the pipe 1.

It will be understood that in operation coal is fed through the hopper 7 and forced upwardly through the pipe 1 by the plunger 3. The coal is then consumed at the upper end of the pipe 1, sufficient air for combustion being supplied through the air passages above described. In burners of large diameter, it may be found that the openings 12, 13 will not supply sufficient air to the fuel at the center of the burner. In order to obviate this difficulty I provide additional means for supplying air in the form of a hollow bridge 70 extending across the burner from side to side and communicating at its ends with the air duct 9 through the openings 16. The twyers 15 are mounted upon the hollow bridge and are provided with air outlets 17 in the sides and top. I have shown the center twyers with a curved top approximating the shape of the mass of coal above it. The lower part 18 of the bridge 70 is brought to a sharp edge, as shown in Fig. 2 of the drawings, in order that this part may afford as little resistance as possible to the upward movement of the coal in the pipe 1. In the view I show but one cross bridge 70 but it is apparent the number of cross bridges or equivalent structures is limited merely by the needs of the size of the burner or burners, and that burners can be constructed according to my invention of any size.

It will be apparent that the only parts of my improved burner which are directly exposed to the destructive heat of the fire are the hollow twyer castings, 20 and 15, and the projecting ring 14. All of these parts are so constructed as to be separately removable from the air pipe 1, thus providing convenient means for renewing them when injured by the excessive heat.

In the form of my invention herein illustrated the burner 2 occupies a position substantially in the center of the fire-box and is connected with the walls of the fire-box only by the structural members necessary for its support. The remainder of the space between the burner and the walls of the fire-box is open and free from grate bars or other obstructions, thus permitting the ashes to fall directly from the burner 2 into the ash pit. While this form of construction is preferred for some purposes, it may be found in other cases that it will be advisable to use a dumping grate. In all cases, however, combustion takes place in the coal occupying the space at the top of the interior of the burner and upon the upper surface of the twyers 20, 20 and protecting ring 14, the rate of supply of coal being so adjusted that it will be completely consumed by the time it overflows from the edge of the ring 14.

In some cases it may be preferable to substitute for the bridge 70 and twyers 15 above described an inwardly directed twyer of the form shown in Figs. 3 and 4 of the drawings. In those views the numeral 22 represents an air supply tube designed to be connected at 23 with the air passage 9 and to be placed in such a position that the part 22 will project radially inward from the periphery of the burner. It will be understood that any number of these inwardly projecting twyers may be used and if found desirable the supply pipe 1 may be built out below the twyers and the projecting part made wedge-

shaped on the lower side in order to offer the least resistance to the coal.

In some instances it may be found advisable to use two or more burners in a single fire-box. I have illustrated such an arrangement in Figs. 5 and 6 of the drawings. The burners may be of substantially the form above described. In order to supply coal to a plurality of burners I provide a supply pipe of the form shown in Fig. 5, in which the pipe 23 diverges, forming two branches 24 and 25, one leading to each burner. It will be obvious that the pipe 23 might be provided with a larger number of branches diverging therefrom, in order to supply a larger number of burners. For the purpose of properly dividing the coal in the pipe 23 between the passages 24 and 25 leading to the respective burners, I provide the dividing plate 26 which is placed in such a position as to secure an equal supply of fuel to the two burners. In the structure shown in Figs. 5 and 6, I have shown a screw forcer in place of the plunger used in the structure shown in Fig. 1. The screw forcer has some points of advantage over the plunger. Where from the nature of the fuel or the position of the apparatus there is a tendency for the fuel to fall back in a direction opposite to that in which it is moved by the propelling means the screw forcer has the advantage of continuously maintaining the fuel in position. It is to be noted that in my device there is a continuous closed passage from the screw forcer to the outlet at the burner thus enabling the screw to force the fuel onward in a compact mass. By this means a uniform flow of fuel is attained, free from irregularities and uncertainty.

The means for supplying air to the burners illustrated in Figs. 5 and 6 is similar to that above described. Air under pressure is admitted through the pipe 27 to the space 28 which communicates with the hollow air ring at the top of the burner, as clearly illustrated in Fig. 6.

In Fig. 7 of the drawings I have illustrated a modified form of twyers, consisting of an internal hollow air supply ring 30 connected to the outer ring 20 by means of bridge pieces 31, 31. The parts 30 and 31 are constructed with apertures for the escape of air in the manner above described in connection with the ring 20.

In some cases, owing to the form of the fire-box, or to other conditions, it may be found advisable to construct the burner of an oval or elliptical form as illustrated in Fig. 8.

In furnaces so arranged that the coal is carried vertically upward instead of through a curved pipe the screw forcer also shown in Fig. 5 will be found preferable to the plunger. I have illustrated such a structure in Fig. 9 of the drawings, from which it will be apparent that the screw forcer acts when revolved not only to raise the coal but when at rest it prevents the fuel from falling from the position to which it has been raised, thus obviating the necessity of using special means for that purpose.

So far as I am informed, the use of a screw forcer in a closed passage communicating directly with the seat of combustion is new. The use of a screw forcer in such a location has the advantage, as above set forth, of serving the double purpose of propelling the coal to the desired position and of retaining it there.

While in the foregoing description and in the claims I refer to an annular air duct and circular flange at the outlet of the conveyer pipe, and in some instances use the word "periphery" in referring to these parts, I do not intend by these terms to convey the idea that it will be necessary in all instances to completely surround the outlet of the conveyer pipe with a combustion area formed of the twyers and flanges referred to, but in some instances I may surround only a portion of the outlet with twyers and the fuel-retaining flange. Where I use the terms referred to, therefore, I do not intend to restrict myself to the continuity of these parts completely around the periphery of the conveyer pipe outlet.

I claim:

1. A burner for solid fuel comprising upwardly directed supply pipes converging into a single inlet pipe, a single forcer in said inlet pipe for forcing fuel through both of said supply pipes, a dividing plate in front of said forcer at the junction of said supply pipes, and fuel supporting rings and twyers surrounding the outlet ends of said supply pipes.

2. A burner for solid fuel comprising a fire box, a conveyer pipe having walls diverging toward its outlet end, a twyer box composed of separate sections surrounding and resting on the outlet of said conveyer pipe, said twyer box being spaced from the side walls of said fire box and forming a support for the fuel during combustion, said support being spaced from the side walls sufficiently to permit ashes and clinkers to fall between said support and side walls, and means for forcing fuel through said conveyer pipe, said means also forcing the ashes and clinker from said support.

3. A burner for solid fuel comprising a fire box, a conveyer pipe having walls diverging toward its outlet end, a twyer box surrounding the outlet of said conveyer pipe, an outwardly and downwardly sloping fuel supporting ring surrounding and projecting from said twyer box, said ring being spaced from the side walls sufficiently to permit ashes and clinkers to fall between said ring

and side walls, and means for forcing fuel through said conveyer pipe and thereby forcing the ashes and clinkers from said twyer box and ring.

4. A burner for solid fuel comprising a fire box, a conveyer pipe having walls diverging toward its outlet end, a twyer box composed of separate sections surrounding and resting on the outlet of said conveyer pipe, said twyer box being spaced from the side walls and forming a support for the fuel during combustion, said support being spaced from the side walls sufficiently to allow the ashes and clinkers to fall between said support and side walls, and means for forcing fuel through said pipe thereby forcing the ash from said support for the fuel.

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