Sept. 16, 1947. W. M. FULTON 2,427,596

BURNER FOR SOLID FUELS

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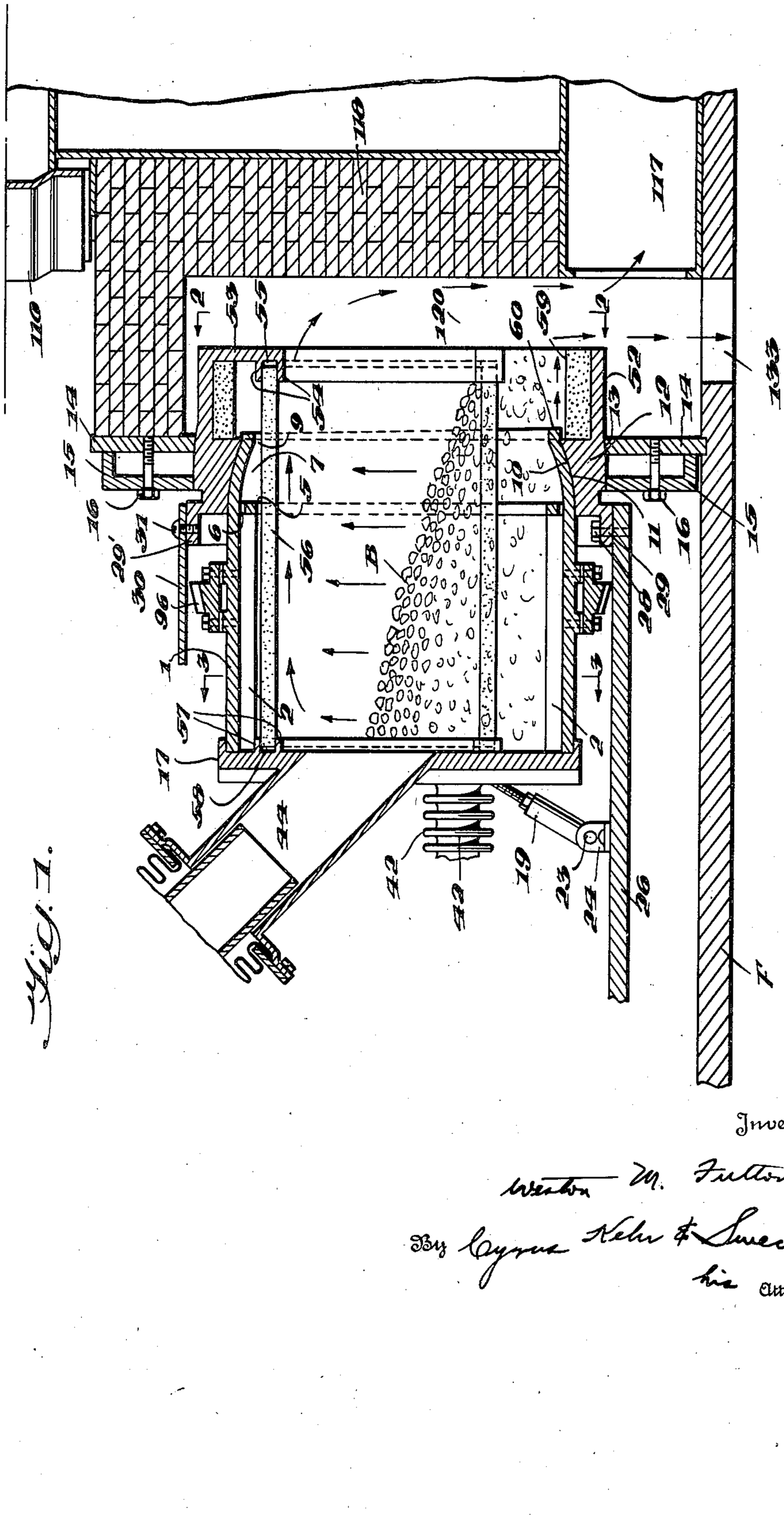

Fig. 1.

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Fig. 3.

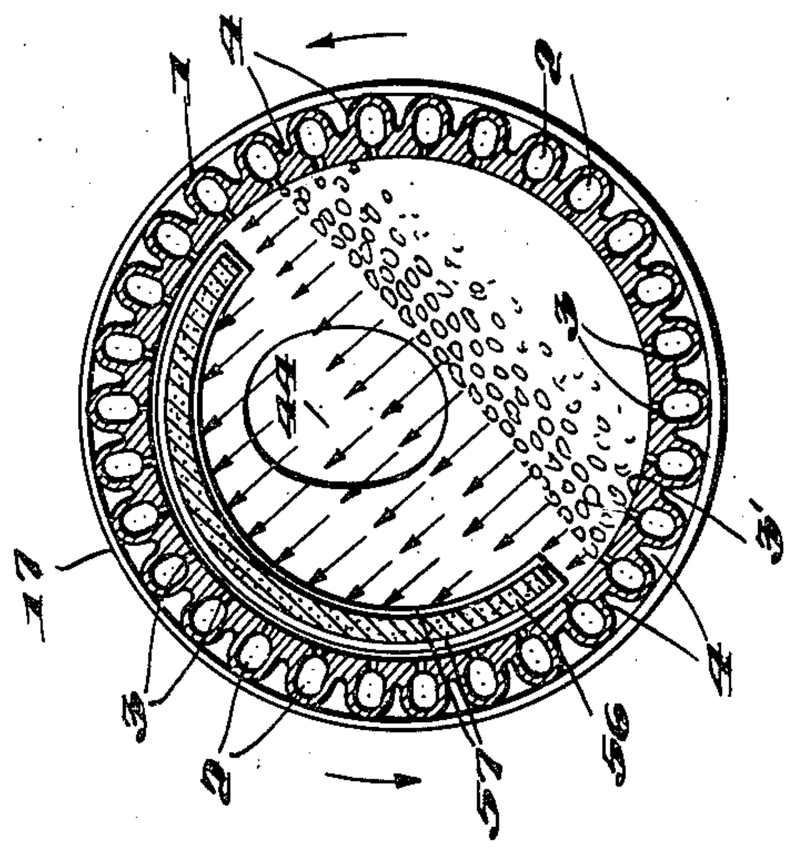
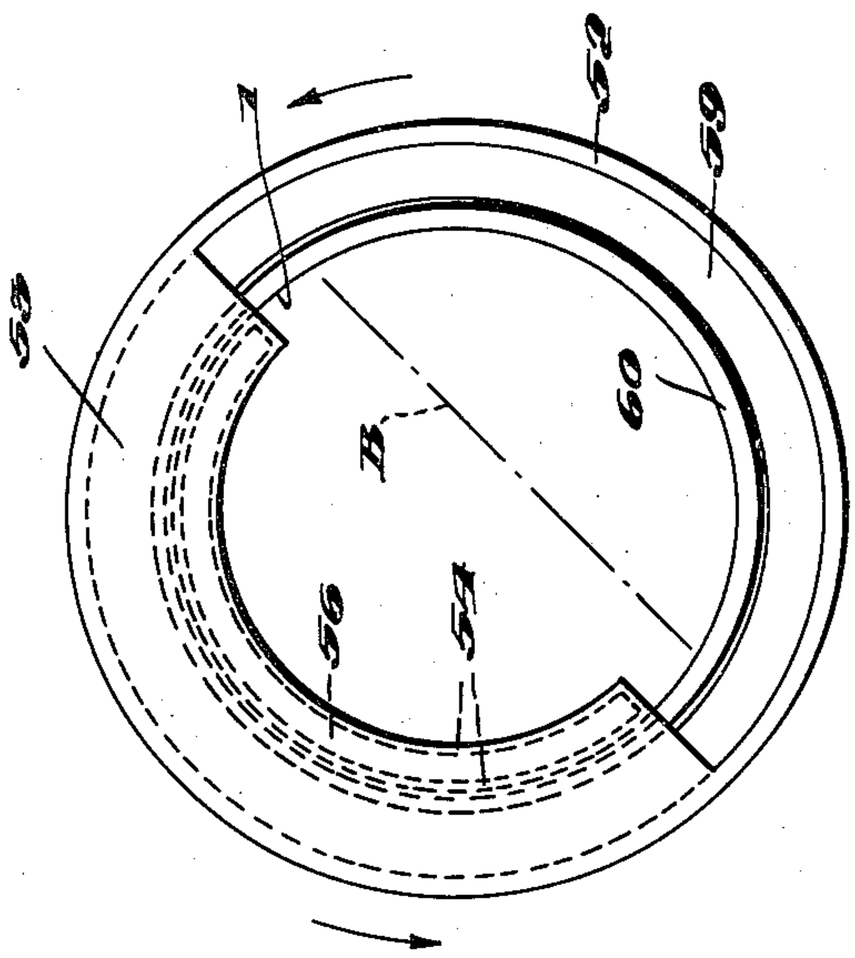


Fig. 2.



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2,427,596

BURNER FOR SOLID FUELS

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Application May 16, 1944, Serial No. 535,848

9 Claims. (Cl. 110—165)

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This invention relates to improvements in burners for solid fuels, particularly of the general type set forth in my application for patent on Fuel burners, filed April 4, 1944, Serial No. 529,503.

In the use of these rotary burners, it is necessary to maintain the temperature of the inner surface of the burner below the temperature of fusion of the ashes formed from the fuel being burned, in order to prevent fused ash from adhering to the inner wall of the burner and producing objectionable results. The burner set forth in my prior application is so constructed as to be maintained at a temperature below the fusing temperature of the ash. At the same time, it is desirable to maintain the temperature of the hot gaseous products given off from the burning fuel at as high a degree as possible for a substantial length of time before these gaseous products are brought into contact with any relatively cooler surface.

One of the objects of this invention is to maintain the inner surface of the burner cool enough to prevent ash-fusion within the body of the burning fuel, while also preventing the gaseous products emanating from the fuel from contacting the relatively cool surface immediately upon leaving the fuel bed, in a practical and efficient structure.

I prefer to accomplish this object by providing a stationary baffle within the burner disposed in close proximity to the side of the burner opposite the bed of burning fuel, so that the hot gases will impinge against this baffle instead of against the inner wall of the burner. This baffle is spaced a short distance away from the inner burner wall, thereby enabling it to maintain a much higher temperature than the inner wall of the burner. The baffle serves also to direct the gases from the fuel to the burner outlet.

I have found that, due to the widely fluctuating load-demand made upon burners of this type, when used for domestic heating, there arises certain occasions when particles of partly burned fuel may be discharged from the burner along with the ashes. This represents a waste of fuel, since it is economically desirable that combustion be complete in all respects before the refuse is discharged from the burner. Furthermore, it causes undesirable smoking.

Another object of the invention is to improve the construction of the burner, so as to insure against the discharge of partly consumed unburned fuel, whereby only the resultant ash will remain for discharge, thus maintaining maximum efficiency of operation.

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I prefer to accomplish this object by providing an extension so positioned relative to the rotary burner that the refuse from the burner will be discharged upon this extension where additional combustion may take place of any fuel particles contained in the refuse. The refuse may be moved over the extension in passing to the point of discharge, but so slowly as to allow ample time for complete combustion before the ash particles resulting therefrom are fully discharged.

I have shown a preferred embodiment of the invention in the accompanying drawings, in which:

Fig. 1 is a longitudinal sectional view through a burner structure illustrating this invention applied thereto;

Fig. 2 is an end elevation of the burner structure, taken substantially on the line 2—2 of Fig. 1; and

Fig. 3 is a transverse section through the rotary burner on the line 3—3 of Fig. 1.

The invention is shown as applied to a rotary burner of the character set forth more in detail in my prior application, Ser. No. 529,503, filed April 4, 1944, the rotary burner being designated generally by the numeral 1. While that application shows this rotary burner as applied to an ordinary hot air house-heating furnace, it will be understood that the invention is equally applicable to burners of this type when applied to steam and hot water boilers. The furnace or boiler is designated generally by the numeral 110, such as may be provided with a heating chamber therein surrounded by a hot air chamber or a hot water or steam jacket. The heating chamber will receive products of combustion through a passage 117 in the base of the furnace in the form illustrated, although it will be understood that the invention may be used in connection with any suitable form of air or water heater, as desired.

The peripheral wall of the burner 1 is formed substantially of corrugated shape, as shown more in detail in Fig. 3 with longitudinal air passages 2 through the wall, each of which is connected with the interior of the burner by a longitudinal slot 3 formed by a tuyère in the wall, the slots 3 extending to the inner wall surface 3′ of the burner. Corrugations 4 between adjacent air passages 2 extend lengthwise of the burner at the periphery thereof, but these corrugations are closed against communication with the inside of the burner by the solid portion of the wall thereof, as shown in Fig. 3. The air passages 2, slots 3 and corrugations 4 extend from the inlet

end of the burner substantially to the discharge end thereof.

Adjacent the discharge end of the burner, on the inner side thereof, is an annular closure 5 at the ends of the air passages 2, which air passages are closed except for a small orifice 6 therein (Fig. 1) for the purpose of admitting a limited amount of air into the space 7 in the discharge end of the burner having a discharge opening 9 smaller than the inlet end of the burner.

The discharge end of the burner at its periphery is formed with a spherical section 10 having its center on the center axis of the burner, as described more in detail in my prior application, Serial No. 529,503. This spherical portion 10 is mounted in a similarly shaped seat 11 in a surrounding ring 12. The ring 12 has a peripheral portion also of spherical shape as shown at 13, seated within a surrounding support 14 and confined thereagainst by a series of clamps 15 held in place by screws 16. The spherical seat 13 is generated on a radius from a center located on the axis of rotation of the burner 1 within the discharge opening 9, whereby the support 14 and clamps 15 will be on opposite sides of the greatest diameter thereof, and conforming in contour with the seat portion 13, and held in spaced relation, form a universal connection between the ring 12 and the support 14, while the burner 1 is also supported in a universal connection in the ring. The burner is also capable of rotation therein while maintaining a reasonably gas-tight joint between the burner and the ring. When the clamps 15 are loosened upon loosening of the screws 16, it is possible to adjust the ring 12, which is otherwise held stationary, to vary the position of the device relative to the support 14.

At the inlet end of the burner 1 is mounted a head 17, which is recessed on its inner side having a peripheral flange surrounding the burner, and is adapted to bear in slidable relation against the end of the burner substantially in a closed air-tight fit. The head 17 is adapted to supply air to the burner, as well as to admit the fuel thereto.

The head 17 is supported on longitudinally adjustable arms, designated generally at 19. A pair of arms 19 are located on opposite sides of the head 17, pivotally connected therewith at or adjacent a horizontal longitudinal plane through the center axis of the burner, and are capable of adjustment lengthwise to provide for tilting adjustment of the burner on the seat 11. The lower ends of the arms 19 are pivotally supported at 23 by brackets 24 mounted on a base 26 which extends generally horizontally beneath the burner, as shown in Fig. 1, and forms a platform upon which the major portion of the stoker structure is mounted. The outer end of the base 26 may be supported adjustably upon the floor F for longitudinal tilting movement. The inner end of the base 26 is connected by screws 28 to a lower extension member 29 formed on the ring 12 and extending outwardly therefrom.

A jacket 30, preferably of sheet metal, extends around the burner over the base 26, being supported at the top by screw connections 31 from a flange portion 29' on the ring 12, as described more in detail in my prior application, Serial No. 529,503. The jacket 30 extends across the top and down opposite sides of the burner 1, being secured to the base 26, also extending over the outer end of the burner, forming a chamber there-

around through which the fluid to be heated may be circulated, if desired.

The head 17 has an arcuate slot therein (not shown), extending about a portion of the lower periphery thereof to supply air to the air passages 2. Provision is made for directing air through the slot from a blower through a pipe 42, as described more in detail in my application, Ser. No. 529,503. The slot in the head 17 extends through an angle no greater than the arcuate extension of the fuel bed B, admitting air into all of the air passages 2, which are subtended within this angle. These air passages discharge the air through the slots 3 at the inner face 3' of the burner into and through the bed of fuel. A small portion of the air is discharged also through the orifices 6 at the closed ends of the passages to complete the combustion of any portion of fuel that may pass to the discharge end of the burner.

The burner head 17 also is provided with an upwardly inclined fuel inlet 44 in the upper portion thereof, arranged at such an angle that the fuel will slide down its interior wall freely by gravity and drop onto the inner surface of the burner 1 or the partial fuel bed therein adjacent the inner surface of the burner head 17. Any suitable provision may be made for introducing coal or other solid fuel to the inlet 44, such for instance, as the fuel supply means set forth in my prior application, Ser. No. 529,503.

The burner 1 is adapted to be rotated during operation, such for instance, as by power means having operative connection therewith, as shown also in my application, Ser. No. 529,503. For this purpose, the burner 1 is shown as having a surrounding ring gear 96 secured thereto adapted for geared connection with the power means for operation thereby. The burner is being rotated in a counterclockwise direction as viewed from the inner end thereof (on the line 2—2 in Fig. 1), whereby the fuel bed B, during operation, will be disposed substantially as shown in Figs. 2 and 3.

The structure described above is substantially that set forth in my prior application, Ser. No. 529,503, which will be operated in the manner as set forth more in detail in said prior application.

Referring to Fig. 1, the ring 12 is provided with an inwardly projecting annular extension 52, which extension has an inwardly projecting flange 53 at the inner extremity thereof, and extending only partway around the circumference of the extension, forming a crescent-shaped flange thereon, as shown in Fig. 2. This is arranged preferably on the side of the burner opposite the fuel bed B. The flange 53 partially overlaps the discharge open end 9 of the burner.

Integral with the surface of the flange 53, facing the open end of the burner, are parallel arcuate ribs 54 joined at their extremities and forming a recess 55 therebetween, into which is loosely fitted one end of a baffle 56. Similar ribs 57 integral with the burner head 17 form an arcuate recess 58 on the inner surface of said head, into which the opposite end of the baffle 56 is inserted, said baffle being supported in bridging relation between the opposing faces of the flange 53 and head 17.

The baffle 56 is constructed of crescent-shape in cross section, as shown in Fig. 3, and is preferably made of refractory material, such as fire clay, graphite or carborundum. The baffle extends throughout the entire length of the burner and is spaced inwardly a short distance away from

the inner wall 3' of the burner so that the burner can rotate freely without contacting the baffle. It is disposed adjacent to the portion of the inner burner wall which is diametrically opposite from the bed B of burning fuel, so that the hot gaseous products of combustion given off from the fuel will impinge directly against the baffle 56, as indicated by the arrows in Figs. 1 and 3. The baffle 56 is also constructed with a continuous smooth surface at its concave face, thereby enabling the hot gases to move readily lengthwise of the burner toward its discharge end, as indicated by the arrows in Fig. 1.

The small space which separates the baffle 56 from the adjacent wall surface 3' of the burner, serves to insulate the heat so that only a limited amount of heat can escape from the baffle, whereby it reaches a much higher temperature than the burner wall. This enables the gaseous products of combustion to retain their heat and thus remain at a sufficiently high temperature to promote the process of combustion within these gases.

The annular extension 52 serves to receive the ashes discharged through the open end 9 of the burner. This extension 52 preferably has a lining of fire-clay 59 throughout the inner surface thereof, partly to insulate the extension from the heat of the ashes lying thereon and partly to prevent the rapid cooling of the ashes by heat conduction therefrom. The lining 59 is made thicker at the bottom of the extension 52 than at the top, because the bottom is exposed to the maximum amount of heat.

It will be noted that the ring 12 does not rotate with the burner 1, and the extension 52 integral with the ring will likewise be stationary. Consequently when the ashes are discharged through the open end of the rotating burner 1 onto the extension 52, these ashes tend to lie dormant unless they are moved outward by force. This is provided by forming the end surface 60 of the burner 1 in helicoidal shape, substantially corresponding with a single turn of a screw conveyor, of low pitch.

Then as the burner is rotated in the direction indicated by the arrows in the drawings, the ashes lying on the bottom portion of the extension 52 or its fire-clay lining 59, and in physical contact with the helicoidal surface 60, will be pushed slowly in the direction indicated by the arrows in the bottom of Fig. 1. The distance through which the ashes will be pushed during each revolution of the burner will depend upon the degree of inclination or pitch of this surface 60. I prefer that the helicoidal pitch of this surface should be comparatively small so that the ashes will be moved very slowly. This makes it possible for these ashes to remain banked on the extension 52 for a considerable length of time in order to allow ample opportunity for all particles of fuel to be completely burned before the ash is discharged.

The ash and products of combustion are discharged from the open end of the burner into a chamber 120 enclosed by a masonry wall 118, shown as located at one side of the furnace 110. An opening 133 in the bottom of the chamber 120 allows the ashes to fall therethrough for discharge, while the products of combustion pass into and through the passageway 117 to the heating chamber of the furnace.

The high temperature maintained in the gas chamber 120 promotes combustion of any particles of fuel in the ash supported upon the extension 52; and the fire-clay lining 59 being a poor conductor of heat prevents the ashes from cooling rapidly. Since the volume of ashes is quite small as compared with the volume of fuel fed into the burner, these ashes can move out of the discharge end of the burner much more slowly than the fuel enters it.

I claim:

1. A burner for solid fuel comprising a rotary surrounding wall structure arranged on an approximately horizontal axis and adapted to contain a fuel bed therein and having an outlet opening for discharging ashes therefrom, a stationary member mounted adjacent said opening in position to receive ashes discharged therethrough, and means operatively connected with the rotary wall structure for slowly pushing the ashes off of said surface.

2. A burner for solid fuel comprising a rotary surrounding wall structure arranged on an approximately horizontal axis and adapted to contain a fuel bed therein and having an outlet opening for discharging ashes therefrom, a stationary member mounted adjacent said opening in position to receive the ashes discharged therethrough, and means connected with the rotary wall structure for pushing the ashes off of said stationary surface.

3. A burner for solid fuel comprising a rotary surrounding wall structure arranged on an approximately horizontal axis and adapted to contain a fuel bed therein and having an outlet opening for discharging ashes therefrom, a stationary member mounted adjacent said opening in position to receive the ashes discharged therethrough, and means fixed to the rotary wall structure and forming a helicoidal screw surface in position to push the ashes off of said stationary member during rotation of the wall structure.

4. A burner for solid fuel comprising a surrounding wall structure mounted for rotating movement about an approximately horizontal axis and constructed for containing a fuel bed therein, said wall structure having an open discharge end for removal of ashes therefrom during rotation, means forming a stationary shelf underlying the open end of the burner to receive the ashes therefrom, and means forming helicoidal screw portion fixed to the rotatable wall structure for turning movement thereby and disposed in position to push the ashes off of the shelf during operation of the burner.

5. A burner for solid fuel comprising a rotary wall structure arranged substantially on a horizontal axis to receive the fuel in one end portion thereof for progressive movement through said rotary wall and having an outlet at the opposite end thereof for the discharge of ashes, means forming an ash-receiving surface adjacent said discharge outlet in position to receive the ashes through said outlet, and means operatively connected with the rotary wall structure for moving the ashes from said surface.

6. A burner for solid fuel comprising a tubular structure mounted substantially on a horizontal axis for rotating movement and arranged to receive fuel in one end portion thereof for progressive movement through said structure during combustion therein, said structure having a discharge opening at the opposite end thereof, means forming a surface adjacent said discharge opening in position to receive ashes through said opening from the structure, and means operatively connected with the tubular structure for moving the ashes from said surface.

7. A burner for solid fuel comprising a tubular structure mounted substantially on a horizontal axis for rotating movement and arranged to receive fuel in one end portion thereof for progressive movement through said structure during combustion therein, said structure having a discharge opening at the opposite end thereof, means forming a surface adjacent said discharge opening in position to receive ashes through said opening from the structure, and means operatively connected with the tubular structure for rotation therewith for moving the ashes over said surface.

8. A burner for solid fuel comprising a tubular structure mounted for rotating movement about an approximately horizontal axis and arranged to receive fuel in one end portion thereof for movement of the fuel progressively therethrough, said structure having a discharge opening substantially at the opposite end thereof, means forming a surface externally of the discharge opening and independent of the tubular structure for relative rotation of the latter with respect to said surface and in position to receive solid products of combustion discharged through said opening, and means operatively connected with the tubular structure for moving said products of combustion over said surface.

9. A burner for solid fuel comprising a tubular structure mounted for rotating movement about an approximately horizontal axis and arranged to receive fuel in one end portion thereof for movement of the fuel progressively therethrough, said structure having a discharge opening substantially at the opposite end thereof, means forming a surface externally of the discharge opening and independent of the tubular structure for relative rotation of the latter with respect to said surface and in position to receive solid products of combustion discharged through said opening, and means forming a helicoidal screw portion connected with the rotating structure and arranged in position to move the products of combustion over said surface.

WESTON M. FULTON.

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