Dec. 1, 1942. C. SMERLING 2,303,406

COMBUSTION APPARATUS

Filed July 2, 1940 2 Sheets-Sheet 1

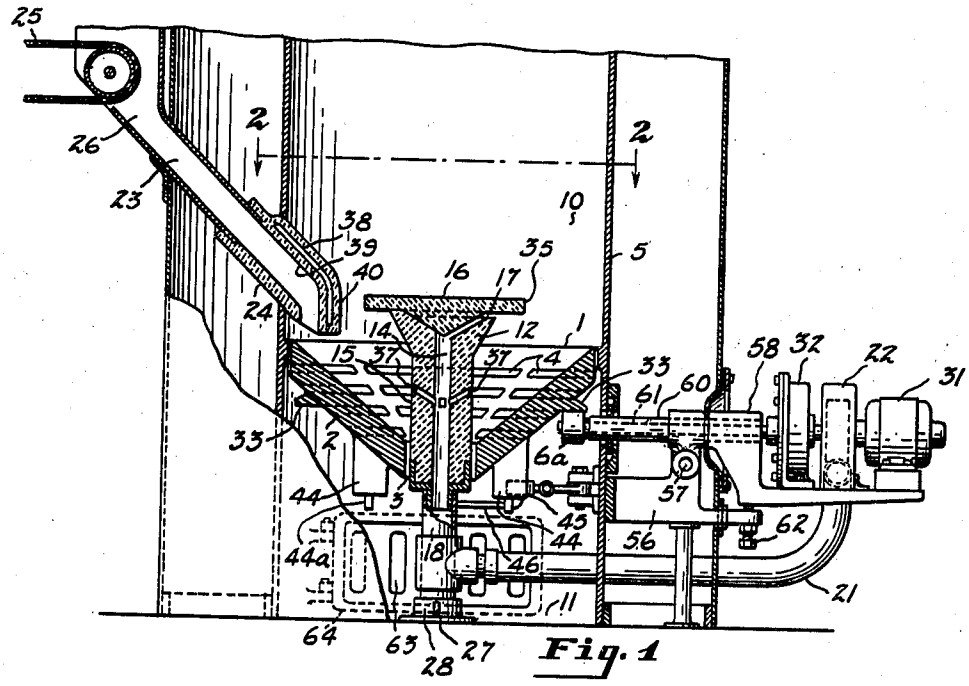


Fig. 1

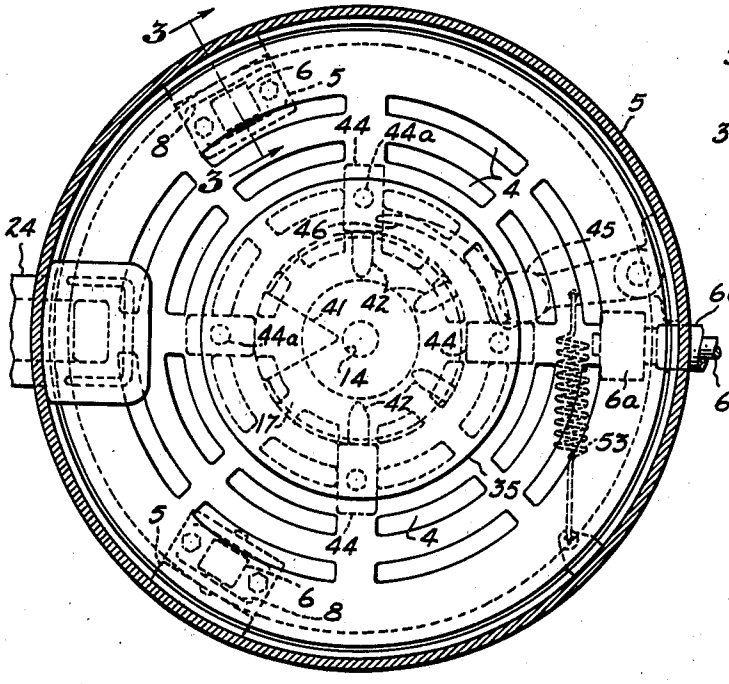


Fig. 2

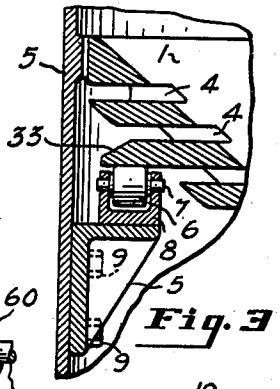


Fig. 3

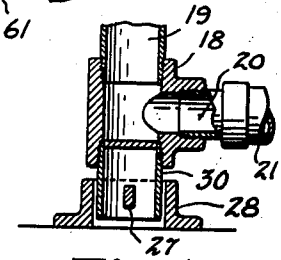


Fig. 4

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Dec. 1, 1942. C. SMERLING 2,303,406

COMBUSTION APPARATUS

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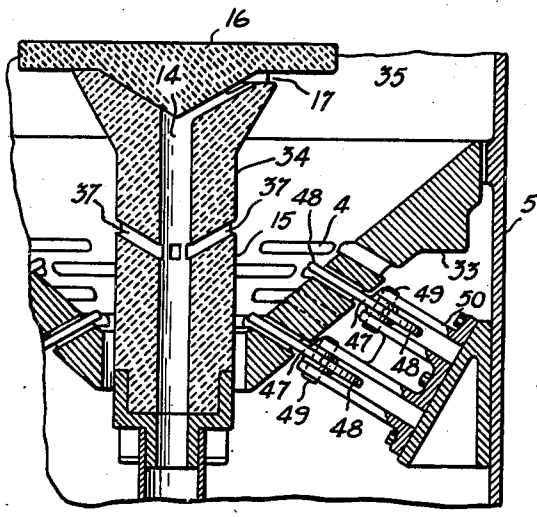


Fig. 5

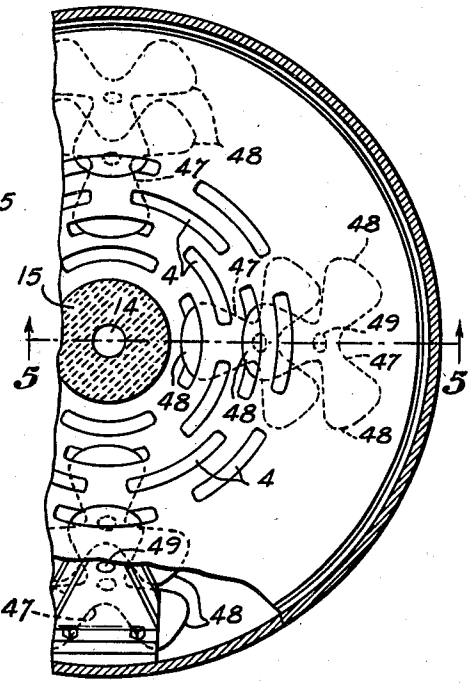


Fig. 6

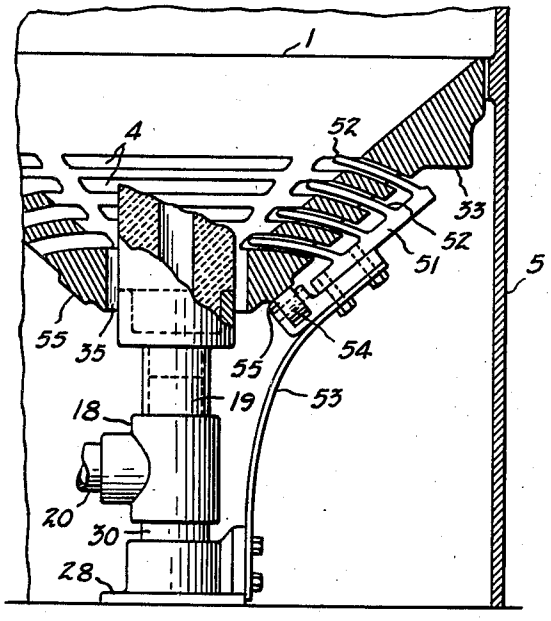


Fig. 7

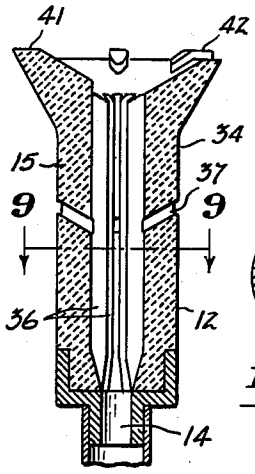


Fig. 8

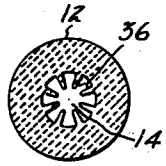


Fig. 9

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UNITED STATES PATENT OFFICE

2,303,406

COMBUSTION APPARATUS

Carl Smerling, Salem, Ohio

Application July 2, 1940, Serial No. 343,607

16 Claims. (Cl. 110—36)

This invention relates to automatic combustion apparatus and particularly to stokers adaptable for small installations and suitable for burning relatively low grade fuel which has a high percentage of volatile matter.

It is an object of this invention to provide a relatively inexpensive stoker suitable for installation in domestic furnaces.

It is another object of this invention to provide a stoker which will burn coal having a high percentage of volatile matter without forming noticeable smoke, and which is adapted to maintain in the fuel bed a temperature below the melting point of ash so that clinkers are not produced.

It is a further object of this invention to provide relatively inexpensive, efficient, automatically controllable combustion apparatus, which is adaptable for home heating systems, which will burn relatively low grade fuel without the formation of noticeable smoke, which will eliminate soot, which will prevent the formation of clinkers in the fuel bed, and which will automatically remove ash therefrom.

It is a further object of this invention to provide efficient home heating apparatus having automatically controllable means for burning relatively low grade coal without the formation of noticeable smoke and without the formation of clinkers.

Other objects will be apparent from the following detailed description of the drawings illustrating the present invention, in which:

Figure 1 is an elevational view, partly in section, of a furnace having a stoker embodying the present invention;

Fig. 2 is a sectional view, taken on the line 2—2 of Fig. 1;

Fig. 3 is a sectional view on the line 3—3 of Fig. 2, and shows suitable means for rotatably mounting the grate member;

Fig. 4 is an elevational view, partly in section, of a portion of the support for the air preheating member showing the passageways for the passage of air from a blower to the air preheating member;

Fig. 5 is a sectional view on the line 5—5 of Fig. 6, showing a stoker having a modified form of stirrer for progressively moving the fuel bed toward the central portion thereof;

Fig. 6 is a plan view of a stoker having a modified form of stirrer for progressively moving the fuel toward the central area of the grate member;

Fig. 7 is an elevational view, with parts broken away and partly in section, of a portion of a furnace showing a stoker with another modified form of stirrer for progressively moving ash and fuel toward the center of the grate;

Fig. 8 is a sectional view through the air preheating member showing suitable means for increasing the surface of said member to improve heat transfer; and

Fig. 9 is a sectional view on the line 9—9 of Fig. 8.

Referring more particularly to the drawings, wherein like parts are designated by like numerals of reference throughout the several views, the combustion apparatus of the present invention has a grate member 1, which is adapted to support a fuel bed and which is preferably of inverted, frusto conical shape, or other suitable shape, with upwardly sloping sides 2 and a central opening 3, which may be cylindrically-shaped. The sides 2 have suitable ports 4 for the passage of air into the fuel bed. It is supported for rotation with respect to the furnace walls 5 by suitable means, such as rollers 6 mounted on axle 7 journalled in the supports 8, which may be attached to the walls 5 by suitable means, such as the bolts 9. An annular flange 33 is preferably provided on the lower face of the grate member 1 and this flange has a bearing surface to engage the rollers 6.

Means such as the roller 6*a*, carried by the shaft 61 and driven by the motor 31 through the reducing gear 32, is provided for rotating the grate member 1 with respect to the walls 5. The roller 6*a* may drive the flange 33 by friction or by suitable gears. When the drive of the grate member is through friction between roller 6*a* and the grate, means is preferably provided for raising or lowering the roller 6*a* to support a larger or smaller percentage of the weight of the grate member. Such means may include a motor mounting with the driving assembly pivotally mounted on the pedestal support 56 for movement about the pivot 57.

The driving assembly may comprise the roller 6*a*, the motor 31, the fan or blower 22, the gear reducer 32, the support 58 which carries the bearing tube 60, and the shaft 61 which carries the roller 6*a*, and which extends through the bearing tube 60 and connects the driving roller 6*a* with the speed reducer 32. By turning the adjusting screw 62, the height of the roller 6*a* may be raised or lowered, as desired.

The grate member 1 separates the combustion chamber 10 from the ash chamber 11; the ash

chamber being defined by the funace walls 5, the grate member and the furnace floor, and the combustion chamber being defined by the walls 5, the grate member and the upper portion (not shown) of the furnace.

Means is provided for supplying preheated air above the surface of the fuel bed for causing the complete combustion of volatile matter from said fuel bed. Such means includes means, such as an air preheating member 12, for transferring heat from the fuel bed to the air for combustion. The air preheating member is disposed centrally of said grate member and has a body portion 15 and a cap 16. The body portion is preferably cylindrically-shaped and has a passageway 14 for the passage of air through said fuel bed, without permitting it to come in contact with the fuel therein. Means such as the cap preferably having an annular edge portion 35, which extends a considerable distance beyond the body portion 15 is provided for deflecting the relatively highly preheated air from the air preheater toward said fuel bed. Both the cap 16 and the body 15 may be of refractory material, carborundum, a suitable alloy steel, or other suitable material. One or more discharge ports 17 communicate with passageway 14 and are preferably located adjacent the cap 16 and above the surface of the fuel bed. The discharge ports 17 may be conveniently formed by spacing the cap 16 from the body 15 on the lands 41 and 42. The air preheating member is of sufficient length to extend completely through the fuel bed with the discharge ports 17 above the surface of the fuel, and the lower end disposed through the central opening 3 of the grate member. The passageway 14 preferably has means, such as fins 36, for increasing the surface area which may come in contact with air forced therethrough. It is preferable that at least the upper portion 34 of the preheater 12 be of highly conductive material, such as carborundum or a metal, to increase the withdrawal of heat from the fuel bed to heat the air which may be forced through the passageway 14. Bleeder ports 37 communicate with the passageway 14 and the fuel bed adjacent the body portion 15. These ports serve to by-pass to the fuel bed a portion of the air forced through said passageway and insure more intense heat in the fuel bed adjacent the body portion 15.

The air preheating member is carried by a suitable support 18 which has a passageway 19 adapted to communicate with the passageway 14 of the air preheating member and a passageway 20 in a pipe 21 connected to the blower 22, which may also be operated by suitable means, such as the driving motor 31.

The outer diameter of the cylindrical body 15 of the air preheater is substantially less than the diameter of the central opening 3 of the grate member to provide an annular space between the walls of the opening 3 and air preheater for the removal of ashes.

Rotation of the body 15 of the air preheating member and of the support 18 is prevented by suitable means, such as the cotter pin 27 which extends through the base member 28, which is attached to the furnace floor, and the extension 30 of the support 18. The cotter pin preferably fits loosely through registering holes in the base member and in extension 30. Considerable gyratory movement of the preheating member and the support 18 about the base member is thus permitted.

Means such as the chute 23 having a nozzle 24 disposed above the grate member is provided for automatically supplying fuel to the grate member at a controllable rate. The rate may be controlled by any desirable means, such as by controlling the speed of the belt conveyor 25 which is adapted to transport coal from a suitable storage bin (not shown) to the hopper 26.

Coking of coal in the nozzle 24, which is preferably constructed from refractory material, is prevented by the dead air space 38 formed by the nozzle walls 39 and 40. In order to prevent the heated air and resultant flame from contacting the nozzle 24, the land 41, which with land 42 supports the cap 16 and forms the discharge ports 17, is made sector-shaped and substantially closes the port 17 adjacent the nozzle 24.

Means is provided for agitating the fuel bed and progressively moving it toward the central opening 3 of the grate member. Vibratory means, operable by rotation of the grate member, is illustrated in Figs. 1 and 2. Such means may include suitably spaced projections or lugs 44 which are rigidly attached to the sides of walls 2 of said grate member. Means, such as the spring actuable hammer 45 pivotally carried on the walls 5, may be provided to periodically cause vibration of the lugs 44. The hammers 45 are adapted to contact the lugs 44 on rotation of the grate member and are provided with a cam-shaped tail portion 46. The tail portion is adapted to ride on the arm actuating pins 44*a*, carried by the lugs 44, and move the hammer against the force of spring 53 as the lugs 44 are moved by rotation of the grate member. The tail 46 is of sufficient length to permit the spring 53 to move the hammer 45 into contact with a succeeding lug 44 as it is moved into striking position. When such vibratory means for progressively moving the ashes or the fuel bed toward the opening 3 is used, the ports 4 preferably have horizontal walls so that they afford less resistance to the movement of ashes and the like.

In the operation of the stokers or combustion apparatus of this invention, the coal is deposited from the chute 23 and nozzle 24 in the grate member, where it is ignited, the upper surface of the coal being below the cap 16 and the orifice 17. Power is applied by the motor 31 to rotate the grate member 1 slowly on the rollers 6 and driven roller 6*a*, and to force air from the blower 22 through the passageway 14 and the ports 17 and 37 in the preheater.

The openings 63 in the draft door 64 are sufficiently restricted to prevent sufficient air from entering the ash chamber and passing through the ports 4 to permit free burning of fuel in the fuel bed on the grate member 1. By restricting the air passing through the ports 4, the temperature in the fuel bed may be readily held between about 600° C. and about 1100° C., so that the melting temperature of the ash is not reached and yet the volatile matter is gradually driven from the fuel to the vicinity of the cap 16, where it comes in contact with the preheated air from the orifice 17 and burns as a gas flame.

As the grate member 1 is slowly rotated, the stirring members operate to move the fuel toward the central opening 3 in the grate member where, because of the grinding action caused by the relative movement of the non-rotating air preheater and the rotating grate, the ashes are dropped through the annular space between the walls of the opening 3 and the body 15 of the air preheater. The relative movement of the air preheater and the fuel bed also insures good contact

between the air preheater body and the burning fuel, and thus substantially improves the efficiency of the air preheater. By regulation of the speed of the conveyor **25**, the rate of fuel consumption may be varied, as desired.

Referring particularly to Fig. 6, a modified form of a stirrer, operable by rotation of the grate member, may comprise rotatable members having projections which are adapted to extend through the ports **4** and periodically disturb the fuel bed. The rotatable members may be star wheels **47** with suitably spaced arms rotatably mounted about shafts **49** journalled in the bracket **50** carried by the walls **5**. The ports **4** are spaced so that the lands between them substantially correspond to the space between the successive legs of the star wheels. In the operation of the stoker, the star wheels **47** are rotated by rotation of the grate member. The arms **48** protrude through the spaced slots into the fuel bed and move the fuel and ashes intermittently and progressively toward the central opening **3**, where the ash is discarded.

Referring particularly to Fig. 7, another modified form of a stirrer for moving the material in the grate member **1** progressively toward the central opening **3** may comprise a poker **51** having a plurality of arms **52** carried by a spring **53** rigidly mounted on the base member **28**. Means, such as the roller **54** and cooperating cams **55**, are provided to move the poker in and out of the ports **4** as the grate member **1** is rotated. The roller **54** is adapted to ride upon cams **55** attached to said grate member, and the cams **55** are suitably spaced so that the highest point of each cam is in contact with the roller **54** when the arms **52** are opposite the lands separating the slots **4**. In the operation of the stoker, the rotation of the grate member causes the poker to be moved, flexing the spring **53**, so that the arms **52** are periodically inserted through the slots **4** into contact with the fuel bed. They thus gradually prod the fuel toward the central portion of the grate.

It will be seen that the temperature of the fuel bed in furnaces and stokers of the present invention is relatively low, substantially the entire heat therein being obtained by burning the non-volatile matter of the coal at a controlled rate. The ash never having been melted is obtained in a readily pulverizable or powdered state and can be removed in a dustless manner from the ash chamber by suitable automatic means (not shown). By bringing sufficient preheated air into contact with the volatile material, the latter may be completely consumed and the formation of smoke prevented. While I have described the combustion apparatus of the present invention as particularly suitable for low grade fuel having a high percentage of volatile matter, it is understood that it will apply to any coal whether anthracite or bituminous if gases emanate from the coal during burning.

The principles of the present invention may be utilized in various ways, numerous modifications and alterations being contemplated, substitution of parts and changes in construction being resorted to as desired, it being understood that the embodiments shown in the drawings and described above are given merely for purposes of explanation and illustration without intending to limit the scope of the claims to the specific details disclosed.

What I claim is:

1. In a furnace stoker, an annular rotatable grate member having an opening substantially centrally thereof and having upwardly sloping sides adapted to support a fuel bed, said sides having inlet ports spaced therein for the passage of air into said fuel bed, an air preheating member disposed centrally of said grate member and having a passageway for the passage of air through said fuel bed and through said central opening in said grate member without permitting the air to come in contact with the fuel in said fuel bed, the sides of said central opening in said grate member being spaced from said air preheating member to provide a space for the removal of ashes, means for supporting said grate member in a rotatable manner, a cap on said air preheating member for deflecting heated air toward said fuel bed, means for rotating said grate member with respect to said preheating member, means for forcing air through the passageway in said preheating member, and means for separately regulating the passage of air through said inlet ports into said fuel bed, whereby free burning of the fuel in said fuel bed may be prevented and the temperature of the fuel may be held below its fusion point, so that formation of clinkers may be prevented without interfering with the combustion of the volatile matter.

2. In a furnace stoker, an annular rotatable grate member having an opening substantially centrally thereof and having upwardly sloping sides adapted to support a fuel bed, said sides having inlet ports spaced therein for the passage of air into said fuel bed, an air preheating member disposed centrally of said grate member and having a passageway for the passage of air through said fuel bed and through said central opening in said grate member without permitting the air to come in contact with the fuel in said fuel bed, means for increasing the effective surface of said passageway, a cap on said air preheating member for deflecting heated air toward said fuel bed, means for supporting said grate member in a rotatable manner, means for rotating said grate member with respect to said preheating member, means for forcing air through the passageway in said preheating member and means for separately controlling the passage of air through the fuel bed through said inlet ports in the grate member, whereby the temperature of the fuel bed may be held below the fusion point of the fuel.

3. In a furnace stoker, a rotatable grate member of inverted frusto conical shape adapted to retain a fuel bed, said grate member having an opening substantially centrally thereof and having sides with inlet ports therein for the passage of air into said fuel bed, an air preheating member disposed centrally of said grate member and having a passageway for the passage of air through said fuel bed and through said central opening in said grate member without permitting the air to come in contact with the fuel in said fuel bed, a cap on said air preheating member for deflecting preheated air toward the upper surface of said fuel bed, means for supporting said grate member in a rotatable manner, means for rotating said grate member with respect to said preheating member, means for forcing air through the passageway in said preheating member and means for separately controlling the passage of air through the fuel bed through said inlet ports in the grate member, whereby the temperature of the fuel bed may be held below the fusion point of the fuel.

4. In a furnace stoker, an annular rotatable

grate member having an opening substantially centrally thereof and having upwardly sloping sides adapted to support a fuel bed, said sides having inlet ports spaced therein for the passage of air into said fuel bed, an air preheating member disposed substantially centrally of said grate member and adapted to absorb heat from said fuel bed, said air preheating member having a passageway for the passage of air through said fuel bed to a discharge port disposed above the surface of said fuel bed, means for deflecting preheated air toward said fuel bed, means for supporting said grate member in a rotatable manner, said central opening in said grate member having a substantially larger diameter than the diameter of said air preheating member to provide a space for the removal of ashes, means for rotating said grate member with respect to said preheating member, means for forcing air through the passageway in said preheating member and means for separately controlling the passage of air through the fuel bed through said inlet ports in the grate member, whereby the temperature of the fuel bed may be held below the fusion point of the fuel.

5. In a furnace stoker, an annular rotatable grate member having an opening substantially centrally thereof and having upwardly sloping sides adapted to support a fuel bed, said sides having inlet ports spaced therein for the passage of air into said fuel bed, an air preheating member disposed substantially centrally of said grate member and adapted to absorb heat from said fuel bed, said air preheating member having a passageway for the passage of air through said fuel bed to a discharge port disposed above the surface of said fuel bed, a bleeder port to by-pass a portion of air into said fuel bed adjacent said preheater member, means for supporting said grate member in a rotatable manner, means for rotating said grate member with respect to said preheating member, means for forcing air through the passageway in said preheating member and means for separately controlling the passage of air through the fuel bed through said inlet ports in the grate member, whereby the temperature of the fuel bed may be held below the fusion point of the fuel.

6. In a furnace stoker, an annular rotatable grate member having an opening substantially centrally thereof and having upwardly sloping sides adapted to support a fuel bed, said sides having inlet ports spaced therein for the passage of air into said fuel bed, an air preheating member disposed through the central opening of said grate member and spaced from the wall of said opening to provide a port for removal of ashes from said grate member, said air preheating member having a passageway for conducting forced air above the fuel bed and for raising the temperature of said air with heat conducted from said fuel bed, means for supporting said grate member in a rotatable manner, means for rotating said grate member with respect to said preheating member, means for deflecting preheated air toward said fuel bed at the upper surface thereof, means for forcing air through the passageway in said preheating member and means for separately controlling the passage of air through the fuel bed through said inlet ports in the grate member, whereby the temperature of the fuel bed may be held below the fusion point of the fuel.

7. In a furnace stoker, an annular rotatable grate member having an opening substantially centrally thereof and having upwardly sloping sides adapted to support a fuel bed, said sides having inlet ports spaced therein for the passage of air into said fuel bed, an air preheating member disposed centrally of said grate member and having a passageway for the passage of air through said fuel bed and through said central opening in said grate member without permitting the air to come in contact with the fuel in said fuel bed, means for deflecting preheated air toward the upper surface of said fuel bed, means for supporting said grate member in a rotatable manner, means for rotating said grate member with respect to said preheating member, said central opening in said grate member having a larger diameter than the diameter of said air preheating member, means for progressively moving the material in said grate member to the central opening of said grate member, means for forcing air through the passageway in said preheating member and means for separately controlling the passage of air through the fuel bed through said inlet ports in the grate member, whereby the temperature of the fuel bed may be held below the fusion point of the fuel.

8. In a furnace stoker, an annular rotatable grate member having an opening substantially centrally thereof and having upwardly sloping sides adapted to support a fuel bed, said sides having inlet ports spaced therein for the passage of air into said fuel bed, an air preheating member disposed centrally of said grate member, spaced from said grate member to provide an annular ash removing port and having a passageway for the passage of air through said fuel bed and through said central opening in said grate member without permitting the air to come in contact with the fuel in said fuel bed, means for deflecting preheated air toward said fuel bed, means for supporting said grate member in a rotatable manner, means for rotating said grate member with respect to said preheating member, means operable by rotation of said grate member for progressively moving the fuel and ash toward the central opening in said grate member, means for forcing air through the passageway in said preheating member and means for separately controlling the passage of air through the fuel bed through said inlet ports in the grate member, whereby the temperature of the fuel bed may be held below the fusion point of the fuel.

9. In a furnace stoker, an annular rotatable grate member having an opening substantially centrally thereof and having upwardly sloping sides adapted to support a fuel bed, said sides having inlet ports spaced therein for the passage of air into said fuel bed, an air preheating member disposed centrally of said grate member and having a passageway for the passage of air through said fuel bed and through said central opening in said grate member without permitting the air to come in contact with the fuel in said fuel bed, means for supporting said grate member in a rotatable manner, means for rotating said grate member with respect to said preheating member, vibratory means for progressively moving the material in said grate member to the central opening of said grate member, means for forcing air through the passageway in said preheating member and means for separately controlling the passage of air through the fuel bed through said inlet ports in the grate member, whereby the temperature of the fuel bed may be held below the fusion point of the fuel.

10. In a furnace stoker, an annular rotatable

grate member having an opening substantially centrally thereof and having upwardly sloping sides adapted to support a fuel bed, said sides having inlet ports spaced therein for the passage of air into said fuel bed, an air preheating member disposed centrally of said grate member and having a passageway for the passage of air through said fuel bed and through said central opening in said grate member without permitting the air to come in contact with the fuel in said fuel bed, means for supporting said grate member in a rotatable manner, means for rotating said grate member with respect to said preheating member, a projection carried by said grate member, means operable by rotation of said grate member for periodically causing vibration of said projection and said grate member, means for forcing air through the passageway in said preheating member and means for separately controlling the passage of air through the fuel bed through said inlet ports in the grate member, whereby the temperature of the fuel bed may be held below the fusion point of the fuel.

11. In a furnace stoker, an annular rotatable grate member having an opening substantially centrally thereof and having upwardly sloping sides adapted to support a fuel bed, said sides having inlet ports spaced therein for the passage of air into said fuel bed, an air preheating member disposed through the central opening of said grate member and spaced from the wall of said opening to provide a port for removal of ashes from said grate member, said air preheating member having a passageway for conducting forced air above the fuel bed and for raising the temperature of said air with heat conducted from said fuel bed, means for supporting said grate member in a rotatable manner, means for rotating said grate member with respect to said preheating member, a lug carried by said rotatable member, means for forcing air through the passageway in said preheating member, a hammer member adapted to be actuated by rotation of said grate member so that it periodically contacts said lug and causes the vibration of said grate member and means for separately controlling the passage of air through the fuel bed through said inlet ports in the grate member, whereby the temperature of the fuel bed may be held below the fusion point of the fuel.

12. In a furnace stoker, an annular rotatable grate member having an opening substantially centrally thereof and having upwardly sloping sides adapted to support a fuel bed, said sides having inlet ports spaced therein for the passage of air into said fuel bed, an air preheating member disposed centrally of said grate member and having a passageway for the passage of air through said fuel bed and through said central opening in said grate member without permitting the air to come in contact with the fuel in said fuel bed, means for supporting said grate member in a rotatable manner, means for rotating said grate member with respect to said preheating member, a stirrer having arms adapted to extend periodically through spaced ports in said grate member, said arms being movable relative to said grate member to cause progressive movement of the material in said grate member toward said central opening therein, means for forcing air through the passageway in said preheating member and means for separately controlling the passage of air through the fuel bed through said inlet ports in the grate member, whereby the temperature of the fuel bed may be held below the fusion point of the fuel.

13. In a furnace stoker, an annular rotatable grate member having an opening substantially centrally thereof and having upwardly sloping sides adapted to support a fuel bed, said sides having inlet ports spaced therein for the passage of air into said fuel bed, an air preheating member disposed centrally of said grate member and having a passageway for the passage of air through said fuel bed and through said central opening in said grate member without permitting the air to come in contact with the fuel in said fuel bed, means for supporting said grate member in a rotatable manner, means for rotating said grate member with respect to said preheating member, a rotatable stirrer having arms adapted to extend periodically through spaced ports in said grate member, said arms being movable relative to said grate member to cause progressive movement of the material in said grate member toward said central opening therein, means for forcing air through the passageway in said preheating member and means for separately controlling the passage of air through the fuel bed through said inlet ports in the grate member, whereby the temperature of the fuel bed may be held below the fusion point of the fuel.

14. In a furnace stoker, a rotatable grate member adapted to support a fuel bed and having spaced inlet ports for the passage of air into said fuel bed, an air preheating member disposed substantially centrally of said grate member through a central opening therein, said air preheating member having a passageway for the passage of air through said fuel bed and through the central opening in said grate member, means for supporting said grate member in a rotatable manner, means for rotating said grate member with respect to said preheating member, means for forcing air through the passageway in said preheating member, means for deflecting preheated air toward said fuel bed, and means for separately regulating the passage of air through said spaced inlet ports into the fuel bed and through the air preheater, whereby the temperature of the fuel bed may be held below the fusion temperature of the fuel bed and the formation of clinkers may be prevented.

15. In a furnace stoker, a rotatable grate member adapted to support a fuel bed and having spaced inlet ports for the passage of air into said fuel bed, an air preheating member disposed substantially centrally of said grate member through a central opening therein, said air preheating member having a passageway for the passage of air through said fuel bed and through the central opening in said grate member, means for supporting said grate member in a rotatable manner, means for rotating said grate member with respect to said preheating member, means for controllably supplying fuel to the upper surface of said fuel bed, means for forcing air through the passageway in said preheating member, means for deflecting preheated air toward said fuel bed, and means for separately regulating the passage of air through said spaced inlet ports into the fuel bed and through the air preheater, whereby the temperature of the fuel bed may be held below the fusion temperature of the fuel bed and the formation of clinkers may be prevented.

16. In a furnace stoker, a rotatable grate member adapted to support a fuel bed and having

spaced inlet ports for the passage of air into said fuel bed, an air preheating member disposed substantially centrally of said grate member through a central opening therein, said air preheating member having a passageway for the passage of air through said fuel bed and through the central opening in said grate member, means for supporting said grate member in a rotatable manner, means for rotating said grate member with respect to said preheating member, means for controllably supplying fuel to the upper surface of said fuel bed, means for forcing air through the passageway in said preheating member, means for deflecting relatively highly preheated air from said air preheating member toward said fuel bed, means for preventing the preheated air from contacting said fuel supply means, whereby coking of fuel in said fuel supply means is prevented.

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