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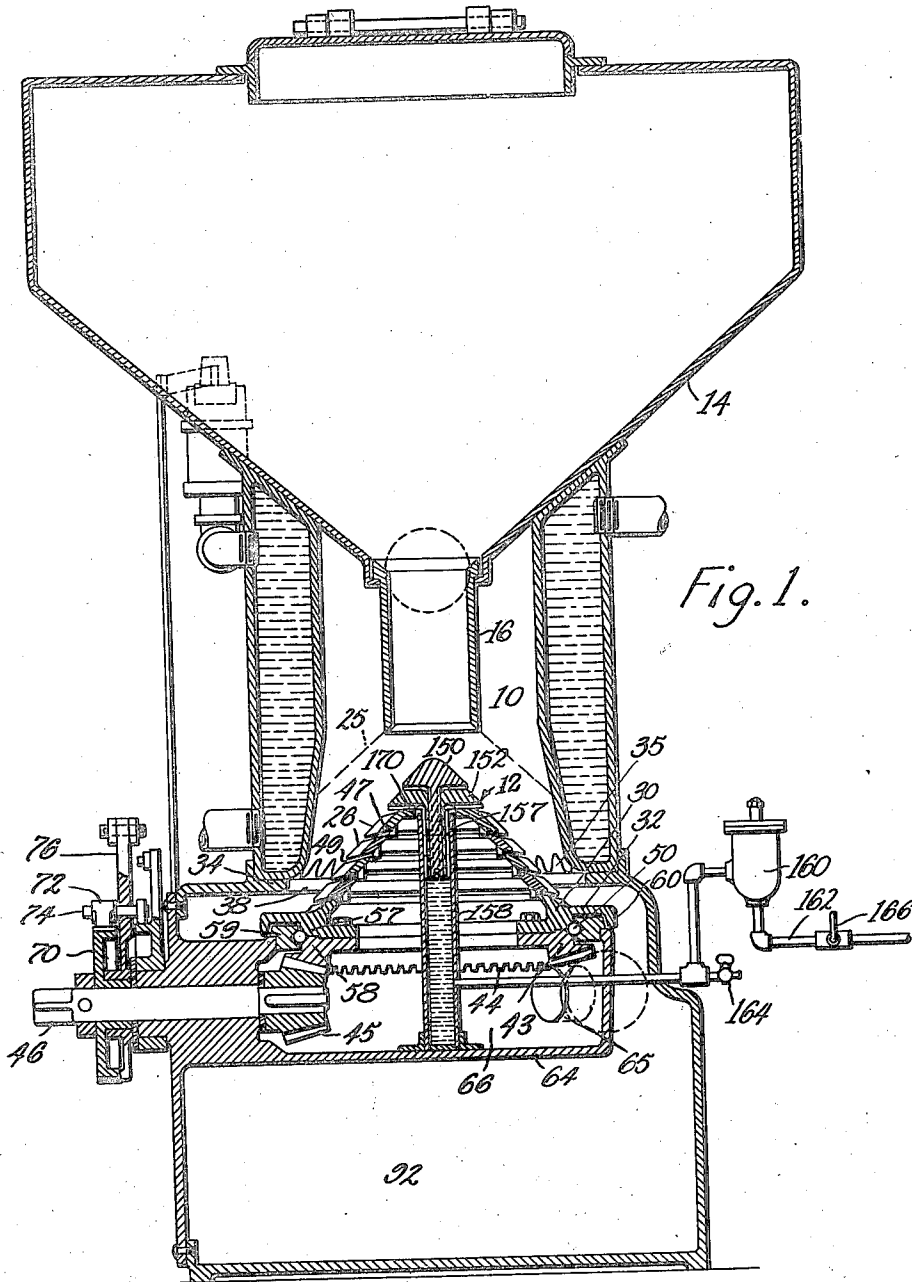
L. W. CORBETT ET AL

1,999,442

COMBUSTION APPARATUS

Filed Feb. 18, 1932

2 Sheets-Sheet 1



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Fig. 2.

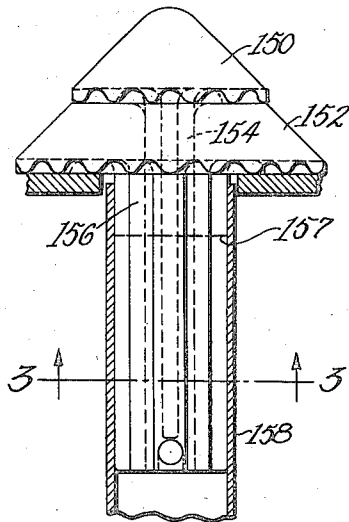


Fig. 3.

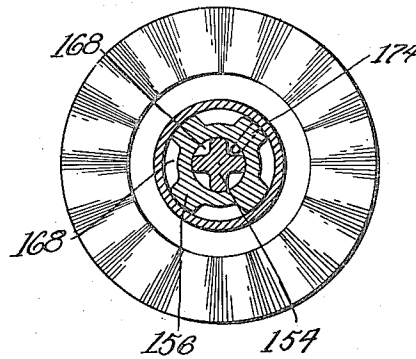
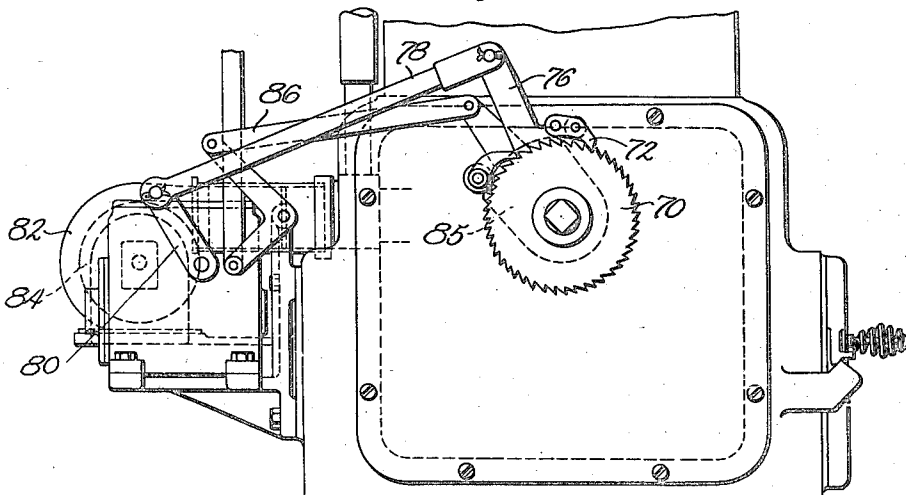


Fig. 4.



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COMBUSTION APPARATUS

Lawrence W. Corbett, Belmont, and Ralph N. Doble, Hingham, Mass., assignors, by direct and mesne assignments, of thirty-three per cent to Blanche L. Doble, Hingham, Mass., thirty-four per cent to William H. Doble, Quincy, Mass., and thirty-three per cent to said Lawrence W. Corbett

Application February 18, 1932; Serial No. 593,736

3 Claims. (Cl. 110—36)

This invention relates to combustion apparatus for burning solid fuel, and more particularly to heating apparatus for domestic purposes, such as to apparatus for heating dwelling houses and garages, moderate sized buildings, and also for heating water for domestic purposes.

In general, the invention has for an object to provide a novel and improved construction of heating apparatus of the character specified which is adapted to efficiently burn various commercial grades of coal and coke in such manner as to avoid interruption in its operation by reason of the formation of clinker in the fuel bed.

With this general object in view, and such others as may hereinafter appear, the invention consists in the combustion apparatus and in the structures, arrangements and combinations of parts hereinafter described and particularly defined in the claims at the end of this specification.

In the drawings illustrating the preferred embodiment of the invention, Fig. 1 is a vertical sectional view of the preferred form of apparatus; Fig. 2 is a vertical sectional detail through the upper portion of the conical grate showing a portion of the mechanism provided for cooling the grate; Fig. 3 is a cross sectional view taken on the line 3—3 of Fig. 2 viewed in the direction of the arrows; and Fig. 4 is a detail in side elevation of a portion of the apparatus shown in Fig. 1 illustrating the grate moving mechanism.

In general, the present invention contemplates a combustion apparatus for burning solid fuel, such as any of the commercial grades of coal or coke, in which provision is made for reducing to a minimum the interference with the operation of the apparatus by reason of the adhesion of clinker to the grate.

In the preferred form of apparatus a rotatable and preferably a conical grate is operatively supported within a combustion chamber, and provision is made for depositing fuel upon the upper portion of the grate to maintain a substantially uniform fuel bed upon the grate as combustion proceeds. During combustion provision is made for moving and preferably rotating the grate, to effect discharge of ash from the lower portion of the fuel bed and to effect a gradual and progressive movement of the burning fuel bed down the grate during periods of active combustion as distinguished from bank fire periods. In order to prevent adherence to the grate of any clinker which may form within the fuel bed, and in order to reduce to a minimum the tendency to form clinker, provision is made for cooling the grate and particularly the upper portion thereof dur-

ing the operation of the apparatus by a cooling medium in addition to the air passed through the grate to maintain the combustion. In the preferred form of the invention, the cooling medium preferably comprises water which is generated into steam by heat absorbed from the grate, and the steam thus formed is preferably distributed through portions of the fuel bed.

Referring now to the drawings, the invention is for purposes of illustration shown as embodied in heating apparatus suitable for heating dwelling houses and other moderate sized buildings, and for general water heating purposes, in which 10 represents a combustion chamber, 12 a conical grate, 14 a supply hopper for retaining a supply of the solid fuel such as coal from which the coal is discharged through a coal discharge tube 16 down onto the conical grate. The end of the discharge tube terminates a short distance above the conical grate, and during the operation of the apparatus a constant bed of fuel is maintained in the position indicated by the dotted line 25 in Fig. 1. It is preferred to construct the conical grate of a plurality of sections 26 which interlock to rotate as a unit, and the lower section 30 is preferably cast to provide a skirt 32, the upper surface of which is preferably substantially horizontal and of a sufficient width so that the skirt projects outwardly a substantial distance beyond the inner wall of the lower portion of the combustion chamber. The lower portion of the inner wall is provided with ribs 35 for cooperation with the rotary grate in grinding ash and such clinker as may be formed. The upper surface of the skirt 32 is spaced from the lower portion of the inner wall of the combustion chamber to form a throat or constricted passage indicated at 38.

The conical grate 12 is, as herein shown, made up of a plurality of sections, and each section is provided with depending lugs 47 which cooperate with recesses in the next succeeding section to lock the sections together and to space one section a short distance from the next lower section so as to provide a series of downwardly and outwardly extending air channels 49 through which the primary air may be caused to pass through the fuel bed supported upon the grate. The lower section of the grate is bolted or otherwise secured to a ring 43 having a ring gear 44 cooperating with a driving pinion 45 secured upon the end of a drive shaft 46 rotated through suitable mechanism, as will be described. The grate is supported on a series of ball-bearings 50 with-

in a raceway formed by cooperative surfaces 57, 58 of portions of the lower section of the grate and ring 43 respectively, and the remaining sides of the raceway are formed by an angular recess in a supporting ring 59 mounted upon the frame, as shown. The skirt 32 projecting from the lower section of the grate is provided with a downwardly turned lip 60 extended over the supporting ring 59 illustrated in detail in Fig. 1 to thereby assist in protecting the bearings against the entrance of ash and dirt.

The conical grate 12 is hollow, and as herein shown, cooperates with the bottom wall 64 of the burner pot to form a closed chamber 66 to which air is admitted under pressure through an air inlet pipe 65 from any convenient source of supply, as for example a blower or fan, not shown. During the operation of the apparatus the air under pressure from within the closed air chamber 66 passes through the narrow air passages 49 between successive sections of the grate to supply air for the combustion of the fuel. The construction of air pressure chamber 66 formed within the grate and burner pot serves to assist in preventing the entrance of ash or dirt into the bearings 50 by reason of the pressure through the bearings and outwardly under the projecting skirt.

During the operation of the apparatus, provision is made for rotating the grate, and as herein shown, the driving shaft 45 upon which the driving gear 45 is mounted, has affixed to its outer end a ratchet wheel 70 with which a pawl 72 cooperates to advance the ratchet wheel and consequently to effect rotation of the conical grate when the pawl is advanced. The pawl is carried upon the top of a pawl arm 74, as best shown in Fig. 1, which is connected to an arm 76, the latter being connected by a link 78 to a crank 80. The crank 80 is arranged to be revolved from an electric motor 82 through the medium of a reduction gearing 84 of any usual or preferred form now upon the market. Provision is made for controlling the effective throw of the pawl 72 to control the extent of grate movement at each revolution of the crank 80, and as herein shown, a shield member 85 pivoted upon the shaft 46 is arranged to be moved relative to the pawl so as to slide under a pin projecting from the pawl to maintain the nose of the pawl disengaged from the teeth of the ratchet wheel for the desired portion of the normal stroke of the pawl to thereby prevent it from picking up any desired number of teeth. The pivoted shield is preferably connected to a control link 86 running from a thermostat or from a manual control.

In order to supply fuel to the conical grate to maintain a substantially uniform bed of fuel thereon, as herein shown, a bulk supply of fuel is stored within a fuel reservoir 14 located above the grate in a position from which the fuel may automatically flow onto the grate by gravity. The flow of the fuel is controlled by the rate of consumption of the fuel bed in cooperation with the ash discharged therefrom and as long as fuel remains in the hopper a substantially uniform fuel bed is maintained upon the grate. During the combustion sufficient air is supplied through the fuel bed to maintain practically the entire fuel bed incandescent, and the ash resulting from the combustion gradually slides and works downwardly toward the restricted throat or passage between the skirt 32 and the dead ring 34 pre-

paratory to being forced over the skirt to drop into the ash-pit where it may conveniently be caught in an ash receptacle 92.

In order to reduce to a minimum the tendency of any clinker which may form in the fuel bed to adhere to the surface of the grate and thereby disturb the normal and efficient operation of the apparatus, and also for the purpose of reducing to a minimum clinker formation in the fuel bed when the apparatus is used upon low grade fuel, provision is made for cooling portions of the grate and preferably the upper portions of the grate by a medium other than the air passed through the grate to maintain combustion. As herein shown, the upper portion of the grate is formed so as to transfer heat therefrom to a body of water, effecting the generation of steam and the accompanying withdrawal of heat from the upper portion of the grate and the consequent cooling thereof. As shown in Figs. 1, 2 and 3, the two upper grate sections 150, 152 are provided with depending metal members 154, 156, respectively, and these depending members are made of sufficient length to project into and a substantial distance below the surface 157 of a body of water received within the standpipe 158. The standpipe 158 is preferably mounted upon the bottom wall 64 of the burner pot, and provision is made for maintaining a constant level of water within the standpipe 158 by any suitable constant level mechanism, herein shown as including a constant level float valve 160 of known construction, in the water inlet line 162. A suitable drain cock 164 may be provided and also a shut-off cock 166 in the line.

Provision is made for effecting the passage through the fuel bed of the steam which may be generated by heat transferred to the body of water from the depending portions 154, 156 of the grate sections 150, 152, and for this purpose the depending members 154, 156 are preferably shaped, as illustrated in section in Fig. 3, to provide vertical passages or channels 168 through which the steam may rise and pass outwardly between the grate sections. To facilitate the passage of the steam outwardly, both grate sections are fluted, as shown, providing a plurality of outwardly extended steam passages. In order to rotate the grate sections 150, 152 as the main body of the grate is rotated, the second section 152 is arranged to be rotated through a lug 170 which cooperates with a slot in the next lower grate section and the top section or apex 150 of the grate is rotated by the grate section 152 through the reception of a pin 174 in one of the steam channels 168, as illustrated in Figs. 2 and 3.

From the description thus far, it will be observed that during the operation of the apparatus, heat is withdrawn from the upper grate sections 150, 152 through the generation of steam within the standpipe 158 and the steam thus generated is forced upwardly through the channels 168 and thence outwardly between the grate sections into the fuel bed. In this manner the uppermost grate sections 150, 152 are reduced in temperature sufficiently to prevent the adhesion thereto of any clinker which may form, and furthermore, the passage of the steam outwardly through the upper portion of the fuel bed has the effect of maintaining a certain porosity in the fuel bed and thereby reducing to a minimum the clinker formation as well as maintaining any clinker which happens to form in the shape of small pieces as distinguished from a solid mass. As a result, any clinker which does form works down-

wardly and is ground and discharged as ash. The diminution of temperature of the upper portion of the grate indirectly reduces to some extent the temperature of the fire immediately surrounding such portion of the grate and this of itself assists in maintaining clinker formation at a minimum.

While it is preferred to utilize water as a medium for cooling the grate, nevertheless other mediums in addition to the air passing through the grate may be used if found desirable.

While the preferred embodiment of the invention has been herein illustrated and described, it will be understood that the invention may be embodied in other forms within the scope of the following claims.

Having thus described the invention, what is claimed is:—

1. In a heating apparatus adapted to burn solid fuel with maximum heating efficiency, in combination, a combustion chamber, a conical grate rotatably mounted therein, means for slowly rotating the grate during active combustion periods to effect the travel of fuel and ash down the surface of the grate, means for automatically supplying fuel to the upper portion of the grate to maintain thereon a fuel bed of substantially constant volume and conical shape, air supply means adapted to maintain the fuel bed at incandescence during active combustion, said combustion chamber and grate being constructed to provide an open annular passage surrounding the lower portion of the grate for permitting free discharge of ash therethrough, and means for cooling the upper portion of the grate sufficiently to prevent adherence of clinker thereto whereby to enable unrestricted downward movement of the fuel bed when the grate is rotated, said means including an open container located within the conical grate containing a body of water, the upper portion of the conical grate being provided with a heat conducting depending portion extending downwardly into said container a substantial distance beneath the water level therein to effect a heat transfer from the upper portion of the grate to the water within the container.

2. In a heating apparatus adapted to burn solid fuel with maximum heating efficiency, in combination, a combustion chamber, a conical grate rotatably mounted therein, means for slowly rotating the grate during active combustion periods to effect the travel of fuel and ash down the surface of the grate, means for automatically sup-

plying fuel to the upper portion of the grate to maintain thereon a fuel bed of substantially constant volume and conical shape, air supply means adapted to maintain the fuel bed at incandescence during active combustion, said combustion chamber and grate being constructed to provide an open annular passage surrounding the lower portion of the grate for permitting free discharge of ash therethrough, and means for cooling the upper portion of the grate sufficiently to prevent adherence of clinker thereto whereby to enable unrestricted downward movement of the fuel bed when the grate is rotated, said means including an open container located within the conical grate containing a body of water, the upper portion of the conical grate being provided with a plurality of heat conducting depending portions extending downwardly into the said container a substantial distance beneath the water level therein to effect a heat transfer from the upper portion of the grate to the water within the container.

3. In a heating apparatus adapted to burn solid fuel with maximum heating efficiency, in combination, a combustion chamber, a conical grate rotatably mounted therein, means for slowly rotating the grate during active combustion periods to effect the travel of fuel and ash down the surface of the grate, means for automatically supplying fuel to the upper portion of the grate to maintain thereon a fuel bed of substantially constant volume and conical shape, air supply means adapted to maintain the fuel bed at incandescence during active combustion, said combustion chamber and grate being constructed to provide an open annular passage surrounding the lower portion of the grate for permitting free discharge of ash therethrough, and means for cooling the upper portion of the grate sufficiently to prevent adherence of clinker thereto whereby to enable unrestricted downward movement of the fuel bed when the grate is rotated, said means including a container for a body of water located within the grate, means for supplying water to said container including control mechanism for maintaining a definite depth of water therein, the upper portion of the grate being provided with a heat conducting depending portion extending downwardly into the container a substantial distance beneath the water level therein to effect a heat transfer from the upper portion of the grate to the water within the container.

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