Sept. 17, 1957 H. L. WAGNER 2,806,439

GRATE

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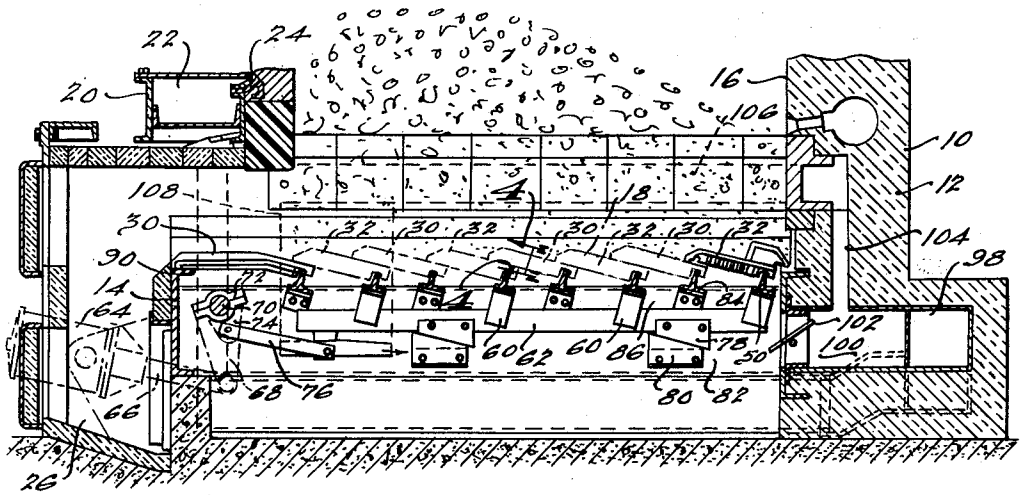


FIG. 1.

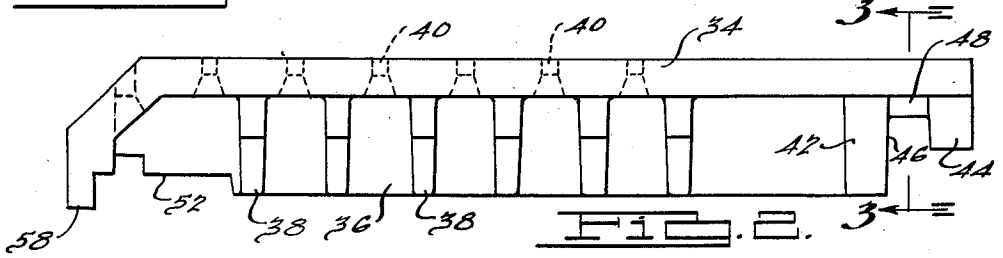


FIG. 2.

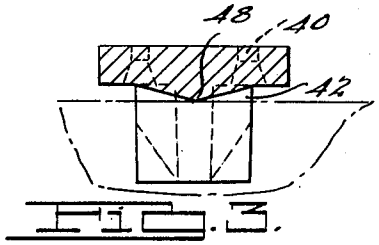


FIG. 3.

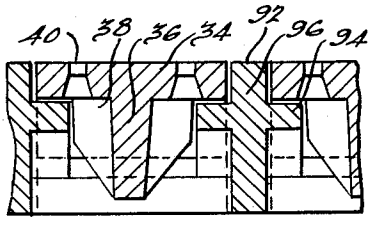


FIG. 4.

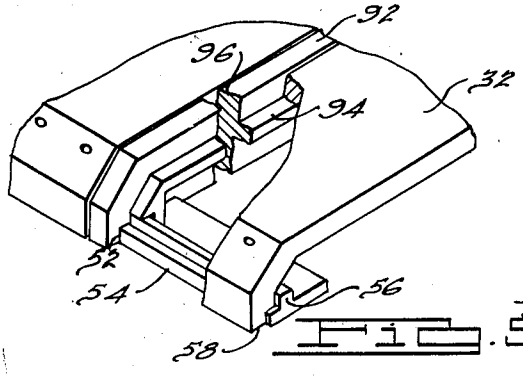


FIG. 5.

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GRATE

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5 Claims. (Cl. 110—38)

This invention relates to furnace grates and, more particularly, to an improved continuous cleaning furnace grate adapted for use in a furnace having a spreader type fuel stoker.

In furnaces of this type, a stoker is usually provided adjacent the front of the furnace which has a plurality of rotating blades which propel coal particles evenly onto the grate with the heavy or large particles being projected farther back into the furnace. Air is supplied under pressure to the underside of the grate and flows upwardly through the grate to support the combustion of the coal on the grate, as well as the combustion of coal particles in suspension adjacent the front of the grate. The grate is provided with overlapping, stationary and movable grate bars which reciprocate relative to each other so as to convey the burning coal forwardly to the front of the furnace where the ashes are dropped into an ash pit adjacent thereto. However, prior grates have not been entirely satisfactory, in that the individual grate bars are supported at the front and rear ends thereof over their entire widths, and as they are commonly rough castings, any warping or twisting thereof, due to the heat within the furnace causes them to cock so that an opening appears between the lower surface of the grate bars and the adjacent surface on which they rest. Such openings cause an excessive air leakage through the grate which seriously upsets the ash and fuel bed conditions and causes a high rate of flow of excess air in the furnace.

Accordingly, an object of the present invention is to overcome disadvantages inherent in such furnace grates and to provide an improved grate having sealing means adapted to prevent leakage of excess air through the grate.

Another object of the invention is to provide improved grate bar supporting means which automatically compensates for warping or twisting of the grate bars, and prevents the formation of openings between the overlapping portions of the bars.

Another object of the invention is to provide an improved grate arrangement that is simple in construction, economical of manufacture, durable, efficient and reliable in operation.

Another object of the invention is to provide an improved grate arrangement on which a greater variety of bituminous coal may be burned more efficiently than was heretofore possible.

Still another object of the invention is to provide an improved furnace grate, adapted for use with a spreader type stoker, having simple and efficient means for obtaining maximum burning efficiency and maximum grate cleanliness.

Yet another object of the invention is to provide an improved furnace grate that may be readily adapted for installation in furnaces of various sizes.

With the above as well as other and in certain cases more detailed objects in view, which will become apparent from the following description and the appended claims, a preferred but illustrative embodiment of the invention is illustrated in the accompanying drawing, throughout

the several views of which corresponding reference characters designate corresponding parts and wherein:

Fig. 1 is a longitudinal, sectional view of a portion of a furnace embodying the grate construction of the present invention;

Fig. 2 is an enlarged, side elevational view of an individual grate bar;

Fig. 3 is a sectional view of the structure illustrated in Fig. 2 taken substantially on the line 3—3 of Fig. 2;

Fig. 4 is a sectional view taken substantially on the line 4—4 of Fig. 1; and

Fig. 5 is a perspective view of a portion of the assembled grate, with portions broken away for purposes of clarity.

Referring to the drawing, and more particularly to Fig. 1, a furnace **10** is illustrated which includes the usual walls **12**, formed of firebrick or the like, and supporting structure **14**. The furnace also includes a combustion chamber **16** in which the fuel, such as coal, is burned, the hot gases passing up through the furnace to heat the boiler and/or heating system, as the case may be. The ash or less combustible portions of the fuel remain on the grate **18** which is disposed adjacent the bottom of the combustion chamber, and is constructed according to the present invention, as will be hereinafter described in greater detail.

A spreader type stoker (not shown) is secured to the box girder **20** attached to the front wall of the furnace adjacent the front portion of the grate **18**. The stoker feeds the fuel into the furnace and onto the grate, spreading the fuel uniformly on the grate, both longitudinally and laterally. The heavier or larger particles are projected onto the rear portion of the grate while the smaller particles fall onto the grate forwardly thereof, or are burned in suspension above the front portion of the grate. In order to facilitate the burning of the lighter particles in suspension, air is supplied through a plenum chamber **22** formed by the box girder **20**, the air passing through the passageway **24** to float the fine particles of fuel into the furnace.

When the furnace is in operation and the fuel is being delivered from the stoker onto the grate, the combustible part of the fuel is converted into hot gases which pass upwardly through the furnace, a boiler and/or fuel heating system and the less combustible parts of the fuel remain on the grate. As the process of combustion continues, the depth of the ash will increase on the grate and the rate of increase is directly proportional to the amount of fuel burned per square foot per hour and the percentage of ash in the fuel being burned. The grate **18** serves two functions. It acts, first, as a grate for burning the fuel and, secondly, as a conveyor for carrying the ash out of the furnace and into an ash pit **26**, adjacent the front end of the grate. According to the present invention, the grate **18** is formed of a plurality of overlapping sections or bars **30** and **32**. Alternate bars **30** are stationary while movable bars **32** are provided between adjacent stationary bars. The front ends of the movable bars **32** overlap the rear or back ends of the stationary bars while the front ends of the stationary bars overlap the rear or back ends of the movable bars. Movable bars **32** are reciprocable relative to the stationary bars **30** and reciprocate from front to rear relative to the furnace or from left to right in Fig. 1.

As shown in Fig. 2, the upper portion **34** of each movable grate bar **32** is substantially flat and an integral, centrally disposed, downwardly extending web portion **36** is provided which extends longitudinally of the bar, while integral, spaced, downwardly extending web portions **38** extend transversely of the bar. Spaced air ports or openings, such as **40**, are provided in the flat portion **34** through which air flows to support the combustion of the fuel.

The rear end portion of each movable grate bar is provided with downwardly extending lugs 42 and 44 defining a transversely extending channel 46 therebetween. An integral, triangularly sectioned projection 48 extends downwardly from the lower surface of the top portion 34 into the channel 46, the apex being substantially on the longitudinal axis of the grate bar. The rear end portion of each movable grate bar rests on a laterally extending, inverted T-sectioned member 50, the web portion of which extends upwardly in the channel 46 and makes substantially line contact with the triangularly-sectioned projection 48.

With the line contact of the grate bar on the T-sectioned member 50, such a construction compensates for any warp or twist in the individual grate bar, since the front end portion of the grate bar is free to lie flat on the surface of the grate bar directly forward thereof, irrespective of any warping, thereby eliminating any possibility of openings occurring between the two overlapping surfaces.

In order to provide a more effective seal between the grate bars 30 and 32 where they overlap, a transversely extending, stepped channel 52 is provided in the forward portion of each grate bar and is adapted to slidably accommodate a seal plate 54 having an upwardly extending rib 56 near, but spaced from, the forward edge thereof, as best seen in Fig. 5. The bottom surface of the seal plate 54 is substantially flush with the bottom surface of the grate bar resting thereon, while the forward edge of the seal plate abuts the downwardly extending flange portion 58 provided on the forward portion of the grate bar. In the event the individual grate bar becomes warped or twisted, the seal plate 54 will remain flat on the surface of the grate bar on which it rests. It will be appreciated that such a construction provides a tortuous passage between the seal plate and the grate bar resting thereon and reduces the air flow or leakage between the overlapping portions of the grate bars.

In the normal operation of the furnace, fine ash or dust will sift through the air ports 40, and become entrained in the air stream beneath the grate. Such fine ash or dust has a tendency to fill or pack in the crevice between the forward face of the seal plate 54 and the rear face of the flange portion 58 to provide a further seal which reduces air leakage to a minimum.

For the purpose of reciprocating the movable grate bars, the opposite lateral ends of each member 50 are connected by suitable brackets 60 with longitudinally extending draw bars 62. One draw bar 62 is provided on each side of the grate, but in the event the grate is extremely wide, more draw bars may be provided. In order to actuate the draw bars, a hydraulic piston and cylinder unit 64 is provided, the piston rod 66 of which is connected to a link arm 68, which in turn is rigidly connected with a laterally extending shaft 70, journaled on the furnace at 72. A second link arm 74 is connected with the shaft 70 adjacent each end thereof, and each link arm 74 is connected with the forward end of one of the draw bars 62 by a link 76. Therefore, when the piston within the unit 64 is reciprocated through a suitable mechanism (not shown) the movable grate bars 32 will be reciprocated through the actuation of the linkage, draw bars and inverted T-members so that the forward end portions of the movable bars 32 and the sealing plates 54 will move over the top surface of the stationary grate bars 30 to move the ash toward the ash pit 26 at the front end portion of the furnace. In order to guide the movement of the movable bars 32 and the sealing plates 54 so that they will move parallel with the surface of the stationary bars 30, which are angularly mounted with their front ends higher than the rear ends, longitudinally spaced shoe members 78 are connected with the draw bars 62 and slidably engage the upper surfaces of shoe members 80 which are bolted to the furnace frame member 82. The shoe members 78 and 80, therefore, positively guide the relative movement between the movable grate bars 32 and the stationary grate bars 30.

The stationary grate bars 30 are constructed similar to the movable grate bars 32 and the triangularly sectioned portions at the rear ends thereof are supported by, and make substantially line contact with, the laterally extending T-sectioned supporting members 84. The supporting members 84 extend the entire width of the furnace and are bolted to side frame members 86 so as to be rigidly supported on the furnace. The forward ends of the stationary bars 30 rest on sealing bars similar to the bars 54 and overlap the adjacent movable grate bars 32, except that the forwardmost stationary bar 30 is supported at 90 on a stationary part of the furnace frame work. It will be appreciated that the number of movable and stationary grate bars may be changed or alternated in accordance with the size of the furnace in which the grate is installed. Furthermore, the width of the grate may be changed because the grate bars 30 and 32 are approximately 3 to 9 inches wide with filler bars 92 disposed therebetween, as shown in Figs. 4 and 5.

The filler bars 92 are of a generally cross shape in section, with laterally extending flanges 94 on opposite sides of the vertically extending central portion 96. The upper surfaces of the flanges 94 engage the underside of the adjacent grate bars so as to prevent ash from seeping down or dropping through between grate bars, while the width of the central portion 96 is somewhat smaller than the space between the side-by-side grate bars in order to permit expansion and contraction of the members. The filler bars 92 are supported at the rear ends thereof by the T-sectioned grate supporting members, while the forward end portions are configured to fit the sealing bars 54 as best seen in Fig. 5. The filler bars adjacent the movable members, of course, move with the movable members while the filler bars adjacent the stationary members do not move. It will be noted that the end portions of the sealing plates 54 project beyond the sides of the grate bars to further seal the space between the abutting surfaces of the grate bar and the filler bar. Such a construction also serves to reduce air leakage through the grate so that air at a high velocity does not flow through the grate.

Air for combustion is supplied to the furnace by a forced draft fan (not shown). The air enters a plenum chamber 98 in the back wall of the furnace and flows through any one of a plurality of paths, such as 100, past the damper 102, or through the passageway 104 and the conduits 106 and 108, to the underside of the grate. The plurality of paths insures that air will be provided in the combustion chamber for burning the fuel on the grate and the fine particles of fuel in suspension adjacent the front portion of the furnace.

During the operation of the furnace, the ash disposed on the grate will be conveyed toward the front of the furnace and into the ash pit by a continual reciprocative motion of the movable grate bars. The number of reciprocations per hour will determine the conveying capacity of the grate, and likewise will determine the depth of the ash on the grate above a fixed minimum.

It will be appreciated that no conveying action will take place until the depth of the ash on the grate has reached a point that the structure of the ashes will be strong enough to withstand the thrust of the movable grate bars 32, so that the entire mass will move forwardly toward the ash pit, with the ash moving from the top surface of one grate bar onto the next grate bar during the grate reciprocation.

From the above description it will be appreciated that the present invention provides an improved grate arrangement, including simple and efficient means for supporting the grate bars which automatically compensates for any twisting or warping of the individual grate bars. The present invention also provides additional sealing means at the forward end portions of the grate bars so that excessive air leakage through the grate is prevented and

more efficient combustion of the fuel is obtained than was heretofore possible.

While a preferred embodiment of the invention has been shown and described, it will be understood that various changes and modifications may be made without departing from the spirit and scope of the invention.

What is claimed is:

1. A furnace grate arrangement comprising a plurality of alternate stationary and movable members, each of said movable members having one end portion thereof overlapping the adjacent stationary member, support means making substantially point contact with the other end portion of each of said members and permitting free rocking movement of said members whereby said members are free to rock to maintain said one end portion of each of said members in sealing relationship with respect to the adjacent member, and means for reciprocating said movable members relative to said stationary members.

2. A furnance grate arrangement comprising a plurality of alternate stationary and movable members, the forward end portion of each of said movable members overlapping the rear end portion of the adjacent stationary member, support means making substantially line contact in a longitudinal direction relative to said movable members with the rear end portion of each of said members and permitting free rocking movement of said members whereby said members are free to pivot to maintain said one end portion of each of said members in sealing relationship with respect to the adjacent member, and means for reciprocating said movable members relative to said stationary members.

3. In combination, a plurality of movable and stationary grate bars, each of said bars having a triangularly sectioned portion extending downwardly from the top portion thereof, the front portion of each of said movable bars overlapping the rear portion of the adjacent stationary bar, support means abutting the apex of said triangularly sectioned portion of each of said bars whereby said members are free to pivot to maintain the forward end portions thereof in sealing relationship with respect to the adjacent member, and means for reciprocating said movable bars.

4. A furnace grate arrangement comprising a plurality of stationary and movable members, the forward portion of each of said movable members overlapping the rear portion of the adjacent stationary member, a sealing element having an upwardly extending rib portion interposed between each of said overlapping portions, the forward portion of each of said movable and stationary members being provided with a transverse groove adapted to receive said upwardly extending rib portion whereby relative sliding movement is permitted between each of said members and said sealing element in a direction perpendicular to the plane of the lower surface of the sealing element, each of said movable and stationary members having a triangular depending portion adjacent the rear end thereof, means effecting substantially line contact with the apex of said depending portion of each of said movable and stationary members whereby said movable and stationary members are free to pivot to maintain the forward portions thereof in sealing relationship with respect to the adjacent sealing element, and means for reciprocating said movable members relative to said stationary members.

5. In combination, a plurality of movable and stationary grate bars, each of said bars having a substantially flat top portion and a centrally disposed, triangularly sectioned portion extending downwrdly from said top portion at a position near, but spaced from, the rear end thereof, the front portion of each of said movable bars overlapping the rear portion of the adjacent stationary bar, a sealing element having an upwardly extending rib portion interposed between each of said overlapping portions, the forward portion of each of said bars being provided with a transverse stepped groove adapted to receive said upwardly extending rib portion whereby relative sliding movement is permitted between each of said bars and said sealing element in a direction perpendicular to the plane of the lower portion of the sealing element, means abutting the apex of said triangularly sectioned portion for supporting the rear portion of each of said bars whereby said bars are free to pivot to maintain the forward end portions thereof in sealing relationship with respect to the adjacent sealing element, and means for moving said movable bars longitudinally with respect to said stationary bars.

References Cited in the file of this patent

UNITED STATES PATENTS

540,669	Ingram et al.	June 11, 1895
689,827	McClave	Dec. 24, 1901
1,111,059	Dietz	Sept. 22, 1914
1,817,484	Goebel	Aug. 4, 1931
1,908,992	Martin	May 16, 1933
2,250,067	Martin	July 21, 1941

FOREIGN PATENTS

369,015	Great Britain	Mar. 17, 1932