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STOKER

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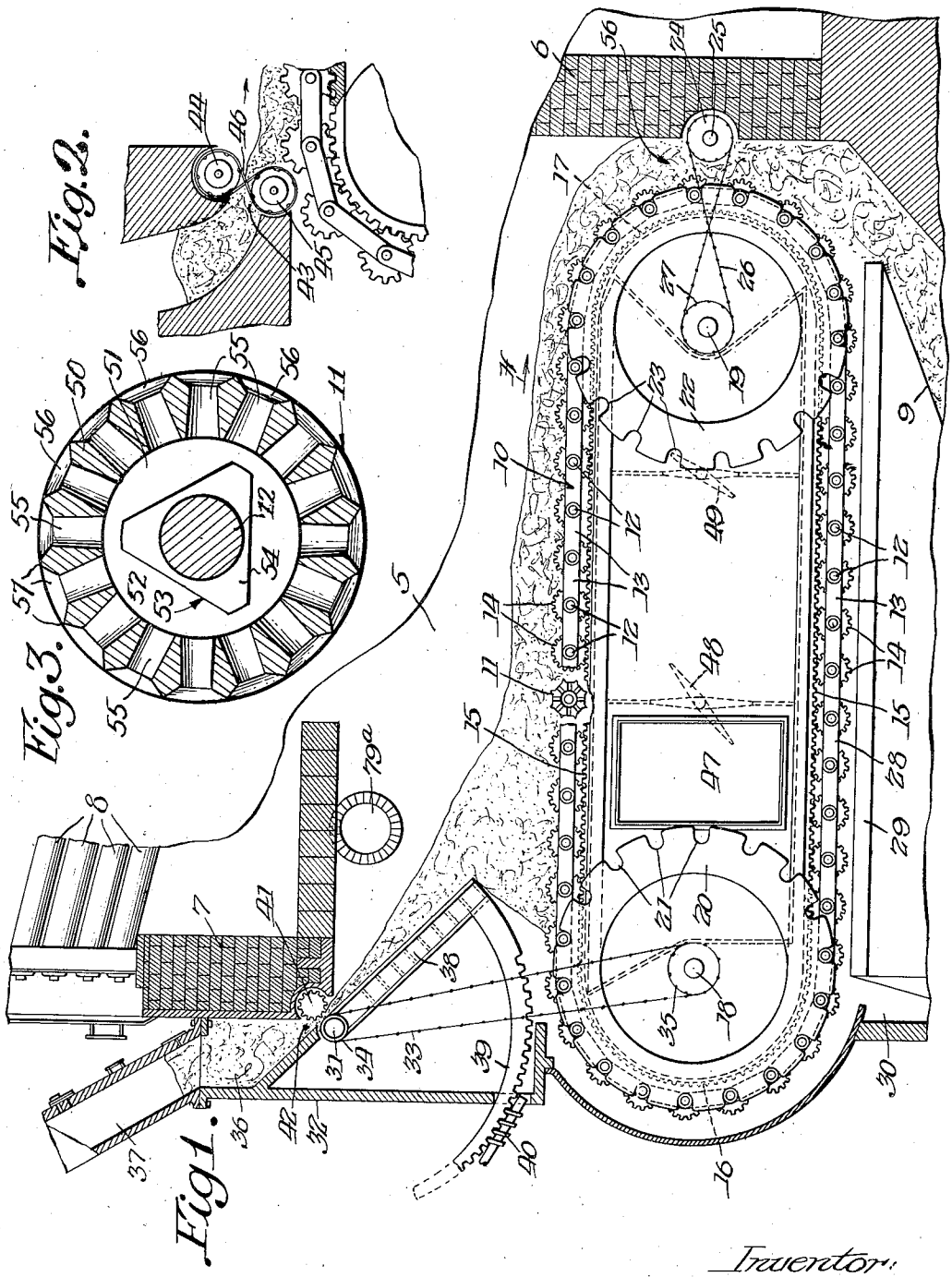


Fig. 1.

Fig. 3.

Fig. 2.

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STOKER

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Original application December 21, 1922, Serial No. 608,228. Divided and this application October 22, 1934, Serial No. 749,434

10 Claims. (Cl. 110—40)

This invention relates broadly to conveying and distributing material, and more particularly pertains to improvements in apparatus for feeding solid fuel, such as coal and the like, to furnaces, such apparatus being commonly known as stokers.

While the invention is illustrated as embodied in an automatic stoking device for the purpose of delivering and distributing fuel in a furnace, whereby to increase the efficiency and the utility of the furnace, it will be readily understood that the invention is not limited to such adaptation, but finds a wide field of utility for other purposes.

Among the more important objects and advantages which characterize this invention, are: the provision of an improved apparatus for conveying and distributing material; the provision of an improved apparatus for conveying and distributing fuel, such as coal and the like; the provision of an improved apparatus for delivering fuel, such as coal for use within a furnace; the provision of an improved apparatus for stoking a furnace; the provision of an improved apparatus for delivering fuel to a furnace and for distributing the fuel evenly in the furnace; the provision of an improved grate structure for furnace and the like; the provision of an improved fuel sizing and delivery apparatus for furnaces and the like; the provision of an improved means for regulating the quantity, size and delivery of fuel to a furnace.

It is an important object of this invention to provide an improved mechanism for sizing and evenly and uniformly distributing the fuel delivered to a furnace, and to this end the invention involves an improved grate bar structure which is characterized by the provision of a series of adjacent hollow perforated grate bars; the provision of a furnace structure characterized by the provision of revoluble grate bars; the provision of a grate bar structure which operates to deliver and distribute fuel to a desired point for consumption and during consumption in a furnace; the provision of an improved grate structure comprising a continuous series of revoluble grate bars; the provision of a grate structure comprising a continuous series of perforated revoluble grate bars; the provision of an improved grate structure comprising a continuous series of adjacent or contiguous hollow perforated grate bars; the provision, in a furnace grate, of a series of parallel perforated revoluble grate bars adapted to rotate in the same direction and at the same speed relatively, for the purpose of distributing and continuously advancing the fuel delivered to the furnace, and for the purpose of shaking out the resultant ash during its formation; the provision of improved mechanism for sizing and delivering fuel in desired increments to a furnace; the provision of means for regulating the point in the furnace at which the fuel is to be delivered so as to maintain a desired depth of bed and uniformly level fire; and the provision of improved means whereby the fuel sizing and delivering mechanism referred to is operated in proper co-ordination with the fuel distributing mechanism.

The foregoing and such other objects and advantages as may appear or be pointed out as this description proceeds are attained in one structural embodiment illustrated in the accompanying drawing, in which:

Figure 1 is a vertical longitudinal sectional view of a furnace structure embodying the operative features of the present invention;

Figure 2 shows an alternative means of delivering the fuel to the grate structure.

Figure 3 is a cross section of the grate bars used in the grate structure.

Referring first more particularly to the improved method of stoking a furnace involved in the present invention, there is included the steps of sizing and depositing continuously, or in measured increments, a required quantity of fuel, such as coal and the like, in a furnace; then the step of continuously agitating, conveying, and thus distributing the fuel uniformly throughout the furnace fire box in order to attain a level fire; and, simultaneously with such distribution and during consumption of the fuel, removing the ash from the entire area of the fire bed as such ash is formed, collecting, and disposing of the resultant ash, thus maintaining in operation a continuously clean, ash-free fire. In attaining the steps, including the distribution of fuel and removal of ash during consumption outlined above, I provide an improved grate structure, particularly characterized by the provision of revoluble grate bars, arranged in a continuous group.

This application is a divisional of my co-pending application S. N. 608,228, filed December 21, 1922, now Patent No. 1,977,620 which issued as Patent No. 1,977,620 on October 23, 1934, and the structure here described is particularly adapted for the use of the hollow cylindrical grate bars described therein and also more particularly described and claimed in my co-pending application S. N. 749,433. Referring to Figure 3, which represents a cross section of a grate bar gener-

ally designated as 11, I provide a cylindrical shell 50, which is provided with an enlarged axial bore 51, said shell or cylinder 50 being closed by end walls 52, preferably integral therewith. The end walls are provided with polygonal openings 53 and complementally shaped blocks 54 are receivable in said openings. A revoluble shaft 12 is fixedly connected to the blocks 54 and extends axially through the shell 50, which may be made in sections of any desired length and then fixedly secured to the shaft 12, said shaft being carried in the furnace structure as will be more particularly pointed out later.

The cylindrical wall of the shell 50 is provided with a plurality of radial apertures 55, these apertures being substantially frusto-conical in longitudinal section, and having their larger ends presented towards the axis of the shell. The outer portions of the openings 55 are countersunk as indicated at 56, so that angularly related intersecting ridges 57 are formed between the countersunk portions of adjacent apertures. These ridges 57 lie in the outer cylindrical surface of the cylindrical shell 50. The function of this grate bar is to receive the fuel and keep the same constantly agitated, at the same time propelling and distributing the fuel over the fire box area and permitting a free draft through the grate structure at all times. Furthermore, the openings 55 permit the ash, in course of formation, to drop through the grate bar and thus prevent fusing or clogging due to clinkering of the ash on the grate. The ridges 57 serve to provide an uneven abrasive surface on the grate bar to constantly remove the ash from partially consumed fuel and thus prevent adherence of large particles of fuel and insure complete combustion.

The grate bars as above described are preferably so mounted as to be closely adjacent to each other, with only sufficient space between the adjacent bars to permit of the necessary rotation in a common direction.

Referring now to Figure 1, there is provided a furnace structure comprising the fire box 5 arranged within and defined by the rear end wall 6 and a front end wall 7, water tubes 8 being supported by said walls. Beneath the fire box 5, there is provided an ash pit 9, and above the ash pit is mounted the grate structure, generally designated 10.

The grate structure 10 here comprises a continuous series of grate bars 11, carried on shafts 12, said shafts being in parallel spaced relation and connected by links 13, the pivot points of said links being co-axial with said shaft. On each of the shafts 12 there are provided pinions 14, which are in continuous meshing engagement with an endless rack 15. The rack 15 is provided with the arcuate portions 16 and 17, said arcuate portions being described about the shafts 18 and 19, respectively, as centers.

The grate bar structure composed of the endless series of grate bars 11 is continuously moved in the direction of the arrow H by the provision of a driving wheel 20 fixedly mounted on the driving shaft 18, and provided with spaced peripheral notches 21, which are adapted to engage each one of the shafts 12. A similar wheel 22 is mounted fixedly on the shaft 19, and said wheel is provided with peripheral notches 23 which engage each one of the shafts 12.

The grate bar structure 10 operates to convey fuel in course of consumption and the larger particles of ash toward the rear wall 6, and the adjacent end of the grate bar structure is spaced from said wall and cooperates with a roller 24, carried on a shaft 25, mounted in the wall 6, to deposit the ash in the ash pit 9. The roller 24 is driven from the shaft 19 by the provision of a twisted chain 26, trained over a sprocket wheel 27, fixedly mounted on the shaft 19.

Below the lower stretch 28 of the grate structure, there is provided a tray or platform 29, and the ash which passes through the grate bars of the top stretch is moved along this platform and drops through an opening 30, which also communicates with the ash pit 9.

Motion is imparted to the grate structure from a drive shaft 31 mounted in a front end section 32, by the provision of a chain 33, trained over a sprocket 34, mounted on said shaft 31, and over another sprocket 35, fixedly mounted on the shaft 18.

The front end section 32 is provided with a hopper 36, to which fuel is delivered through a chute 37, and the passage of the fuel into the furnace is regulated by a baffle 38 pivotally mounted on the shaft 31. The baffle 38 is provided with an arcuate rack 39 which may be manually or otherwise operated by a worm 40, so that the angularity of the baffle may be varied as desired. A sizing and feeding roller 41 is provided adjacent to the discharge opening 42 of the hopper 36, so that the larger particles of fuel are broken up as they pass into the furnace, and the feed of the fuel to the furnace thus regulated.

In Figure 2, there is illustrated a modified form of the feeding mechanism shown in Figure 1, and includes the fuel inlet 42, adjacent which inlet are provided rollers 44 and 45, connected by a crossed chain 46, so that these rollers are caused to revolve in opposite directions. The rate of feed of fuel is regulated as desired as it passes through the inlet 43 between the rollers 44 and 45, and therefrom, is deposited directly upon the grate structure.

A flue 79*a* is provided at the forward end of the furnace and affords an exit for distilled gases developed during combustion at that end of the furnace, and the resultant coke (fixed carbon) is conveyed toward the rear end of grate, and may be burned at this location, or thence it is deposited through opening 56, and conveyed to a point of utilization.

Air draft ducts 47 are provided conveniently at the sides of the furnace adjacent to the end where the fuel enters, and the supply of air to the various sections of the grate is governed in any desired manner, manually or automatically, by operating the dampers 48 in the baffle walls 49.

From the foregoing description and the accompanying drawings, it will be observed that there is provided a fuel feeding device or stoker which may be readily adapted to various types of furnaces, and the provisions of the curvilinear grate bar surfaces increases the burning surface of the grate for a given area at least one-third over that ordinarily attained, and at the same time, while revolving, does not vary the distance between the bars, which would occur with flat bars. Furthermore, the features of operation and the functions possible of attainment in this invention permit of employment of the device either as a steam generating plant or as a coking mechanism, or permits of employment of the device both as a steam generating plant and as a coking mechanism. The provision of the outlet 79*a* shown in Figure 1 permits of the recovery of unburned gases which usually are generated

when fuel is first deposited on a fire, and which gases usually pass off and are wasted or where furnaces are operated for by-products. An important feature of this invention resides in the function of the grate bars wherein they constantly remove ash as formed, so that not only is the fuel properly sized and distributed to maintain a level fire and thus prevent "holes", but the fire is always maintained free of ash. Thus, for all practical purposes, no clinkers can form. The grate structure above described may be used in a level, horizontal plane, as shown, or at any desired angle therefrom.

It will be obvious to those skilled in the art that this stoking device is adaptable for use with various kinds of fuel, with any form or method of draft, natural or mechanically produced and conveniently and effectively responsive to any form of regulation, thereby affording a highly efficient and dependable means for carrying out combustion operation, whether for the purpose of producing power, or for use in connection with metallurgical, by-product processes and commercial and industrial gas manufacturing. This will be clear when it is seen that the device may be readily employed for pre-treatment of the fuel and that the distillates therefrom may enter into the general combustion, or they may be diverted wholly or in part to other uses as desired.

Having thus described my invention and illustrated its use, what I claim as new and desire to secure by Letters Patent is:

1. In a device of the character described, in combination, an endless series of grate bars, a supporting frame therefor affording a complete perimeter, said grate bars being revoluble on relatively fixed individual axes and movable as a unit about the perimeter of said frame, means for moving said bars about said frame, and cooperating means on said frame and on said grate bars for continuously rotating said grate bars during the movement thereof about said frame.

2. A grate structure comprising superposed stretches of revoluble grate bars which form a continuous series mounted upon a supporting frame, means for moving said series of bars as a unit about said frame, and means for imparting individual rotation to said bars continuously during their movement about said frame.

3. In a furnace, in combination, a grate structure comprising an endless series of revoluble grate-bars mounted in parallel closely adjacent relation and each mounted for individual rotation, the outer surfaces of said grate bars comprising a series of intersecting abrading ridges lying in a cylindrical surface, supporting frame for said grate bars, means for moving said series of bars bodily about said frame and means for simultaneously rotating the individual bars continuously during their movement about said frame.

4. In a furnace structure, in combination, a grate structure for conveying fuel during the course of combustion, separating the fine particles of ash from the fuel during combustion and delivering the larger particles of ash at one end of said grate structure, and means for accumulating said fine particles of ash for delivering same by said grate structure at the other end of said grate structure, said grate structure comprising a supporting frame, an endless series of revoluble grate bars mounted upon said frame affording an upper and a lower flight of said grate bars, means for bodily moving the endless series of grate bars about such frame and means for continuously revolving each grate bar simultaneously with said bodily movement, said ash accumulating means being adjacent to the lower flight of said grate bars and retaining the ash for removal thereby.

5. In a grate structure, in combination, a supporting frame forming a closed periphery, a closed series of rotatable grate bars supported by said frame and mounted for simultaneous continuous rotation of the individual grate bars and movement of the series of grate bars about the periphery of said frame, means for moving said grate bars about the periphery of said frame, and means to impart continuous rotation to individual grate bars throughout their movement about said frame, said grate bars being cylindrical in form and mounted in closely adjacent parallel relation to afford a substantially continuous surface.

6. In a grate structure, in combination, a supporting frame forming a closed periphery, a closed series of rotatable grate bars supported by said frame and mounted for simultaneous continuous rotation of the individual grate bars and movement of the series of grate bars about the periphery of said frame, means for moving said grate bars about the periphery of said frame, and means to impart continuous rotation to individual grate bars throughout their movement about said frame, said grate bars being mounted in closely adjacent relation and having their outer surfaces provided with a series of intersecting abrading ridges cylindrically arranged.

7. In a grate structure, in combination, a supporting frame forming a closed periphery, a closed series of rotatable grate bars supported by said frame and mounted for simultaneous continuous rotation of the individual grate bars and movement of the series of grate bars about the periphery of said frame, means for moving said grate bars about the periphery of said frame, and means to impart continuous rotation to individual grate bars throughout their movement about said frame, said grate bars being hollow cylinders mounted in closed adjacent relation and having draft passages through the walls thereof.

8. In a grate structure, in combination, a supporting frame forming a closed periphery, a closed series of rotatable grate bars supported by said frame and mounted for simultaneous continuous rotation of the individual grate bars and movement of the series of grate bars about the periphery of said frame, means for moving said grate bars about the periphery of said frame, and means to impart continuous rotation to individual grate bars throughout their movement about said frame, said grate bars being hollow cylinders mounted in closely adjacent relation and having draft passages through the walls thereof, the outer portions of said draft passages being of flaring contour forming a series of intersecting abrading ridges cylindrically arranged on the surface of said grate bars.

9. In a grate structure, in combination a grate supporting frame forming a closed circuit, having vertically spaced horizontal portions, the periphery of said frame being provided with means adapted to engage pinions, a closed series of rotatable grate bars mounted upon said frame, each of said grate bars having secured thereto a pinion in engagement with the pinion engaging means carried by said frame, for causing rotation of said grate bars when the same are moved

about said frame, and means for continuously moving said series of grate bars around said frame.

10. In a grate structure, in combination a grate supporting frame forming a closed circuit, having vertically spaced horizontal portions, the periphery of said frame being provided with means adapted to engage pinions, a closed series of rotatable grate bars mounted upon said frame, each of said grate bars having secured thereto a pinion in engagement with the pinion engaging means carried by said frame, for causing rotation of said grate bars when the same are moved about said frame, and means for continuously moving said series of grate bars around said frame, the outer surface of said grate bars being provided with a series of intersecting abrading ridges cylindrically arranged.

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