June 7, 1949. L. F. GOUGH 2,472,746

HEATING UNIT, INCLUDING RECIPROCATING GRATES

Filed March 17, 1947 2 Sheets-Sheet 1

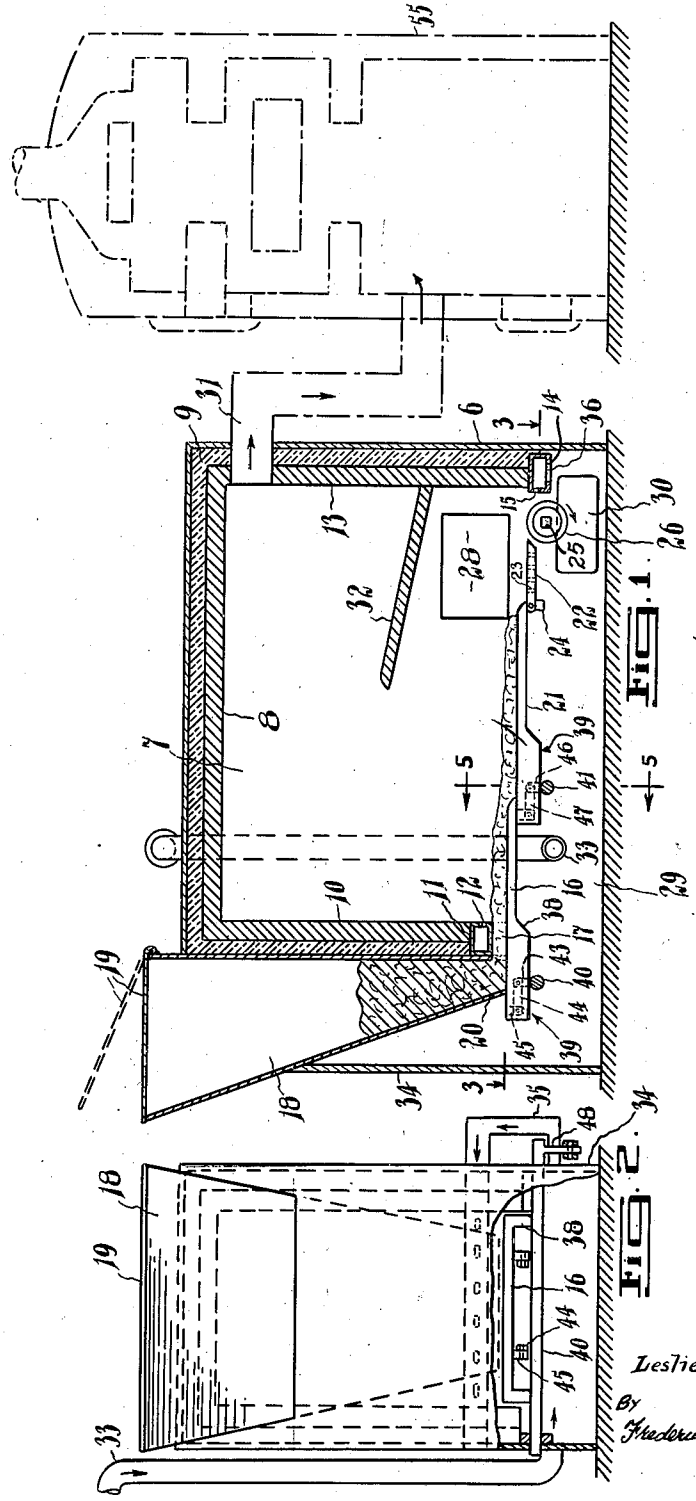


Fig. 1.

Fig. 2.

Inventor
Leslie F. Gough
By Frederick C. Bromley
Attorney

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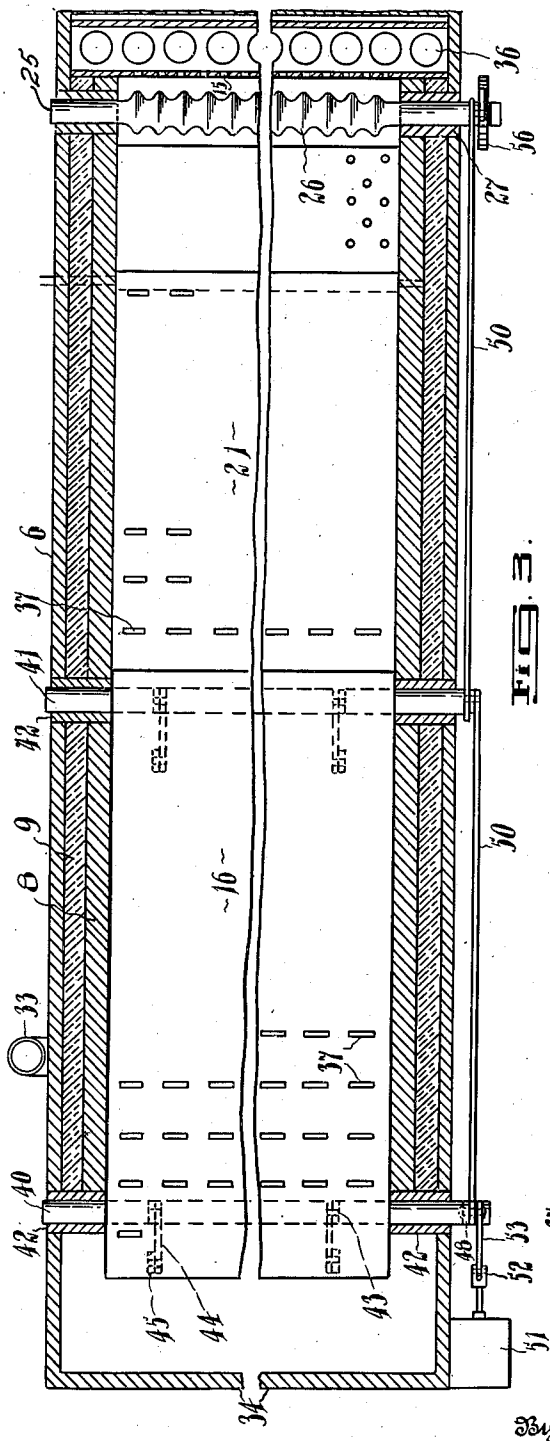


Fig. 3.

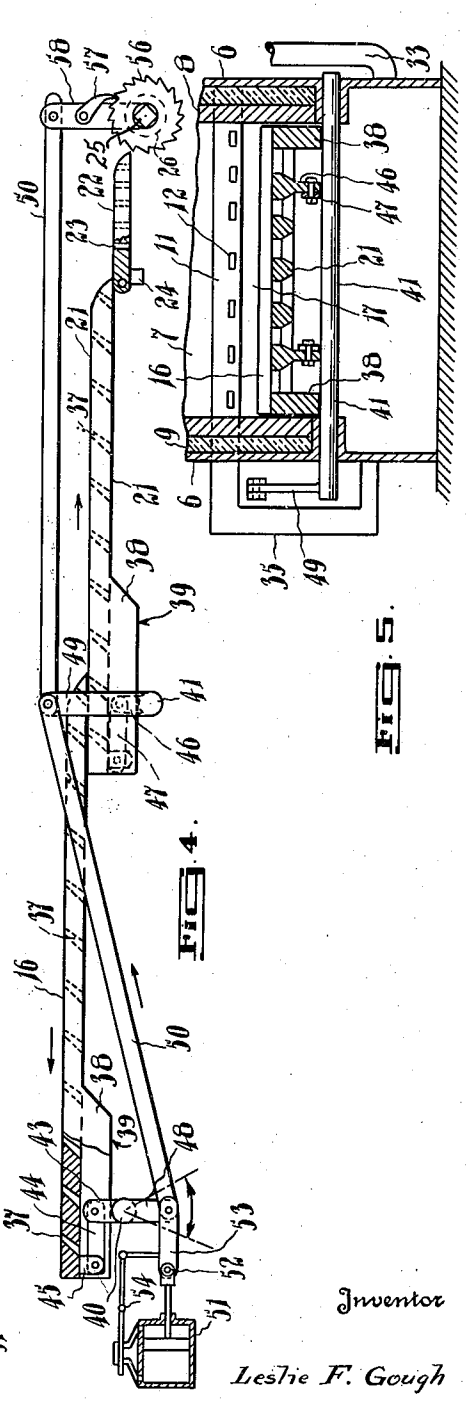


Fig. 4.

Fig. 5.

Inventor
Leslie F. Gough

By
Frederick C. Bromley
Attorney

Patented June 7, 1949 2,472,746

UNITED STATES PATENT OFFICE

2,472,746

HEATING UNIT, INCLUDING RECIPROCATING GRATES

Leslie F. Gough, Toronto, Ontario, Canada

Application March 17, 1947, Serial No. 735,096

3 Claims. (Cl. 110—38)

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My invention appertains to heating units and particularly to a heating plant of the class in which grate bars are reciprocally mounted and mechanically operated for the feeding of coal.

A general object of the invention is to provide a more efficient furnace for the burning of solid fuel, and one which is economical of fuel consumption.

A further object is to provide a furnace incorporating a stoker which not only has a continuous feeding action but which also has a self-cleaning effect.

Another object of the invention is to provide a heating unit with a stoker grate of a simple and efficient construction in which grate bars are reciprocated to and away from each other by means of rock shafts connected together for oscillatory motion by means of a linkage which operates one rock shaft in a reverse direction to the other.

A distinctive feature of the invention is that it provides a heating unit in which fuel is burned at a high temperature by a forced draft system. A further feature is that the invention provides a compact heating unit suitable for steam, hot water or hot air; and one which can be used as a self-contained plant or can be coupled to a standard furnace and the products of combustion passed to the same.

The drawing is illustrative of a selected embodiment of the invention in which

Fig. 1 is a vertical sectional elevation taken longitudinally of the furnace showing my improved construction.

Fig. 2 is a front end view thereof showing a part of the casing broken away to illustrate the grate structure to better advantage.

Fig. 3 is a horizontal section taken on line 3—3 of Fig. 1.

Fig. 4 is a detail in side elevation schematically illustrating the grate structure.

Fig. 5 is a vertical section taken on line 5—5 of Fig. 1.

In the drawing there is shown a furnace of a substantially rectangular configuration comprising a sheet metal casing 6 which defines a combustion chamber 7 which is shown as lined with a refractory material 8 of an approved form such as composed of tiles with an intervening insulation, indicated at 9.

The refractory lining and the insulation is terminated in the region of the grate and suitably supported as by sills. The sill of the front wall 10 of the combustion chamber is shown as a hollow member 11 forming an over-fire draft duct having a longitudinal series of apertures 12 for

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discharge of forced air. The rear wall 13 is similarly provided with a hollow metal sill 14 which also forms an over-fire draft duct and is likewise provided with a longitudinal series of apertures 15 for discharge of forced air. Both the members, 11 and 14, bridge the side walls and are suitably connected to the metal casing. Air is circulated through these members as will later be dealt with more fully.

The front member 11 is spaced above the grate to overlie a front grate bar 16 so as to provide an intervening passage 17 for coal. This passage connects with a forwardly located hopper 18 having an approved closure in the form of a hinged lid 19. The grate bar 16 projects forwardly from the combustion chamber for the reception of coal from the discharge end 20 of the hopper.

The grate structure includes a companion grate bar 21 which coacts with the grate bar 16 in the feeding of coal by means which constitute an automatic stoker as will later be described in detail. The grate bars are arranged in overlapping manner with adjacent ends resting one upon the other for individual reciprocal movement. The rearmost end of grate bar 21 is supported upon a dump grate 22 of a known type which is adapted to be actuated by hand. The dump grate is perforated, as at 23, to provide air passages and is carried by a pivotal bar piece 24 by which a hand dumping operation is carried out as required in the operation of the furnace.

The grate structure desirably includes a clinker grinder 25 which is disposed between the dump grate and the hollow sill 14. The clinker grinder is a cylindrical member having circular ridges in longitudinal series as indicated at 26 and is rotatable in suitable bearings, 27, whereby it may be operated in a step-by-step manner in conjunction with the reciprocation of the grate bars.

The combustion chamber is shown as provided with a fire door 28 located in a side wall thereof and the ash pit 29 is represented as provided with a door 30 also located in such side wall and preferably disposed subjacent the clinker grinder and the dump grate.

To provide for the outlet of the products of combustion there is shown an eduction pipe 31 in the rear wall 13. Below this outlet there is preferably provided a baffle 32 in the form of a plate extending forwardly and upwardly from the rear wall as shown in Fig. 1.

A forced draft system is employed in the operation of the furnace. This comprises a suitable means for introducing air under pressure from a source of supply. Such means may take

the form of a conduit 33 leading in to the ash pit and extending from a conventional fan driven as by an electric motor. The sheet metal casing extends to the floor line on all sides and includes a forwardly located air chamber or enclosing compartment 34 about the hopper and the portion of the grate bar 16 which projects below the same.

The duct of the sill 11 connects at one end with an externally disposed piping 35 which, in turn, connects with the ash pit so that forced air will be circulated through the duct and discharged by the perforations 12 over the fire bed. The sill 14 however has openings, as at 36, arranged in its bottom portion to connect directly with the ash pit whereby air is circulated into this duct and emitted by the perforations 15 for diffusion over the fire bed.

Adverting to the grate structure the grate bars are provided with a suitable arrangement of perforations 37 so as to form distributed air passages which may be in the nature of transverse slits as shown. Each grate bar is formed as a casting having depending flanges 38 on its sides which flanges are located on opposite side edges and have straight bottom edges 39 forming bearing surfaces at their forward ends. The flanges of a grate bar rest and ride upon rock shafts. The rock shaft for the grate bar 16 is denoted by the reference numeral 40 and the rock shaft for the grate bar 21 is denoted at 41. The rock shafts are transversely disposed and journalled in approved bearings 42 carried by the side walls of the casing. The rock shaft 40 is provided with upstanding arms 43 rigid therewith and pivotally united to links 44 horizontally arranged and likewise connected as by lugs 45 to the adjacent end of the grate bar. The rock shaft 41 is provided with a similar arrangement of upright arms 46 pivoted to links 47 connected to the adjacent end of the grate bar 21.

The arms and their linkage form a part of the mechanism for reciprocating the grate bars and this mechanism also includes levers fixed on the rock shafts externally of the furnace. Both levers are rigid with their respective shafts and the lever 48 on the rock shaft 40 depends therefrom while the other lever, indicated at 49, extends upwardly from the rock shaft 41. These levers are pivotally connected by a rod 50 and by this arrangement endwise movement of the rod swings the rock shafts in opposite directions. Accordingly, it will be understood that when the grate bar 16 is caused to move in the direction of its companion in one stroke of reciprocation the companion grate bar is caused to move in the reverse direction; and in the other stroke of reciprocation the grate bars slide in opposite directions one moving away from the other. This movement effects the feeding of coal from the hopper and causes it to be spread over the grates and to travel progressively toward the dump grate. Such reciprocation of the grate bars provides a known feeding movement but the specific mechanism for oscillating the rock shafts and connecting them to the grate bars is novel. This mechanism provides a sturdy and reliable structure and one which is inexpensive to manufacture and is highly serviceable in use. The mounting of the grate bars on the rock shafts by means of the flanged portions provides for their operable connection and support.

Any approved motivating agent may be employed to oscillate the rock shafts and in the present instance there is shown a fluid cylinder

51 having a piston connected, as at 52, to a link bar 53 which in turn is connected to an end of the rod 50. The fluid of the power cylinder may be oil and the cylinder may be connected to a pump driven as by the electric motor which operates the air fan hereinbefore referred to, which motor is not shown. Suitable valve means, indicated at 54, provide for regulating the speed of the fluid cylinder. Such an expediency is well known in the art and need not be detailed. The mechanism for operating the clinker grinder 26 with a step-by-step motion comprises a ratchet wheel 56 rigid therewith and engaged by a pawl 57 which pawl is carried by a lever 58 swingable on the axis of the clinker grinder and pivotally connected to a rod 59. This rod is in turn connected in a similar manner to the lever 49 of the rock shaft 41. It will be understood that by this arrangement oscillatory movement of the lever 49 is communicated to the lever 58 with the result that the pawl 57 serves to impart unidirectional angular movement to the clinker grinder so as to turn it with a step-by-step motion.

The invention provides a highly satisfactory oscillating mechanism for the rock shafts and their connection to the grate bars whereby the grate bars are reciprocated with a reverse movement in each stroke to effect the feeding of the coal. It also provides for the operation of the clinker grinder. The invention provides a highly serviceable and economical heating plant comprehending a self-cleaning and continuous stoker feed.

Although the invention has been described and shown as employing a pair of grate bars it will be understood that the grate structure is not limited to the specific construction and arrangement shown and that more than two bars can be employed if so desired. There may be substituted a set of bars comprising more than two courses and each course may be of a plurality of bars. Also it will be noted by a reference to Fig. 1 that the heating unit is shown as connected by the eduction pipe 31 to a standard hot water furnace, indicated at 55. In this instance the hot gases of combustion would be passed to the combustion chamber of the standard furnace for heating the coils thereof. The invention however is not limited to such a hook-up and may be used as a self-contained heating plant of any type.

Having described a practical embodiment of the invention it will be understood that such changes and modifications may be resorted to as come within the spirit and scope of the appended claims.

What I claim is:

1. In a heating unit, a grate structure comprising a grate bar having depending flanges terminating in flat edge faces constituting bearing surfaces, a rock shaft supported to extend transversely of said grate bar and seating said flat edge faces to provide a support for the grate bar, an arm rigid with said rock shaft and projecting upwardly between said flanges, and means within the confines of said flanges forming a mechanical connection for reciprocating said grate bar when the rock shaft is oscillated, and means for oscillating the rock shaft.

2. In a heating unit, a grate structure comprising a grate bar having a top surface and provided with depending side walls having straight bottom edges parallel with said top surface of the bar, a rock shaft supported to extend transversely of said bar and engaged with said bottom edges to

form a support for said bar, an arm rigid with said rock shaft and extended upwardly between said side walls, a link pivoted to said arm and extended horizontally, a lug on said bar between said side walls thereof, said lug being pivoted to said link, and means for oscillating said rock shaft to effect reciprocation of said bar.

3. In a furnace, a stoker grate including two bars arranged one in advance of the other with adjacent ends overlapped, means for supporting and reciprocating said bars so that they move toward each other in one stroke of reciprocation and move away from each other in the other stroke thereof, said means comprising side walls extending downwardly of an end of each bar and terminating in straight edges which constitute bearing surfaces, a rock shaft mounted transversely of each bar in supporting engagement with the bearing surfaces thereof, erectile arms rigid with said rock shafts within the confines of the side walls of the respective bars, links pivotally connecting said arms to the respective bars for reciprocation thereof when the rock shafts are

oscillated, a lever rigid with each rock shaft, one of the levers extending downwardly and the other upwardly, a rod forming a pivotal connection between said levers, and a reciprocal motivating agent for imparting endwise movements to said rod.

LESLIE F. GOUGH.

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