Oct. 10, 1950 J. A. WORSHAM 2,524,868

FURNACE COMPRISING COKING AND COMBUSTION GRATE

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Fig. 1.

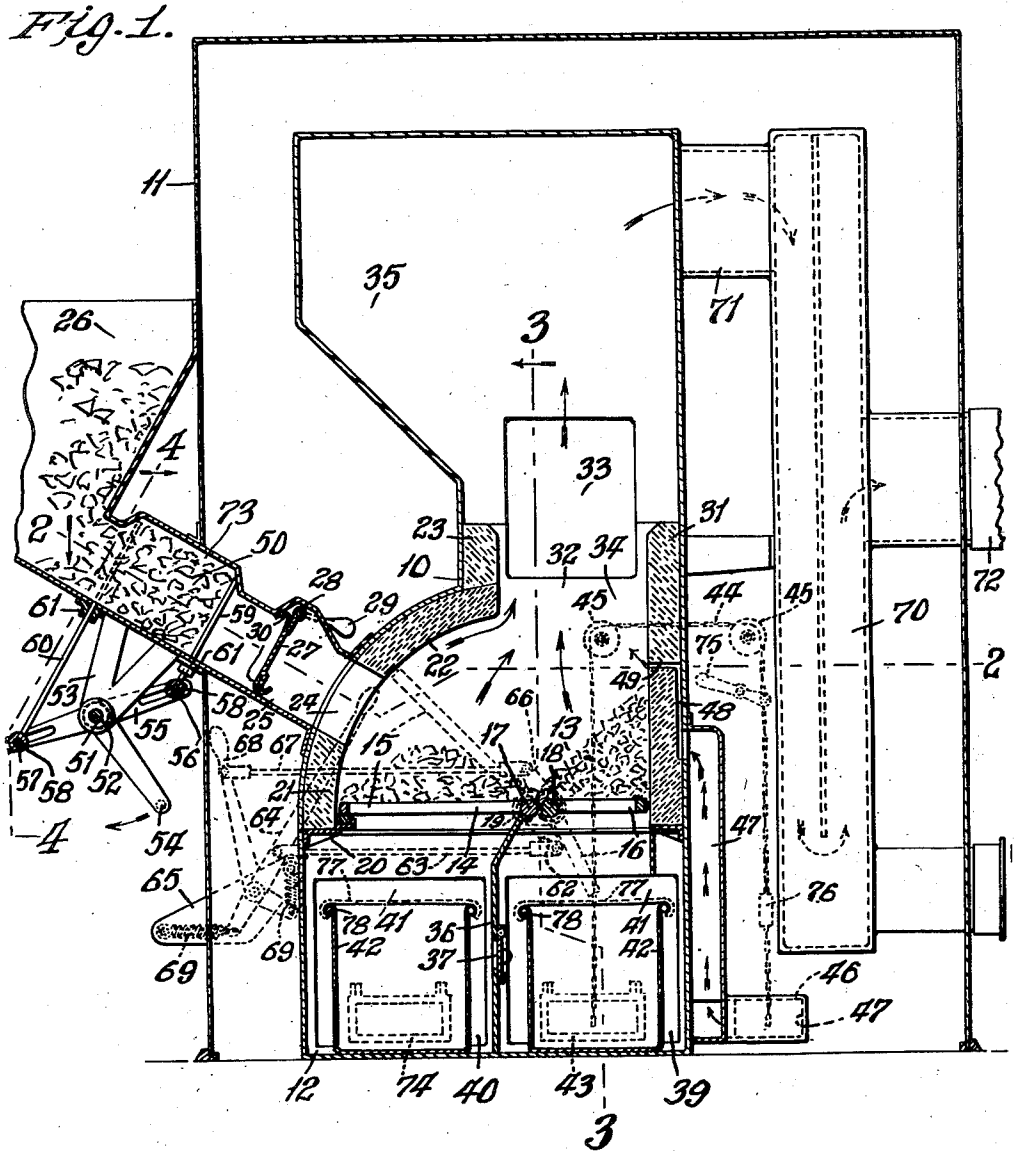
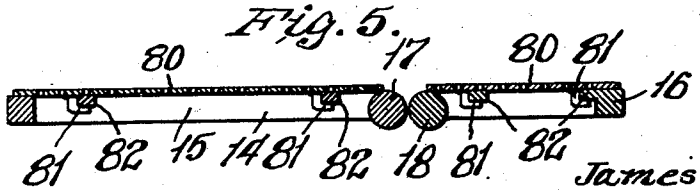


Fig. 5.



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Fig. 2.

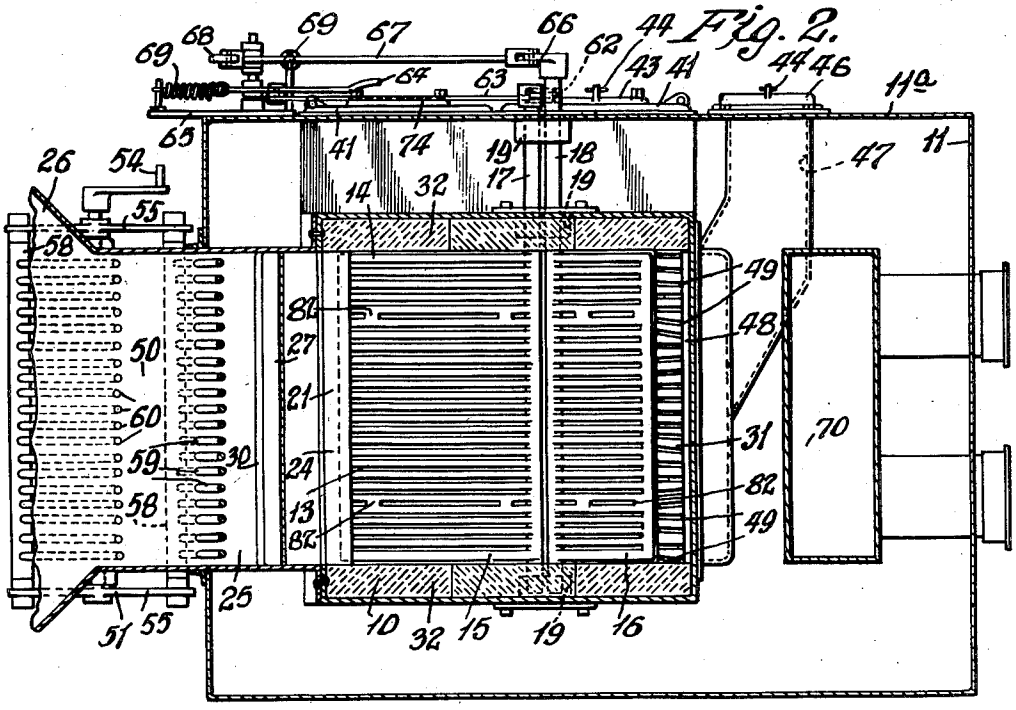


Fig. 3.

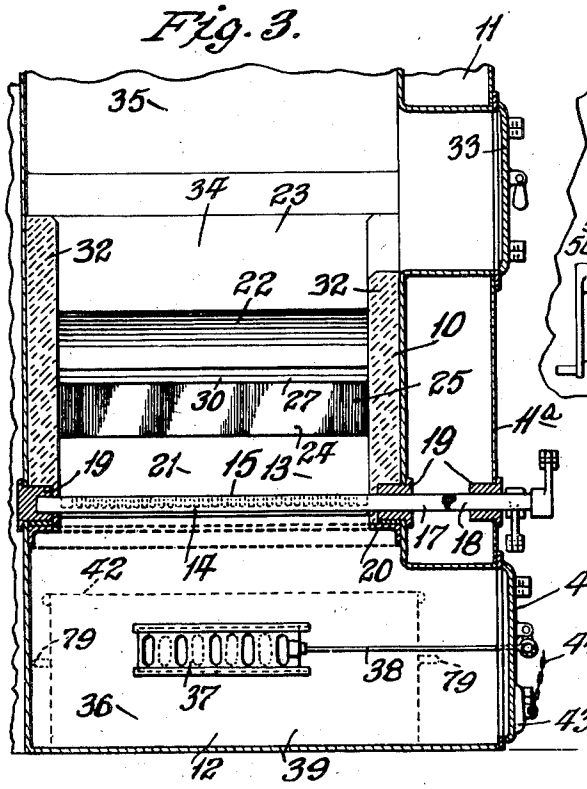
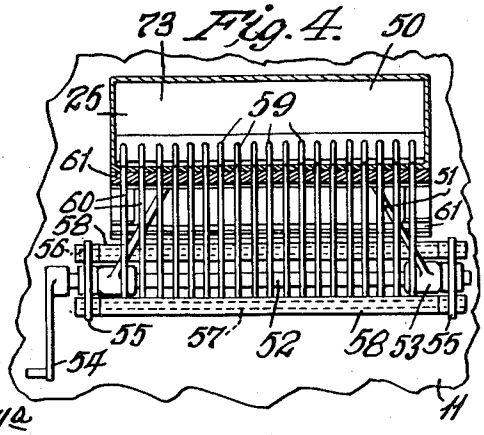


Fig. 4.



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Patented Oct. 10, 1950 2,524,868

UNITED STATES PATENT OFFICE

2,524,868

FURNACE COMPRISING COKING AND COMBUSTION GRATES

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Application April 22, 1946, Serial No. 663,973

2 Claims. (Cl. 110—24)

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This invention relates to improvements in burning devices such as stoves, domestic furnaces and commercial installations for burning solid fuels such as bituminous coal and derivatives thereof, in sizes from screenings to that of briquettes and to burn such volatile fuels, smokelessly.

One of the objects of the invention is to provide a burning device, stove or furnace of an improved construction whereby to first coke a given quantity of coal in one location and to burn the coked coal in another location in the device.

Another object is to provide a furnace with improved means for intermittently feeding measured quantities of coal to the fire pot of the furnace and to intermittently move it through the fire pot in the steps of coking the fuel, burning the coked fuel and subsequently discharging the residue of the burned fuel from the fire pot.

A further object is to provide the fire pot of the furnace with a set of two cooperating fuel supporting grates, one of which is adapted to be actuated to discharge its fuel content on the other grate after the fuel thereon has been heat treated, such as by coking.

A still further object is to provide a furnace fire pot with an improved two section grate for respectively serving as a coking section for coal when fed thereon and a burning section for the coked coal.

Still another object is to provide a two section grate for a furnace of an improved construction whereby one section after coking the coal thereon is operated to discharge the coke onto the other section which is located in the burning zone of the fire pot and the latter section being subsequently operated to discharge the burned residue in the ash pit or the like.

Another still further object of the invention is to feed the fuel to and through the fire pot of a furnace and the like in measured quantities by intermittently operated devices which may be hand operated whereby to first deposit the fuel on the coking section of the grate and after the fuel has been converted into coke, to discharge it onto the grate burning section and to subsequently discharge the ash content from the burning section into the ash pit.

It is still another object to provide a coal chute for the storage bin of a furnace with improved operable means for discharging measured quantities of coal into the fire pot of the furnace.

With the foregoing and other objects in view which will appear as the description proceeds, my invention resides in the combination and arrangement of parts and in the details of construction hereinafter described and claimed, it being understood that changes may be made within the scope of what is claimed without departing from the spirit and intents of the invention.

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An embodiment of the invention is illustrated in the accompanying drawings, wherein—

Figure 1 is a vertical sectional elevation taken through a furnace and showing the invention applied thereto.

Figure 2 is a horizontal sectional elevation taken approximately on the line 2—2 of Fig. 1.

Figure 3 is a vertical transverse sectional elevation taken approximately on the line 3—3 of Fig. 1.

Figure 4 is an end elevation of a fragmentary portion of the furnace taken in the direction of the arrow 4 in Fig. 1.

Figure 5 is an enlarged longitudinal section taken through this improved two section grate and showing the application of draft controlling plates thereon.

Referring by numerals to the accompanying drawings, 10 designates a hot air type of furnace having the conventional surrounding air drum 11 and said furnace having an ash pit 12 and fire pot 13, the ash pit and fire pot being divided by the grate 14.

The grate 14 comprises a coking section 15 and a burning section 16 and are normally disposed on a horizontal plane, each of said grate sections having a side disposed axis designated as 17 and 18 respectively, which are adjacent each other at the meeting sides of the grate sections, said axes on each end being supported in respective ends of the furnace in bearings 19.

Disposed on one side of the section 15 of the grate 14 and supported on a bracket 20 is a fire brick wall 21 which is inwardly curved at 22 as it extends upwardly in the fire pot 13 above the grate and disposed above the inwardly facing arcuate end of the wall 21, and joined therewith, is a vertically extending fire wall 23.

Formed in the inwardly curved portion 22 of the fire wall 21 is an elongated opening 24 forming the discharge end of a chute 25 of a coal storage bin 26 and disposed in the chute 25 inwardly from the discharge opening 24 thereof is a counterbalanced door 27 which is swingably supported on the horizontal rod 28.

The discharge opening 24 of the chute 25 is disposed above the section 15 of the grate 14, said opening and said chute being of the approximate length of the fire pot 13 and the grate 14, and as the chute door 27 is normally held in a closed position in said chute by the counterweight 29 thereof, said door is provided with inflammable packing strips 30, top and bottom thereof for preventing draft currents passing through the chute and entering the coal bin 26.

The fire wall supporting bracket 20 may extend around the ash pit, and supported thereon opposite to the fire brick wall 21 is a fire brick wall 31 and end disposed fire brick walls 32 which extend upwardly to the approximate height of

the lower end of the furnace fire door 33, and between the walls 23 and 31 a vertically extending passageway 34 is formed which leads to the heat chamber 35 of the furnace, said passageway 34 being in vertical alinement with the section 16 of the grate 14.

The ash pit 12 is divided by a wall 36 having a regulating damper 37 operable by a push and pull rod 38 which extends to the outside of the air drum 11 of the furnace, said wall 36 dividing the ash pit into respective compartments 39 and 40, each of which is provided with an ash pit door 41 and each compartment having an ash can 42 therein.

The ash pit door 41 of the compartment 39 which is positioned beneath the burning section 16 of the grate 14, is provided with a damper 43 which is operable by a pull chain 44 secured thereto and entrained over rollers 45, the opposite end of said chain being fastened to a damper 46 of an air inlet passageway 47 which is positioned on the same side of the furnace as is the damper 43, said passageway 47 leading upwardly against the furnace 8 and fire pot 13 thereof and communicating with a passageway 48 formed behind the fire brick wall 31, and which communicates with a series of horizontally dipsosed and differently directed ducts 49 formed in said wall 31 for directing heated air currents into the burning products of combustion in the upper end of the fire pot 13.

The coal chute 25 outwardly of the door 27 is provided with a measuring section 50 with which a discharging device 51 is cooperable, said device comprising a horizontal shaft 52 rockably mounted in a support 53 by a handle 54 secured on one end, and fixed on said shaft are a pair of slotted end walking beams 55, the slots of which support respective horizontal rods 56 and 57, and mounted on each rod between the beams 55 is a sleeve 58.

One of the sleeves 58 has a row of spaced vetrically extending prongs 59 and the other rod has a like row of prongs 60, said prongs 59 and 60 being slidably engaged in respective openings provided in the guiding blocks 61 which are secured to the bottom of the chute 25 and are adapted to be alternately projected into the measuring section 50 of the chute.

One end of the axis 17 of the coking section 15 of the grate 14 extends through a wall 11a of the air drum 11 and has a downwardly extending lever 62 fixedly secured thereto, and connected at one end to said lever is a rod 63 which is connected at its other end to a hand operated lever 64 which is pivoted intermediate its ends to a mounting 65. The axis 18 of the burning section 16 of the grate also extends at one end through the air drum wall 11a and has an upwardly extending lever 66 fixedly secured thereto, and connected at one end to said lever is a rod 67 which is connected at its other end to a hand operated lever 68 which is intermediately pivoted to the mounting 65.

Upon readying the furnace for firing, the sections 15 and 16 of the grate 14 are normally disposed in horizontal alinement and are held in this position by the coil spring 69 of respective hand levers 64 and 68 holding said levers in neutral positions. Fire is then kindled on the burning section 16, access thereto being provided through the fire door 33. Coincidentally therewith, a charge of coal is supplied on the coking section 15 through the discharge opening 24 of the chute 25 and draft is entrained into the ash pit 12 and/or the compartment 39 thereof by adjusting the damper 43 of the ash pit door 41 and to the compartment 40 through the regulated damper 37 in the dividing wall 36 of the ash pit.

The fuel charge deposited on the coking section 15 of the grate was accomplished by turning the handle 54 of the coal discharging device 51 in a right hand direction, thereby withdrawing the prongs 59 from the coal pack thereagainst in the measuring section 50 of the chute 25, and simultaneous therewith the prongs 60 are moved upwardly into the relatable guiding block 61 thereby checking and holding coal from entering the measuring section 50 while the measured coal quantity that was in section 50, is being discharged beneath the swingable door 27 and onto the coking section 15 of the grate through the discharge opening 24 of the chute 25.

In due time by burning action of the fuel kindled on the grate burning section 16, combustion therefrom in the fire pot 13 will expand and coke the coal on the grate section 15 and the heavy vapors and gases from the coking coal will by reason of the inwardly curved wall 22, be directed into combusting contact with the burning products of combustion from the grate burning section 16 and the rising heavy vapors from the coking bed will be ignited and consumed before entering the heat chamber 35 through the vertical passageway 34.

Leading from the upper end of the heat chamber 35 to the flue 70 is an outlet 71, said flue leading to the stack 72.

By the time the kindled fuel on the grate burning section 16 has been consumed, the coke on the grate section 15 will have ignited and the ash content or residue on the grate burning section 16 is discharged into the ash can 42 in the compartment 39.

The discharging of the ashes from the grate section 16 is accomplished by the furnace tender engaging and pushing the hand lever 68 forward, the rod 67 thereof swinging the lever and the grate section 16 on the axis 18, thus downwardly inclining the grate section 16 to a discharging position whereby the ashes therefrom will be dumped into the ash can 42 thereunder.

Upon release of the hand lever 68 the related coil spring 69 will contract and return said lever, grate section 16 and cooperating linkage to normal positions, and the furnace tender will then engage and rearwardly pull the hand lever 64 and the rod 63 connected thereto and to the lever 62, and cause the grate coking section 15 to be swung upwardly to the approximate inclined position shown in dotted lines in Fig. 1, to discharge the ignited coke on the grate burning section 16. Upon release of the lever 64 the grate coking section 15 and connecting linkage will be returned to normal positions by the related coil spring 69 in readiness for the coking section 15 receiving another coal charge from the measuring section 50 in the chute 25.

The grate coking section 15 is wider than the grate burning section 16 to provide spreading space for the expanding coking coal thereon, and when the coke is discharged or dumped on the grate burning section 16 it will be walled against the fire wall 31, in the manner shown in Fig. 1.

When the furnace tender is about to operate, the coal discharging device 51, if it is found that the prongs 60 have been left in chute inserted position after a preceding operation thus holding back coal from discharge into the measuring

section 50, the tender upon turning the handle 54 counter-clock-wise, will simultaneously cause the prongs 60 to be withdrawn and the prongs 59 inserted respectively from and into the chute and the measuring section 50 will thus become coal loaded. The furnace tender will then turn the handle 54 in a clock-wise direction to withdraw the prongs 59 to permit discharge of the measured coal quantity beneath the door 27 through the discharge opening 24 of the chute 25 onto the grate coking section 15.

The measuring section 50 is provided with an upwardly disposed longitudinal pocket 73 to permit the coal to displace or crowd while the prongs 60 are being inserted in the chute.

As the door 27 is remote from the discharge end 24 of the chute 25 and the door 27 being counter balanced, said door is normally closed and consequently the coal in the storage bin 26 is protected against effects of intense heat and ascending gases from the fire pot 13, and if the furnace tender leaves the measuring section 50 empty until another coal feed discharge is made to the coking side of the fire pot, this intervening empty gap obviously provides a greater protecting distance from the fire pot to the coal bin.

In a furnace of this improved character, the fire door 33 and ash pit doors 41 should be kept closed after the furnace has been fired so that the only air entrained to the fire pot 13 will be through the dampers 43, 46 and 74, the damper 43 controlling the draft to the compartment 39 of the ash pit 12 and to the compartment 40 of the ash pit through the damper 37 in the dividing walls 36, the damper 37 relating to the grate coking section 15 which will require only a minimum of air draft comparable with the draft required for the grate burning section 16.

The dampers 43 and 46 are cooperable with each other to the extent that when the damper 43 is full open, the damper 46 is closed; the damper 43 when wide open being for attaining a faster burning of the fuel on the grate burning section 16, whereas when the damper 43 is slightly open or fully closed, the damper 46 is open so that heated air can be entrained to the fire pot 13 above the burning fuel bed in deflecting directions through the ducts 49 from the passageways 47 and 48 to assist in providing a more complete combustion by admitting warm oxygen laden air above the fire pot to mingle with the rising burning gases and to be combusted therewith.

A pivoted lever 75 connected to the chain 44 when swung in either direction, operates either dampers 43 or 46 and as said chain is counterweighted at 76 said dampers will be held in the positions controlled by the lever 75.

When the damper 43 is closed, no air will be admitted to the ash pit 12 and consequently air cannot enter through the damper 37 to the compartment 40 beneath the grate coking section 15 of the fire pot, and if draft is needed to be admitted to the coking section for coking purposes through a required burning period, air may be admitted through the damper 74 in the ash pit door 41 of the compartment 40 and the damper 37 in the dividing wall 36 may be closed so that air cannot be entrained into the compartment 39 beneath the grate burning section 16.

By intermittently dumping ashes from the grate burning section, ash accumulation is prevented, thus providing a clean grate burning section for efficient firing.

When one ash can 42 is filled by ash discharge from the burning section 16, it is removed and

replaced by inserting the other ash can in the compartment 39 and a sliding lid 77, shown in dotted lines in Fig. 1, is engaged on the side beads 78 of the ash can so that it may be carried like a suitcase or otherwise, by engaging either handle 79 of the ash can for conveying and emptying the ash cans, thereby preventing the escape of fly ash while carrying the cans.

While all of the operating devices for feeding coking, burning of the coke and dumping the ash residue are shown as being manually operated, these devices may be mechanized to be successively and timely operated by thermostat control.

Inasmuch as this improved furnace both cokes and burns the coked coal in the two zones provided therefor, it may be required to change the grate structure by mounting a plate 80 on each grate section 15 and 16, as shown in Fig. 5, with perforated draft openings therein for more adequately burning certain types of fuels. For securing the plates 80 to respective grate sections, each plate has depending hooks 81 for under-engagement with respective parts 82 on each grate section.

What I claim is:

1. A furnace having a fire pot and a horizontally alined two section grate in the fire pot, one of said grate sections being a coking section and the other section being a burning section, said fire pot having an inwardly facing arcuate wall, and a coal chute having its discharge end through said wall adjacent and above said coking section, said coking section being swingably mounted on one end and disposed to have its free end travel in conformity with the curvature of said wall.

2. A furnace having a fire pot with a two section grate in the fire pot, said grate sections being disposed in approximate horizontal abutment and are swingably mounted at or adjacent their ends in the fire pot, said grate sections comprising a coking section for receiving raw coal and a burning section for receiving the coked coal from the coking section when said coking section is upwardly swung, said burning section arranged to be downwardly swung for dumping burnt residue therefrom, a wall in said fire pot extending upwardly and inwardly over said coking section, said wall having a coal opening therein positioned above said coking section.

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