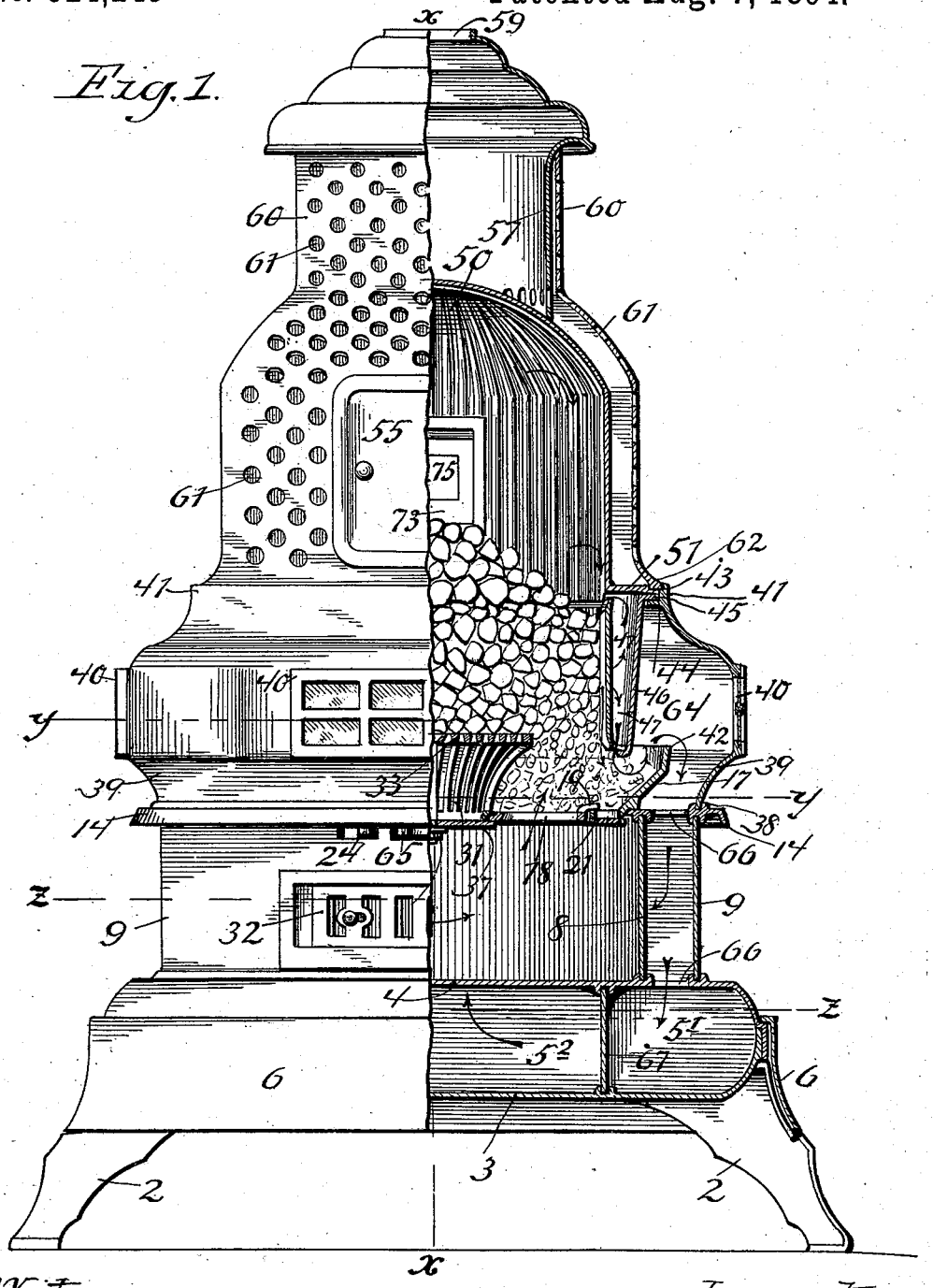
(No Model.) 4 Sheets—Sheet 1.

J. S. HARKINS.

HEATING STOVE.

No. 524,248 Patented Aug. 7, 1894.

Fig. 1.



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(No Model.) 4 Sheets—Sheet 2.

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HEATING STOVE.

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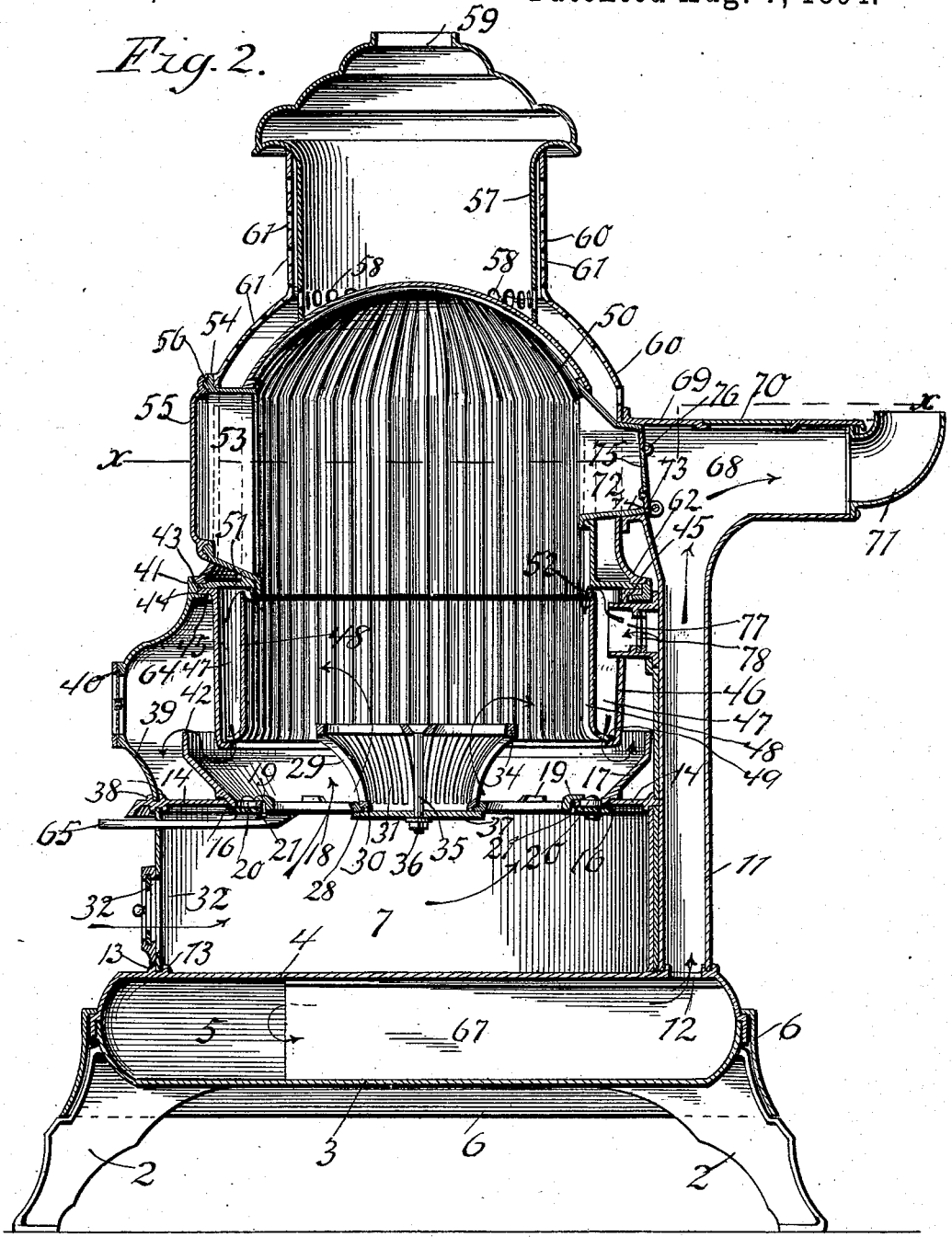
Fig. 2.



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(No Model.) 4 Sheets—Sheet 3.

J. S. HARKINS.

HEATING STOVE.

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Fig. 3.

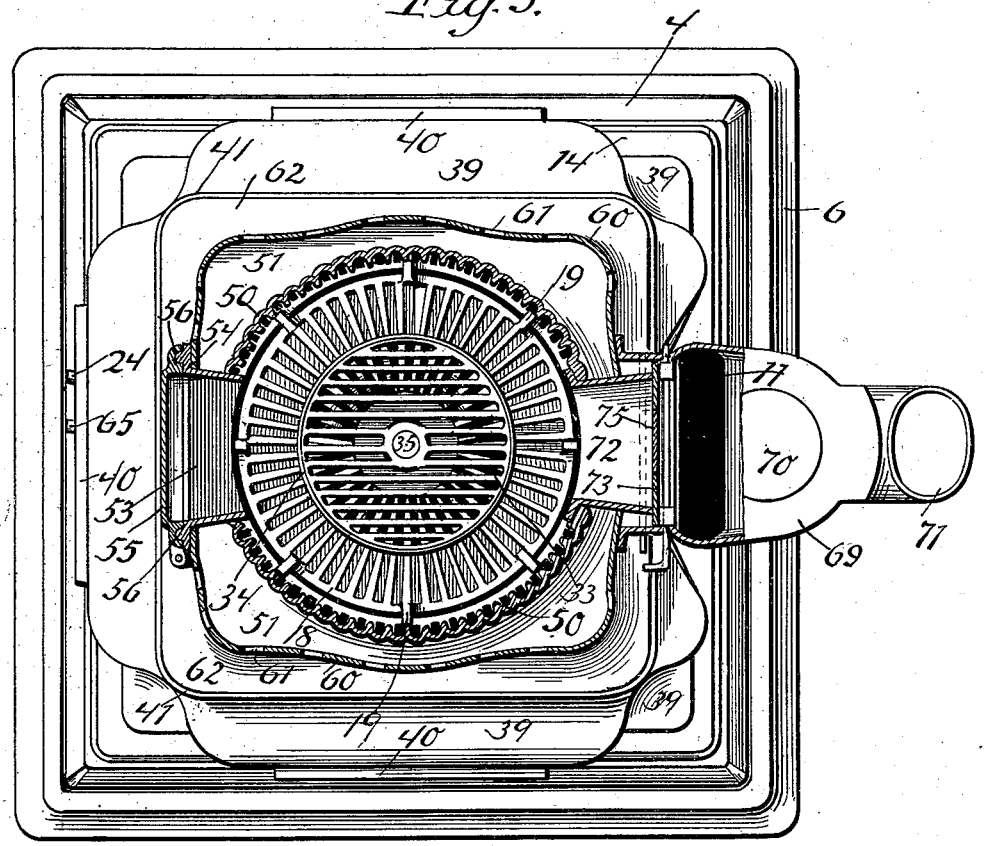


Fig. 7.

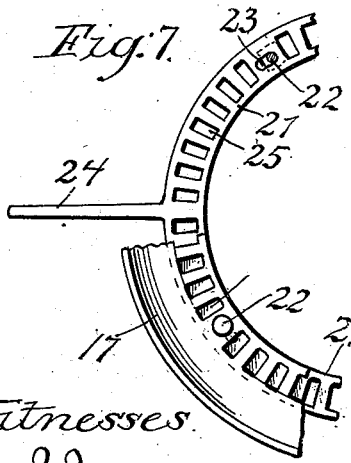


Fig. 6.

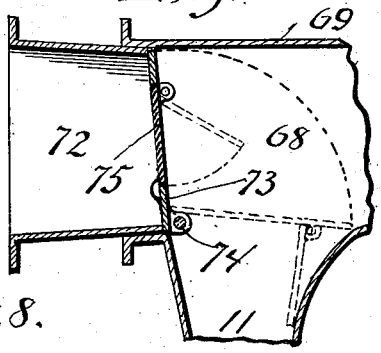
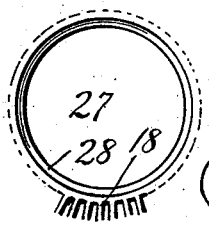


Fig. 8.



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(No Model.) 4 Sheets—Sheet 4.

J. S. HARKINS.

HEATING STOVE.

No. 524,248. Patented Aug. 7, 1894.

Fig. 5.

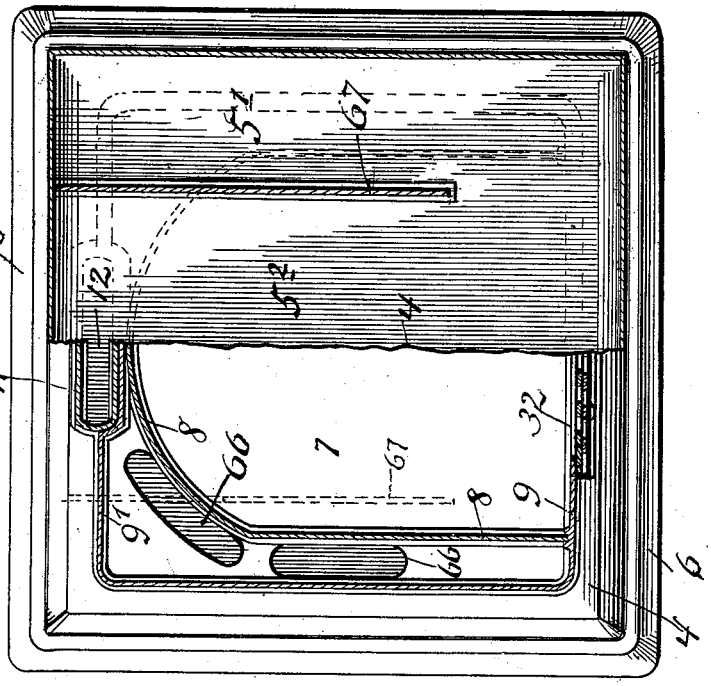
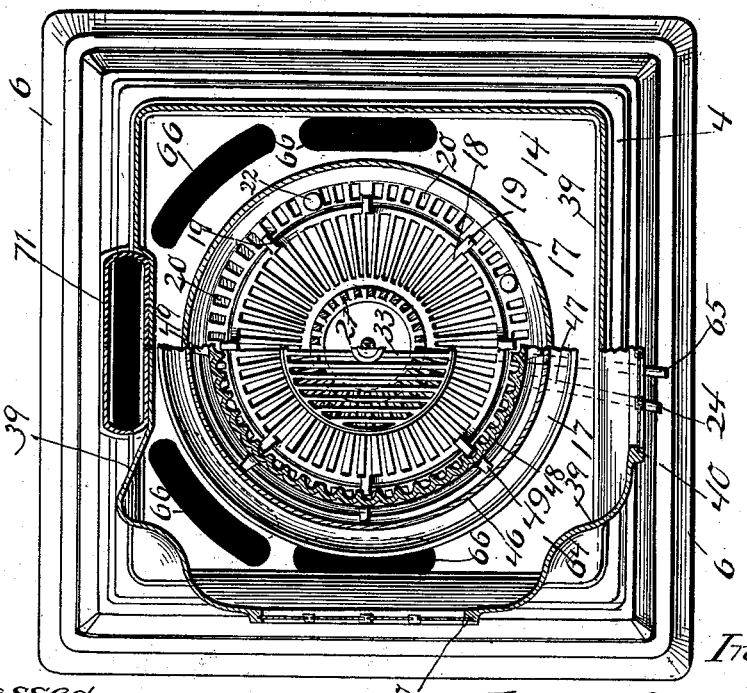


Fig. 4.



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Inventor:
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By Paul & Mennen Atty's.

UNITED STATES PATENT OFFICE.

JAMES S. HARKINS, OF MINNEAPOLIS, MINNESOTA.

HEATING-STOVE.

SPECIFICATION forming part of Letters Patent No. 524,248, dated August 7, 1894.

Application filed January 18, 1892. Serial No. 418,396. (No model.)

To all whom it may concern:

Be it known that I, JAMES S. HARKINS, of Minneapolis, in the county of Hennepin and State of Minnesota, have invented certain new and useful Improvements in Heaters, of which the following is a specification.

My invention relates to a new and improved construction for stoves, heaters, or boiler furnaces, and is designed to economize the gases of all so-called soft coals, including lignite, and thereby obtain a much greater heat from a given amount of either kind of fuel, and at the same time abate the dense black smoke which ordinarily follows the use especially of bituminous coal.

A further object is to provide for the control of the rate of combustion of these coals, and thereby insure an even radiation of heat therefrom.

To attain these objects, I employ the hereinafter described and claimed construction, the essential features of which are a normally closed and imperforate dome or cap, a hollow wall or channel adjacent to the lower portion of said dome and formed with openings at top and bottom, a grate arranged beneath the open lower end of said dome, a space being left between the top of the grate and the lower edges of said dome for an air opening. In connection with the above I employ an ash pit beneath said grate having draft openings, a gas combustion chamber arranged about said exit opening, and a flue system connected with said gas-combustion chamber. In this construction the fuel is burned from the bottom, the draft is from above and from below being made to meet above the grate and deflect radially across the same, whereby gases are distilled from the upper and non-burning portion of the fuel in the dome or retort, by the heat from the lower burning portion, and the gases so distilled compelled to descend with renewed supplies of oxygen through the fuel to said exit opening where they are ignited by the heat of the burning fuel and burned in said gas combustion chamber. I also provide heated channels for inducing draft currents in such manner as to prevent the escape of gases outward through the shell of the stove into the room.

My invention will be more readily understood by reference to the accompanying drawings, in which—

Figure 1 is a front elevation of a heater embodying my invention, one-half of the same being shown in vertical section. Fig. 2 is a vertical section on the line x—x of Fig. 1. Fig. 3 is a horizontal sectional view on the line x—x of Fig. 2. Fig. 4 is a horizontal compound section on the line y—y of Fig. 1. Fig. 5 is a similar compound section on the line z—z of Fig. 1. Fig. 6 is an enlarged detail view showing the division of the direct and indirect smoke outlets with the novel damper arrangement. Fig. 7 is a plan detail of the underlying grate ring. Fig. 8 is a plan detail of the seat for the crown of the grate which I employ.

In the accompanying drawings, I have shown a stove or heater constructed for the most part of molded castings, the joints, by means of which the parts are fixed together, being particularly set out.

In the drawings, 2 represents the four legs of the stove, which are secured to the bottom casting 3 upon the edge of which sits the counterpart casting 4, the chamber 5 being formed between them.

6 represents the skirting arranged about the bottom of the stove. The ash-pit 7 has the rounded back-wall 8, and its side walls extend clear out to the front wall of the stove. This wall is substantially square, and, as shown in Figs. 1, 4 and 5, extends around the ash-pit walls at some distance therefrom. The rear wall 9 is recessed at the back to admit the indirect smoke flue 11 which extends up from the opening 12 provided in the plate 4, and through which the smoke leaves the chamber 3. The walls 8 and 9 are held by the ribs 13 on the top of the part 4. The substantially rectangular plate 14 having the overhanging edge rests upon the upper edges of the ash-pit and the inclosing walls 9, as shown in Figs. 1, 2 and 4. This plate 14 has the annular opening 16, and is adapted to receive the lower edge of the fuel fender 17 which, as shown, flares outwardly to form the exit opening about the lower edge of the retort. The part 17 has the inwardly extending horizontal rim provided with the perforations 20 forming continuations of the radial

slots of the main grate 18, and these perforations are usually kept closed by the sliding ring 21 supported beneath the rim containing the perforations 20 by the bolts 22 moving in slots 23 arranged in the ring 21. The ring 21 has the shaker bar 24 extending out through the front of the stove, and by moving the same so as to make the perforations 25 on the ring register with those 20 of the part 17, the clinkers and ashes are permitted to drop through into the ash-pit. A bar 65 is provided for shaking the main grate 18. The ring and flange may be and sometimes are omitted without material difference in operation. The main grate 18, which is supported in the annular base or fender 17, is in turn provided with an annular opening 27, provided with the ledge 28 upon which the upwardly and outwardly flaring crown 29 having the shouldered base or rim 30 is adapted to rest. This crown is made up of bars 31, through which the air entering the slides in the ash-pit door 32 may pass into fuel in the combustion chamber.

In the top of the flaring crown, I arrange the small parallel bar grate 33 which sits within the outside ring 34 of the crown, and is held in place by the bolt 35 having its head fastened in the solid center of the small grate, and its lower end secured by the nut 36 in the cross bar 37 arranged beneath the lower edge of the crown and of the ring 18. The upper edges of this crown grate project out considerably beyond the lower edges.

Resting between the ribs 38 on the top of the plate 14 is the casting 39 flared out at the points, provided with the mica door frames, and following the combustion chamber 64 arranged upon the depending retort walls, the only exit therefrom being down through the diving flue openings 66. This casting 39 is recessed at the back, as shown in Fig. 3, to accommodate the indirect smoke flue 11. Above these points the casting 39 is considerably contracted, so that the inner edge of its upper rim 41 is much smaller than the lower part of this casting, and is also smaller than the circumference of the upper edge 42 of the fender or base 17. This rim 41 of the casting 39 is provided with two continuous shoulders or ledges 43 and 44, and on the latter rests the flaring edge 45 of the deep ring 46 forming the outer wall of the air heating chamber or channel 47. The ring 48 forming the inner wall of this channel has the deep corrugations or convolutions 80, and at the bottom has the lugs 49 shown in Figs. 2 and 4, resting upon the inwardly turned lower edge of the outside ring 46.

Above the fire-pot rises the similarly corrugated retort dome 50 having the wide flange 51 resting upon the edge 45 of the ring 46. This dome is preferably of the same diameter as the ring 48, and has the beveled edge 52 which projects down over the upper edge of the ring preferably forming a very narrow space between the two, although the small opening thus formed may be omitted if desired. The door casting 53 enters the forward side of the dome 50 and has the outer frame 54 upon which the door 55 is secured, a balk joint 56 being arranged between the stationary part and the swinging door to close off all draft from that quarter which would be most detrimental.

The stove top or extension 57 having the series of holes 58 in its lower edge stands upon the top of the dome 50 and has the opening 59 in its upper part through which the heated air may be conducted away. The exterior of the cap 57 and of the fire-pot is protected and concealed by an ornamental covering 60, having the form shown in the sectional view Fig. 3, and standing away some distance from the fire-pot dome or cap. This part having the perforations 61, is secured upon the rim 41 by the continuous foot 62, held in place on the ledge 43 of the rim 41. It will be seen that the air from the room will enter the lower perforations of this casting 60, and being heated by contact with the dome 50 will pass off through the upper perforations of the part 60 or into the extension 57 through the opening 58, and thence out through the opening 59 in its top.

At points outside of the ash-pit wall 8 and in the plate 4 and the plate 14, I provide openings 66 shown plainly in Figs. 1, 4 and 5. Through these openings the products of combustion pass from the combustion chamber and dive down into the lower chamber 5 of the stove. This chamber is divided into three parts, namely, the two narrow side ducts 51, and the middle portion 52, the division being made by the plates or partitions 67 extending out from the rear wall of this part of the stove. It will be seen, therefore, that the products of combustion entering from the diving flues must pass around the forward ends of these partitions before escaping into the indirect smoke flue 11, thus insuring sufficient time for the complete radiation of heat from these parts of the stove to warm the floor. Passing up the lower portions of the smoke flue 11, the smoke enters the enlarged chamber 68 having the flat top 69 provided with removable lid 70. The elbow 71 extends from the back of this chamber 68 and is connected directly with the smoke pipe. A direct connection with the chamber 68 and the fire-pot dome is made by the sleeve 72 extending from the same through the walls of the perforated casing 60 and the dome 50. At the rear end of this sleeve I hinge the large damper 73 at its lower edge 74, means being provided on the outside of the stove for throwing the damper into either of its two positions indicated in Fig. 6. When the fire is being started in the stove the damper is turned into the position shown by dotted lines in Fig. 6, thereby leaving a free passage directly from the dome into the smoke pipe, while after the fire is fully started the damper is turned up to tightly close the opening.

To obviate the common difficulty encoun-

tered in burning lignite fuel, namely, the rapid and intermittent collection and expulsion of the gases therefrom when used in the ordinary stove, and arising from its tendency to rapidly decrepitate, I employ within the main damper of the direct flue, a smaller damper 75 hinged along its upper edge 76, in the other damper and adapted to swing outwardly. The large damper, when in the position shown in Fig. 2, is held in such position by gravity, but the smaller damper is free to swing and readily yield outwardly to pressure from any undue accumulation of gas in the retort, thus acting as a safety valve for the escape of gas into the flue, and the preventing of troublesome explosions noticeable with lignite. With other fuels this damper is not required.

At the back of the stove, or in any other convenient position, I arrange the tube 77 extending through the rear wall 46 of the chamber 47. In the outside of this tube I arrange perforations and the slide 78 by means of which the inlet of fresh air to the chamber 47 and its exit therefrom may be properly regulated.

It will be noticed that the corrugations 80 of the ring or fire-pot portion of the dome are deep. The object of this construction is to maintain a large number of small ducts on the outside of the mass of fuel into which the generated gases are passed to be led down to the lower edge of the retort. Without this construction, it has been found that the lignite coal which upon being burned breaks up into fine dust, will pack so closely against the walls of the retort as to completely shut off the downward flow of the gases along the retort walls.

To further avoid the cutting off of the main lateral draft across the grate, and prevent the detrimental packing down of disintegrated fuel in the center of the grate, I project the top of the grate crown close to the walls of the retort, leaving only a comparatively narrow annular opening about the same through which the fuel may drop on the grate, the greater portion of the weight of the fuel body being supported on this crown, thus insuring a proper looseness of the burning fuel on the grate and permitting free and unobstructed passage of the horizontal draft to carry the products of the direct combustion through the exit opening into the gas combustion chamber.

The operation of my heater so constructed is as follows: Fuel being placed on the grate in quantity sufficient to extend up into the retort or cap, the fire then started, and all dampers closed, the observed action is this: Combustion does not go forward actively in the latter but is confined in the vicinity of the grate, and the lateral space around it. Above the plane drawn through the downward projecting walls of the cap or dome, combustion does not ascend except by a slow destructive process on the fuel as in a retort, the upper portion of said fuel remaining dead as in the top of a self-feeding magazine. Hence, being distilled by the heat from the zone at and near the grate, where combustion is most active, the gases ascend through the center of the slowly deflagrating fuel in the retort, until, escaping above the fuel, they impinge against the top of the cap, where, by their gathering pressure from beneath and the pressure exerted by heated air they are forced to commence an outward and downward flow along the closed sides of the cap. As they approach the lower end of the cap, the highly heated walls and the incandescent fuel lying against the same force the gases to make their appearance through the gas exit in a horizontally outward flow of flame. It will be observed that the retort or cap serves as a canopy to entrap the gases and to establish their return flow from their first point of escape above the fuel to the incandescent portion thereof, on or near the grate, through the outer edges of which fuel they must pass to reach the gas exit where they are ignited. To insure the better combustion of the gases and to accelerate their flow to the combustion chamber, the double walls forming an air heating channel between them, are employed, air being admitted to said channel at its base and by contact with the heated walls being expanded and forced upward, causing an induced flow of air through dispersed perforations leading into said cap. This expanded air, filling the upper portion of said cap, becomes a force exerting itself by pressure upon the gases in the dome, generated from the fuel and accelerating the downward flow of gases to the exit. A further supply of air is given to the gases at the exit point through the perforations or a continuous narrow slot from which air is discharged against the escaping gases in the exit, in all, furnishing the needed oxygen for maintaining active combustion. The small streams of air passing from the channel into the fire dome or cap do not create a strong draft therein, but diffuse with the gases descending along its walls, and enriching the same with its oxygen. The enrichment of the gases above the fuel in this way must, when used, be guarded, as too great a supply of air would impair the economical operation of my stove. The enrichment of the gases within the exit opening is also important, as the air is there mixed with the gases at the point of actual ignition and combustion, thereby greatly increasing the intensity of the flame, or flames, jetting outwardly into the enlarged gas combustion chamber. By the upward and downward direction of drafts in my construction the confluence of three currents of highly combustible gases is secured and their point of meeting in the exit to the gas combustion chamber made the intensest point of combustion. As a result of this method, I have noted a pronounced abatement of black smoke. Again the meeting of the upward flowing, with the downward flow-

ing air and gas currents at a point just above the grate, intensifies the lateral draft under the fuel resting on the grate, so that it is here that the fuel is consumed to ash, and a self-feeding action downward from the cap or retort established for coals whether the same be cementing, caking coals or disintegrating lignite. As combustion goes on at the base, the superimposed fuel settles as its supports are burned away, and this process continues, with little needed attendance, until all is consumed.

I claim—

1. The combination, in a heater, of a dome imperforate and normally closed supported over a grate, a hollow chamber or channel adjacent to the lower portion of the dome and formed with openings at its upper and lower portions, means for admission of air to said chamber or channel, a grate, and an annular exit opening between the grate and lower end of said chamber or channel, substantially as described.

2. The combination, in a heater, of a dome imperforate and normally closed supported over a grate, a fire pot wall formed with an air chamber or channel terminating at its upper portion adjacent to the lower portion of the dome and formed with openings at top and bottom, means for admission of air into the chamber or channel of the fire pot wall, and a grate spaced from the lower end of the fire pot wall to form an exit opening between the grate and said wall, substantially as described.

3. The combination, in a heater, of a dome imperforate and normally closed supported over a grate, a hollow chamber or channel adjacent to the lower portion of the dome and formed with openings at its upper and lower portions, a duct extending laterally from the chamber or channel a distance sufficient to induce an indraft into said chamber or channel and prevent the outward escape of gas, a grate, and an annular exit opening between the grate and lower end of said chamber or channel, substantially as described.

4. The combination in a heater, of a retort having a normally closed top or dome, its lower end open toward the grate, an enlarged combustion chamber below and arranged around the lower section thereof, with double walls around said retort, having an air channel between, an air supply duct extending into said air channel, perforations 52 through the interior wall leading from said air channel into the retort, a grate below the center of said combustion chamber, said combustion chamber having a flue system connected therewith for carrying off the products of combustion, all substantially as described, and for the purpose intended.

5. The combination in a heater, of a retort depending over a grate and combustion chamber, its top or upper end being a normally closed dome, its lower end open toward the grate an enlarged combustion chamber arranged over and around said grate and around the lower section of the retort, a flue system connected therewith, said lower section of the retort having double walls, an air channel between said walls, an air duct leading therein and openings leading therefrom, for distributing the air, a part through perforations in the upper interior wall of said air channel, and a part downward through perforations or a continuous slot in or near the bottom of the same, all substantially as described, and for the purposes specified.

6. The combination, in a heater, of a normally closed and imperforate dome or cap, the lower walls of which form the fire-pot, and are provided with deep corrugations forming semi-diving flues, with a grate arranged beneath the open lower end of said cap, a space or exit opening being provided between the lower edges thereof and said grate, and a combustion chamber surrounding said exit opening, substantially as described.

7. The combination in a heater, of a retort supported above a grate, the lower end thereof open, the interior wall thereof being provided with deep corrugations forming with the fuel lying against them diving flues, a combustion chamber arranged around and above said grate, and enlarged outwardly and upwardly to embrace the lower section of said retort, an ash-ring or fender forming with the lower edge of said retort a gas exit, a flue system connected with the enlarged portion of said combustion chamber, all substantially as described and for the purpose specified.

8. The combination in a stove, of an inverted retort having a closed top or dome, a grate arranged beneath the lower edges of said retort, a base ring larger than said retort, a combustion chamber arranged about the retort, diving flues extending from said chamber, the top of said chamber being closed, an ash-pit, a chamber 5 arranged between the same, partitions provided in said chamber 5 to compel a circuitous passage of the products of combustion entering from said diving flues, and an indirect smoke flue extending from the chamber 5, substantially as described.

9. The combination in a stove, of a retort having the closed top or dome with a hot air channel arranged about said retort, the walls of the top of the chamber provided with openings leading into the retort, the lower walls thereof having openings leading therefrom, an air-supply duct extending into said hot air channel, a grate arranged between the retort and base ring, 17, a chamber, 64, arranged about said retort, an ash-pit arranged beneath said grate, a chamber 5, arranged beneath the ash-pit, diving flues extending between the chamber surrounding the retort and the chamber 5, and an indirect smoke flue adapted to carry off the products of combustion from the chamber 5, substantially as described.

10. The combination with a retort having a closed top or dome, of a hot air channel arranged about the same, and having openings

leading from its top into said retort, and openings arranged in its bottom, the grate provided beneath the retort, a space being left between the lower edges of the same and the grate, an upwardly and outwardly flaring grate section concentric with the retort, a chamber 64, arranged about the walls of the retort and hot-air channel, said chamber closed at the top, means for admitting air to said hot-air chamber, an ash-pit, diving flues extending from the chamber 64, an indirect flue in connection therewith, and a direct smoke outlet extending from the closed top or dome of the retort, substantially as described.

11. The combination with the retort having the closed top or dome, of a grate arranged beneath the same, a plate 14, supporting the grate, the ash-pit walls and the inclosing walls thereof, whereon the plate is arranged, the casting 39, having an upwardly extending upper portion to close the top of the chamber between the castings 39, and the retort, the plate 4, and chamber 5, arranged beneath the same, openings 66 arranged in the plate 14, and the plate 4, partitions 67 extending from the rear walls of the chamber 5, and an indirect smoke flue 11 leading from the central compartment of the chamber 5, substantially as described.

12. The combination in a stove, of the deeply corrugated retort wall 48, with the ring or wall 46, wherein the same is supported, a grate arranged beneath the same, means for supporting the grate, a dome arranged above said retort wall, or ring 48, perforations being provided between the same and the upper edges of said wall or ring 48, and openings being left between the lower edges of the rings 46 and 48, a hot-air channel surrounding said retort, and a sleeve 77 projecting through the wall of said chamber, and through the ring 46 and provided with a regulating slide 78, substantially as described.

13. The combination in a stove, of a retort having a dome 50, with a grate arranged beneath said retort, an ash-pit arranged beneath the grate, a chamber 64, surrounding the retort, and wall 39, the said chamber having the rim 41, to support said retort, a door leading into said retort, and an ornamental casing extending about said dome and having its lower edge 62, secured on said rim 41, said casing being perforated, substantially as described.

14. The combination in a stove, of the retort having a closed top or dome, with a hot-air channel arranged about said retort and having openings leading from its top into the retort, and openings leading from its bottom, a chamber 64, surrounding the same, an ash-pit having walls 8, the surrounding walls 9, the recessed wall 9′, the chamber 5, arranged beneath the ash-pit, diving flues extending between said chamber 5 and the chamber 64, the castings 3 and 4, the latter having the smoke outlet, and the indirect smoke flue 11 arranged within the recess of the wall 9′, substantially as described.

In testimony whereof I have hereunto set my hand this 11th day of January, 1892.

JAMES S. HARKINS.

In presence of—
C. G. HAWLEY,
F. S. LYON.