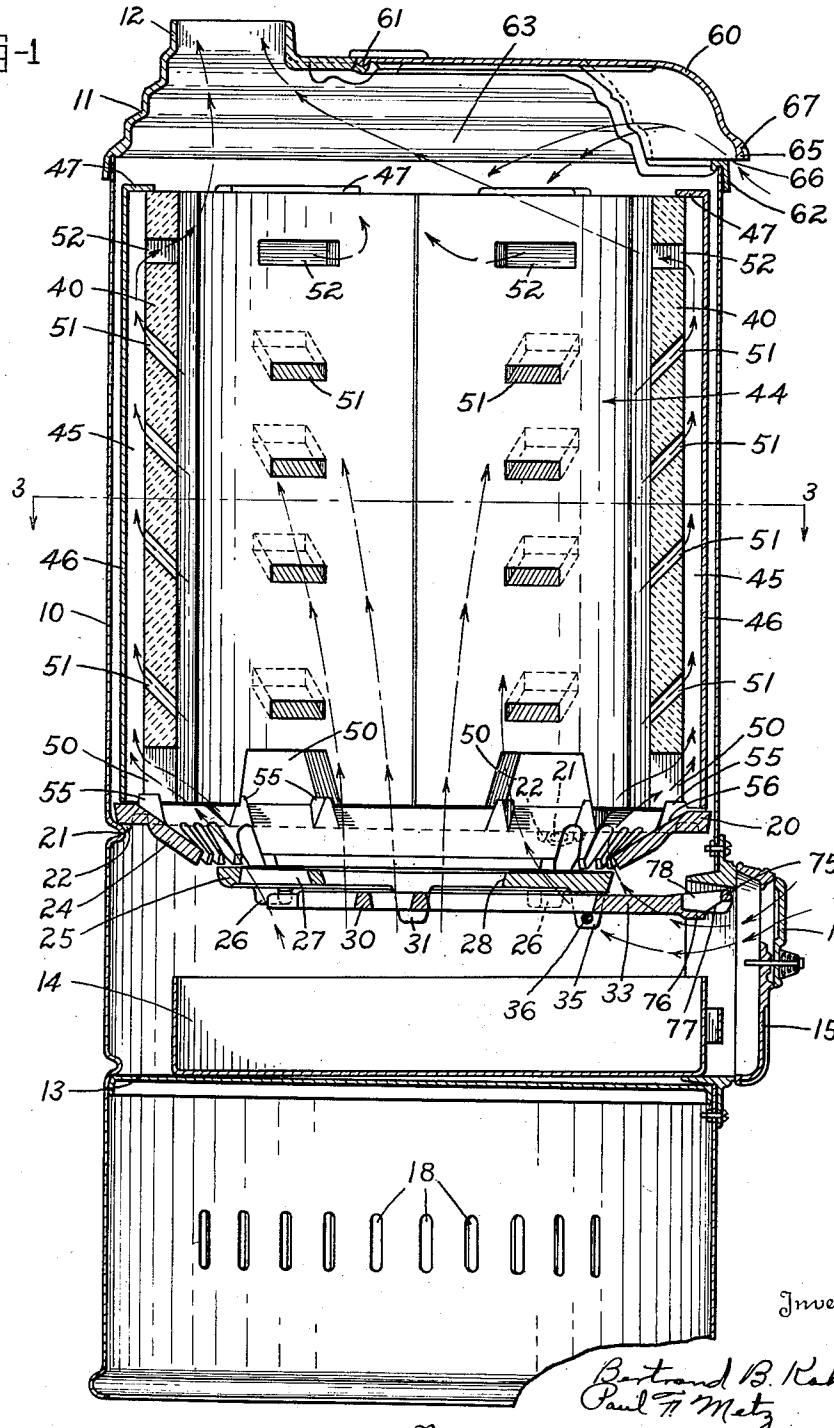
April 29, 1952 B. B. KAHN ET AL 2,595,146

MAGAZINE TYPE SOLID FUEL BURNING HEATER

Filed Jan. 23, 1947 2 SHEETS—SHEET 1

Fig-1



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Fig-3

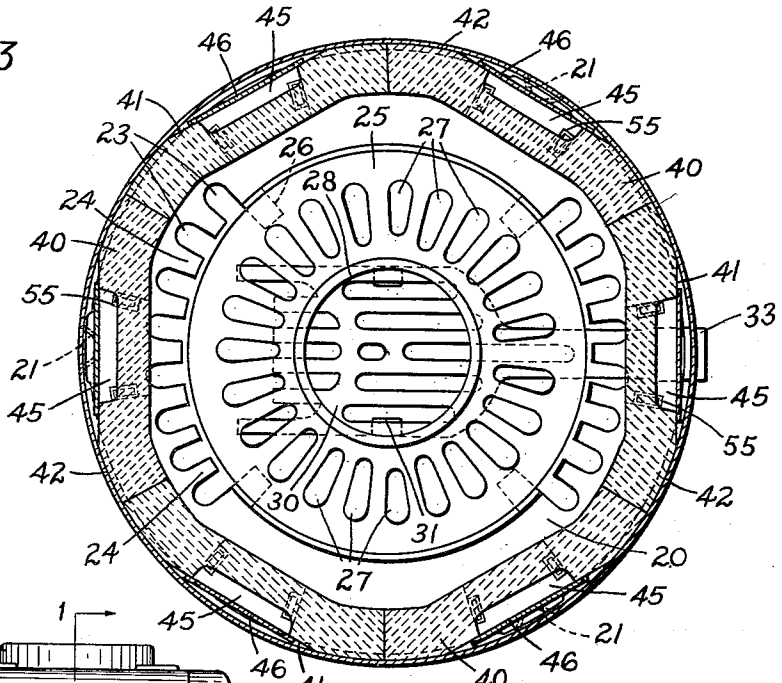


Fig-2

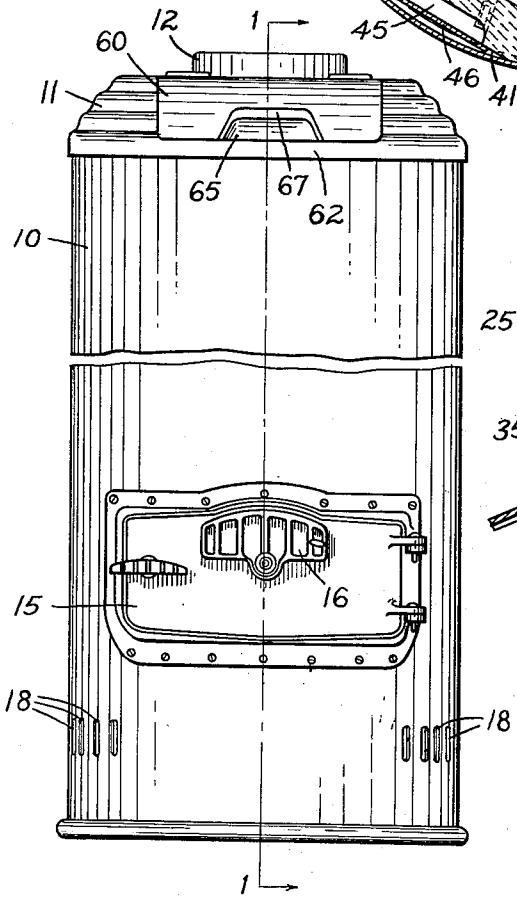


Fig-4

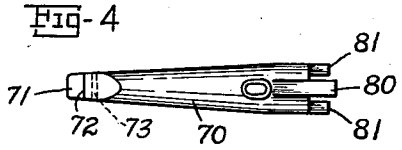


Fig-5

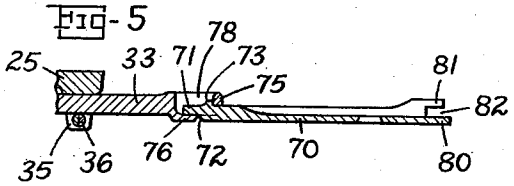
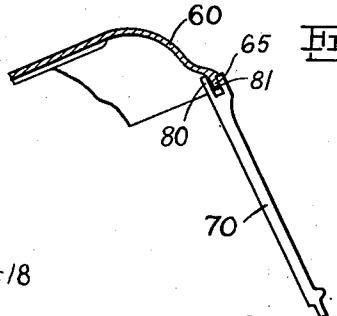


Fig-6



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MAGAZINE TYPE SOLID FUEL BURNING HEATER

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2 Claims. (Cl. 126—73)

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This invention relates to radiant heaters designed to burn solid fuels.

One of the principal objects of the invention is to provide an improved radiant heater constructed of comparatively few and simple parts and which is adapted to contain a relatively large supply of solid fuel and to consume this fuel at a readily controllable rate to heat the surrounding space with high efficiency and for a substantial period of time without requiring refueling.

Another object is to provide such a heater in which the gases distilled from the solid fuel are consumed at the sides and top of the heater in close proximity to heat-radiating surfaces, with resultant coking of the solid fuel to provide a loose fuel bed assuring adequate draft therethrough to maintain proper combustion.

An additional object is to provide such a heater wherein the gases distilled from the solid fuel are drawn off from the fuel magazine at different levels and either burned at the sides of the heater or bypassed around the unburned solid fuel and then returned to the magazine for combustion at a position above the fuel bed, and wherein provision is made to assure an adequate supply of fresh air at all times above the unburned fuel for complete combustion of these gases in the heater.

Still another object is to provide such a heater which will operate satisfactorily and efficiently with a wide variety of solid fuels, including particularly such small sizes of coal as chestnut, pea and nut.

It is also an object of the invention to provide such a heater having a plurality of vertical flue passages between the fuel magazine and the outer wall of the heater and connecting with the interior of the magazine at a plurality of points to receive distilled gases therefrom, and particularly to provide such a heater wherein these vertical passages also serve to convey air from below the magazine to the top of the fuel bed.

Another object is to provide such a heater wherein the passages for conveying air and gases from the lower parts of the heater to the top thereof are formed in the outer surfaces of the refractory lining enclosing the fuel magazine and are constructed to avoid burning out or overheating of the heater casing.

A further object is to provide such a radiant heater wherein the various passages for air and other gases are constructed to avoid resistance to upwardly moving gases in operation and also

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to reduce the possibility of an accumulation of ash tending to clog or choke such passages.

A still further object is to provide such a radiant heater having a shaker bar of special construction adapted not only for use in shaking the grate of the heater but also serving as a handle for the feed door to the fuel magazine which is normally out of contact with the feed door and thus remains cool for comfortable handling at such times as refueling of the magazine is required.

Other objects and advantages of the invention will be apparent from the following description, the accompanying drawings and the appended claims.

In the drawings, in which like characters of reference designate like parts throughout—

Fig. 1 is a view in vertical section of a heater constructed in accordance with the invention, the view being taken on line 1—1 of Fig. 2;

Fig. 2 is a view in front elevation of the heater shown in Fig. 1 and on a reduced scale;

Fig. 3 is a view in horizontal section taken on the line 3—3 of Fig. 1;

Fig. 4 is an elevational view illustrating the combined shaker bar and feed door handle for the heater shown in Figs. 1–3;

Fig. 5 is a detail view in vertical section illustrating the use of the shaker bar shown in Fig. 4 for shaking the grate of the heater shown in Fig. 1; and

Fig. 6 is a detail view illustrating the use of this shaker bar for raising the feed door of the heater shown in Fig. 1.

The drawings illustrate a preferred embodiment of the present invention, which includes a generally cylindrical outer casing 10 provided with a top 11 of cast iron or the like formed with a flue collar 12 for connection to a smoke pipe. A plate 13 is mounted within casing 10 and spaced from its lower end, as shown, to support the ash pan 14. An ash pit door 15 is mounted on the front of the casing, as shown in Fig. 2, and provided with an adjustable draft register 16. The lower part of the casing 10 below plate 13 is provided with a plurality of slots 18 for air circulation through this bottom part of the casing to keep the supporting floor area cool.

A grate frame 20 is supported within casing 10 above the ash pan. As shown in Figs. 1 and 3, the casing is swedged inwardly to provide three inwardly extending projections 21 angularly spaced above the periphery of the casing, and the grate frame rests on these projections. Also, the grate frame is provided with spaced pairs

of downwardly projecting lugs 22 which are adapted to receive the projections 21 therebetween and thus cooperate with these projections to secure the grate frame and casing in fixed angular relation. Radially arranged slots 23 are provided in grate frame 20, leaving radially extending fingers 24 therebetween to support the fuel while still permitting adequate upward circulation of air through the grate.

The grate frame 20 supports a rotary grate 25, which is shown as of circular outline and is rotatably supported upon a plurality of downwardly and inwardly projecting lugs 26 formed integrally with the grate frame 20, there being four of these lugs as shown in Fig. 3. The rotary grate 25 is formed with radially arranged slots 27 for draft purposes and also with a circular center aperture 28 which is closed by a draw or dump grate 30 of latticed construction. As shown in Figs. 1 and 3, the dump grate 30 is mounted for sliding movement on a pair of downwardly and inwardly projecting lugs 31 integrally formed on the rotary grate 25, and it includes a handle portion 33 or shank by which it may be drawn outwardly, to the right as viewed in Figs. 1 and 3, to open the opening 28 in the rotary grate 25 for dumping clinkers and the like. Also, this shank 33 is adapted to receive a shaker bar for shaking the rotary and dump grates back and forth to free them of ashes. Two additional downwardly extending lugs 35 are formed on the bottom of rotary grate 25 and receive the shank 33 in guided relation to prevent the dump grate 30 from cocking and also to prevent its accidental withdrawal too far forward of the rotary grate, means such as a cotter pin 36 being mounted in these lugs as shown in Fig. 1 to retain the shank 33 in properly supported position.

A refractory lining formed of fire bricks 40 is provided within the casing 10 and above the grates. As shown in Fig. 3, these fire bricks are arranged to form in cross section the outline of a regular polygon, shown as a hexagon, having straight outer sides 41 but with the outer corners 42 curved for close engagement with the inner surface of casing 10. This refractory lining is supported on the grate frame 20 and forms a fuel magazine above the grate which is designated generally by the reference character 44. Each of bricks 40 is formed in the flat part 41 of its outer surface with a vertically arranged groove 45 forming a flue, there being thus six of these flues 45 equally spaced about the interior of the heater as shown in Fig. 3. The flues 45 extend from the grate substantially to the top of casing 10, but each is provided with a plate 46 positioned between the casing and the outer surface of the fire brick and which is bent over at its top 47 to close the top of the flue. These plates 46 thus serve both to shield the casing from flames in the flues 45, to prevent burning out of the casing, and also they prevent discharge from the tops of flues 45 except through the passages in bricks 40, as will be described.

Referring particularly to Fig. 1, it will be seen that the refractory lining of the heater is provided with a plurality of vertically arranged rows of passages 50, 51 and 52 extending completely therethrough, one of these passages in each row being formed in each of the bricks 40 to provide communication at a plurality of points from the interior of the fuel magazine 44 to each of flues 45. The passages 50 in the lowermost of these rows of passages are formed in the bottom edges of bricks 40 so that they are bounded on their lowermost sides by the grate frame 20. Also, each of these passages 50 is substantially larger than any of the other passages 51 and 52 in the upper part of the magazine, thus providing for a relatively strong and direct draft through the fuel closely adjacent the grate to the flues 45 to maintain an active fire in the vicinity of the grate at all times when the heater is in operation. The grate frame 20 is formed as shown in Fig. 1 with a plurality of upwardly projecting lugs 55 which are adapted to extend into and engage opposite sides of each of passages 50 and thus to secure the grate and refractory lining in fixed angular relation. In addition, the grate frame 20 is inclined inwardly and downwardly below each of passages 50, as shown at 56 in Fig. 1, to relieve any ash accumulation in these passages 50 and thus to assure that the passages will be kept open for proper draft at all times in operation.

Passages 52 in the uppermost row in the refractory lining are relatively closely adjacent but spaced downwardly from the top of the fuel magazine, for example approximately 1.5 inches in a magazine of 15-inch diameter and with the bricks 19 inches in height. These passages 52 thus provide for the discharge of gases from the flues 45 into the fuel magazine, and they are shown as horizontally arranged in order to direct these discharged gases radially into the magazine. The passages 51 in the intermediate rows are inclined upwardly and outwardly, thus giving less resistance to gases moving in an upwardly direction and also safeguarding against the pocketing or accumulating of ashes therein.

The top 11 of the heater is cut away to provide an opening having a door 60 for filling the magazine with fuel. This feed door is mounted at 61 for upwardly swinging movement relative to top 11 to provide access to the magazine, and a portion 62 of top 11 extends across the casing below the front of the door as shown in Figs. 1 and 2. This feed door 60 is constructed to provide a fixed port for constantly supplying air from outside the heater to the space 63 at the top of and above the fuel magazine. As shown in Figs. 1 and 2, the front of the door is formed with an outwardly projecting lip portion 65, having its lower edge spaced outwardly from the adjacent portion 62 of the casing and casing top to provide a slot 66 through which air can freely enter the top of the heater, as shown by the arrows in Fig. 1. This lip 65 is also formed, as shown in Figs. 1 and 2, to serve as a handle for lifting the feed door, and it includes at the front a projecting flange 67 which cooperates with the combined shaker bar and handle member of the invention as described below in connection with Fig. 6.

It will be seen that since the door 60 is directly exposed to the heat from the fire in the fuel magazine, and since it is accordingly preferably made of a good heat conducting and radiating material, it will become much too hot in use for convenient handling without adequate protection. The invention accordingly provides a shaker bar for the grates of the heater which has one end formed for shaking attachment to the grates and its other end of special construction for lifting feed door 60 by means of lip 65. This combined shaker bar and door handle is normally separated from the heater and thus remains cool to the touch and ready for use with-

out a cloth, glove or other protection. Its construction and use are illustrated in Figs. 4 to 6.

Referring first to Figs. 4 and 5, the bar 70 is formed at its shaker end with a longitudinally extending tongue portion 71 of reduced thickness, leaving a shoulder 72 at the inner end of this tongue. On its opposite side and adjacent tongue 71, bar 70 is formed with a laterally projecting transverse rib 73. The operation of this end of the shaker bar and its inter-engagement with the outer end of the shank 33 on draw grate 30 are shown in Figs. 1 and 5. Shank 33 is formed at its outer end with a rib 75 spaced outwardly and upwardly from the axially adjacent lip portion 76 of the shank and leaving a slot 77 therebetween, this construction being complementary to that of the tongued end of member 70 so that these parts readily interengage for shaking the grates.

In use, the handle 70 is inserted into the heater, preferably through the draft opening 16 to minimize escape of ashes into the room, and diagonally upward at an angle such that its tongue 71 and rib 73 will enter the slot 77, until shoulder 72 engages the outer edge of lip 76. Thereafter, the outer end of the handle is raised until it and shank 33 are in line, in which position the tongue 71 will lie flat against the lip 75 on the shank, and the rib 73 on the handle will engage the inner edge of rib 35 on the shank to prevent withdrawal of the handle, with the sides of this end of the bar engaged between the side portions 78 of shank 33 connecting rib 75 and lip 76 to provide a firm connection for shaking the grate. The subsequent disengagement of the handle may be accomplished in the same manner as its engagement, by lowering the outer end and withdrawing it diagonally downwards from the heater.

The opposite end of the shaker bar 70 from that just described is constructed for inter-engagement with the lip 65 on feed door 60 to serve as a handle in raising and lowering the feed door. Referring to Figs. 4 to 6, it will be seen that this handle end of bar 70 opposite tunnel 71 is formed with three longitudinally projecting finger portions, a middle finger 80 and two outer fingers 81, spaced as shown in Fig. 5 to define a slot 82. These fingers and the slot 82 are of such dimensions as to receive the lip portion 65 on feed door 60 therebetween, as shown in Fig. 6. The middle finger 80 is slightly longer, for example one-eighth of an inch to facilitate rapid engagement with lip 65, in which position the ends of the outer fingers 81 engage the flange 67 at the upper part of the lip, as shown in Fig. 6. With this construction, when it is desired to add fuel to the magazine, it is merely necessary to fit this end of bar 70 into engagement with lip 65 and then raise the door for refueling, and a slight angular force on the bar during this operation will readily retain it in gripping relation with the feed door to hold the door from falling either forward or backward at the time of use. In this way the door can readily be handled at any necessary time without any special protection for the hands, since the shaker bar 70 will normally be kept near but out of contact with the heater and hence will remain sufficiently cool for manipulating with the bare hand.

In operation, in order to start a fire in this heater, the draft register 16 and the usual damper in the smoke pipe are opened and a small amount of a small coal placed on the grates, to a depth of approximately 2 to 3 inches. Then a quantity of paper is placed on the coal, and kindling wood in small pieces on top of the paper, followed by a small additional amount of coil on the wood. The paper is then ignited and the fire permitted to burn until the kindling and coal are burning well. During this stage of operation, the products of combustion and gases pass directly through the center of the magazine and out through the flue collar 12, since the only fuel is at the bottom of the magazine and the remainder is open to provide a stack effect.

After the first charge of coal has had a good start, more coal is added in small amounts until approximately one-half of the magazine is filled with fuel, with intervals between the additions of fuel to allow sufficient time for the coal to be burned through. During this stage of operation a large proportion of the products of combustion and gases continue to pass up through the magazine, but some will pass through the passages 50 and the lower passages 51 into flues 45 and thence through passages 52 to the top of the heater. Also, during this stage there may be a considerable quantity of air drawn up through the grate and the fuel in the vicinity of the grates to the passage 50 and thence through flues 45 to the top of the heater.

After all the fuel added as described is burning well, the remainder of the magazine can be filled with fresh fuel, care being taken not to fill the magazine beyond the level of the top row of draft passages 52. At this time it is also advisable to close the draft register 16 in the ash pit door until it is only slightly open, thus retarding devolatilization of the green fuel and promoting proper burning of gases on top of the fuel bed. During this stage of operation, the gases distilled from the fuel pass through the passages 51 and are either burned in the flues 45 or on top of the fuel bed. In some cases it is found that after a full fuel charge is made, it may be some time before the flame appears on top of the fuel bed, and it is at this time that the gases are being burned within flues 45. The arrangement of the top passages 52 in a horizontal plane adjacent the top of the fuel bed provides for improved operation by discharging flame from the flues 45 into direct contact with the fuel bed and with the gases arising therefrom within the magazine. Also, the air which is admitted through the fixed port 66 provided by the lip 65 on the feed door tends to be drawn across the upper part of the heater toward the flue collar 12 and supplies sufficient oxygen for completing combustion of gases which may accumulate in the space 61 above the fuel bed.

The operation of the heater as just described is illustrated by the series of arrows in Fig. 1, and it continues until such time as the entire fuel charge within the magazine has been devolatilized. Thereafter the combustion takes place more or less directly through the fuel bed, since by this time the coal has been largely changed to coke, providing a loose fuel bed. During the subsequent burning, since devolatilization of the fuel is substantially complete, the flues 45 will be found to be largely conveying air from the lower part of the heater to the top of the fuel bed and the smoke pipe. Also, during all the stages of operation, there will be a substantial air flow through the grate and passages 50 to the flues 45, thus assuring the maintenance of an active fire in the vicinity of the grate.

It will accordingly be seen that the invention provides a radiant heater constructed of comparatively few and simple parts and which is easy to assembly as well as to operate. Such a heater, constructed with the illustrative dimensions given above, will contain as much as 100 pounds of fuel and will operate satisfactorily at rates ranging as widely as from 2 to 15 pounds of fuel per hour with good response at all times to the air register setting. The heaters of the invention can be used with any size of coal, preferred results being obtained with small sizes such as chestnut, pea and nut, and they have been tested with coals from widely different sources within the United States, with satisfactory operation. In addition, these heaters require a minimum of attention after being once well started, operating at a substantially constant rate for many hours without adjustment or refueling, and when shaking or refueling is required, the shaker bar of the invention provides for readily accomplishing either operation quickly and easily and without danger of burning the hands.

While the form of apparatus herein described constitutes a preferred embodiment of the invention, it is to be understood that the invention is not limited to this precise form of apparatus, and that changes may be made therein without departing from the scope of the invention which is defined in the appended claims.

What is claimed is:

1. A heater of the character described comprising, in combination, a cylindrical casing, a refractory lining within said casing forming a fuel magazine, a grate positioned below said magazine, a plurality of angularly spaced inward projections on said casing supporting said grate, a plurality of downward projections on said grate cooperating with said inward projections on said casing to secure said grate and casing in fixed angular relation, said lining having vertically arranged flues formed in the outer surface thereof and angularly spaced about said heater, means providing for admission of air to said flues from below said grate, said lining having a plurality of vertically spaced rows of passages formed therethrough and communicating with said flues to convey gases from the interior of said magazine to said flues, the passages in the lowermost of said rows being formed in the lower edge of said lining, and means on said grate engaging opposite sides of at least one of said lowermost passages to secure said lining and grate in fixed angular relation.

2. A heater of the character described comprising, in combination, a casing, a grate within said casing, means projecting inwardly from said casing to support said grate above the bottom level of said casing, a refractory lining supported on said grate and forming a fuel magazine, a door at the top of said heater to provide for filling said magazine with fuel, said lining having vertically arranged flues formed in the outer surface thereof and angularly spaced about said heater, means positioned between said flues and said casing to shield said casing from direct contact with flames in said flues and extending across and closing the top of said flues, said lining having a plurality of vertically spaced rows of passages therethrough providing communication between the interior of said magazine and said flues, the passages in the lowermost of said rows being substantially larger than the others of said passages and being bounded on their lowermost side by said grate, projection means on said grate engaging opposite sides of said passages in said lowermost row to secure said lining and grate in fixed angular relation, the uppermost row of said rows of passages being adjacent but spaced from the top of said lining and being horizontally arranged to discharge gases from within said flues substantially directly into said magazine, the passages in the intermediate rows being inclined upwardly and outwardlly to convey gases from said magazine into said flues without pocketing or accumulating ash therein, and means on said door providing a constantly open port for supplying air to the space above said magazine to support combustion of gases accumulating in said space.

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