Feb. 21, 1956 G. A. KOHOUT 2,735,384

STOKER

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Fig. 1

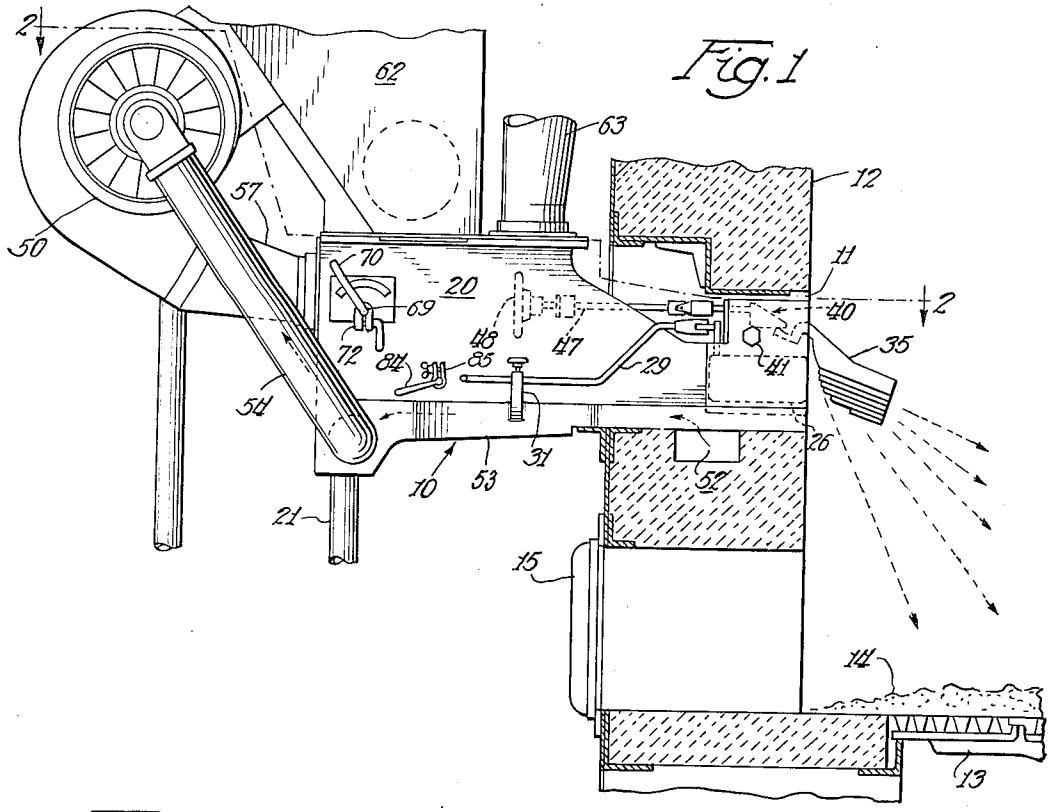
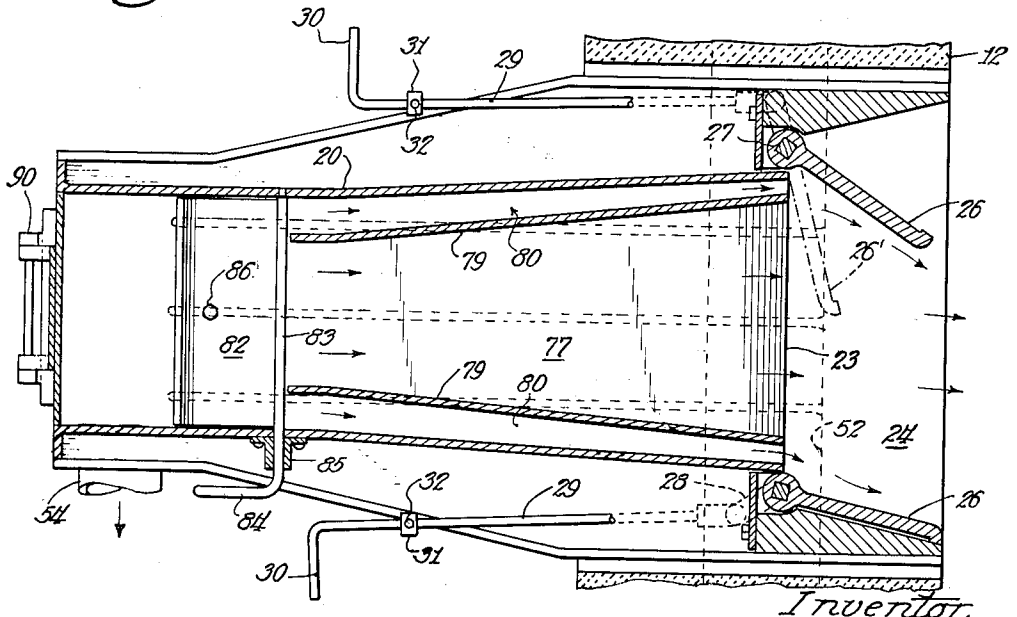


Fig. 3



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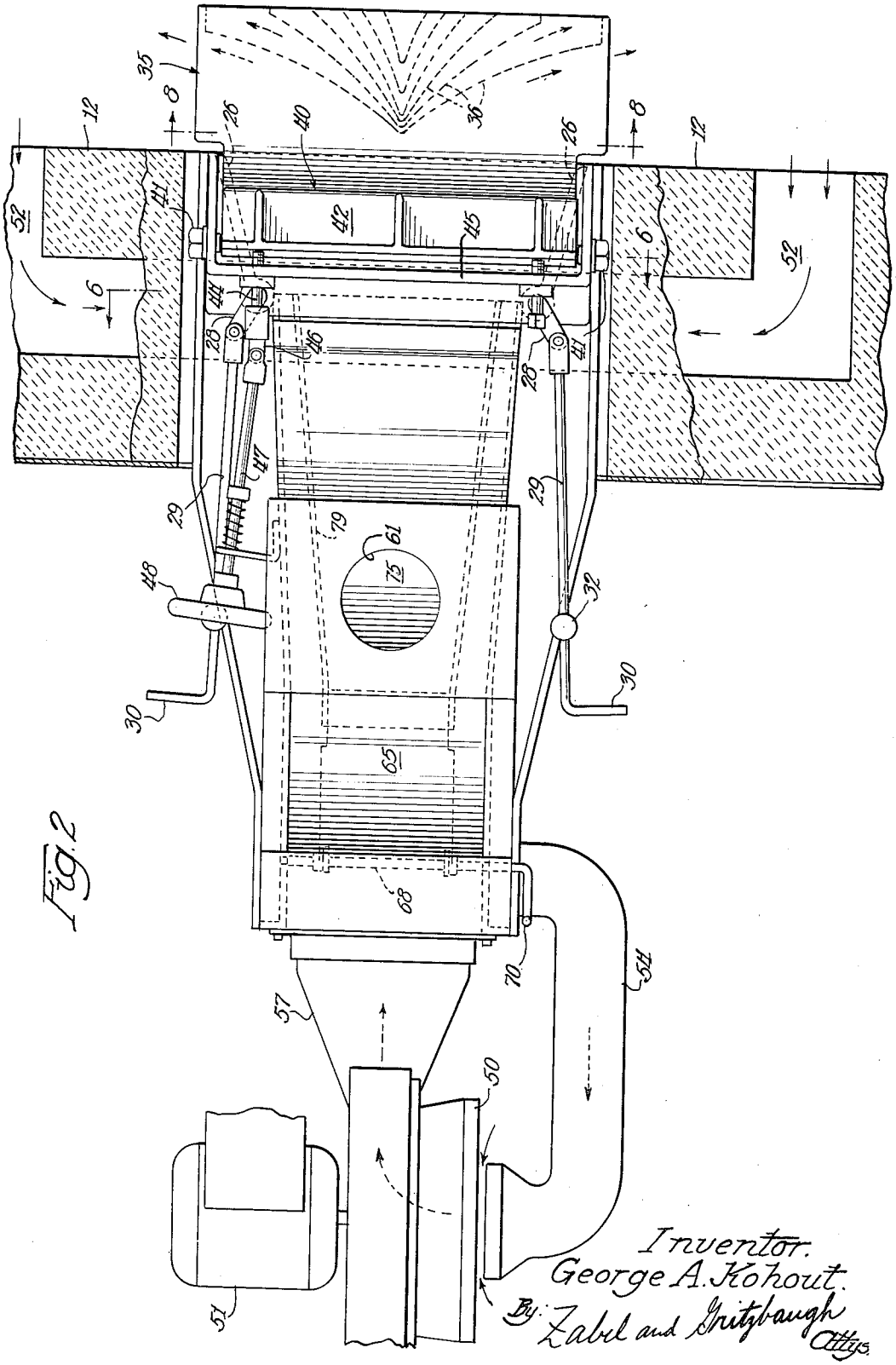


Fig. 2

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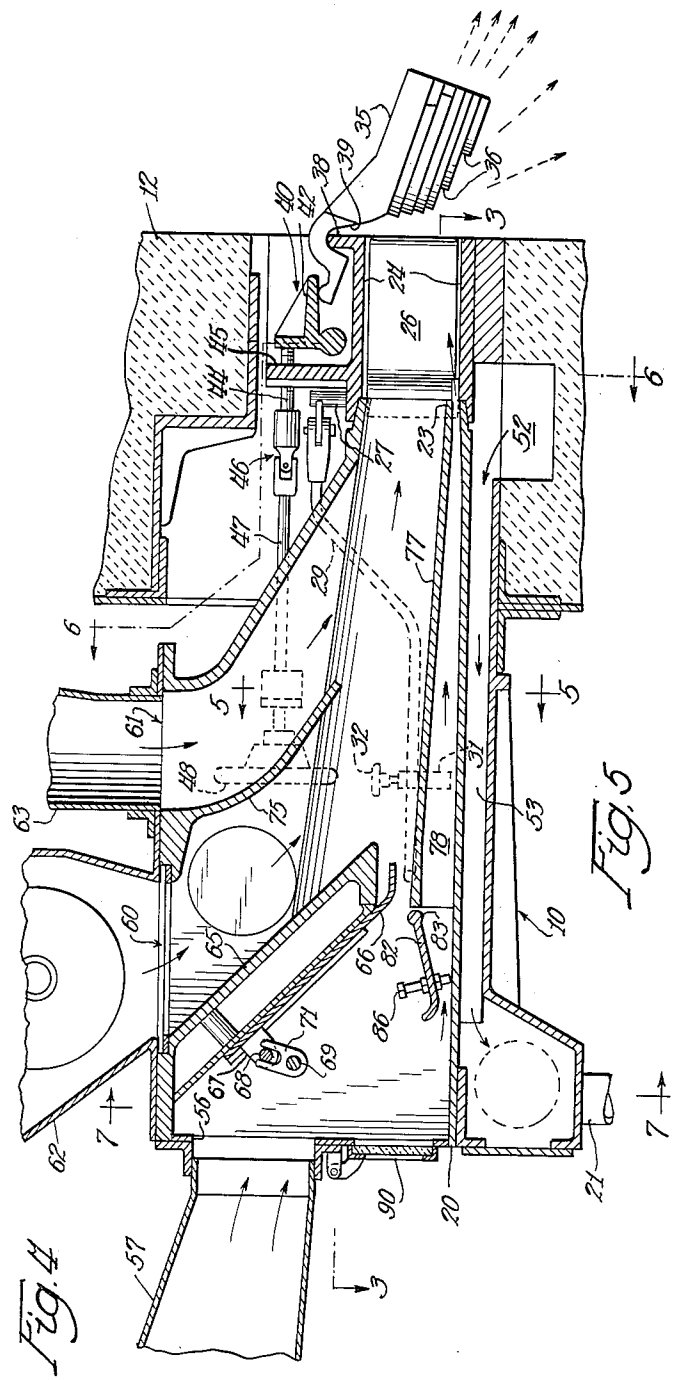


Fig. 4

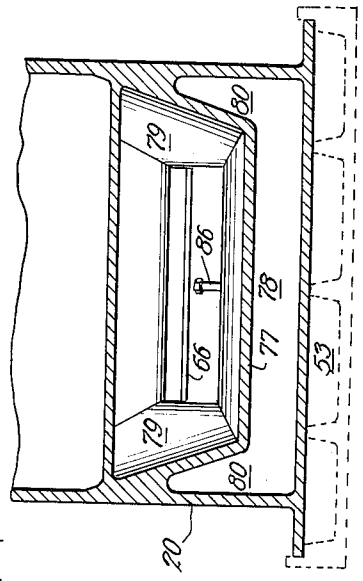


Fig. 5

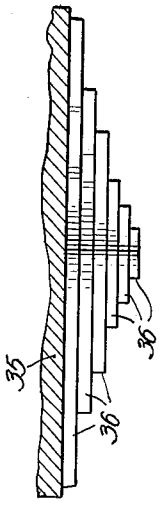


Fig. 8

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Fig. 6

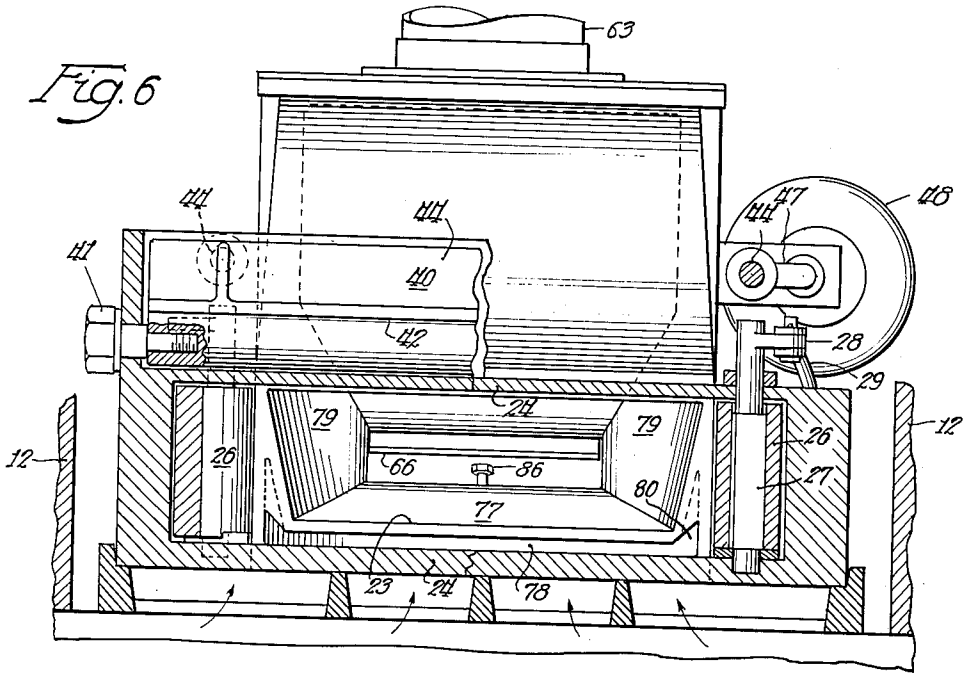
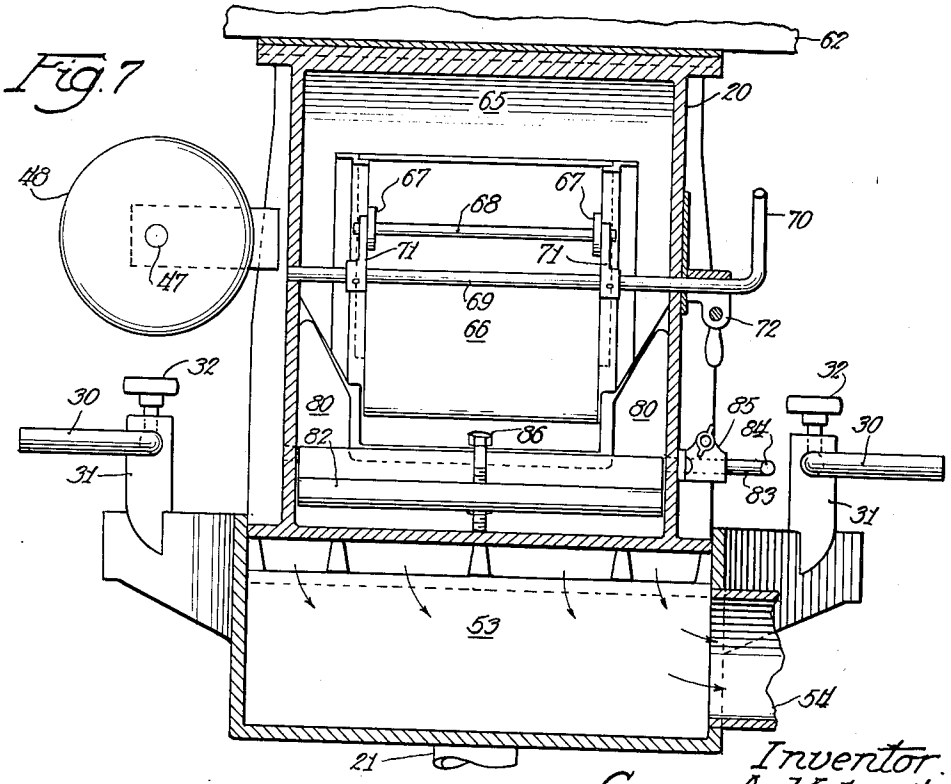


Fig. 7



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United States Patent Office 2,735,384 Patented Feb. 21, 1956

2,735,384

STOKER

George A. Kohout, Chicago, Ill.

Application January 28, 1952, Serial No. 268,537

7 Claims. (Cl. 110—104)

My invention relates to an automatic stoker for small size solid fuels, and more particularly to a stoker that functions as both a carburetor and a distributor of such solid fuels.

One object of the invention is to provide a stoker adapted to handle all types of small size solid fuels. Suitable fuels include sawdust, hogged wood, shavings, wood chips, corn cobs, bagasse, hogged bark, coal, coal sweepings and screenings, paper cuttings, nut shells, wood trash, and a mixture of any of the foregoing. As an example, small size coal and hogged wood may be used with particular efficiency either individually or together in my stoker.

Another object is to provide a stoker that may easily be applied to an existing furnace. The stoker is relatively small in size, and it is adapted to be mounted in the fire door or other suitable opening in the front wall of a furnace.

Another object is to provide a stoker wherein the small size solid fuel is mixed with pressurized gaseous material, such as air, and wherein the gaseous material performs the dual function of transporting the fuel and supplying a combustion supporting element such as oxygen. This mixing has been referred to above as a carburetor function.

Another object is to provide a stoker which is itself capable of properly distributing the fuel with respect to the combustion chamber of the furnace. This distribution function, mentioned above, is produced by a plurality of baffles which cooperate with the stream of fuel that is transported by the pressurized gaseous material. By adjusting the baffles, the fuel may be distributed uniformly throughout the combustion chamber, or it may be concentrated to the front, rear, left, or right regions of the chamber, as may be desirable for cleaning other regions of the chamber.

Still another object is to provide a stoker of this type wherein the flow of pressurized gaseous material is easily regulated within the stoker. This feature makes it possible to meet the requirements of different fuels both for transportation and combustion. For example, as far as transportation is concerned, light weight fuel such as wood requires more gas volume and less gas pressure, while heavier weight fuel such as coal requires less volume and more pressure.

Another important object is to provide a stoker wherein the fuel outlet region of the stoker is more or less self-cleaning. This object is attained by the provision of thin streams of pressurized gaseous material on the bottom and sides of the fuel outlet region. These streams function to scavenge the walls of this region, and, in addition, they also boost the speed of the transported fuel to assist in bringing about proper distribution and combustion within the combustion chamber of the furnace.

Other objects and advantages of the invention will be apparent as the description proceeds, reference being had to the accompanying drawings which illustrate one structural form of the invention. It is to be understood, of

course, that in commercial applications of the invention various details might well vary somewhat from those here shown and described.

In the drawings:

Fig. 1 is a side view of a stoker embodying my invention showing the installation thereof in the front wall of a furnace;

Fig. 2 is a top view of the stoker;

Fig. 3 is a horizontal sectional view on line 3—3 of Fig. 4;

Fig. 4 is a side sectional view of the stoker;

Fig. 5 is a transverse sectional view on line 5—5 of Fig. 4;

Fig. 6 is a transverse sectional view on lines 6—6 of Figs. 2 and 4;

Fig. 7 is a transverse sectional view on line 7—7 of Fig. 4, and

Fig. 8 is a fragmentary view of one of the baffles of my invention, the view being taken on line 8—8 of Fig. 2.

This application is a continuation-in-part of my co-pending application for Stoker, Serial No. 69,907, filed January 8, 1949, now abandoned.

Referring to Fig. 1 of the drawings, a stoker embodying my invention is designated generally by the numeral 10. The forward end of stoker 10 is received within a suitable opening 11 extending through the front wall 12 of a furnace. A portion of the furnace grate is shown at 13, and fuel or ash on grate 13 is designated by 14. A customary door in the lower part of furnace wall 12 is shown at 15.

Referring to Figs. 1 and 4, the stoker 10 includes a generally boot-shape housing 20. The toe of the boot-shaped housing 20 is the front of the stoker, the portion that enters opening 11 of the furnace wall 12. The rear or heel end of housing 20, as well as the central portion of the housing, is disposed in front of wall 12, as clearly shown in the figures. Suitable support members such as pipes 21 are provided to properly position the stoker with respect to the furnace wall.

The toe or front end of housing 20 is provided with a discharge opening 23. This opening is generally rectangular in shape, as best shown in Fig. 6, and its long dimension extends transversely of housing 20. Forwardly of the discharge opening 23 in housing 20 there may be provided a spout structure 24, best shown in Fig. 3. Spout structure 24 is generally rectangular in cross section, and it provides a communication between housing opening 23 and the furnace interior. The lateral sides of spout structure 24 may be gently diverging to the front, as shown in the figure.

Still referring to Fig. 3, a pair of vertically disposed baffles 26 are mounted in a hinged manner, one on each side of discharge opening 23. The length of each baffle 26 is substantially equal to one-half the width of opening 23, and the baffle height is substantially equal to that of the opening. Thus, when a baffle is closed, as shown in dotted line at 26', it covers one-half of opening 23.

Referring to the right hand side of Fig. 6 and Fig. 2, a baffle 26 is carried on a vertical shaft 27 that is mounted for rotation at its ends in spout structure 24. The upper end of shaft 27 has a horizontally extending arm 28 that is pivoted at its free end to one end of an actuating rod 29. The other end of actuating rod 29 is bent to form a handle 30. It will be apparent that movement of an actuating rod 29 correspondingly varies the hinge angle of the associated baffle 26. When a rod 29 is in a rearmost position, as shown at the bottom of Fig. 3, baffle 26 is wide open. When in a frontmost position, a rod 29 is effective to close its associated baffle 26 as shown in dotted lines at 26'. The baffles 26 may, of course, be set at any intermediate position by suitable manipulation of rods 29. Each rod 29 may pass through a bear-

ing member 31 in which is provided a set screw 32 (Figs. 2 and 7). The latter may be tightened to secure actuating rod 29 in desired adjustment position.

Referring to Figs. 2 and 4, a horizontally disposed baffle 35 is positioned generally above and forwardly of the discharge opening 23 and spout structure 24. Baffle 35 comprises a generally flat plate which has its underneath face provided with laterally diverging stepped vertical walls 36. The wall 36 of each step faces the fuel stream when the baffle is mounted on the stoker, as shown in Fig. 4. A view of the underneath surface that is presented to the fuel stream is shown in Fig. 8. The diverging walls 36 preferably have a slight curvature as indicated by the dotted lines in Fig. 2. The function of baffle 35 will be described later.

Baffle 35 is mounted on the stoker in a hinged manner, as best shown in Fig. 4. The top plate of spout structure 24 has a transverse flange 38 along its forward edge. Baffle 35 has a recess 39 adjacent the rear edge thereof adapted to receive flange 38 with a loose fit, as shown in Fig. 4. A transverse member 40 extends across the top of spout structure 24, and it is pivoted at its ends as shown at the left in Fig. 6 by means of bolts 41. Member 40 is generally T-shaped in cross section, and bolts 41 engage the member at one end of the cross bar of the T. The web 42 of the T extends forwardly into overlying relation with the rear edge of baffle 35, as best shown in Fig. 4.

A threaded stud 44 (Fig. 4) extends through a threaded opening in a flange 45 on the top of spout structure 24 and engages member 40 near the end of the cross bar opposite to that which is engaged by bolts 41. Threaded stud 44 is connected by a universal joint 46 to an actuating shaft 47. A hand wheel 48 or the like is provided on the end of shaft 47. Rotation of stud 44 by means of hand wheel 48 and shaft 47 produces axial movement of the shaft, and this, in turn, causes member 42 to pivot on its bolts 41. Pivotal movement of member 42, of course, varies the hinge angle of baffle 35 so that the latter may be positioned to point generally downward as shown in Fig. 4 or generally horizontally, or even slightly upward.

Referring to Figs. 1 and 2, a compressor 50 is mounted at the rear of the stoker. It supplies the pressurized gaseous material to the stoker for the aforementioned carburetor and distribution functions. A suitable motor 51 (Fig. 2) drives the compressor.

Various types of gaseous material may be used in my stoker, but a mixture of air and hot furnace gases usually is the most convenient. Referring to Figs. 1 and 2, hot gases from the furnace interior are drawn through ducts 52 in furnace wall 12. These ducts join in a hollow duct 53 extending beneath stoker housing 20. A circular duct 54, Figs. 1 and 2, extends from the rear of duct 53 to the inlet of compressor 50. It will be understood that compressor 50 creates a suction that draws hot gases from the furnace interior through ducts 52, 53, and 54 to the compressor. The preheated furnace gases are mixed at the compressor inlet with a limited amount of air, and the mixture is drawn into the compressor where it is compressed and delivered to the stoker.

Referring to Fig. 4, the rear end of housing 20 is provided with an opening 56, and this opening is connected to compressor 50 by a duct 57. Opening 56, of course, is the port through which the pressurized and preheated gaseous material is delivered to the stoker.

Referring to Fig. 4, the top member of housing 20 is provided with a main fuel opening 60. Optionally, it may also be provided with an auxiliary fuel opening 61. Main fuel opening 60 communicates with a suitable fuel hopper 62 that is adapted to provide a more or less continuous supply of small size solid fuel to the stoker. Normally, the force of gravity is utilized to convey the fuel from hopper 62 to the stoker.

Auxiliary fuel opening 61, if provided, normally is adapted to receive fuel that is transported by air through a pipe 63. Opening 61 normally would receive hogged wood or other light weight fuel suited to this form of delivery. If a fuel delivery pipe 63 is not provided, it is desirable to cover opening 61 with a hinge cover (not shown). This cover should be adjustable so as to provide a controllable auxiliary air inlet.

The rear edge of main fuel opening 60 is provided with an inclined plate member 65 (Fig. 4) that extends downwardly and forwardly therefrom. Plate member 65 terminates at its lower end short of the bottom of housing 20. It extends transversely substantially across the housing interior. Fuel dropping from hopper 62 passes through opening 60 and strikes the inclined plate member 65. Thereafter, the fuel falls into the stream of pressurized gaseous material as will be described presently.

Inclined plate 65 is provided with means whereby its effective length may be varied. As illustrated, this means takes the form of a plate 66 carried beneath plate 65. Plate 66 is slidingly mounted with respect to plate 65 so that the effective length of the latter may be varied by adjusting the position of plate 66.

Referring to Figs. 4 and 7, sliding plate 66 has a pair of spaced lugs 67 on its under side. A rod 68 extends between, through and slightly beyond these lugs as shown in Fig. 7. An actuating member 69 with a handle 70 extends through housing 20 parallel to, and spaced slightly from, rod 68. Actuating member 69 carries spaced arms 71 that have bifurcated free ends. The bifurcations embrace rod 68 on sliding plate 66 so that rotation of actuating rod 69 produces sliding movement of plate 66. A suitable clamp 72 is provided to fix the position of actuating member 69 after adjustment has been made.

Opening 61 in the top of housing 20 has a plate member 75 (Fig. 4) extending downwardly and forwardly from the rear edge thereof. It terminates at a central position within the housing as shown in Fig. 4. Auxiliary fuel delivered through opening 61 is guided by plate member 75 in proper direction for efficient merger with the fuel stream traveling through the housing.

Again referring to Fig. 4, housing 20 is provided with a false bottom 77. This false bottom extends generally across the housing interior and from the front opening 23 of the housing to a rear termination immediately below the lower end of inclined plate 65. False bottom 77 is spaced from and thus cooperates with the main bottom of housing 20 to form a flat chamber 78 through which passes some of the pressurized gaseous material delivered to the rear of the housing. This gaseous material in escaping from the forward end of chamber 78 is effective both to scavenge the bottom of sprout structure 24 and to boost the speed of the conveyed fuel. This gaseous material also mixes with the fuel to assist in combustion.

As best shown in Figs. 5 and 6, false bottom 77 has upwardly inclined sides 79 that are spaced somewhat from the main sides of housing 20. The spaces between inclined sides 79 and the main sides of housing 20 constitute narrow vertical chambers 80. Pressurized gaseous material from the rear of housing 20 passes through the chambers 80 and at the forward opening 23 of the housing is effective to scavenge the sides of the spout structure 24, or, more accurately, is effective to scavenge the adjacent surfaces of the vertical baffles 26. This gaseous material, of course, is also effective to boost the speed of the transported fuel, as well as to supply elements used in combustion.

A damper 82, best shown in Fig. 4, is provided at the rear end of false bottom 77. Damper 82 is carried on a rotatable shaft 83 (Fig. 3) that extends through housing 20 in close parallelism with the end of false bottom 77. One end of shaft 83 extends considerably beyond the side of housing 20 and is bent to form an actuating handle 84. A suitable clamping means 85 (Fig. 7) is provided to fix the adjusted position of actuating shaft 83.

A bolt 86 (Fig. 4) may be threaded through damper 82 to function as a limiting stop beyond which damper 82 may not be controlled by actuating handle 84.

It is apparent that damper 82 forms a fine adjustment for controlling the flow of pressurized gaseous material respectively through the chamber 78 and the interior of the stoker proper. The sliding plate 66 also is effective to control the absolute volume of gaseous material passing through the stoker interior. As previously mentioned, different fuels require different volumes and pressures of gaseous material in order to be transported and burned efficiently. Damper 82 and sliding plate 66 enable the stoker to be operated most efficiently with the various possible fuels.

The rear end of housing 20 is desirably provided with an observation and service door 90 (Figs. 3 and 4). As illustrated, this door is located immediately below the duct 57 that conveys the pressurized gaseous material into the stoker.

In operation, the main small size solid fuel enters the stoker from hopper 62. It strikes inclined plate 65 and is directed toward the front of the stoker and into the stream of pressurized and preheated gaseous material flowing beneath the lower end of plate 65. The gaseous material conveys the fuel more or less in suspension through the stoker interior to and through the outlet opening 23. At this point the fuel stream is joined by the previously mentioned scavenger and booster streams from chambers 78 and 80, and the fuel is then transported through the spout structure 24.

Assuming baffles 26 to be in open position, the fuel strikes baffle 35, and particularly the bottom surfaces and diverging vertical walls 36 thereof. Baffle 35 directs the fuel laterally and forwardly in accordance with the hinge angle setting of the baffle. With the baffle in the position illustrated in Figs. 1 to 4, the fuel is directed downwardly and laterally so as to substantially cover the width of the combustion chamber of the furnace. In this setting the far or forward region of the combustion chamber would receive little or no fuel. By moving baffle 35 to a more horizontal position, the fuel would be directed farther to the forward region of the combustion chamber. Thus it will be seen that near and far distribution of fuel in the combustion chamber is controlled primarily by the hinge angle baffle 35. It should be mentioned, however, that this distribution also may be controlled by the settings of sliding plate 66 and damper 82, as well as by varying the speed of the compressor.

The vertically disposed baffles 26 are, of course, effective to control and vary the lateral distribution of fuel in the combustion chamber. These baffles also make it possible to limit the flow of fuel to a lateral one-half portion of the combustion chamber. When this is done, the other half of the chamber may be allowed to burn itself out after which this portion may be cleaned or otherwise serviced.

From the above description it is thought that the construction and advantages of my invention will be readily apparent to those skilled in the art. Various changes in detail may be made without departing from the spirit or losing the advantages of the invention.

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

1. A stoker for small size solid fuels comprising a generally boot-shaped housing, said housing having a generally rectangular discharge opening at the toe end thereof, the long dimension of said opening extending transversely of said housing, a pair of vertically disposed baffles mounted in a hinged manner one on each side of said discharge opening, the length of each baffle being substantially half the opening width, means for selectively adjusting the hinge angle of each baffle, a horizontally disposed deflector baffle mounted in a hinged manner above and forwardly of said discharge opening, said last baffle having its underneath face provided with laterally

diverging stepped vertical walls facing said opening, means for adjusting the hinge angle of said last baffle, said boot-shaped housing having an opening at the rear thereof for the entrance of pressurized gaseous material and an opening at the top thereof for the entrance of small size solid fuels, an inclined plate member extending downwardly and forwardly from the rear edge of said top opening, said plate member terminating at its lower end short of the housing bottom and having means for selectively varying the length thereof, and a false bottom plate extending from the toe of said housing rearwardly to a position adjacent the lower end of said inclined plate member, said false bottom plate and the housing bottom forming a chamber for the passage of air adapted to scavenge the bottom and sides of said discharge opening.

2. The combination according to claim 1 wherein the rear end of said false bottom plate is provided with a damper hinged thereto, and means for selectively adjusting the hinge angle of said damper to control the relative amounts of said pressurized gaseous material passing respectively through said chamber and through the space between the lower end of said inclined plate member and the rear end of said false bottom plate.

3. The combination according to claim 2 wherein said boot-shaped housing has a second opening in the top thereof, said second opening being located forwardly of the first top opening and being adapted to pass auxiliary small size solid fuels and pressurized gaseous material to the housing interior, and a plate member extending downwardly and forwardly from the rear edge of said second opening to a central position within said housing.

4. A stoker for small size solid fuels comprising a generally boot-shaped housing, said housing having a generally rectangular discharge opening at the toe end thereof, the long dimension of said opening extending transversely of said housing, said boot-shaped housing having an opening at the rear thereof for the entrance of pressurized gaseous material and an opening at the top thereof for the entrance of small size solid fuels, an inclined plate member extending downwardly and forwardly from the rear edge of said top opening, said plate member terminating at its lower end short of the housing bottom and having means for selectively varying the length thereof, a false bottom plate extending from the toe of said housing rearwardly to a position adjacent the lower end of said inclined plate member, said false bottom plate and the housing bottom forming a chamber for the passage of air adapted to scavenge the bottom and sides of said discharge opening.

5. The combination according to claim 4 wherein the rear end of said false bottom plate is provided with a damper hinged thereto, and means for selectively adjusting the hinge angle of said damper to control the relative amounts of said pressurized gaseous material passing respectively through said chamber and through the space between the lower end of said inclined plate member and the rear end of said false bottom plate.

6. The combination according to claim 5 wherein said boot-shaped housing has a second opening in the top thereof, said second opening being located forwardly of the first top opening and being adapted to pass auxiliary small size solid fuels and pressurized gaseous material to the housing interior, and a plate member extending downwardly and forwardly from the rear edge of said second opening to a central position within said housing.

7. A stoker for small size solid fuels comprising a generally boot-shaped housing, said housing having a generally rectangular discharge opening at the toe end thereof, the long dimension of said opening extending transversely of said housing, a pair of vertically disposed baffles mounted in a hinged manner one on each side of said discharge opening, the length of each baffle being substantially half the opening width, means for selectively adjusting the hinge angle of each baffle, a horizontally disposed deflector baffle mounted in a hinged manner above and forwardly of said discharge opening, said last baffle having its under-

neath face provided with laterally diverging stepped vertical walls facing said opening, means for adjusting the hinge angle of said last baffle, said boot-shaped housing having an opening at the rear thereof for the entrnce of pressurized gaseous material and an opening at the top thereof for the entrance of small size solid fuels, and an inclined plate member extending downwardly and forwardly from the rear edge of said top opening, said plate member terminating at its lower end short of the housing bottom and having means for selectively varying the length thereof.

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