

Jan. 6, 1953

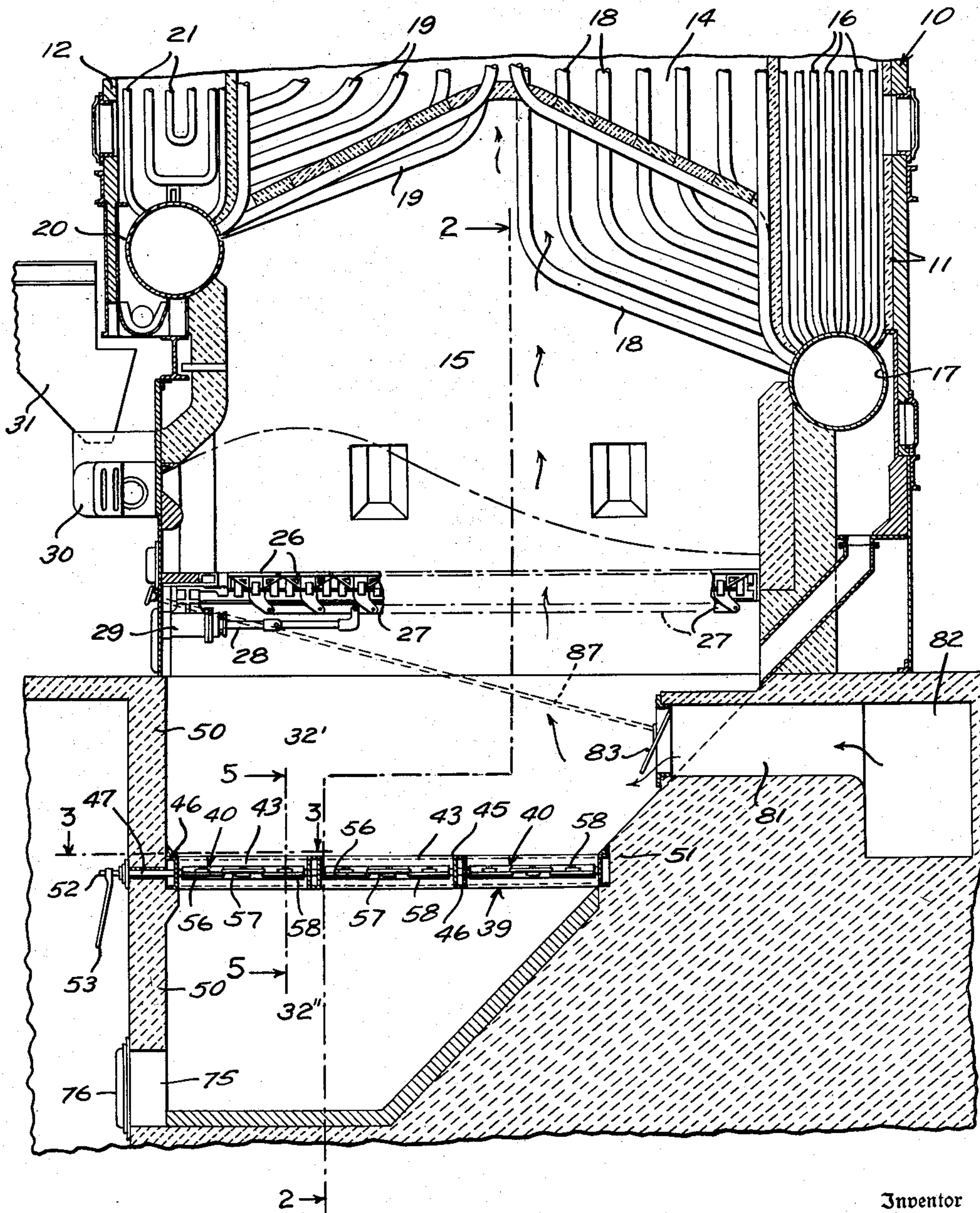
O. W. HONSINGER
COMBINATION AIR CONTROL AND ASH REMOVAL
APPARATUS FOR GRATE FIRED FURNACES

2,624,300

Filed Sept. 27, 1949

4 Sheets-Sheet 1

Fig. 1.



Inventor

OLIVER W. HONSINGER

By

Edmund Ventworth Jr.

Attorney

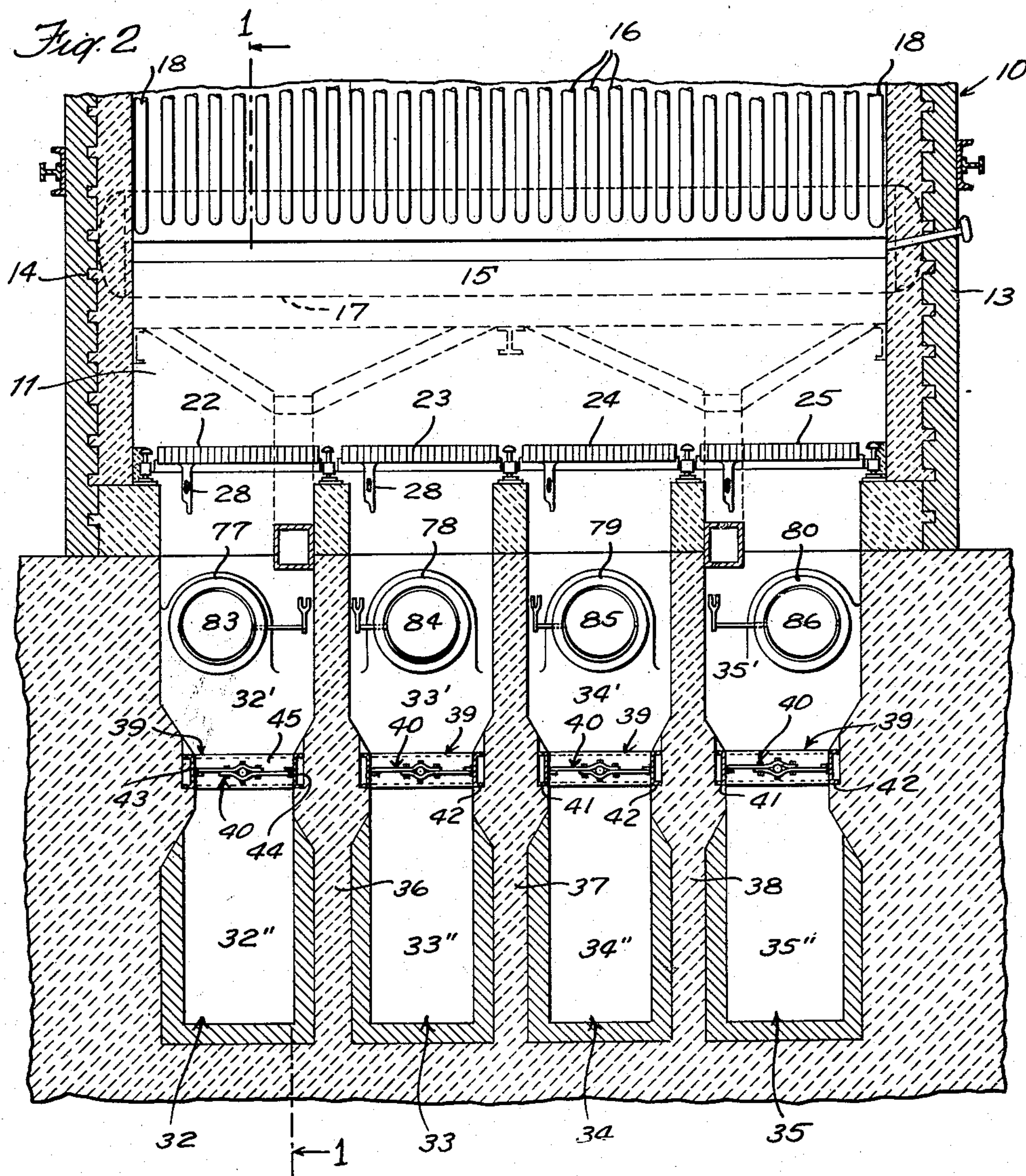
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4 Sheets-Sheet 2



Inventor
OLIVER W. HONSINGER
By *E. Francis Wentworth Jr.*
Attorney

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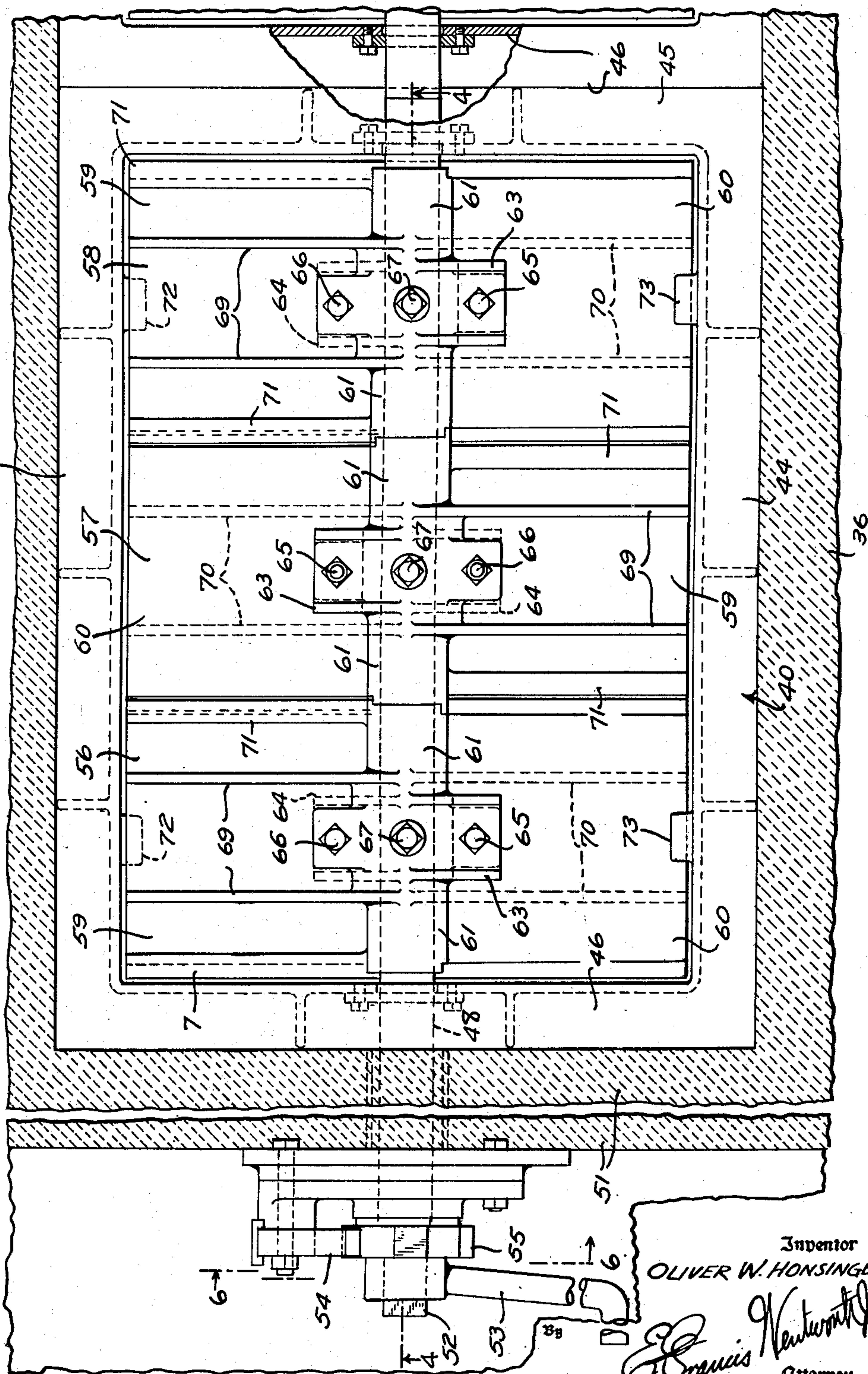
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Fig. 3.



Inventor
OLIVER W. HONSINGER
Francis Venturoli
Attorney

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4 Sheets-Sheet 4

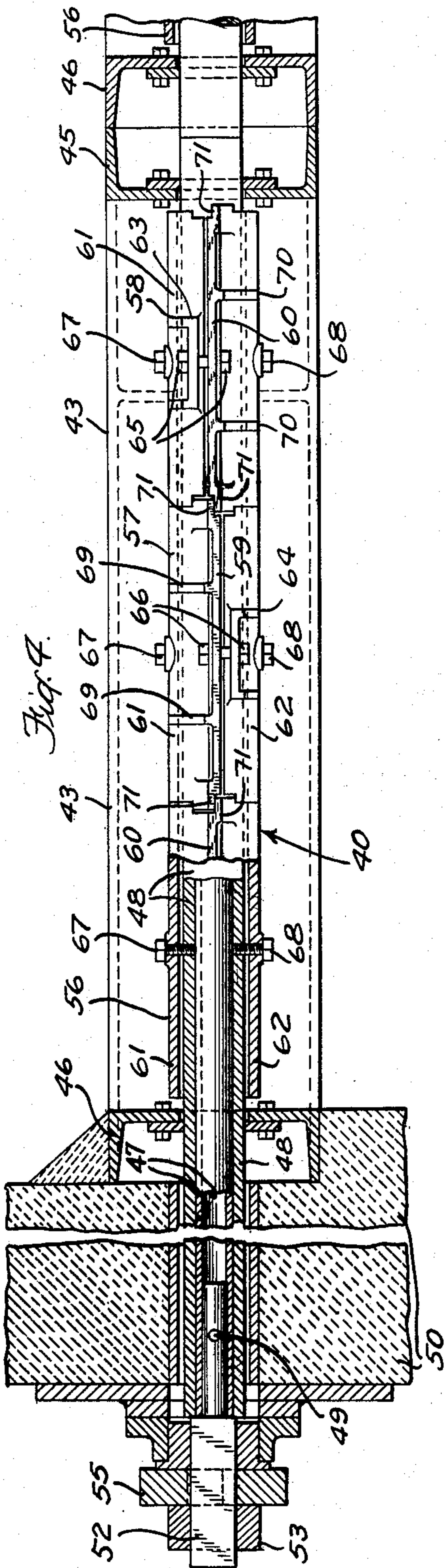


Fig. 4.

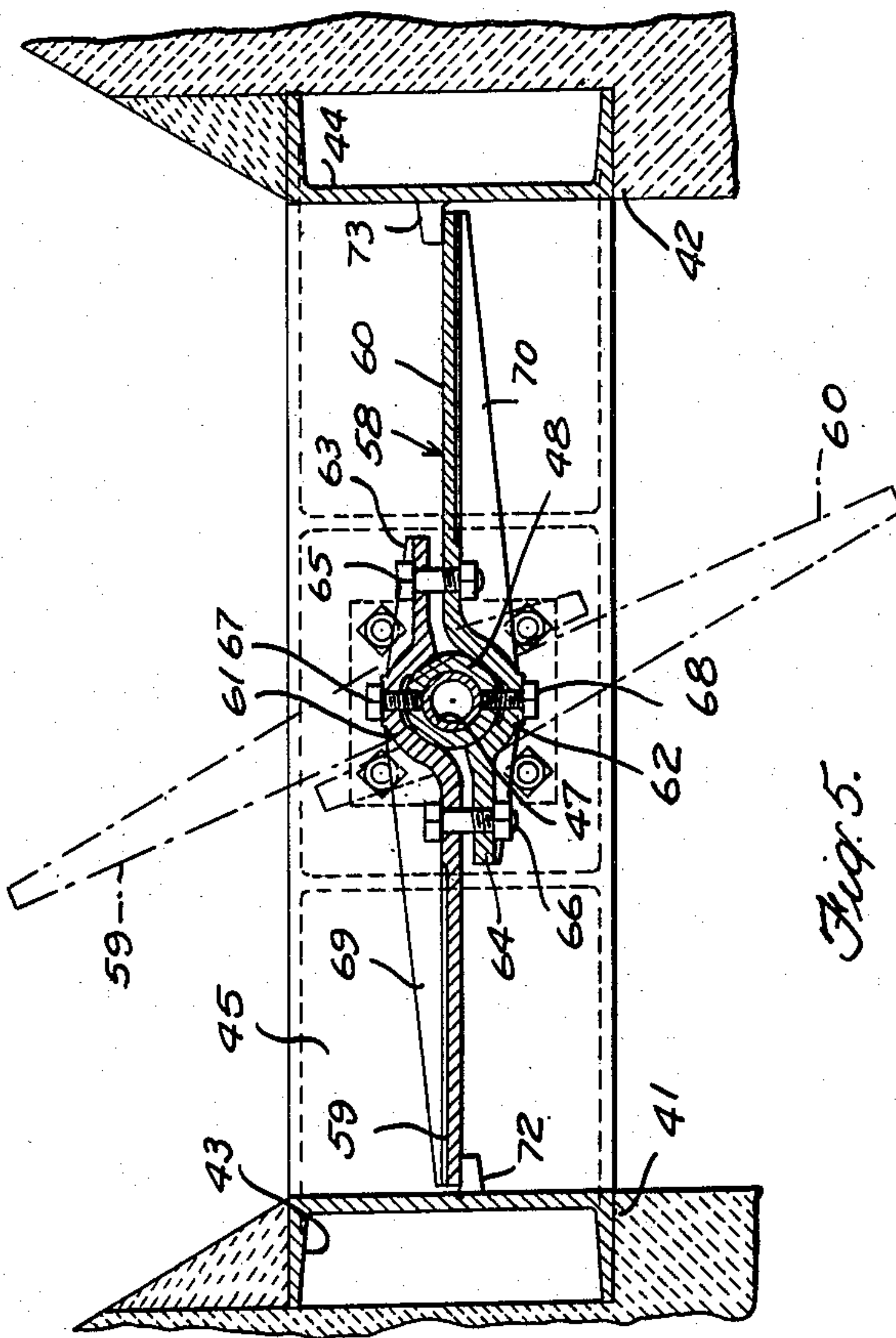


Fig. 5.

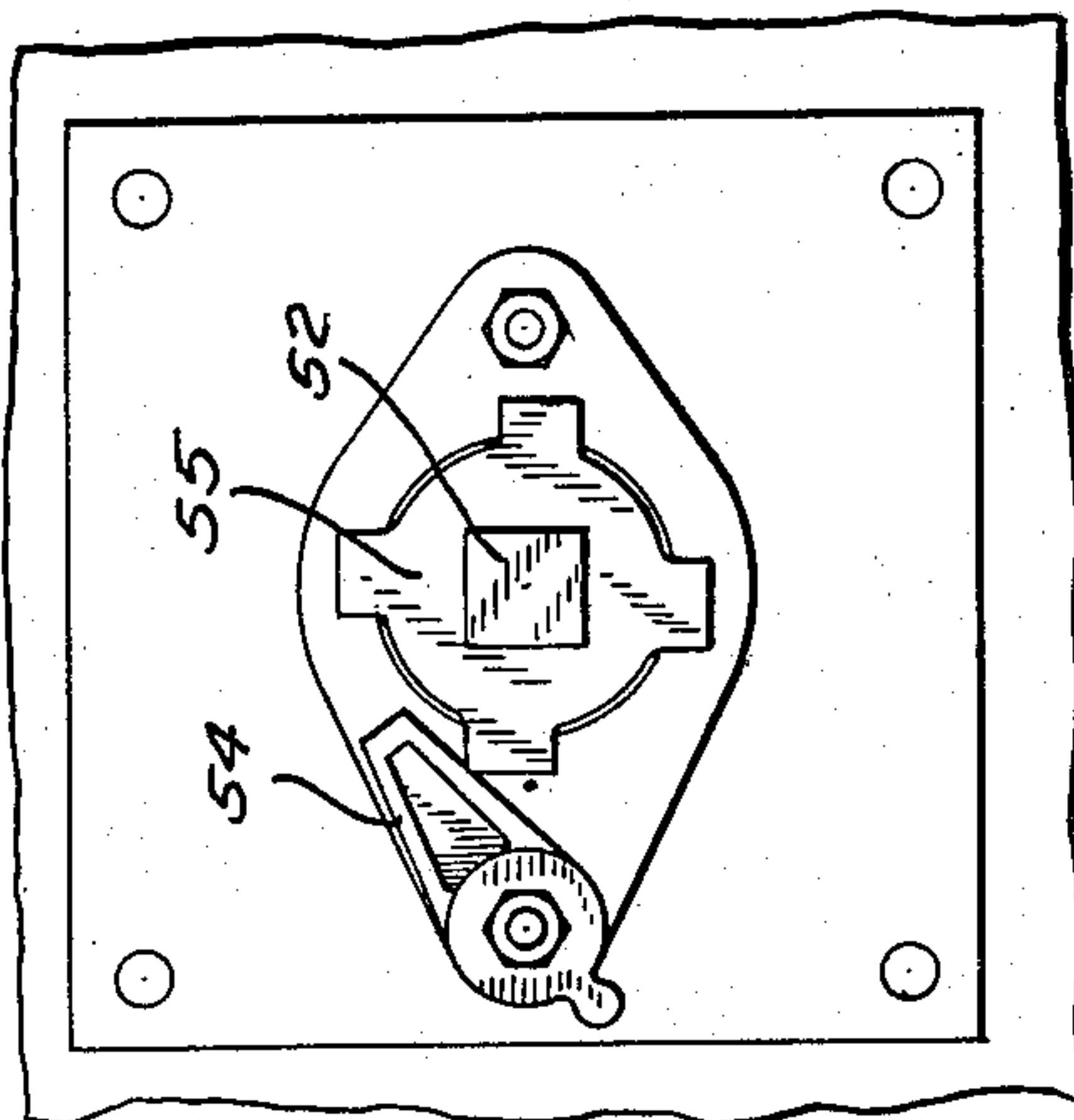


Fig. 6.

Inventor
OLIVER W. HONSINGER

By *Francis Wentworth Jr*
Attorney

UNITED STATES PATENT OFFICE

2,624,300

COMBINATION AIR CONTROL AND ASH REMOVAL APPARATUS FOR GRATE FIRED FURNACES

Oliver William Honsinger, Saint Catharines, Ontario, Canada, assignor to Foster Wheeler Corporation, New York, N. Y., a corporation of New York

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13 Claims. (Cl. 110—72)

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This invention relates to furnaces and more particularly to grate type furnaces.

The present invention provides a grate type furnace which is fired with solid fuel and which has a plurality of separate longitudinally extending laterally adjacent grate sections upon which said fuel is burned. The grate sections are disposed above laterally adjacent and separated ash pits. The furnace receives air for combustion from a plurality of damper controlled air inlets beneath the grate sections which inlets communicate with the ash pits at a position in spaced relationship with the bottom of the pits. Louvres are positioned in the ash pits intermediate the air inlets and the bottom of the pits, said louvres being so constructed and arranged that the upper portion of the ash pit and the lower portion thereof are separated from one another when the louvres are in their closed position and ashes dumped from the grate can pass into the lower portion of the pits when the louvres are in their opened position.

The invention will be understood from the following description when considered in connection with the accompanying drawings forming a part thereof and in which:

Fig. 1 is a longitudinal sectional view of the present invention taken on the line 1—1 of Fig. 2 and illustrated in association with a vapor generator, the lower portion only of which is shown;

Fig. 2 is a transverse sectional view taken on the line 2—2 of Fig. 1;

Fig. 3 is a plan view taken on the line 3—3 of Fig. 1 but on an enlarged scale;

Fig. 4 is a longitudinal sectional view taken on the line 4—4 of Fig. 3;

Fig. 5 is a vertical sectional view taken on the line 5—5 of Fig. 1 but on an enlarged scale; and

Fig. 6 is an end view taken on the line 6—6 of Fig. 3.

Like characters of reference refer to like parts throughout the several views.

Referring to the drawings, Figs. 1 and 2, the reference numeral 10 designates the setting of a vapor generator having a rearward wall 11, a front wall 12 spaced therefrom and opposite side walls 13 and 14 also spaced from one another, the opposite side walls, front and rear walls enclosing a furnace chamber 15. As shown, a bank of vapor generating tubes 16, which are in communication at their lower ends with a drum 17, are positioned along the inner side of rearward wall 11, while side wall 14 is lined with water wall tubes 18 which communicate with drum 17 and water wall tubes 19 which communicate at their

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lower ends with a drum 20 arranged adjacent front wall 12. Vapor generating tubes 21 extend adjacent front wall 12 and are connected at their lower ends to drum 20.

A plurality of grate sections 22, 23, 24 and 25 are disposed adjacent the bottom of chamber 15. The grate sections are separate from one another and separately actuated. The sections extend longitudinally of the furnace chamber 15 from a point adjacent front wall 12 to a point adjacent rearward wall 11 and are disposed laterally adjacent one another, each section comprising a plurality of tuyères 26. The tuyères of each grate section are associated with a longitudinal dumping bar 27 which is actuated through an actuating rod 28 by dumping mechanism 29. Separate dumping mechanisms 29 and actuating rods 28 are associated with each of the grate sections so that they may be dumped independently of one another.

As shown, fuel is fed upon grate sections 22, 23, 24 and 25 by a spreader stoker 30 which receives said fuel from a chute 31.

A plurality of vertically extending elongated ash pits 32, 33, 34 and 35 are positioned beneath grate sections 22, 23, 24 and 25 respectively. Ash pit 32 is separated from pit 33 by vertical wall 36, while ash pits 33 and 34 are separated by wall 37 and pits 34 and 35 are separated by wall 38. Walls 36, 37 and 38 extend upwardly to a point closely adjacent the grate sections, the grate sections being mounted on the top of said walls.

Louvres 39 are disposed in each of the ash pits vertically intermediate the top and bottom thereof thereby dividing the ash pits into upper portions 32', 33', 34' and 35' respectively and lower portions 32'', 33'', 34'' and 35'' respectively. Each louvre has a damper member 40 adapted to separate said upper and lower portions of the ash pit when the damper members are in closed position. As shown in Figs. 3 to 5, the louvres of each ash pit comprise longitudinal rectangular openings bounded by U-beam frames supported in the ash pits on shoulders 41 and 42 along the opposite sides of the pits. Each frame has opposite side members 43 and 44 and opposite end members 45 and 46. A damper member actuating shaft 47, having a tubular member 48 mounted thereover in engaging relationship and secured thereto by pin 49 so that said tubular member will be rotatable with said shaft, extends through longitudinally adjacent louvres 39 substantially centrally between opposite side walls 43 and 44 of the louvres. Shaft 47 and tubular member 48 are rotatable in respect to the louvres

and front wall 50 and rear wall 51 of the ash pits. Shaft 47 has a squared end 52 extending outwardly of front wall 50 of the ash pit and a crank 53 is mounted on the squared end so that the shaft may be turned by the crank. As shown in Fig. 6, the squared end 52 has a detent 55 mounted thereon which detent cooperates with a pawl 54 so that the shaft may be rotated to a predetermined position in one direction and locked in that position against movement in the opposite direction.

Damper members 40, as shown more particularly in Figs. 4, 5 and 6, each comprise three sets of closure plates 56, 57 and 58 mounted on the tubular member 48 so as to turn therewith. Each set of closure plates comprises a plate 59 extending radially from the tubular member 48 at one side thereof and a plate 60 extending radially from the tubular member at the other side of the tubular member, said plates extending outwardly of tubular member 48 at substantially diametrically opposed points. Plate 59 has a semi-circular section 61 extending over and engaging the upper peripheral surface of tubular member 48, while plate 60 has a semi-circular section 62 extending over and engaging the lower peripheral surface of said tubular member (Fig. 5). A centrally disposed lug 63 projects from semi-circular section 61 on the side thereof opposite that on which plate 59 projects, while a centrally disposed lug 64 likewise projects from section 62. A bolt 65 secures lug 63 to plate 60, while a bolt 66 secures lug 64 to plate 59. Set screws 67 and 68 fasten sections 61 and 62 respectively to tubular member 48. Since plates 59 and 60 are secured together by bolts 65 and 66 and also are secured to tubular member 48 by set screws 67 and 68, the plates will turn with tubular member 48 and shaft 47. Re-enforcing webs 69 and 70 extend transversely of plates 59 and 60 respectively. Flanges 71 extend along opposite ends of the plates, the adjacent flanges 71 of sets of plates 56 and 57 being so formed as to overlap one another in engaging relationship, while the adjacent flanges of plate sets 57 and 58 likewise overlap one another. Stops 72 and 73 project inwardly from side members 43 and 44 of the louver frame, the stop 72, as shown in Fig. 5, being positioned to engage the under surface of plate 59, while the stop 73 is positioned to engage the upper surface of plate 60. These stops thereby limit the counterclockwise movement of the plate sets.

A clean-out opening 75 normally closed by a door 76 is in communication with the lower portion 32'' of each ash pit so that ashes may be removed from said lower portion.

An air inlet opening, through which air to support combustion of fuel on a grate section enters, is in communication with the upper portion of each ash pit at a point intermediate the grate section and the louver. As shown in Fig. 2, air inlet openings 77, 78, 79 and 80 are in communication with upper portions 32', 33', 34' and 35' of ash pits 32, 33, 34 and 35. Each opening is at one end of a horizontally extending branch air inlet conduit 81 which is connected at the opposite end with a main air conduit 82. Flow of air from openings 77, 78, 79 and 80 is controlled by dampers 83, 84, 85 and 86 respectively. Each damper is operated by a separate controlling rod 87 (Fig. 1).

In operation, when ashes must be dumped from the grates, it is desirable that this be done without loss of pressure or load on the vapor

generator. With the present invention, this is accomplished by dumping one grate section at a time, for example, grate section 22 could first be cleaned by operating controlling rod 87 so as to actuate damper 83 into a closed position thereby stopping the flow of air into upper portion 32' of ash pit 32. Crank 53 is then turned in a clockwise direction thereby rotating shaft 47, tubular member 48 and damper members 40 in a clockwise direction and into an open position as indicated in dot and dash lines in Fig. 5. Tuyères 26 of grate section 22 are then moved to a dumping position through dumping mechanism 29, actuating rod 28 and dumping bar 27. Ashes will then fall from grate section 22, into upper portion 32' of ash pit 32 thence through louvres 39 into lower portions 32'' of the ash pit. When the ashes have been dumped, the tuyères are returned to the position shown in Fig. 1 by actuation of dumping mechanism 29, crank 53 is moved in a counterclockwise direction thereby turning shaft 47, tubular member 48, and damper members 40 in a counterclockwise direction to their closed position, as shown in full lines, Fig. 5. Air damper actuating rod 87 is then moved so as to turn damper 83 to an open position permitting air to pass through inlet opening 77 into upper portion 32' of ash pit 32. After cleaning grate section 22, grate sections 23, 24 and 25 may be consecutively cleaned in the same way as section 22 hereinbefore described. The order of cleaning the grate sections need not necessarily be consecutive, such order of cleaning being given by way of example and not by way of limitation.

In this manner, one section of the grates may be cleaned at a time so that one section only is out of service at a time and then for no longer period than is required to dump said grate section because cleaning of the ashes from the lower portion of an ash pit may be done at any time after dumping at the operator's convenience. Since the lower portion of an ash pit is separated from the upper portion thereof by closing of the louver dampers 40, which louvres are closed immediately after dumping of the grates, air to support combustion over a grate section may be permitted to enter the upper section immediately after the closing of the louvres and need not await ash removal from the lower portion of an ash pit.

Inasmuch as changes may be made in the form, location and relative arrangement of the several parts of the apparatus herein disclosed without departing from the principles of the invention, it will be understood that the invention is not to be limited excepting by the scope of the appended claims.

What is claimed is:

1. In a grate type furnace, a grate comprising a plurality of separate grate sections each section being adapted to dump ashes therefrom, ash pit forming means forming separate ash pits below each grate section, each pit having an air inlet in communication therewith beneath its grate section, control means for controlling the flow of air through said inlets, damper means in each pit below the air inlet and in spaced relationship with the bottom of the pit, said damper means being so positioned in a pit as to separate the pit into an upper portion with which the air inlet is in communication and a lower portion when said damper means is in a closed position and to permit ashes to pass through the upper portion and into the lower portion of the pit when the damper is in an opened position, and actuating means so associated with the damper means as to move said

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damper means into said opened and closed positions.

2. In a grate type furnace, a grate comprising a plurality of separate sections each section being adapted to dump ashes therefrom, means for separately actuating each section into and out of dumping position, means forming a separate ash pit beneath each grate section, each pit having an air inlet in communication therewith beneath its grate section, means for separately controlling the flow of air through each air inlet into a pit, damper means in each pit below the air inlet and in spaced relationship with the bottom of the pit, said damper being so positioned in the pit as to separate it into an upper portion with which the air inlet is in communication and a lower portion when said damper means is in a closed position and to permit ashes to pass through the upper portion and into the lower portion when the damper is in an opened position, and separate actuating means operatively associated with the damper means in each of the pits so as to move one of the damper means into said opened and closed positions independently of the separate actuating means operatively associated with the damper means of other pits.

3. In a grate type furnace, a grate comprising a plurality of separate sections each section being adapted to dump ashes therefrom, means for separately actuating each section into and out of dumping position, means forming a separate ash pit beneath each grate section, each pit having an air inlet in communication therewith beneath its grate section, means for separately controlling the flow of air through each air inlet into a pit, damper means in each pit below the air inlet and in spaced relationship with the bottom of the pit, said damper being so positioned in the pit as to separate it into an upper portion with which the air inlet is in communication and a lower portion when said damper means is in a closed position and to permit ashes to pass through the upper portion and into the lower portion when the damper is in an opened position, and separate actuating means operatively associated with the damper means in each of the pits so as to operate one of the damper means into said opened and closed positions independently of the separate actuating means operatively associated with the damper means of other pits, each of said pits having an ash removal opening adjacent the bottom thereof.

4. In a grate type furnace, a grate comprising a plurality of laterally adjacent, separate, longitudinally extending grate sections, each section being adapted to dump ashes therefrom, a plurality of spaced partition walls extending longitudinally along adjacent sides of adjacent grate sections and downwardly to form separate ash pits below each grate section, each pit having an air inlet in communication therewith beneath its grate section, control means for controlling the flow of air into said inlets, damper means in each pit below the air inlet and in spaced relationship with the bottom of the pit, said damper means being so positioned in a pit as to separate the pit into an upper portion with which the air inlet is in communication and a lower portion when said damper means is in a closed position and to permit ashes to pass through the upper portion and into the lower portion when the damper is in an opened position, and actuating means so operatively associated with the damper means as to operate said damper means into said opened and closed positions.

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5. In a grate type furnace, a grate comprising a plurality of laterally adjacent, separate, longitudinally extending grate sections, each section being adapted to dump ashes therefrom, means for separately actuating each section into and out of dumping position, a plurality of spaced partition walls extending longitudinally along adjacent sides of adjacent grate sections and vertically downwardly to form a separate ash pit beneath each grate section, each pit having an air inlet in communication therewith beneath its grate section, means for separately controlling the flow of air through each air inlet into a pit, damper means in each pit below the air inlet and in spaced relationship with the bottom of the pit, said damper being so positioned in the pit as to separate it into an upper portion with which the air inlet is in communication and a lower portion when said damper means is in a closed position and to permit ashes to pass through the upper portion and into the lower portion when the damper is in an opened position, and separate actuating means operatively associated with the damper means in each of the pits as to operate one of the damper means into said opened and closed positions independently of the separate actuating means operatively associated with the damper means of other pits as to operate said damper means thereof, each of said pits having an ash removal opening adjacent the bottom thereof.

6. In a grate type furnace, a grate adapted to dump ashes therefrom, ash pit forming means forming an ash pit beneath the grate so as to receive ashes dumped therefrom, means for controlling the flow of air into said pit, a louvre in the pit below the air inlet and in spaced relationship with the bottom of the pit, said louvre comprising a frame having an opening therethrough, said frame being so arranged in the pit as to separate the pit into an upper portion and a lower portion which portions communicate with one another through the opening, a damper so associated with said frame and so disposed in the opening thereof as to separate the upper and lower portions of the pit when the damper is in a closed position and to permit ashes to pass through the opening from the upper portion to the lower portion when the damper is in an opened position, and actuating means operatively associated with the damper as to operate the damper to open and close the same.

7. In a grate type furnace, a grate adapted to dump ashes therefrom, ash pit forming means forming an ash pit beneath the grate so as to receive ashes dumped therefrom, means for controlling the flow of air into said pit, a louvre in the pit below the air inlet and in spaced relationship with the bottom of the pit, said louvre comprising a rectangular-shaped frame having a rectangular-shaped opening, the frame being mounted in the pit and so arranged as to separate the pit into an upper portion and a lower portion which portions communicate with one another through the opening, a damper actuating shaft rotatably mounted in respect to the frame and passing through the central portion thereof, a damper mounted on said shaft to rotate therewith, the damper being of such size and shape as to separate the upper and lower portions of the pit when the damper is in a closed position and to permit ashes to pass through the opening from the upper portion to the lower portion when the damper is in an opened position, and actuating

means operatively connected to the shaft so as to rotate said shaft and the damper to open and close the damper.

8. In a grate type furnace, a grate comprising a plurality of separate grate sections each section being adapted to dump ashes therefrom, ash pit forming means forming separate ash pits below each grate section, each pit having an air inlet in communication therewith beneath its grate section, control means for controlling the flow of air through said inlets, louvres in each pit below the air inlet and in spaced relationship with the bottom of the pit, each louver comprising a rectangular-shaped frame having a rectangular-shaped opening, the frame being mounted in the pit and so arranged as to separate the pit into an upper portion and a lower portion which portions communicate with one another through the opening, a damper actuating shaft rotatably mounted in respect to the frame and passing through the central portion thereof, a damper mounted on said shaft to rotate therewith, the damper being of such size and shape as to separate the upper and lower portions of the pit when the damper is in a closed position and to permit ashes to pass through the opening from the upper portion to the lower portion when the damper is in an opened position, and actuating means operatively connected to the shaft so as to rotate said shaft and the damper to open and close the damper.

9. In a grate type furnace, a grate comprising a plurality of laterally adjacent, separate, longitudinally extending grate sections, each section being adapted to dump ashes therefrom, means for separately actuating each section into and out of dumping position, a plurality of spaced partition walls extending longitudinally along adjacent sides of adjacent grate sections and vertically downwardly to form a separate ash pit beneath each grate section, each pit having an air inlet in communication therewith beneath its grate section, means for separately controlling the flow of air through each air inlet into a pit, louvres in each pit below the air inlet and in spaced relationship with the bottom of the pit, the louver of each pit comprising a plurality of rectangular-shaped frames having rectangular-shaped openings, the frames being mounted in said pits in a horizontal plane in end-to-end relationship, a damper actuating shaft extending longitudinally through the frames in the central portion thereof and rotatably mounted in respect to the frames, damper means mounted on said shaft in each of the frame openings to rotate therewith, the damper means being of such size and shape as to separate the upper and lower portions of the pit when the damper is in a closed position and to permit ashes to pass through the opening from the upper portion to the lower portion when the damper is in an opened position, and actuating means operatively connected to each shaft so as to separately rotate each shaft and the damper means mounted thereon to open and close the damper, each of said pits having an ash removal opening adjacent the bottom thereof.

10. In a grate type furnace, a grate comprising a plurality of separate grate sections operable to dump ashes therefrom, means forming a plurality of separate compartments beneath said grate, the compartments being disposed so that at least one of said compartments receives ashes dumped from one of said grate sections and at least another of said compartments receives ashes dumped from another of said sections, the compartments

each having an air inlet in communication therewith below said grate, control means for controlling the flow of air through said inlets, damper means positioned below the air inlet of each compartment, said damper means being so constructed and arranged as to prevent flow of air downwardly in a compartment past the damper means when said damper means is in closed position and to permit the passage of ashes downwardly in a compartment past the damper means when said damper means is in opened position, and actuating means operatively associated with the damper means to move said damper means into said opened and closed positions.

11. In a grate type furnace, a grate comprising a plurality of separate grate sections operable to dump ashes therefrom, means for separately actuating said sections into and out of dumping position, means forming a plurality of separate compartments beneath said grate, the compartments being disposed so that at least one of said compartments receives ashes dumped from one of said grate sections and at least another of said compartments receives ashes dumped from another of said sections, the compartments each having an air inlet in communication therewith below said grate, means for separately controlling the flow of air through each air inlet into a compartment, damper means positioned below the air inlet of each compartment, said damper means being so constructed and arranged as to prevent flow of air downwardly in a compartment past the damper means when said damper means is in closed position and to permit the passage of ashes downwardly in a compartment past the damper means when said damper means is in opened position, and separate actuating means operatively associated with the damper means in each of the compartments so as to move one of the damper means into said opened and closed positions independently of the separate actuating means operatively associated with the damper means of other compartments.

12. In a grate type furnace, a grate comprising a plurality of laterally adjacent, separate, longitudinally extending grate sections operable to dump ashes therefrom, means for separately actuating said sections into and out of dumping position, a plurality of spaced partition walls extending longitudinally along adjacent sides of grate sections and downwardly thereby providing side walls for a plurality of separate, longitudinally extending, laterally adjacent compartments beneath said grate, said side walls of the compartments being disposed so that at least one of said compartments receives ashes dumped from one of said grate sections and at least another of said compartments receives ashes dumped from another of said sections, the compartments each having an air inlet in communication therewith below said grate, control means for controlling the flow of air through said inlets, damper means positioned below the air inlet of each compartment, said damper means being so constructed and arranged as to prevent flow of air downwardly in a compartment past the damper means when said damper means is in closed position and to permit the passage of ashes downwardly in a compartment past the damper means when said damper means is in opened position, and actuating means operatively associated with the damper means to move said damper means into said opened and closed positions.

13. In a grate type furnace, a grate comprising a plurality of laterally adjacent, separate, longi-

itudinally extending grate sections operable to dump ashes therefrom, means for separately actuating said sections into and out of dumping position, a plurality of spaced partition walls extending longitudinally along adjacent sides of grate sections and downwardly thereby providing side walls for a plurality of separate, longitudinally extending, laterally adjacent compartments beneath said grate, said side walls of the compartments being disposed so that at least one of said compartments receives ashes dumped from one of said grate sections and at least another of said compartments receives ashes dumped from another of said sections, the compartments each having an air inlet in communication therewith below said grate, means for separately controlling the flow of air through each air inlet into a compartment, damper means positioned below the air inlet of each compartment, said damper means being so constructed and arranged as to prevent flow of air downwardly in a compartment past the damper means when said damper means is in closed position and to permit the passage of ashes downwardly in a compartment past the damper means when said damper means is in opened position, and separate actuating means operatively associated with the damper means in each of the compartments so as to move one of the damper means into said opened and closed

positions independently of the separate actuating means operatively associated with the damper means of other compartments.

OLIVER WILLIAM HONSINGER.

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