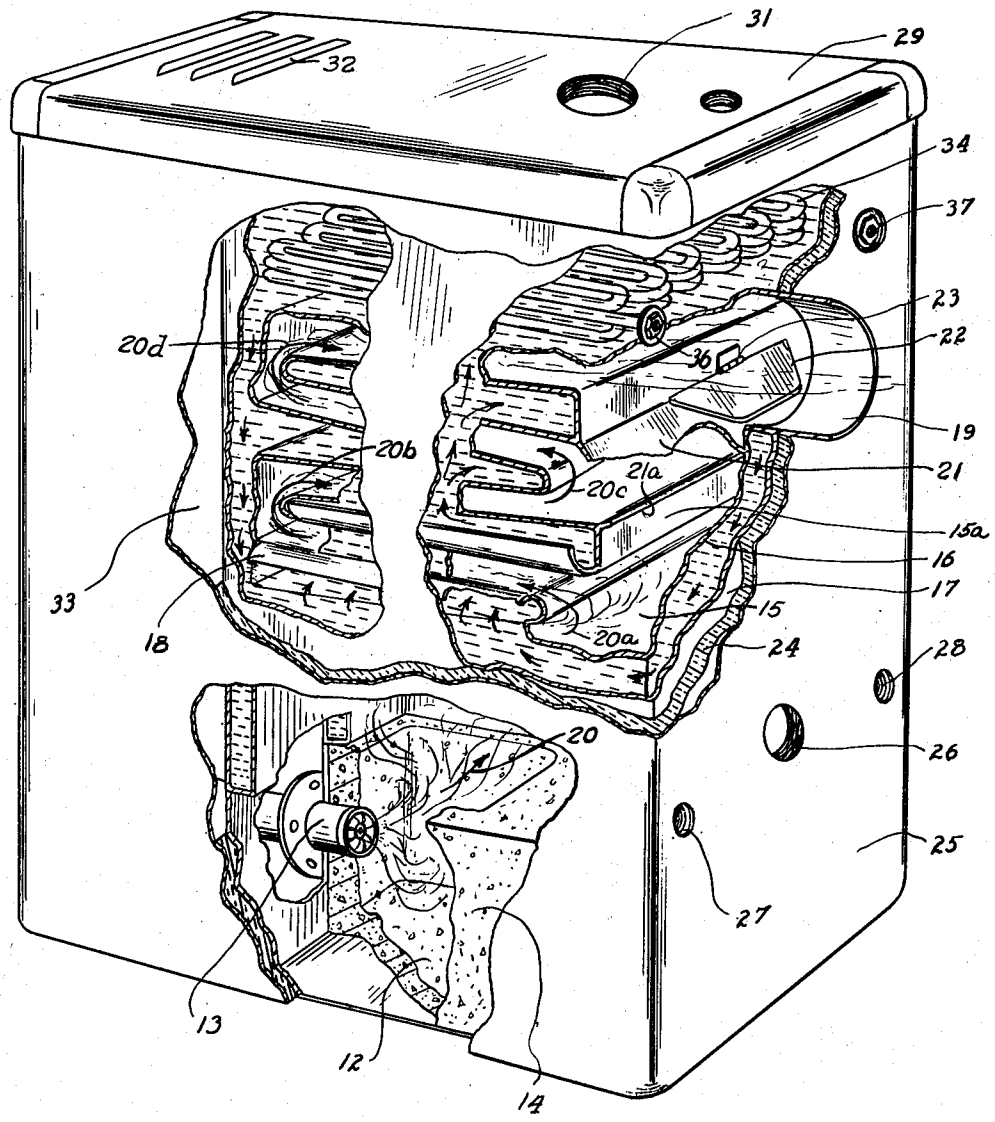
March 31, 1953 B. W. MANDELBURG 2,633,107

HEATING BOILER WITH VERTICAL UNDULATING FLUE

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Fig. 1



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Fig. 2

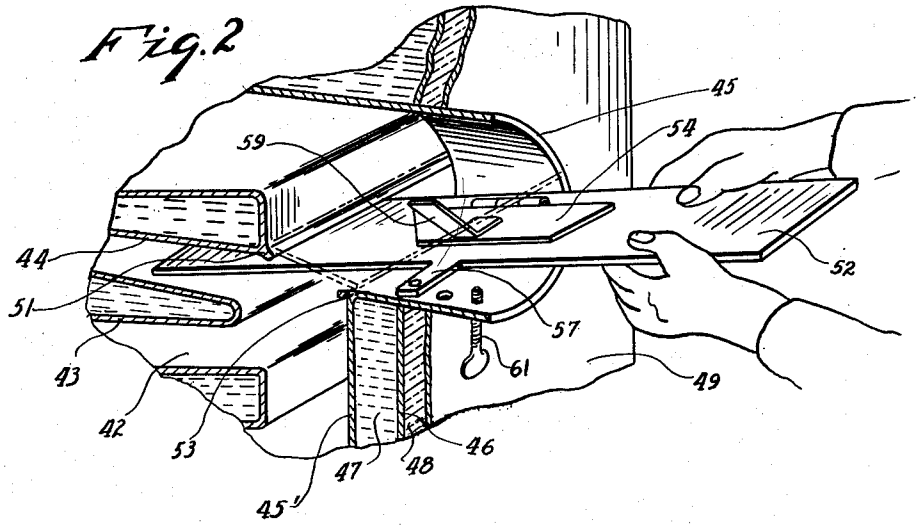


Fig. 3

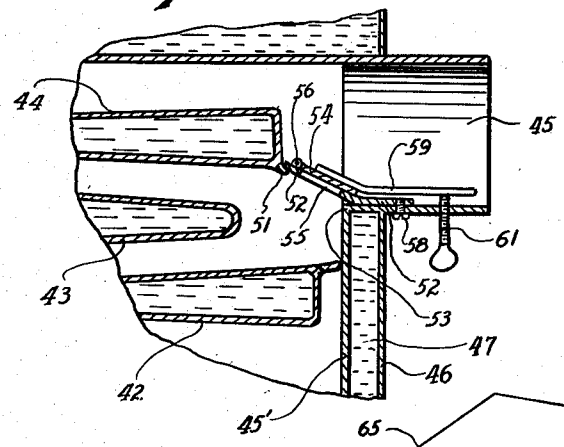


Fig. 4

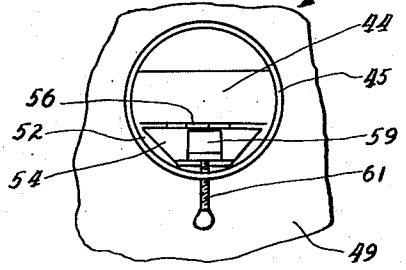


Fig. 5

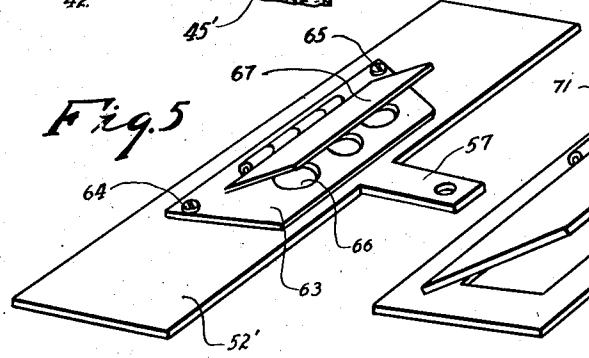
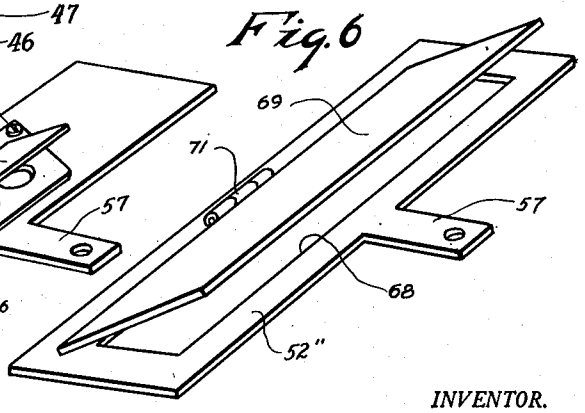


Fig. 6



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Fig. 8

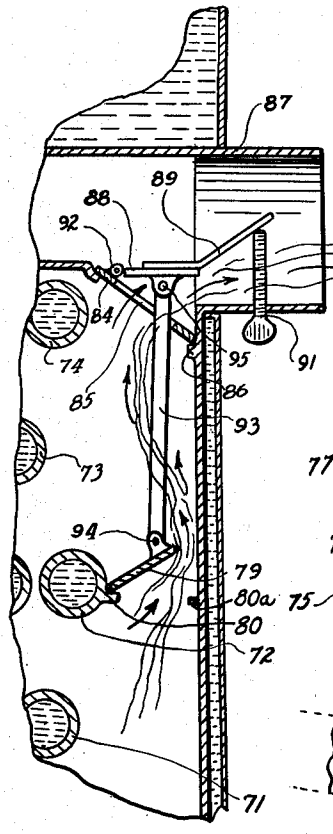


Fig. 7

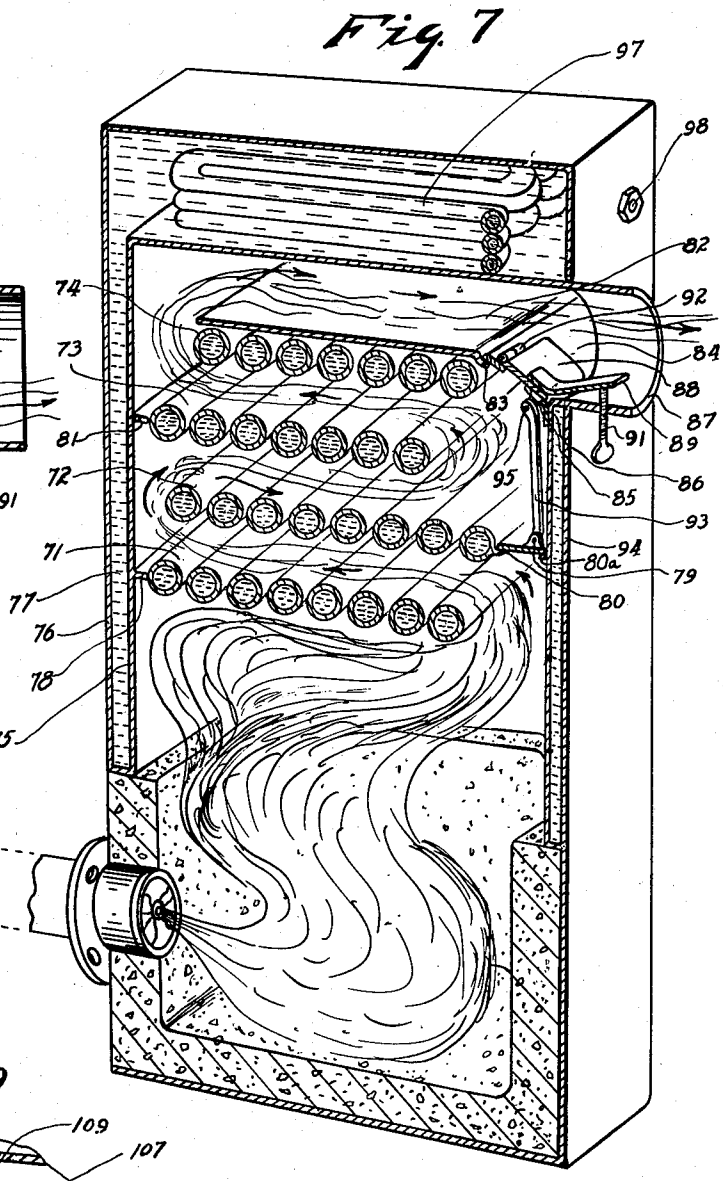
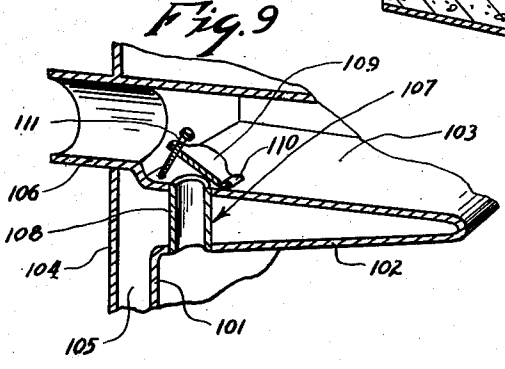


Fig. 9



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Patented Mar. 31, 1953

2,633,107

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2,633,107

HEATING BOILER WITH VERTICAL UNDULATING FLUE

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Application April 15, 1950, Serial No. 156,116

8 Claims. (Cl. 122—165)

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This invention relates to heating boilers and more particularly to expansion relief doors therefor.

It is an object of the present invention to provide in a heating boiler an internal automatic damper adjacent the stack outlet whereby to relieve the boiler of internal pressure resulting from the heat expanded gases and to prevent rumbling and pulsations which often occur in such boilers.

It is another object of the present invention to provide an automatic control valve which can be set into the boiler through the stack outlet or built into the boiler during its construction and wherein there is means extending from below the stack outlet to adjust the valve element to give it a definite and variable open position to relieve by degrees such excess or back pressure as may develop during the process of combustion.

It is still a further object of the present invention to provide an integral round stack outlet for boilers which has a distinct advantage during construction and when the boiler is installed by saving the making of an extra part to be attached in the manufacture, and in installing it, it saves time over that which is required for the oblong, obrotund or obround type of smoke outlet and the need of making an adapter to fit on the boiler with one end being oblong, obrotund or obround and the other end round.

It is still a further object of the invention to provide an adjustable relief valve or damper within the heating boiler adjacent to the flue outlet of the boiler whereby to manually control the passage of the flue gases to the outlet to shorten the travel of the gases through the boiler and reduce the internal resistance of the boiler and to adapt the boiler to variations in combustion and draft that is inherent to a particular installation and varying atmospheric conditions.

Other objects of the present invention are to provide an internal damper valve for boilers to automatically relieve the same of excess pressure of the heating gases, which is of simple construction, easy to install in the boiler, inexpensive to manufacture, automatic in operation, can be adjusted manually either internally or at an external point, has a minimum number of parts, adjustable to different size openings, adapted to be installed through the stack outlet opening or built within the boiler as an integral part, and efficient in operation.

For other objects and for a better understanding of the invention, reference may be had to the following detailed description taken in connection with the accompanying drawing, in which

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Fig. 1 is a perspective view of a complete boiler with portions broken away to show the fire box and the passages of water and heating gases through the boiler and wherein there is installed according to one form of the invention, a flapper or swinging valve to automatically bypass flue gases when an abnormal expansion of such gases occurs.

Fig. 2 is an enlarged fragmentary and perspective view of a boiler and of a damper valve assembly constructed according to another form of the invention and illustrating the manner in which the assembly is fitted into the boiler through the stack outlet.

Fig. 3 is a vertical sectional view taken through the boiler and through the valve assembly of the form of the invention shown in Fig. 2.

Fig. 4 is an elevational view looking into the end of the stack outlet of the boiler and upon the valve assembly.

Fig. 5 is a perspective view of a further form of a valve assembly.

Fig. 6 is a perspective view of a still further form of valve assembly.

Fig. 7 is a vertical and perspective sectional view of a tubular boiler employing the valve arrangement which includes a second damper valve connected with the valve assembly to be operated therewith and stationed at a location below the main valve.

Fig. 8 is an enlarged fragmentary and sectional view of the valve arrangement shown in Fig. 7 with both of the valve elements elevated to open positions.

Fig. 9 is a fragmentary view of a modified form of the invention.

Referring now particularly to Fig. 1, 12 represents a fire box into which extends a gun type oil burner 13. Flames, which are extended into the fire box and against fire wall surfaces 14 thereof, are elevated into a tubeless plate steel boiler assembly, indicated at 15. The boiler assembly is provided with an internal shell 16 and an external shell 17 between which is water space for the flow of water. To control the flow of water through the vertical water space, there are provided water baffles 18. The gases flow upwardly and back and forth in the boiler assembly. A round stack outlet 19 extends from the inner shell 16 and is integral therewith. This round stack outlet gives less restriction for the outlet passage of the flue gases than with prior types of boiler constructions and eliminates the necessity for an external stack box coming from an oblong, obrotund or obround outlet of the usual boiler.

According to the invention, the flue flases follow the path generally indicated by the arrows 20, 20a, 20b, 20c and 20d. The flue gases are constrained to the lower path 20a by a lip 21a along the side wall section 15a, and engaging the surface of the inner shell 16. After following the path indicated by arrow 20b, the gases are then constrained to the upper path 20c by an integral baffle wall 21 that lies across the boiler assembly to normally divert the rising heating gases laterally over an upper heating section of the boiler assembly. In order to relieve the boiler of an excess pressure of these heating gases and to bypass a portion of such gases to the stack outlet 19, an expansion relief or flapper valve 22 is hinged to the inner shell at 23 and extends over the inclined baffle 21. The baffle 21 has an opening therein through which the gases can be projected upon the same lifting the flapper valve 22 for communication with the stack outlet thereby to shorten temporarily the travel of part or all of the flue gases.

Surrounding the outer shell 17 is insulation 24 and a casing or jacket 25 forming the exterior of the combined boiler and burner. In one end of the boiler is a return opening 26 for the water and drain or outlet openings 27 and 28. A cover 29 is adapted to fit over the top of the casing 25 and facing upwardly through the jacket is a radiator supply connection opening 31 through which the steam or water passes from the boiler. In this cover 29 are ventilating openings 32 lying above space 33 in front of the boiler and burner assembly.

Lying in the upper section of the boiler and surrounded by the water and steam being developed by the boiler are a set of domestic hot water coils 34 that extend through the end of the casing to provide outlet and inlet connections 36 and 37. The baffle plate 21, according to this form of the invention, can be built in at the time the boiler is fabricated from the various sheet steel shapes or parts. The flap valve 22 can be installed later by insertion through the stack outlet by the mere connecting together of the hinge parts of the inner shell and the plate 22.

Referring now particularly to Figs. 2, 3 and 4, there is shown a modified form of construction wherein the baffle plate assembly is inserted in its entirety through the stack outlet for its assembly upon the inner shell of the boiler. The inner shell heating sections of the boiler are indicated at 42, 43 and 44 of Fig. 2 and they are spaced apart from one another to permit the normal flow of the heating or flue gases thereover in the usual serpentine fashion. The heating gases finally leave the boiler from over the inner shell heating section 44 and through stack outlet 45 which is round and integrally connected to a wall portion 45' of the inner shell. The outer shell is indicated at 46 and between the shells is water space 47. Insulation 48 lies externally of the outer shell 46 and about this is a sheet metal casing 49.

On the upper inner shell heating section 44 is a depending ledge or lip 51 (Figs. 2 and 3) on which a removable baffle plate 52 can be rested when inserted into the boiler through the stack outlet 45. The lower edge of the baffle plate 52 can be rested on a transversely extending shoulder 53 and upon the bottom of the inside surface of the stack outlet pipe 45.

Assembled upon the baffle plate 52 is a hinged valve plate 54 which extends over an opening 55 in the plate 52 and is hinged to the baffle plate, as indicated at 56. In order to fix the baffle plate 52 within the boiler against displacement and to keep it from lifting, there is a forwardly extending tongue 57 that can be bent to the proper angle and secured by a screw or bolt 58 (Fig. 3) to the bottom of the stack outlet 45. This tongue and the stack outlet is sufficiently thick to receive screw threads.

The hinged valve plate 54 has a bent strap piece 59 that extends forwardly from the same and will rest upon an adjusting screw 61. If it is desired to keep the valve plate 54 open a slight amount, the screw 61 is raised sufficiently to lift the plate 54 to allow for leakage of the flue gases through the opening 55. If additional opening space is necessary, the pressure of the gases will automatically lift the valve plate 54 to the required amount to relieve the internal pressure of the gases. As shown in Fig. 2, it will be seen that the baffle plate assembly can be inserted as a unit through the stack outlet into space between the sections 43 and 44 in order to effect the assembly of the baffle plate upon the depending ledge 51 and shoulder 53.

In Fig. 5, there is shown a modified form of the baffle plate assembly wherein the size of the opening in the baffle plate itself can be varied by a secondary baffle plate which is replaceable upon the main baffle plate. The main baffle plate is indicated at 52' and is of the same shape as the plate 52 shown in Fig. 2 and has the same opening 55 therein. Above the opening 55 is a second removably connected plate 63. This second plate 63 is secured to the main plate 52' by fastening elements 64 and 65. This second plate 63 has openings 66 therein and hinged to it is a puff valve plate 67. This assembly of the plate 63 and the valve plate 67 can be removed and another assembly having different size openings 66 therein can be substituted therefor. The puff valve plate 67 may be removed from the plate 63 entire, if desired. The plate 63 which is used and the size of the openings will depend upon the characteristics of the boiler and draft conditions of the installation. In some installations, it may be desirable to have only small bypass outlet openings 66 and in other installations larger outlet openings are preferred. The valve plate 67 is operated automatically and is without the strap bracket 59 of Fig. 2 for regulating its closed position.

In Fig. 6 there is shown a still further form of the invention wherein a large valve plate is used and the baffle plate itself has an extra large opening. The baffle plate is indicated at 52'' and has the tongue 57. A large elongated opening 68 is provided in the plate 52'' and thereover lies a valve plate 69 which is hinged at 71 to the plate 52''. This valve plate 69 will be lifted automatically with the increase in pressure within the boiler to permit the flow of the flue gases through the stack without having to pass about the uppermost heating section 44. If desired, to definitely shorten the flue travel at times when the boiler is to be converted to the use of solid fuel which necessitates shorter flue travel, the plate 67 may be elevated to the full open position and rested against the section 44 to partially close the passage over the section 44 and to exhaust directly the gases from sections 42 and 43.

Referring now particularly to Figs. 7 and 8, there is shown the adaptation of the present automatic valve arrangement to a tubular boiler having tube sections 71, 72, 73 and 74 spaced

from one another and about which is an inner shell 75 providing the space through which the heating gases will flow. This shell 75 is jacketed by an outer shell 76 to provide a water space 77. The flow of the heating gases through the coil sections is in a serpentine manner. The lower section 71 is blocked off at one side, as indicated at 78, and the gases flow upwardly over the other side of the section 71 and thereover. The section 72 is closed at the right side by an adjustable baffle plate 79 which has its inner edge resting upon a ledge or shoulder 80 on the outer tube and 80a on the inner shell of the boiler. The next section 73 is blocked off by a plate, as indicated at 81, so that the gases may flow over the top of the section 73 after being forced to pass over the bottom of the coil section 73. Upon the gases passing between the coil sections 73 and 74, they will be elevated and pass over a top plate 82 which has a depending ledge or shoulder 83 for supporting a baffle plate 84 having an opening 85 therein. The lower edge of the baffle plate 84 is supported on a shoulder 86 on the inner shell and the baffle plate 84 will thereby be retained in an inclined manner covering the space at the right of the tube section 74 which leads to integral stack outlet 87.

Hinged upon the baffle plate 84 is a valve plate 88 having a bracket 89 which extends into the stack outlet 87. If it is desired to lift the plate 88, an adjusting screw 91, which is threaded into the bottom of the stack outlet 87, can be turned to provide a stop against which the bracket 89 may abut to hold the valve plate 88 in an elevated position. The valve plate 88 is connected to the plate 84 by hinge means 92.

In order that a simultaneous adjustment can be effected with the plate 79 at the end of the section 72, a link 93 is pivotally connected by its ends, as indicated respectively at 94 and 95, to the respective plates 79 and 88.

It will be seen that if pressure is suddenly increased within the heating space that the gases can be bypassed to the stack outlet 87 from under the section 72 by lifting the valve plates 79 and 88. The tube sections 72, 73 and 74 can thereby be bypassed and a quick release or relief of the gases is effected through the stack outlet 87 and the flue travel is substantially shortened. The domestic hot water coil is completely within the upper space of the boiler as indicated at 97 and has connections 98 which extend through the outer shell 76.

It will be seen that where it is desired to convert a boiler from an oil burning type to a solid fuel type, the path of the heating gases must not be so long and this conversion to a short travel of the gases can be effected quickly through the adjustable valve plate assemblies which have been provided by this invention. The adjusting screw can be elevated to leave the openings in the baffle plate free to pass the flue gases at all times or, if desired, the baffle plate itself can be readily removed through the stack outlet.

It will be apparent also that there has been provided a boiler having a round integral stack outlet. The outlet is integral with the inner shell and through to the outer shell for connection with a chimney to exhaust the flue gases from the boiler.

In Fig. 9, there is shown a form of the invention having an inner shell 101 which is folded at different elevations to provide the vertically spaced water carrying sections 102 extending respectively and alternately from the opposite sides of the boiler to provide a serpentine passage 103 through which the flue gases pass. About the inner shall is an outer shell 104 that is spaced from the inner shell to provide a water space 105 with which the water carrying sections 103 communicate. Penetrating the outer shell and integrally connected with the inner shell is a stack outlet structure 106 that communicates with the upper end of the serpentine passage to pass the flue gases to the chimney. At times when it is desired to convert the boiler from one burning oil to a boiler burning solid fuels, it is necessary that the flue passage be shortened. Accordingly, there is associated with the water carrying section 103 bypass means indicated generally at 107 and including a pipe 108 and a valve plate 109 hinged at 110 to the top of the water carrying section and adapted to be elevated to permit the bypass of the gases directly to the stack outlet structure from beneath the water carrying section 103. An adjustable screw 111 can retain the valve plate 109 in an elevated position. If desired, the adjusting screw 111 can be retracted to a point to permit the valve plate 109 to rest flush over the upper end of the pipe 108 so that the bypass means provides an expansion relief valve for the boiler. The plate 109 is left in an elevated position at times when the boiler is being heated by solid fuels. The bypass pipe 108 interconnects portions of the heating gas passage at different points therealong and at different elevations. Accordingly, the heating gas passage has been shortened when the valve plate 109 is elevated.

Accordingly, there has been provided a stack outlet which is shaped to take the full flow of gases leaving the space within the boiler. This stack outlet is welded to the inner and outer shells and becomes an integral part of the boiler. The stack outlet opening bridges the flue travel spaces above and below the top heating section and by placing a baffle between the lower part of stack outlet and the edge of the top heating section, as, for example, of the heating section 44, the flue gases take the full travel through the boiler, circulate around the section 44 and over the top thereof, downwardly into the stack outlet 45 and outwardly thereof to the chimney. This is accomplished without restriction of the gases at any point during their travel.

While various changes may be made in the detail construction, it shall be understood that such changes shall be within the spirit and scope of the present invention as defined by the appended claims.

I claim:

1. A boiler construction comprising inner and outer shells spaced apart to provide a water space therebetween, said inner shell having substantially horizontally-extending, water-carrying heating sections vertically spaced from one another and interconnected through said water space, said heating sections being arranged to provide for the normal serpentine flow of heating gases around and between the heating sections, a cylindrical integral stack outlet structure extending between the inner and outer shells and lying in an elevated location adjacent the uppermost heating section and bridging spaces lying above and below the uppermost heating section, and transversely-extending, downwardly and rearwardly inclined baffle means in the interior of the boiler extending from the uppermost heating section to the wall of the inner shell adja-

cent to and below the lower part of the stack outlet structure.

2. A boiler construction as defined in claim 1 and said baffle means having a pressure-relief opening and a pressure-relief valve hinged over said relief opening.

3. A boiler construction as defined in claim 1 and said baffle means having a pressure-relief opening and a pressure relief valve hinged over the opening, and control means mounted on the stack outlet and available for adjustment externally of the boiler, said control means being connected to the relief valve to adjust the normal position of said relief valve.

4. A boiler construction as defined in claim 1 and said baffle means comprising a main baffle plate having an opening therein, a relief valve hingedly connected to the main plate and disposed normally to cover the opening, a bracket fixed to the relief valve and extending into the stack outlet and a manually adjustable screw extending through the bottom of the stack outlet and available from outside the stack outlet, the inner end of the screw being engageable with the bracket to provide an adjustable stop to retain the relief valve in different open positions.

5. A boiler construction as defined in claim 1 and said baffle means having a main baffle plate with an opening therein, a secondary baffle assembly releasably secured to the main baffle plate and disposed to be positioned over the opening thereof, said secondary baffle assembly including a control plate having an opening therein smaller than the opening of the main baffle plate and a relief valve plate hinged to the control plate to cover the opening in said control plate, said secondary baffle assembly being replaceable by another assembly having a control plate with a different size opening.

6. A boiler construction as defined in claim 1, and said baffle means comprising a main baffle plate having an overall width less than the diameter of the outlet structure whereby to permit the insertion through the outlet structure into the boiler of the main baffle plate, the space below the uppermost heating section being adapted to receive the main baffle plate while being fitted within the boiler, said uppermost heating section having a ledge and said inner shell having a shoulder, said main baffle plate when in place being adapted to rest upon the ledge and the shoulder.

7. A boiler construction as defined in claim 3 and a second relief valve disposed between another heating section and the inner shell and interconnecting means extending between the relief valves and through the pressure relief opening whereby to effect simultaneous operation and adjustment of said relief valves.

8. A boiler construction as defined in claim 6 and said main baffle plate having a tongue adapted to extend into the stack outlet when the main btffle plate is in place, fastening means accessible from the exterior of the outlet structure to fix the tongue to the outlet structure, a bracket extending from the relief valve into the outlet structure and an adjusting screw in the outlet structure and engageable with the bracket on the pressure relief valve to adjust the normal position of said valve.

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