May 24, 1955 B. W. MANDELBURG 2,708,915

CROSSED DUCT VERTICAL BOILER CONSTRUCTION

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Fig. 1

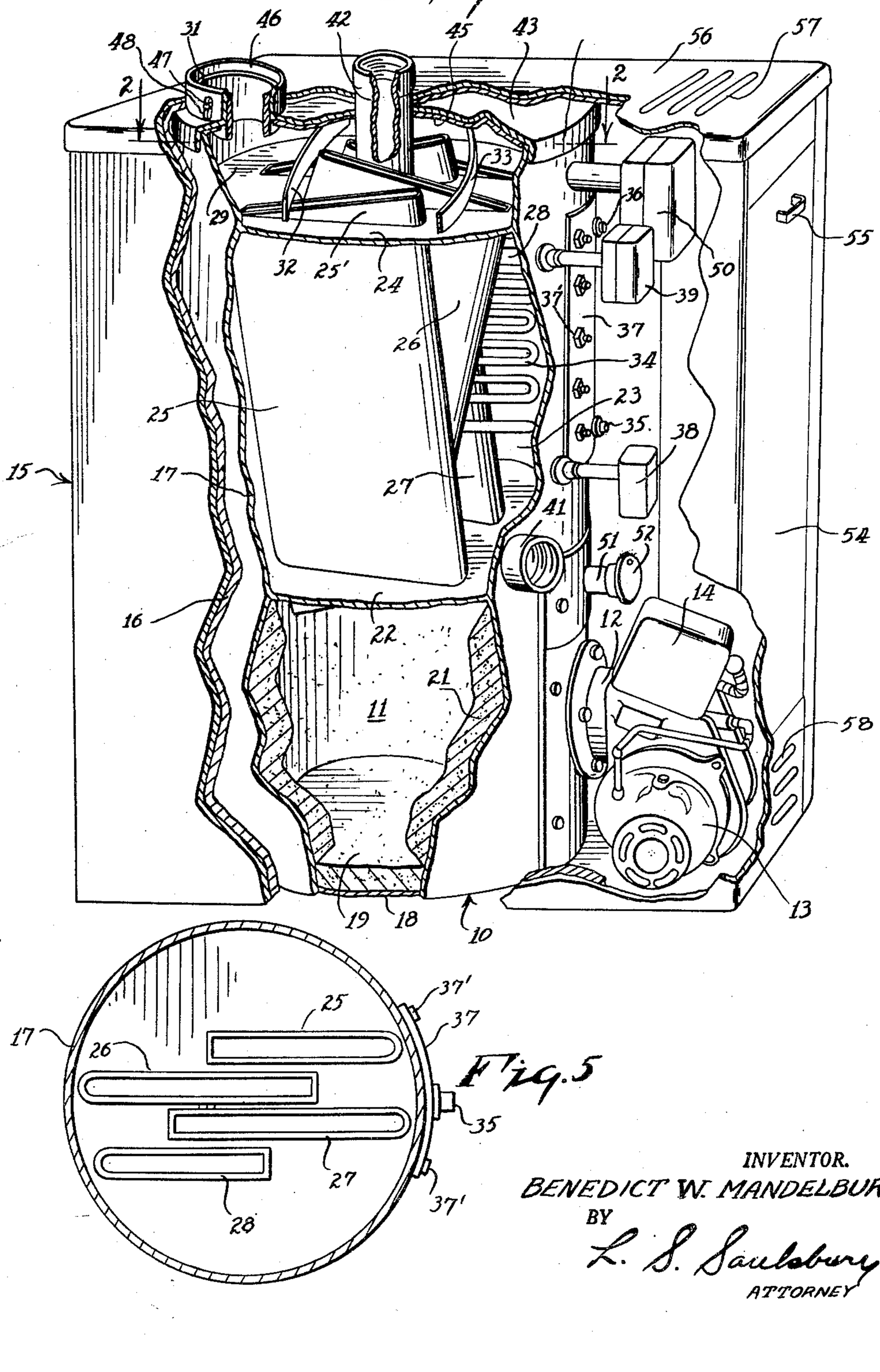

Fig. 5

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Fig. 2

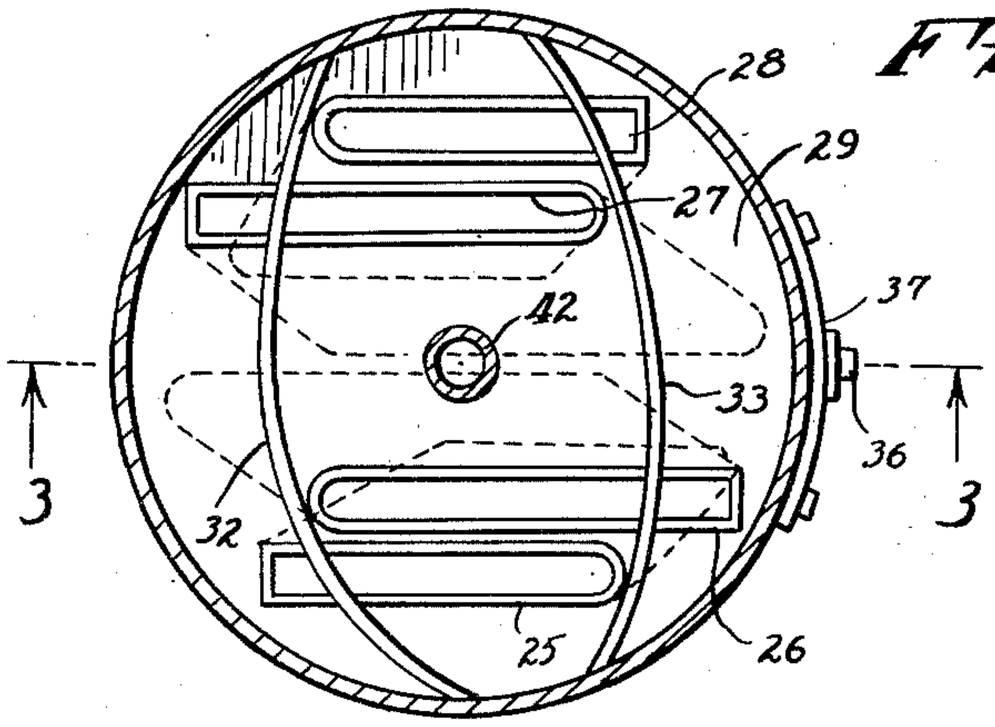
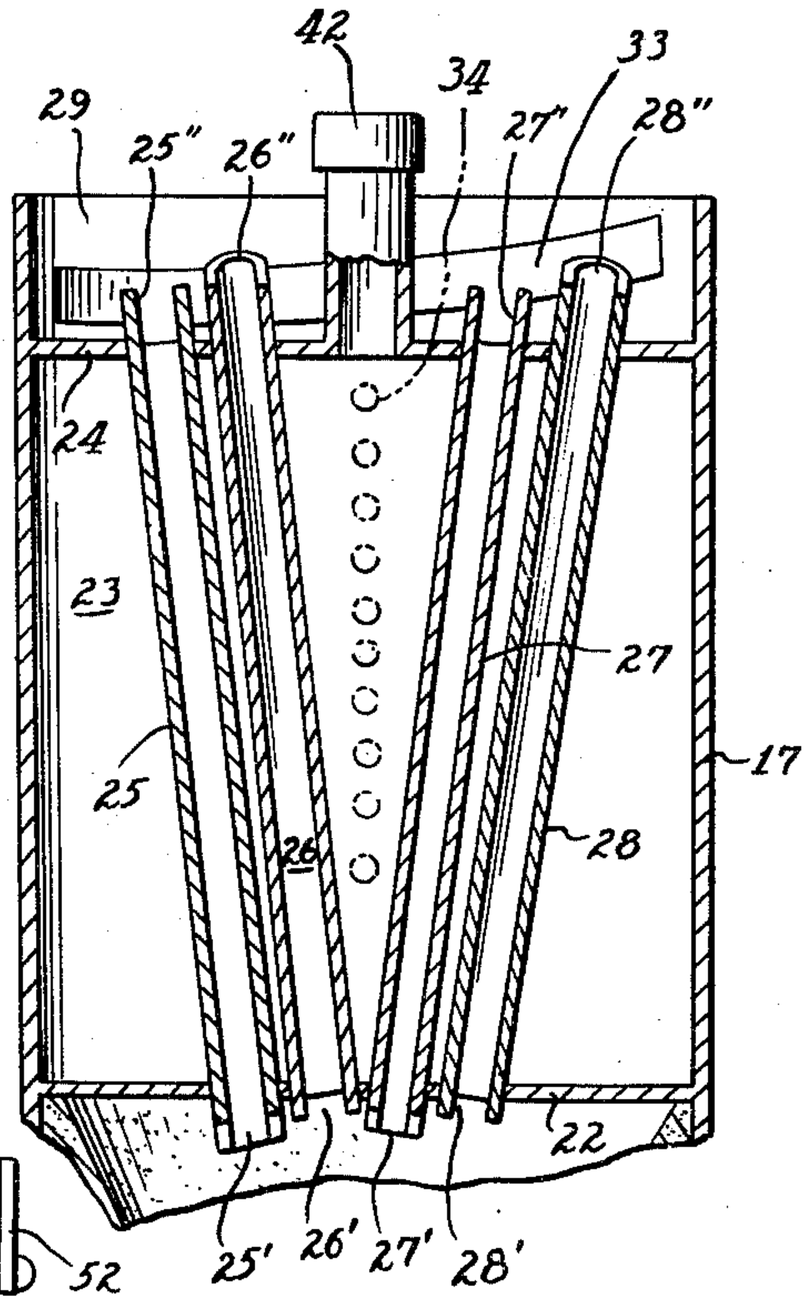


Fig. 4



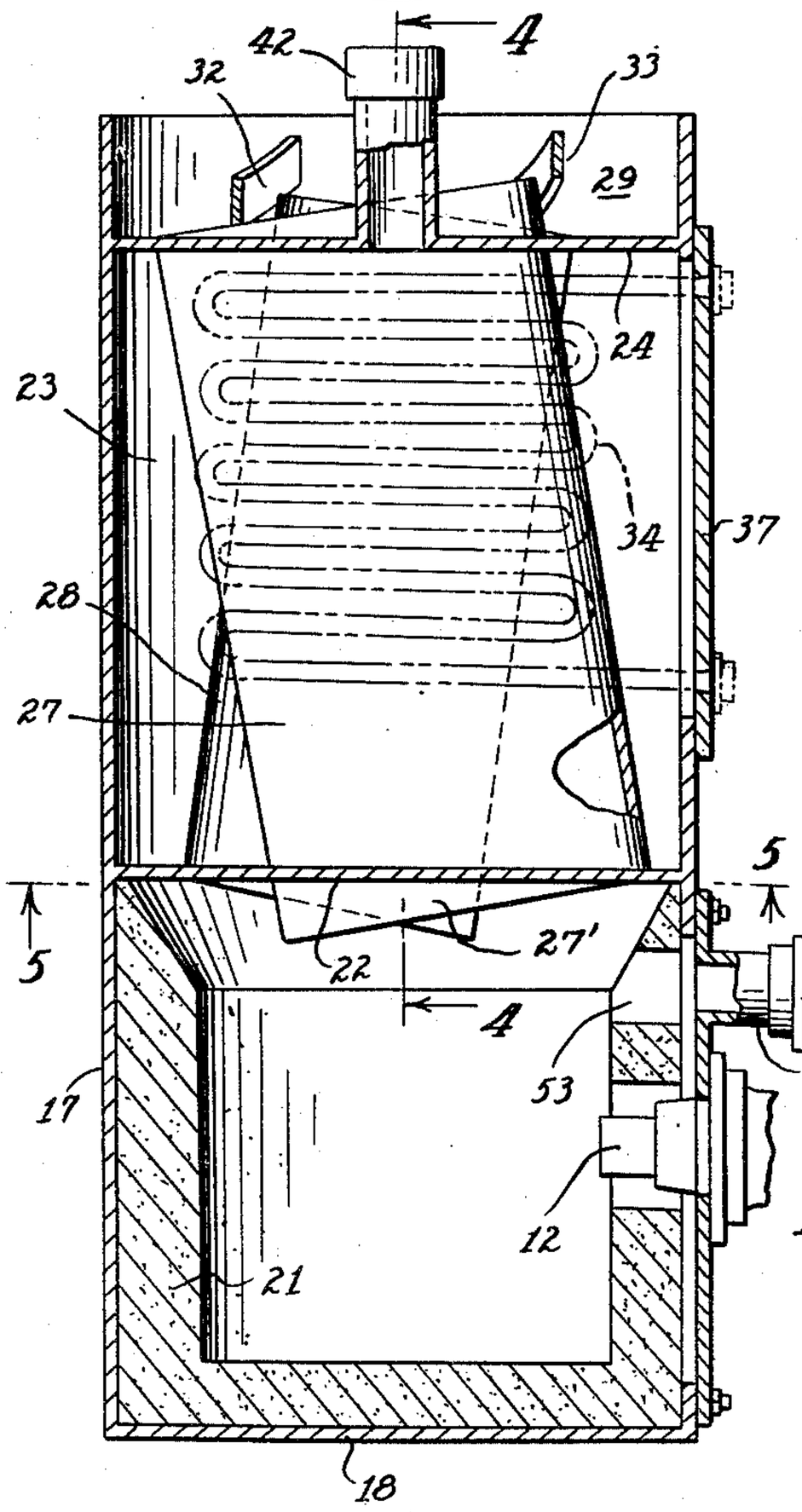


Fig. 3

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CROSSED DUCT VERTICAL BOILER CONSTRUCTION

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Application November 13, 1952, Serial No. 320,278

7 Claims. (Cl. 122—109)

This invention relates to boilers for heating purposes.

It is an object of the present invention to provide a heating boiler which does not restrict the flow of the expanding gases, but which will induce turbulence and slow up the passage of the gases through the boiler to thereby cause and permit greater scrubbing effect and heat absorption of the gases as they pass over the heat-absorbing surfaces wherein stratification of the gases in the boiler will be reduced to a minimum so that there will be an ever-changing contact of the gases with the metal heat-absorbing surfaces of the boiler.

It is another object of the invention to provide a heating boiler having bottom and upper head plates and with tubes or ducts which extend upwardly through the boiler and incline in two directions and cross each other, whereby a swirling action and scrubbing effect will be had upon the surfaces of the ducts and thereby obtain a highly efficient boiler or heat exchanger.

It is another object of the invention to provide a boiler having a short overall height and wherein the expansion space above the fire tubes or ducts has baffle elements to cause the gases to be restrained and a continuation of the turbulence of the gases and to require the gases to follow a path over the upper head of the boiler and around before leaving the boiler through the smoke outlet without severe restriction or arrestation of combustion, and wherein the chimney outlet member is adjustable in the upper plate of the boiler so as to project downwardly into the expansion space and effect a greater or less flow of the gases on leaving the boiler and so that the boiler can be adjusted in an easy manner for the different draft conditions or installations of the boiler.

Other objects of the invention are to provide a heating boiler having the above objects in mind, which is of simple construction, inexpensive to manufacture, has a minimum number of parts, compact, easy to insulate, creates a turbulence without retarding the passage of the gases therethrough and avoiding carbonization or sooting of the inner boiler surfaces, has effective scrubbing and mixing action of the gases as well as of the water, and is highly efficient in operation.

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

Figure 1 is a perspective view of the heating boiler embodying the features of the present invention with portions of the boiler broken away to show the interior construction thereof and to show the location of the burner and the several gauges on the front of the boiler;

Fig. 2 is a transverse sectional view taken through the top of the boiler showing the opposed, curved baffling strips in the low head space therein;

Fig. 3 is a vertical sectional view, taken on line 3—3 of Fig. 2;

Fig. 4 is a fragmentary vertical sectional view taken on line 4—4 of Fig. 3 and showing the fire tubes or ducts in section;

Fig. 5 is a transverse sectional view taken on line 5—5 of Fig. 3 and looking upwardly into the fire tubes or ducts.

Referring now to the figures, and particularly to Fig. 1, 10 represents the boiler structure having a fire chamber 11 into which is extended an oil or gas burner 12, having a fan motor 13 and an ignition transformer box 14 and an external casing 15 suitably insulated from the boiler structure by insulation 16.

The boiler structure 10 has a hollow cylindrical shell 17 that extends in an upright manner and which has a bottom plate 18 that supports a heavy thickness of fire clay 19 in the bottom of the fire chamber 11. Around the inner wall of the chamber is a heavy thickness of fire clay 21 so as to withstand the thrust of the flame issuing into the fire chamber 11 from the burner 12.

The flame will rise in the fire chamber 11 against a bottom head plate 22 which has its periphery welded to the inner surface of the cylindrical shell 17. This plate 22 serves as the bottom of a water chamber 23 and the upper part of this chamber is closed by an upper head plate 24. This upper head plate 24 is likewise secured by its periphery to the inner face of the wall of the cylindrical shell 17.

The bottom plate 22 has openings cut therein, through which extend upwardly and through the water chamber 23, a plurality of fire tubes or ducts 25, 26, 27 and 28. The two inner fire tubes 26 and 27 cross each other with the tube 26 inclined upwardly from the rear of the inner structure and toward the front of the inner structure and with the tube 27 inclined upwardly from the front of the boiler structure to the rear thereof. These fire tubes or ducts 26 and 27 are elongated in section and are of greater cross-sectional area than the fire tubes 25 and 28. The tube 25 is inclined upwardly from the front of the structure and toward the rear of the structure, whereas the tube 28 is inclined upwardly from the rear of the structure toward the front thereof. The lower ends of these fire tubes project downwardly from the bottom plate 22 to provide inclined extensions 25′, 26′, 27′ and 28′ and are welded in the openings of the bottom plate 22 in a water-tight manner. The fire tubes or ducts extend upwardly through openings in the upper head plate 24 to provide extensions 25″, 26″, 27″ and 28″. These extensions lie in a turbulating chamber or turbulator 29 where the gases are confined against movement toward a chimney fitting 31 by opposing arcuate baffle strips 32 and 33 welded by their ends to the inner opposed side wall surfaces of the cylindrical shell 17.

The fire tubes 25 and 26 not only cross each other but are inclined to one side of the water chamber 23, while the tubes 27 and 28 are inclined toward the opposite side of the water chamber 23 whereby to provide a central space 23′ for receiving a hot water coil 34 having an inlet fitting 35 and an outlet fitting 36. This hot water coil 34 is carried on a plate 37 bearing the inlet and outlet fittings 35 and 36 and this plate 37 is secured to the boiler wall 17 by studs and nuts indicated at 37′. This hot water coil unit serves to supply the household with domestic hot water.

Water temperature control elements 38 and 39 are connected to the wall 17 to have communication with respectively lower and upper levels of the water supply in the water chamber 23 to control the operation of the burner.

The water enters the water chamber 23 through a

fitting **41** to which the return pipe of the heating radiation is connected. This water thus enters the water chamber **23** through an upwardly-extending central fitting **42** that extends upwardly from the upper head plate **24**, through the gas turbulating chamber **29** and through a top steel cover **43** that has a peripheral depending flange **44** that fits over the upper edge of the cylindrical shell **17**, whereby to close the chamber **29**. The bottom face of the steel cover **43** is protected with an asbestos layer **45**.

The chimney fitting **31** has an adjustable sleeve **46** which is held in its adjusted position by a screw **47** fitted into the sleeve **46** and extending through a vertically-extending elongated slot **48** in the chimney fitting **41**. This sleeve **46** can be lowered to give a longer path to the gases leaving the chamber and to provide added baffle means, or it can be elevated to give less path to the gases leading toward the chimney. The adjustment of the sleeve **46** will depend upon the installation and the draft upon the chimney to which the boiler is connected.

Connected to the upper part of the shell **17** and entering the turbulating chamber **29** is a thermally responsive safety control instrument **50**. Entering the fire chamber **11** is an inspection pipe **51** having a shutter **52** thereon. The fire clay **21** has an opening **53** adjacent the inspection pipe **51** so that the condition of the flame or fire can be examined upon lifting the shutter **52**.

The outer casing **15** has a door **54**, Fig. 1, to provide access to the burner and to the front of the boiler. Door **54** can be pulled down by the handle **55**. A top cover **56** lined with asbestos fits over the top of the casing **15**. This cover has ventilating openings **57**. Air can enter the openings **58** at the bottom of the casing and circulate upwardly through the casing and leave through the openings **57** of the cover.

In operation, the flame is extended into the fire chamber **11** and the gases and products of combustion move upwardly through the different fire tubes or ducts, all of which respectively extend in different directions, so that the gases on passing through the tubes are given a swirling and spiralling action and will enter the turbulator **29** at different locations and from different directions and continue through the turbulator so that the curved baffles **32** and **33** will further cause a swirling movement of the gases in the chamber **29** and will lengthen the path therethrough toward the chimney fitting **31**. Thus, the gases will be caused to scrub the upper head plate **24** and these will remove from them the last amount of heat to thereby keep the upper part of the water chamber hot and in so doing will retard the flow of gases therebelow.

To further cause the swirling action of the gases, the sleeve baffle **46** will require the gases to dip under the lower edge thereof before finally entering the chimney. By having a swirling and turbulent action, the movement of the gases will be slowed up through the boiler, and a high scrubbing of the surfaces and high heat absorption from the gases will result. The flow of the gases through the boiler is not restricted or retarded but are caused to be turbulent and to be slowed up in passing through the boiler. Because of the angle which the fire tubes extend through the water chamber **23**, the movement of the water through the water chamber will have a turbulent pattern and a greater scrubbing action will be had upon the water surfaces of the fire tubes. The return water from the heating radiators enters the lower part of the water chamber through fitting **41**, and the outlet water is passed through the fitting **42**.

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

What is claimed is:

1. A boiler construction comprising a hollow shell having spaced lower and upper head plates, providing a water chamber therebetween, said shell having a fire chamber below the lower head plate, pairs of upwardly extending inclined fire tubes or ducts and the tubes of each pair crossing one another and extending through and between said lower and upper plates to conduct the hot gases through the water chamber said tubes being elongated in section and having inclined extensions above the upper head plate, a cover plate connected to the upper end of said shell and spaced from the upper end plate whereby to provide a turbulating chamber for the gases, a chimney pipe extending upwardly from the side of the cover plate, vertical baffle means extending laterally between the side walls of the shell and over the open upper ends of the tubes or ducts intermediate the vertical edges thereof, said baffle means being transverse of gases flowing between the upper ends of the fire tubes and the chimney pipe, whereby to induce a swirling action of the gases leaving said duct and to slow up the passage of the gases to the chimney and cause them to scrub the surfaces of the upper head plate.

2. A boiler construction, as defined in claim 1, and said baffle means comprising spaced opposedly curved baffle strips extending laterally over the upper ends of the fire tubes or ducts and connected between the side walls of the shell.

3. A boiler construction, as defined in claim 1, said chimney fitting means including a sleeve fixed to the cover and an inner sleeve adjustably fitted with the fixed sleeve and adapted to be lowered to different elevations within the turbulating chamber whereby to provide a varying baffle means therewithin, and means for securing the adjustable sleeve to the fixed sleeve in any of its adjusted positions.

4. A boiler construction as defined in claim 1 and the pairs of crossed fire tubes being inclined upwardly and outwardly towards opposite sides of the shell, a water fitting connected to the upper head plate and communicating with space between the pairs of fire tubes, said water fitting extending through the cover plate.

5. A vertical boiler construction comprising a hollow shell having spaced lower and upper head plates providing a water chamber therebetween, said shell having a fire chamber below said lower head plate, a plurality of inclined relatively narrow fire tubes extending upwardly through and between said lower and upper head plates to conduct the hot gases through the water chamber, the lower ends of said tubes passing through said lower head plate adjacent one another at substantially the central portion thereof, said tubes passing through said upper head plate adjacent opposite first and second wall portions of said shell relative to a substantially longitudinal plane of said shell, said lower end of one of said tubes being located adjacent another third wall portion of said shell and having its opposite end located adjacent another fourth wall portion of said shell, said ends being on opposite sides of a longitudinal plane transverse to said first plane, the lower end of said other tube being adjacent said last mentioned wall portion and its upper end being adjacent said third wall portion, whereby said tubes are inclined and crossed, the major transverse dimension of each tube section being at least one-third the width of said shell, and a cover plate connected to the upper end of said shell and spaced from said upper head plate to provide a turbulating chamber for the gases.

6. A boiler construction as defined in claim 5 wherein said tubes extend through said upper head plate and into said turbulating chamber, the upper end of each of said tubes being inclined toward the adjacent side of said shell.

7. A boiler construction as defined in claim 5 having a gas outlet leading from one side of said turbulating chamber and vertical baffle means in said turbulating cham-

ber extending laterally between the side walls of said shell and over the open upper ends of said tubes intermediate the vertical edges thereof, said baffle means being transverse of gases flowing between the upper ends of said fire tubes and said gas outlet whereby to induce a swirling action of the gases to slow up their passage and to cause them to scrub the surface of said upper plate.

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