

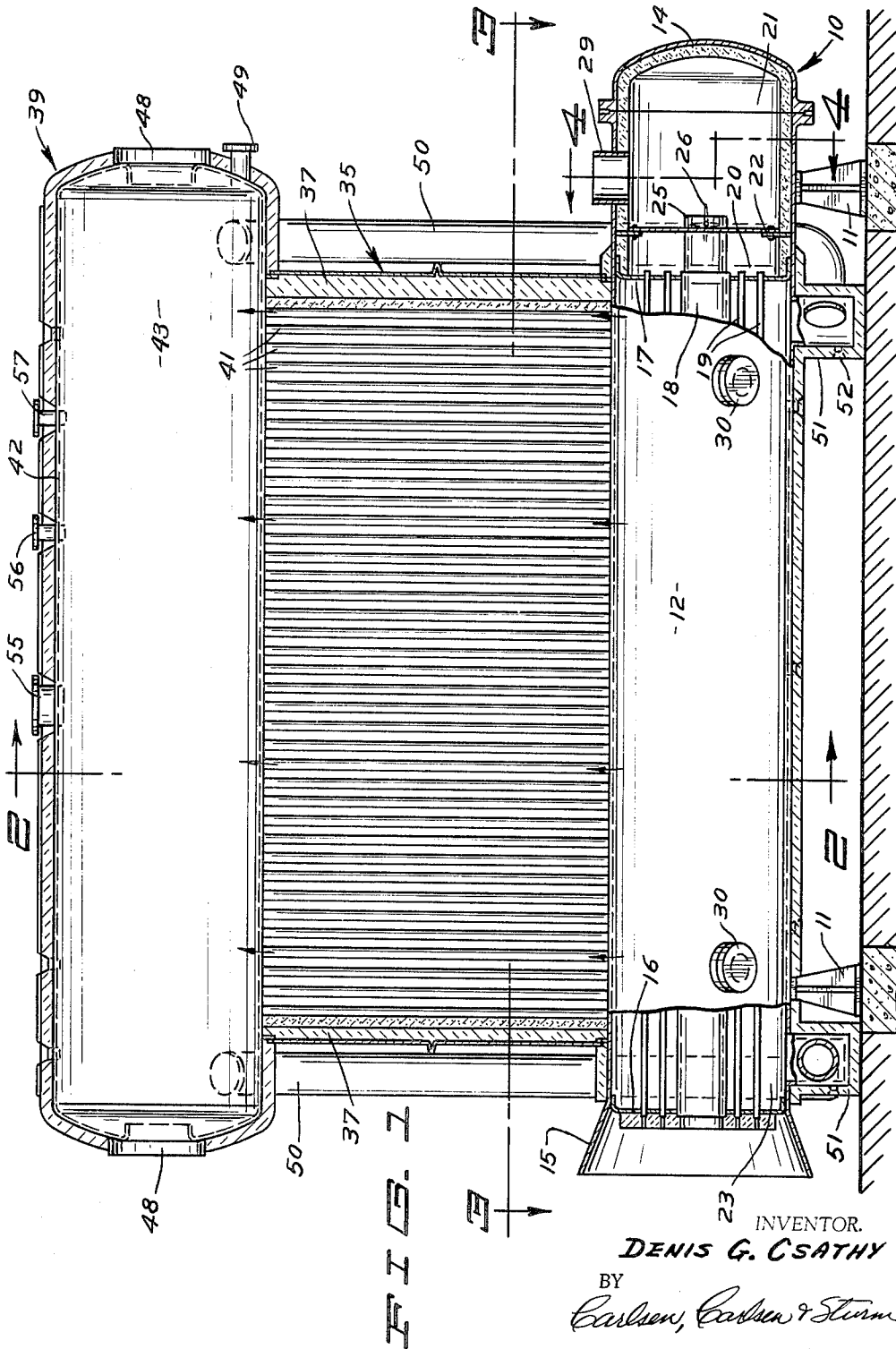
April 19, 1966

D. G. CSATHY
BOILER CONSTRUCTION

3,246,633

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3 Sheets-Sheet 1



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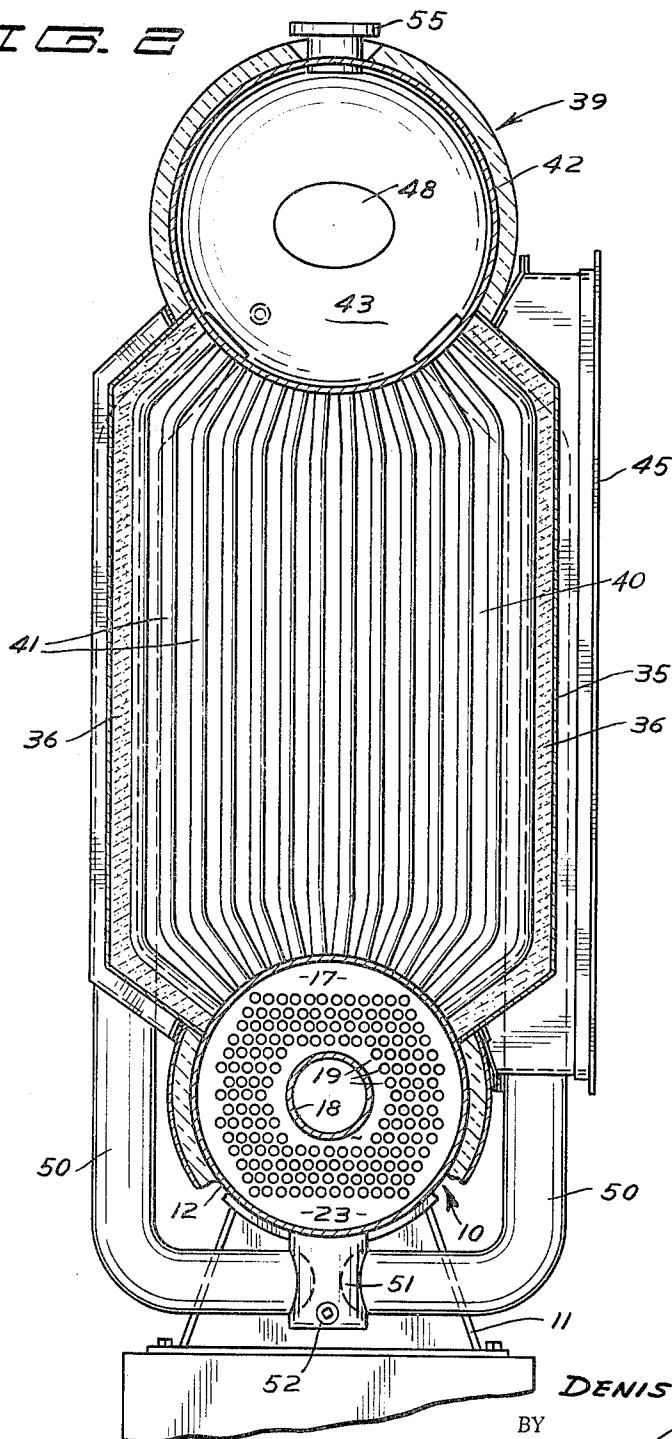
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FIG. 2



INVENTOR.
DENIS G. CSATHY
BY
Carlson, Carlson & Funn
ATTORNEYS

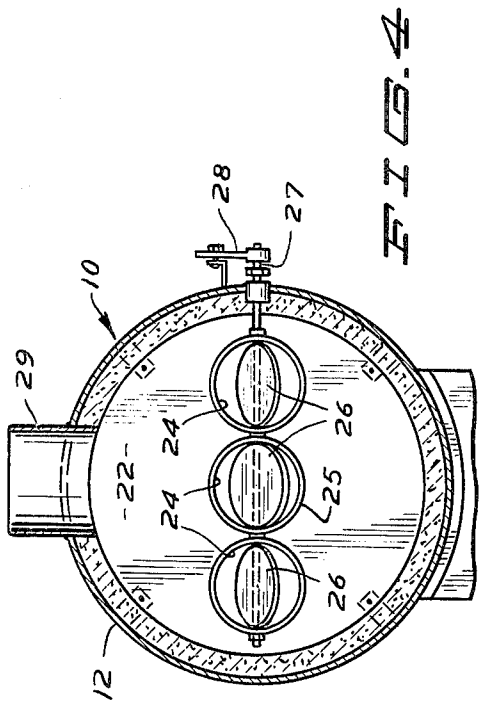
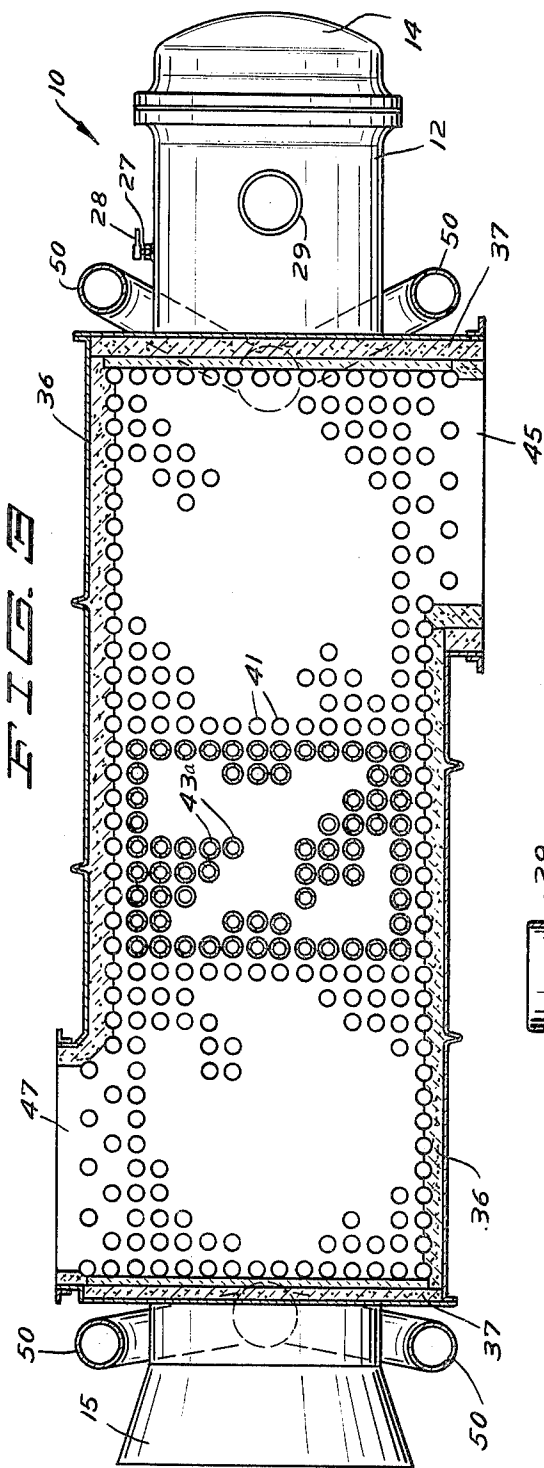
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INVENTOR.
DENIS G. CSATHY
BY
Carlson, Carlson & Storm
ATTORNEYS

1

3,246,633

BOILER CONSTRUCTION

Denis G. Csathy, Minneapolis, Minn., assignor to Bros Incorporated, Minneapolis, Minn., a corporation of Minnesota

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1 Claim. (Cl. 122—7)

This invention relates generally to boiler construction and more particularly relates to a combined water tube and fire tube boiler for transmitting heat from two independent gas flows to a common body of water.

The carrying out of certain chemical processes results in two separate gas flows, both of which are at elevated temperatures but under different pressures. The one flow is a process gas normally held in the pressure range of 150 to 400 pounds per square inch. It is desirable to reuse the process gas as the process is performed but it must be constantly cooled for its continuous use. It has accordingly become common practice to run such gases through the tube section of a fire tube boiler in order that the heat dissipated therefrom might be utilized.

The other gas flow resulting from the process is a flue gas which is near atmospheric pressure and which is not reused in the process. It is known to utilize such gases by recovering the heat therefrom before they are discharged by passing the gases through a boiler containing water tubes in order that the water in the tubes might be heated or converted to steam.

The primary object of the present invention is to provide a boiler adapted to receive and utilize two independent flows of gas under different relative pressures as heat sources for a common body of water.

Another object of the invention is to provide a novel boiler construction which combines the capabilities of a fire tube boiler and a water tube boiler for recovering heat from two independent gas flows to heat a single body of water.

Still another object of the invention is to provide a boiler structure adapted for connection with two independent gas flows to heat a common body of water with said connections adapted to carry the flows in opposite directions through the water body for uniform heating.

The above mentioned and still additional objects of the invention will be brought to light during the course of the following specification, reference being made to the accompanying drawings, in which—

FIG. 1 is a longitudinal vertical section through the boiler.

FIG. 2 is a transverse vertical section through the boiler taken on line 2—2 of FIG. 1.

FIG. 3 is a horizontal section through the boiler taken on line 3—3 of FIG. 1 and looking downwardly.

FIG. 4 is an enlarged transverse vertical section taken on line 4—4 of FIG. 1 through the lower drum.

Referring now more particularly to the drawings, reference characters will be used to denote like parts or structural features in the different views. A fire tube drum 10, shown partially in section in FIG. 1, is of elongated cylindrical design and is mounted over a supporting floor in horizontal position on supporting feet 11. The drum has a tubular wall 12 closed at one end by the end wall 14. The opposite end is flared as at 15 for closed connection with a suitable source of process gas supplied under relatively high pressure such as 150 to 400 p.s.i. A pair of partition walls 16 and 17 are provided at longitudinally spaced positions within the drum. These partitions jointly support an axially extending gas bypass pipe 18 and a plurality of fire tubes 19 which surround pipe 18 as best shown in FIG. 2. All of the tubes 18 and 19 open through both partitions 16 and 17 so that process gases entering

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the inlet 15 might pass therethrough and into the opposite end portion of the drum. This end portion (at the right as viewed in FIG. 1) is divided into inner and outer chambers, denoted respectively at 20 and 21, by a partition 22. Partition 22 is provided with a row of vent openings 24 (FIG. 4) the central one of which receives the extension 25 of pipe 18. Each of the openings 24 is provided with a damper disk 26 and all of said disks are mounted on a common transverse shaft 27 which is suitably journaled on the partition 22 for oscillating movement by arm 28 to vary the open area of the vents 24. The drum 10 is provided with an outlet pipe 29 for discharge of process gases from the chamber 21 into a suitable conduit for reuse. The drum is also provided with inspection holes covered by caps 30.

It will be understood that the drum 10 functions as a fire tube boiler. With chamber 23 between plates 16 and 17 being substantially full of water, the process gases will pass through the tubes 18 and 19 with the heat therefrom being transferred to the water. The gases will pass through the chambers 20 and 21 and out the discharge stack 29 from which it is piped for reuse.

A water tube enclosure or casing 35 is mounted over the drum 10. This casing has insulated side walls 36 and end walls 37. A cylindrical steam drum 39 is mounted at the upper end of the casing 35. Walls 36 and 37 have their lower edges sealed to drum 10 and their upper edges sealed to drum 39 to provide an enclosed vertically extending chamber 40 between the drums. A plurality of water tubes 41 extend vertically through the chamber 40 with their lower ends connected to and opening through the upper portion of wall 12 whereby the interior of the tubes 41 are in open communication with the chamber 23. Similarly the upper ends of tubes 41 are connected to and open through the lower portion of wall 42 of the steam drum 39 whereby the interior of the tubes 41 are in open communication with the chamber 43 within the drum 39.

The water tube casing 35 has its side and end walls 36 and 37 insulated, as best shown in FIG. 3. One of the side walls 36 is provided with a relatively large gas inlet opening 45 near one end wall 37, said inlet opening being adapted for connection to a source of flue gas. The other side wall 36 is provided with a gas outlet opening 47 adjacent the opposite end wall 37. It will be observed that the flue gas inlet 45 is over the discharge end of the drum 10 while the outlet 47 is over the intake end of drum 10. The purpose of this arrangement will be subsequently explained in detail.

The central section of water tube casing 35 is provided with finned tubes 43^a as shown in FIG. 3.

The steam drum 39 has end closure caps 48. At one end the drum is provided with a water inlet coupling 49. Feeder tubes 50 have their upper ends connected into the lower side of the drum 39 and extend downwardly from each end of the drum outside of the casing 35 and connect at their lower ends with pocket members 51 mounted on the underside of and opening into drum 10 near the ends thereof. These pockets 51 are provided with drain plugs 52.

On its top side the drum 39 has a steam outlet coupling 55 adapted for connection to suitable conduit means to carry steam from the drum to its place of use. The drum is also provided with suitable safety valves denoted at 56 and 57.

In normal use of the boiler, water is introduced thereto through the inlet 49, flowing through the tubes 50 and pockets 51 into the chamber 23 of the fire tube drum 10. Process gases, to be cooled and reused, are introduced to the drum through the open end 15 with the gases passing through the fire tubes 19, chamber 20, the two side vent openings 24, chamber 21, and outlet 29, from which it is

carried back for reuse in the process concerned. The pipe 18 is a conventional bypass line for allowing a portion of the gases to avoid the tubes 19 so that the cooling of the gas to the desired temperature may be regulated. The relative distribution of the gases between lines 18 and 19 and the speed of flow therethrough can be regulated by adjustment of the damper disks 26.

As the water is heated in chamber 23 and with continued inflow, the heated water and steam will rise into the casing 35 through tubes 41 for further heating and vaporization by the combustion gases flowing horizontally through the casing from inlet 45 to outlet 47. It is desirable that there be equalized steam production along the steam drum 39. This is accomplished by passing the gases through drum 10 and the water tube boiler casing 35 in opposite directions. Further equalization is obtained by using the finned tubes 43^a in the center section for maximum heat transfer in that area where steam production would otherwise be the least. The steam created in the boilers 10 and 35 is released from the steam drum 39 through the outlet 55. Any unvaporized fluids will return to the drum 10 through the feeder tubes 50.

The boiler accordingly combines the fire tube and water tube boiler principles in a single unit allowing heat recovery in a single water flow from two independent process gases. The construction also provides for a considerable saving in piping, trim, controls and so forth as compared with the use of two independent boilers. The dual gas flow in relatively opposite directions provides for desirable even steam production along the steam drum. The invention accordingly economically and effectively carries out the aforementioned objectives.

It is understood that suitable modifications may be made in the structure as disclosed, provided such modifications come within the spirit and scope of the appended claim. Having now therefore fully illustrated and described my invention, what I claim to be new and desire to protect by Letters Patent is:

In a steam boiler construction, a horizontally elongated fire tube boiler having a water chamber, a plurality of high pressure gas tubes extending longitudinally

through the chamber, a gas inlet at one end of the fire tube boiler for admitting gas into the gas tubes, a gas outlet at the other end of said boiler for discharging gas from the gas tubes, damper means adjacent the outlet for controlling the gas flow through the gas tubes between the inlet and outlet, an elongated upright water tube boiler mounted along the top of the fire tube boiler and having an internal gas chamber, an elongated steam drum mounted on top of the water tube boiler in parallelism with the fire tube boiler, a plurality of water tubes extending vertically through the gas chamber and having their lower ends in open communication with the water chamber and their upper ends in open communication with the interior of the steam drum, a pair of feeder tubes one connecting the lower portion of each end of the steam drum with the adjacent end of the fire tube boiler water chamber, inlet and outlet means in the water tube boiler for passing a low pressure gas horizontally through the gas chamber, a water inlet connection and a steam outlet connection on the steam drum whereby as the water and gas flows are active, the water will flow from the inlet connection through the feeder tubes to the fire tube boiler water chamber, then dissipate heat from the fire tube gases in the water chamber, then rise through the water tubes and dissipate heat from the gases in the water tube boiler, then rise into the steam drum in a vaporized state for discharge from the boiler construction through said steam outlet connection.

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CHARLES J. MYHRE, *Primary Examiner.*

JAMES W. WESTHAVER, *Examiner.*