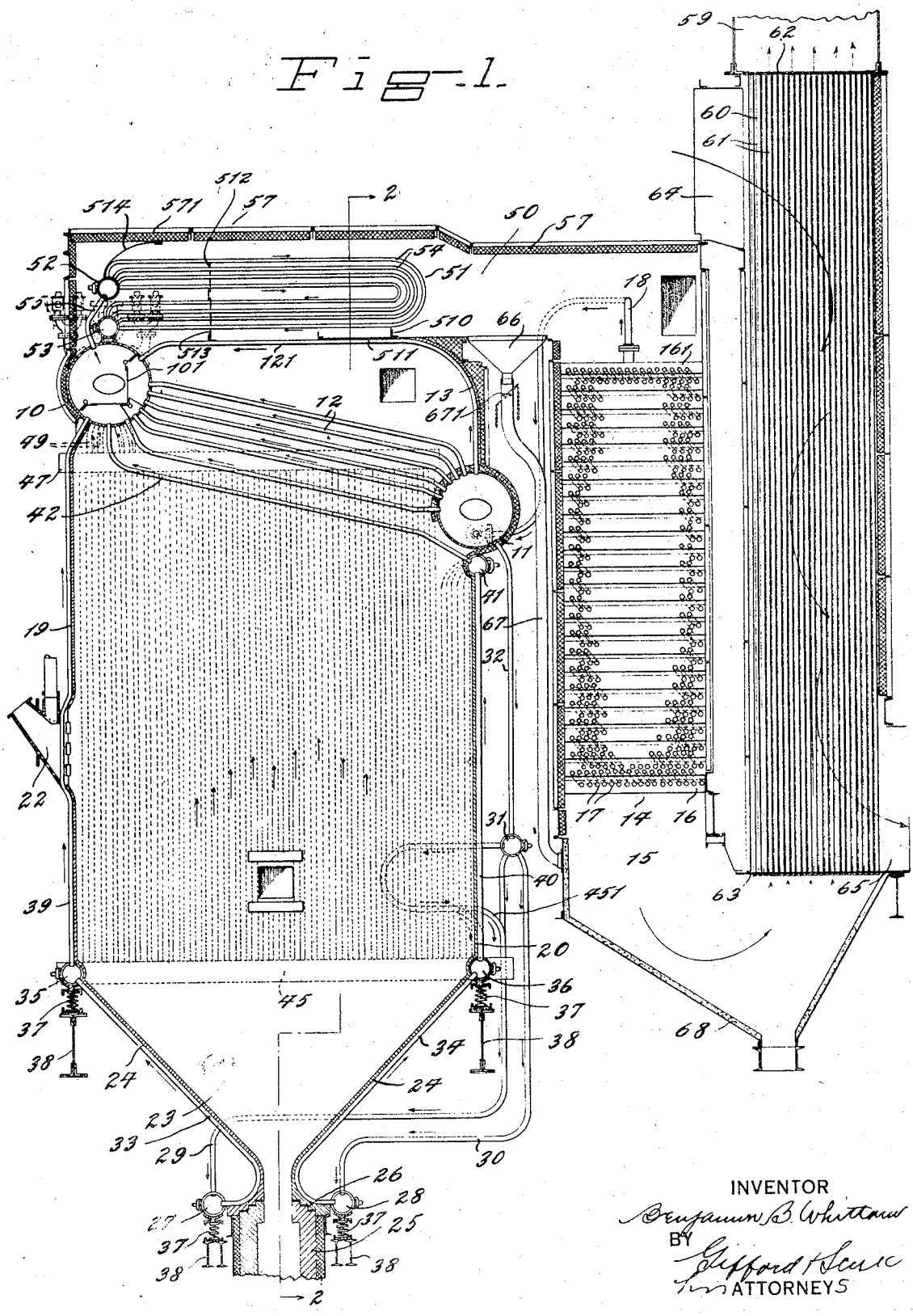
March 24, 1931. B. B. WHITTAM 1,797,386

STEAM BOILER AND SETTING THEREFOR

Filed March 16, 1927 2 Sheets-Sheet 1

Fig. 1.



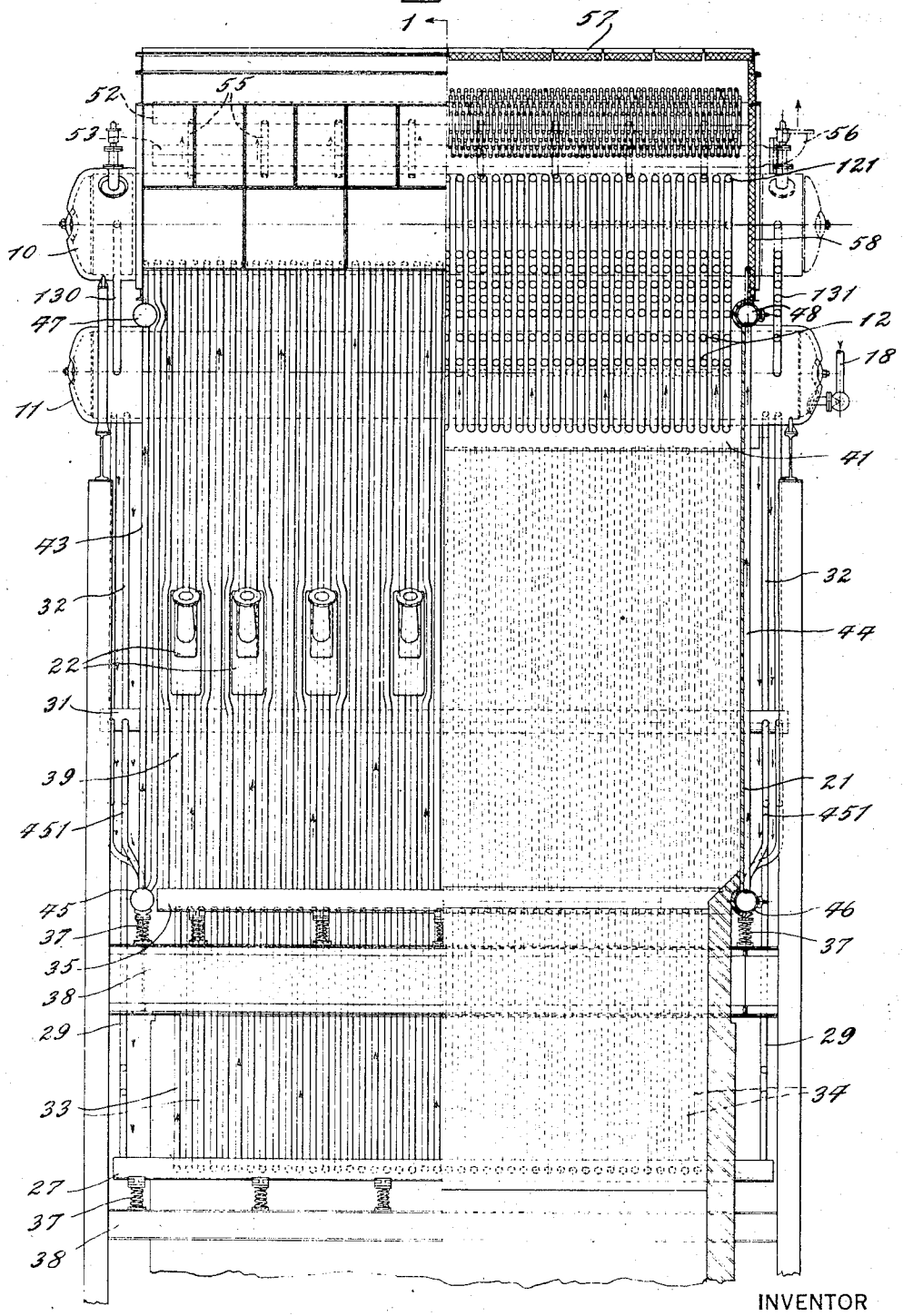
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Fig. 2.



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1,797,386

UNITED STATES PATENT OFFICE

BENJAMIN B. WHITTAM, OF ELIZABETH, NEW JERSEY, ASSIGNOR TO THE BABCOCK & WILCOX COMPANY, OF BAYONNE, NEW JERSEY, A CORPORATION OF NEW JERSEY

STEAM BOILER AND SETTING THEREFOR

Application filed March 16, 1927. Serial No. 175,641.

My invention consists of certain novel parts and combination of parts particularly pointed out in the claims, and is an improvement on the boiler shown in an application of David S. Jacobus, Serial No. 622,720, which was filed in the Patent Office on or about March 5, 1923, and patented July 8, 1930, Patent No. 1,769,997 particularly Fig. 8 thereof.

My invention will best be understood by reference to the accompanying drawings in which Fig. 1 is a vertical sectional view through the boiler and setting embodying my invention taken along the plane of the line 1—1 of Fig. 2, and Fig. 2 is a partial elevation taken at the left of Fig. 1, the right-hand portion thereof being a section taken along the plane of the line 2—2 of Fig. 1.

Like reference characters indicate like parts throughout the drawings.

Referring now to the drawings in which I have illustrated one embodiment of my invention, 10 is an upper drum and 11 a drum preferably arranged at a somewhat lower level than the drum 10 and connected thereto by a bank of water tubes 12, outside circulator tubes 130 and 131, and an upper row of circulator tubes 121, the major portion of the lengths of which are preferably horizontal as illustrated and which are curved downwardly to enter the drum 11. The drum 10 is preferably provided with a baffle 101 extending longitudinally thereof in front of the tubes 12 and 121. The tubes 121 assist in supporting a baffle wall 13 which extends upwardly from the drum 11.

An economizer, indicated generally by the reference character 14, is arranged in the flue 15, the same comprising headers 16 located at one side of the flue and connected by U-tubes 17. The feed water enters one of the lowermost headers by a feed inlet (not illustrated), and flows back and forth from a given header on one side, through the tubes to a next higher header and in a generally upward direction, and is discharged from the uppermost header 161 through a pipe 18 which is connected to the drum 11.

The setting of the boiler comprises a front wall 19 and a rear furnace wall 20, which are here illustrated as metallic, and side walls 21, one of which is illustrated at the right in Fig. 2. In the embodiment illustrated, the furnace is fired by powdered fuel, the burners for which are illustrated at 22, and set in the front wall of the furnace. The furnace also, in the embodiment illustrated, comprises a hopper-shaped bottom 23, the sloping sides 24 of which are mounted on a suitable support 25, a suitable expansion joint 26 preferably being interposed between the two.

In addition to the circulation set up in the boiler by means of the tubes 12, there is an auxiliary circulation which, in the embodiment illustrated, comprises lower cross headers 27 and 28 to which are connected flexible tubes 29 and 30, respectively, leading to a distributing header 31, which is in turn connected to drum 11 by a tube or tubes 32. Rows of tubes 33 and 34 extend upwardly from the cross headers 27 and 28, respectively, beneath the sloping floors 24 of the furnace and serve as a support therefor, the upper ends of these tubes being connected to headers 35 and 36, respectively. The lower ends of the tubes 33 and 34 are preferably curved outwardly as illustrated, the major portion of the length of the tubes preferably being straight, thereby reducing the number of curved members which are laid next to the tubes and which curved members are necessarily expensive.

The headers are preferably supported by yielding members 37 which are in turn carried by I-beams 38 or other supports, whereby the headers may rise and fall under the expansion and contraction of the tubes which are connected thereto as hereinafter described. Similarly, the cross headers 27 and 28, as well as headers 45 and 46 hereinafter described, are preferably carried by yielding members.

Cooling tubes 39 are located adjacent the front wall of the furnace and are connected at their lower ends to the header 35, while the upper ends thereof are preferably connected to the upper drum 10, except the tubes 39 at the extreme left and right, as viewed in Fig. 2, which are connected at their lower ends to the headers 45 and 46, respectively (such connection being illustrated at the left

of Fig. 2, but not at the right). Tubes 40 are located adjacent to the rear wall of the furnace and are connected at their lower ends to the header 36 and at their upper ends to a header 41 which is preferably located beneath the lower drum 11. A row of tubes 42 are connected at one end to the header 41, and at their other ends to the drum 10, the row of tubes 42 serving as a slag screen to prevent an excessive amount of slag producing matter being carried by the gases into contact with the boiler tubes 12. These tubes also serve to protect the drum 11 from the intense heat of the furnace.

The auxiliary circulating system which also serves to cool the side walls of the furnace, also comprises side wall cooling tubes 43 and 44 located adjacent the side walls of the furnace and connected at their lower ends to the lower headers 45 and 46, extending along the sides of the furnace and preferably located at about the same level as the headers 35 and 36. The upper ends of the tubes 43 and 44, except those at the right as viewed in Fig. 1, are connected to upper headers 47 and 48 which are in turn connected to the drum 10 by tube connections 49 (see Fig. 1). The tubes 43 and 44 at the right as viewed in Fig. 1 (three of the tubes 43 being so illustrated, the right-hand tubes 44 not being illustrated) discharge into the header 41. The headers 45 and 46 are connected to the distributing header 31 by flexible tubes 451.

Located above the circulator tubes 121 is a horizontally extending flue 50 within the left-hand portion of which is a superheater indicated generally at 51, comprising inlet and outlet headers 52 and 53, respectively, connected by U-tubes 54, a plurality of rows of which, here shown as four in number, are illustrated. The inlet header of the superheater is preferably connected to the upper drum 10 by a plurality of tube connections 55 which serve to support the upper header of the superheater and at the same time conduct steam to the inlet header at a plurality of spaced points therealong. These tubes may be simply expanded and of relatively small diameter, thereby decreasing the cost of the connections as compared with the cost of large diameter connections. The outlet connection for the outlet header 53 is indicated at 56.

The portion 571 of the roof 57 which is located above the superheater, is preferably elevated, the side walls of the flue preferably being provided with panels 58 through which the superheater tubes may be inserted and removed at the side of the setting. It will be noted that the arrangement of the superheater tubes within the flue and which extend longitudinally thereof, permits adding very appreciably to the superheating surface by lengthening the tubes in case this is desired, and will permit the removal of the tubes from the side of the setting.

The ends of the tubes are supported by a member 510 engaging the ends of the tubes and the lower portion engaging a plate 511 which is laid on the top of the circulator tubes 121. The intermediate portions of the tubes are supported by plates 512 and 513, also supported on the circulator tubes, the two plates 512 and 513 being joined by the plates that permit the gases to flow between the two plates and longitudinally of the superheater. A curved plate 514 preferably extends upwardly from the inlet header 52 of the superheater, to the roof portion 571, which prevents soot from precipitating on the headers and handhole fittings and provides an easy flow for the gases when they pass over the front end of the superheater. The outlet header 53 of the superheater may be directly supported upon the drum 10.

The flue 15 within which the economizer is located communicates at its lower end with an upwardly extending flue 59 within which is located an air heater 60 comprising a plurality of vertically extending tubes 61 connected at their upper and lower ends to tube sheets 62 and 63, respectively. The air inlet for the air heater is indicated at 64 and the air outlet therefor at 65.

In accordance with my invention, a soot hopper 66 is provided in the bottom wall of the flue 50 and between the superheater and the economizer in which dust carried over beyond the superheater tends to collect. The bottom of the hopper 66 is connected by a tube 67 to the flue 15 below the economizer, the tube preferably being provided with a damper 671 as illustrated. Any dust therein carried over past the superheater tends to pass through the hopper 66 and the tube 67, to the hopper 68, beneath the flues 15 and 59, and prevents or at least lessens the accumulation of dust and soot on the tubes of the economizer.

The operation of the device embodying my invention will readily be understood from the foregoing description and is as follows:

Feed water enters the lowermost header of the economizer 16 by a connection not illustrated, and passes back and forth through the tubes of the economizer in the manner hereinbefore indicated, to the upper header 161, from which it passes through the pipe 18, to the drum 11. From the drum 11 the water flows through the tubes 32, to the distributing header 31, and from thence through the tubes 29 and 30, to the headers 27 and 28, respectively, from which it flows upwardly through the tubes 33 and 34, to the headers 35 and 36. From the header 35 the water flows upwardly through the tubes 39, to the drum 10, and from the header 36 the water flows upwardly through the tubes 40, to the header 41, and from thence through

the slag screen tubes 42, to the drum 10. Water also passes from the distributing header 31, through the pipes 451, to the headers 45 and 46, from which it flows upwardly through the tubes 43 and 44, respectively, to the upper headers 47 and 48, and through the tubes 49, to the upper drum 10. It will, of course, be understood that circulation between the drums 10 and 11 takes place through the tubes 12.

The hot gases from the combustion chamber pass upwardly, first over the slag screen tubes 42 and then over the boiler tubes 12 and circulator tubes 121, thence the gases pass between the circulator tubes and over the superheater, at least a portion of the gases which pass upwardly over the superheater tubes to the left of the plates 513 passing between the tie pieces which join the plates 512 and 513 and between the two legs of the superheater and flowing longitudinally over the tubes thereof. The gases then pass downwardly over the tubes of the economizer and thence upwardly through the tubes of the air heater.

I claim:

1. A steam boiler comprising two drums connected by boiler tubes, a row of circulator tubes located above said boiler tubes, a superheater located above said circulator tubes, means for supporting the tubes of said superheater by said circulator tubes and for supporting the headers of said superheater directly above and by one only of said drums.

2. A steam boiler comprising two drums connected by boiler and circulator tubes, a horizontally extending flue located above the boiler, and a superheater comprising U-tubes extending longitudinally of said flue, the tubes of the superheater being supported by said circulator tubes and a header thereof being directly supported above and by one only of said drums.

3. In combination, a steam boiler and an economizer connected by a flue and over which the heated gases pass in succession, said economizer being located in a vertical flue, a soot hopper located in the flue between the boiler and the economizer and communicating with said vertical flue beyond the economizer, and a common means for removing soot carried through the economizer and the soot from said hopper.

4. In a steam boiler, a steam and water drum, a circulating system for said boiler comprising circulator tubes entering said steam and water drum, a superheater located above said circulator tubes and the tubes of which are supported thereon, and means for supporting the outlet header of said superheater above and on said drum.

5. In a steam boiler, a steam and water drum, a circulating system for said boiler comprising circulator tubes entering said steam and water drum, a horizontally extending flue located above said circulator tubes, a superheater located in said flue and the tubes of which extend longitudinally thereof, said flue extending beyond the ends of said tubes, the tubes of said superheater being supported on said circulator tubes, and means for supporting the outlet header of said superheater above and on said drum.

6. A steam boiler comprising two upper drums, one located at a higher level than the other, a bank of inclined tubes connecting said drums, circulator tubes extending upwardly from the lower drum and then horizontally and connected to the upper drum, a superheater located above said circulator tubes, the tubes of said superheater being supported on said circulator tubes, and the outlet header for said superheater being located above and supported directly on said upper drum.

7. A steam boiler comprising two upper drums, one located at a higher level than the other, a bank of inclined tubes connecting said drums, circulator tubes extending upwardly from the lower drum and then horizontally and connected to the upper drum, a superheater located above said circulator tubes and comprising headers located above said upper drum, one of said headers being supported directly on said uppermost drum, said superheater headers being connected by U-shaped tubes, and means for supporting said superheater tubes on said circulator tubes.

8. In combination, a boiler including horizontally inclined water tubes, a furnace therefor having an inclined floor and walls, a cooling system including water cooling tubes supporting the floor and a wall of the furnace, slag screen tubes, substantially parallel to said inclined water tubes and traversing the upper portion of the furnace chamber and connected in series with said cooling tubes, and connections for completing a natural circulation through said tubes.

9. In combination, a boiler including horizontally inclined water tubes, a furnace therefor having an inclined floor and walls, a cooling system including water cooling tubes supporting the floor and a wall of the furnace, slag screen tubes substantially parallel to said inclined water tubes and traversing the upper portion of the furnace chamber, the tubes for said floor and wall and the slag screen tubes being connected in series, and connections for completing a natural circulation through said tubes.

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