E. D. MEIER.

SUPERHEATER FOR BOILERS.

APPLICATION FILED AUG. 31, 1912.

1,114,785.

Patented Oct. 27, 1914.

2 SHEETS—SHEET 1.

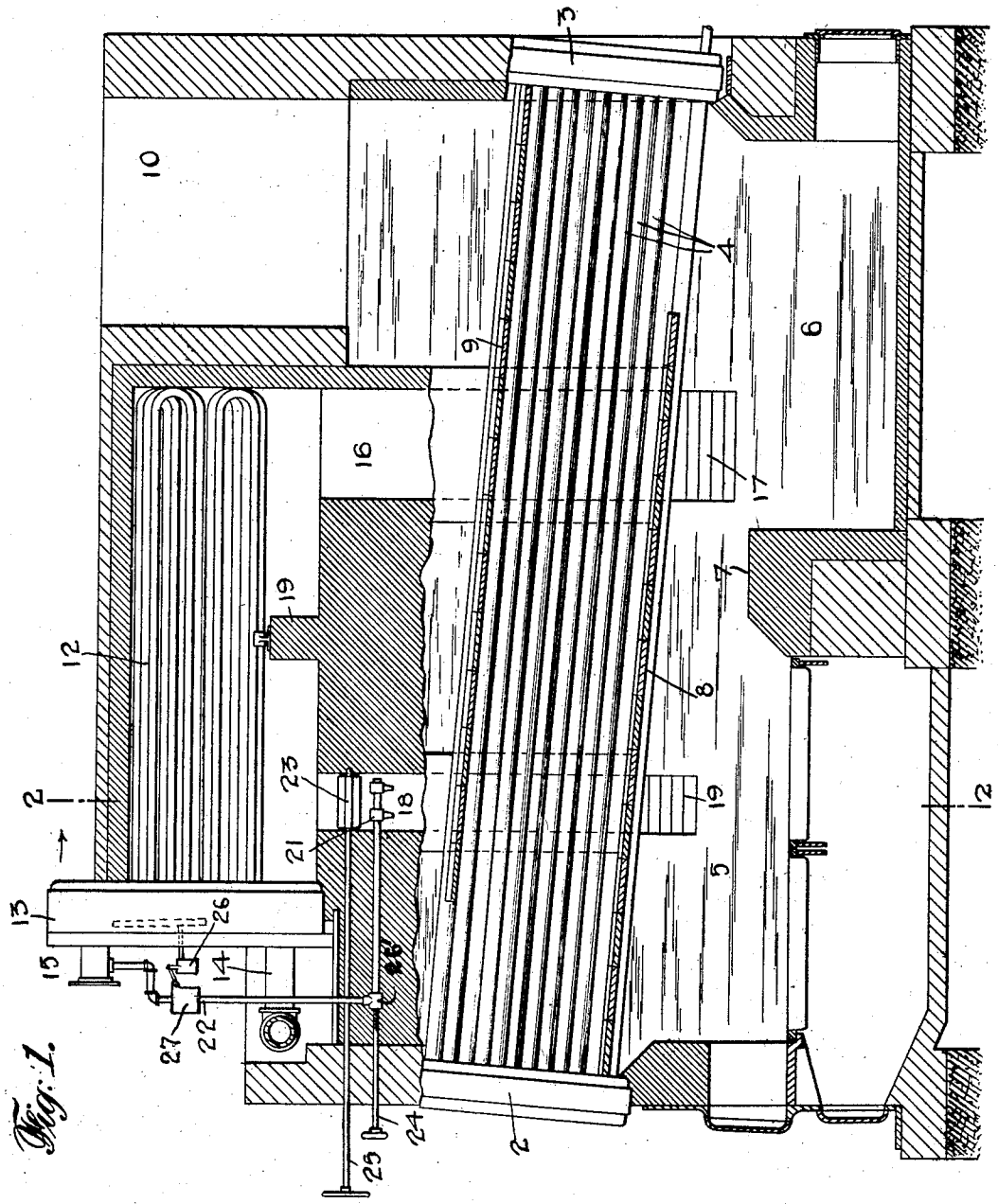


Fig. 1.

Witnesses:
Max P. A. Doring.
A. R. Kimball

Edward D. Meier Inventor

By Attorney Munson & Seaman

E. D. MEIER.

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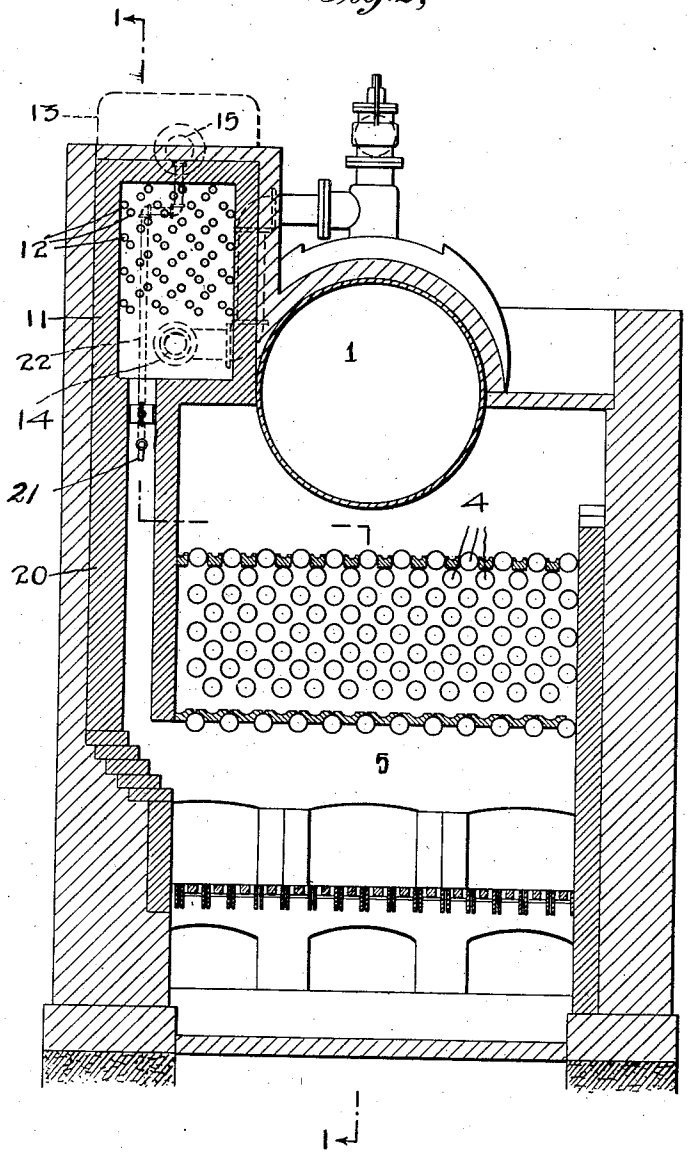
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2 SHEETS—SHEET 2.

Fig: 2,



Witnesses:
Max B. A. Doring
A. R. Kimball

Edward D. Meier Inventor

By Attorney
Thurston & Ames

UNITED STATES PATENT OFFICE.

EDWARD D. MEIER, OF RIDGEFIELD, CONNECTICUT.

SUPERHEATER FOR BOILERS.

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To all whom it may concern:

Be it known that I, EDWARD D. MEIER, a citizen of the United States, residing at Ridgefield, Connecticut, have invented the following-described Improvements in Superheaters for Boilers.

The object of the invention is to provide an efficient and compact combination of superheater and boiler wherein the degree of superheat is readily controllable, and obtained with the greatest economy, the combustion gases, after superheating the steam, being returned to the boiler proper from the superheater, where they are further utilized to stimulate the combustion and contribute to the heating effect.

The superheater employed herein comprises a bank of steam conducting elements inclosed in a hot-gas chamber, being so disposed and of such number that the greater portion of the chamber space is occupied by the hot combustion gases coming from the furnace, while only the smaller portion of the chamber is occupied by the elements containing the steam to be superheated, the total steam flow through the superheater being thus subdivided by the several conducting elements, which are uniformly distributed throughout the cross-section of the chamber. The chamber is built into the boiler setting above and at one side of the furnace, and the hot gases pass into and leave it by means of side wall flues which are incorporated in the structure of the setting. The flow of hot gases through the superheater is created and controlled by draft-inducing means, located in the path of the gases and preferably in the outlet side wall flue, suitable controlling means projecting through the front of the boiler setting, being provided for regulating the amount of draft, so that the degree of superheat can be controlled with substantial exactitude and within a wide range. In the most desirable construction the inlet flue for the superheater chamber leads upward from a point in rear of the fire-bridge, and the outlet or return flue from the chamber discharges at a point in front of the fire-bridge. Thus, the outlet flue discharges at a point in the path of travel of the boiler-heating gases in advance of the intake end of the inlet flue, so that a circulation of gases through the superheater and the hottest part of the furnace can be obtained.

In the accompanying drawings illustrating the invention: Figure 1 is a longitudinal section on the line 1—1 of Fig. 2; and Fig. 2 is a cross-section on the line 2—2 of Fig. 1.

The boiler is of the water-tube variety, and comprises a substantially horizontal drum 1, front and rear water-legs 2 and 3, and water-tubes 4 connecting the water-legs. The furnace proper, which may be of usual construction, has a fire-box 5, a combustion chamber 6, and the usual intervening vertical fire-bridge 7. The usual baffle 8 is supported on the bottom tier of water-tubes over the fire-box, and a second similar baffle 9 is supported on the top tier of water-tubes, being extended in the reverse direction, so that the gases from the fire-box flow in the customary tortuous manner, through the group of water-tubes and thence to the stack 10.

The superheater 11, located above the level of the water in the drum 1, and above and at one side of the furnace, as above stated, comprises a suitable bricked chamber extending fore and aft of the furnace, in a horizontal position and contains the steam-circulating elements 12, also disposed in a substantially horizontal position. The latter are U-shaped pipes, connected at their front ends to the header structure 13, which it will be understood comprises at least two chambers, one being connected with the drum by means of the steam pipe 14 and the other having the outlet 15, for connection with the service system. The U-pipes or elements 12 are staggered in the chamber and, as above stated, occupy but a small portion of the cubical space of the chamber, the greater part thereof being for unobstructed gas passage and through which the gases pass with sufficient slowness to be effective in efficiently transferring their heat to the steam.

The combustion gases pass to the superheater chamber from the furnace, through the uptake flue 16, which has its intake end 17 in rear of the fire-bridge 7 and discharges at its upper end into the rear part of the horizontal superheater chamber, the outlet from the superheater chamber being located at the forward part thereof, as a downtake flue 18. The gases pass from the rear forwardly through the superheater chamber and a transverse bridge or baffle 19 is placed midway therein, so that the hot

gases are caused to flow around and between the group of steam pipes before escaping. This baffle wall 19 may constitute a support for the steam tubes or it may be hung from them and it may extend across between the tubes as far upward as may be found desirable. The outlet side wall flue 18 discharges the spent superheater gases into the main body of combustion gases at a point where they are still capable of performing work, and preferably such gases are delivered at a point in advance of the intake end 17 of the inlet flue 16. In the most desirable construction the outlet end 19 of the said flue delivers at a downward inclination into or above the fire-box 5, where it directly encounters the flames rising from the fuel bed and by slightly agitating them stimulates the combustion.

The draft-inducing means consists of one or more small steam-jet nozzles located in the forward side wall flue 18, being supplied with steam from connections 22 with the superheater or elsewhere. This forward flue 18 is considerably smaller than the intake flue 16 in order to secure an effective entraining action of the steam jets on the gases and a somewhat forcible delivery of the same into the flame in the fire-box, while the relatively larger capacity of the flue 16 produces a relatively slow motion of the gases into the superheater chamber, but the provision of positive draft-producing means allows for both flues to be built within the thickness of an ordinary setting wall, and without increasing the length of a battery of boilers built side by side according to the usual custom. When so arranged the steam-jet pipes, incorporated in the structure of the setting, extend therein to the front walls of the boilers and wherein they are best protected from the intense heat when the steam is shut off. It will be understood that the arrangement of the superheater flues is such that there normally can be little or no natural draft through the superheater in the direction of the steam induced draft, and that the flow through the superheater may therefore be entirely created and controlled by the steam jet provisions, resulting in a positive control of the superheat by the appropriate regulation of the steam jets.

In order to provide means for isolating the superheater chamber from the furnace, a damper 23 is placed in the smaller outlet flue. This damper need be no larger than that flue—and hence is very easily operable and it can be operated by automatic regulating means as later described.

Both the steam nozzles 21 and the damper 23 have controlling means projecting through the front wall of the boiler setting. The former consists of a shaft 24 controlling a throttle or needle valve 26′, in the steam line 22, and by its rotation in obvious manner this shaft serves to vary the force of the steam-jet or jets.

The damper 23 is mounted on a damper axle 25 extending forwardly in the structure of the setting to the front of the furnace where a handle is provided at its end.

In operation, when the superheater is being employed, the aspirating action of the steam-jet or jets causes a portion of the hot gases flowing from the fire-box 5 to enter the intake end 17 of the side-wall flue 16, whence they enter the superheater chamber and flow over and around the steam pipes therein, thereby effectively superheating the steam. Although having given up heat in this manner, the gases are still of a high temperature, and this remaining heat is utilized by causing them again to enter the fire-box at 19, where they impinge upon and mingle with the hot gases rising from the burning fuel, passing therewith to the boiler and thence to the stack. The degree of superheat may be diminished or increased by regulating the force of the steam jet in the obvious manner or by adjusting the damper, or both, and the superheater may be cut out entirely by shutting off the nozzle supply, and preferably also, by closing the damper, though this may not be necessary.

The control just described particularly lends itself to regulation by automatic means, such as a thermostat or equivalent device, whereby a uniform superheat can be at all times obtained without special attention by the attendant. For this purpose the present invention includes, in combination with the induced draft construction above described, an automatic thermostatic regulator such as indicated at 26, and which comprises a suitable thermo-expansive member exposed to the superheated steam leaving the superheater and connected either mediately or immediately with the steam supply valve 27. This device is arranged in a well known manner so that increase of superheat will tend to restrict the flow of steam through the valve and decrease to enlarge such flow, similarly to the action of automatic steam heat regulators, which is well understood and need not be here described, but such control is subordinate to the hand control effected by the valve 26′ which can be set according to the requirement of the apparatus.

I claim:—

1. The combination with a steam-boiler furnace, of a superheater chamber above the same having a hot gas inlet flue in the rear of the furnace leading hot gases upwardly and discharging them into such chamber, and a forwardly located return flue leading downward from such chamber and discharging into the combustion space of the furnace at a point which is in

advance of the intake end of said inlet flue with relation to the path of the main body of combustion gases.

2. The combination with a water-tube boiler furnace having its tubes located in the path of the hot gases from the furnace, of a horizontally disposed superheater chamber with steam-conducting elements therein located above the boiler, a hot gas inlet flue leading upward from the furnace and discharging into the rear of said superheater chamber, and an outlet flue leading downward from the superheater chamber and discharging the gases therefrom into the combustion space of the furnace at a point which is in advance of the intake end of said inlet flue with relation to the path of the main body of combustion gases, and means for moving the hot gases through such flues.

3. The combination with a water-tube boiler and furnace having a suitable setting, of a superheater chamber with steam-conducting elements therein located at one side of and above the water level of the boiler, a side flue incorporated in the wall of the setting for leading hot gases into the superheater chamber, and a return flue from the said chamber leading downward through the setting wall and discharging back into the furnace at a point materially below the superheater chamber and in advance of the intake end of the inlet flue with reference to the path of the main body of combustion gases, and steam-actuated means for inducing a draft current through the superheater chamber.

4. The combination with a steam-boiler furnace having a fire-bridge, of a superheater chamber and inlet and return flues communicating each at one end with said chamber and at the other end with the furnace, the furnace ends of said flues being at approximately the same level and at opposite sides of the fire-bridge, and jet aspirating means for creating draft through the chamber.

5. The combination with a steam-boiler furnace, of a superheater chamber, both incorporated in the same masonry setting, an inlet flue leading upward from the furnace through the setting and discharging into the chamber, an outlet flue leading through the setting from the chamber and delivering into the lower part of the furnace at a point which is in advance of the intake end of the inlet flue with relation to the path of the main body of furnace gases, and steam-jet draft-inducing means in said outlet flue.

6. The combination with a steam-boiler furnace having a suitable setting, of a superheater chamber having an inlet flue leading upward from the furnace through a wall of the setting, an outlet flue leading downward through a wall of the setting and of less cross-sectional area than the inlet flue, and draft-inducing means in said outlet flue.

7. The combination with a steam-boiler furnace, of a superheater comprising steam-conducting elements and an inclosing gas chamber of which the greater portion is occupied by hot gases from the furnace and the smaller portion by steam distributed in said elements, an inlet flue arranged to conduct the hot gases from the furnace into said chamber, an outlet flue leading from the chamber, said inlet flue being of larger and said outlet flue of smaller cross-sectional area, and steam-jet draft-inducing means in the smaller flue.

8. The combination with a steam boiler furnace, of a superheater chamber having an inlet flue, an outlet flue of smaller cross-section than the inlet flue, steam-jet means in said outlet flue for inducing a flow of hot furnace gases through said chamber, and a damper in the same flue for cutting off the flow of gases through the superheater.

9. The combination with a steam-boiler furnace and boiler setting, of a superheater chamber having a flue, steam-jet means in said flue for inducing a flow of hot furnace gases through said chamber, a damper in the same flue for cutting off the flow of gases through the superheater, controlling means for the steam-jets and controlling means for the damper both projecting through the front of the boiler setting.

10. The combination with a steam-boiler furnace with a suitable setting, of a superheater chamber comprising a series of steam-conducting elements and an inclosing superheater chamber therefor of which the greater part is occupied by the hot furnace gases and a relatively smaller part by the steam in said elements, a flue built in the wall of the boiler setting and leading upwardly to such chamber, an outlet flue also in the wall of the boiler setting discharging into the furnace at a point which is in advance of the intake end of the inlet flue with relation to the path of the main body of furnace gases, and steam-jet aspirating means for inducing a draft of hot gases through said flues and chamber.

11. The combination of a steam-boiler furnace, a superheater chamber and suitable flues for conducting combustion gases to and through the same, a steam-jet device for inducing a draft through such flues and chamber, a thermostat subjected to the temperature of the superheated steam in such chamber, and means connecting such thermostat to control the steam supply to said steam-jet device.

12. In a steam-boiler furnace, a superheater chamber and controlled means for passing the furnace gases through the same, such means comprising inlet and outlet flues,

the discharge end of the outlet flue being in advance of the intake end of the inlet flue with relation to the main flow of combustion gases so that there is substantially no natural draft through the superheater, and an aspirating device, said means being arranged to produce the lowest velocity of gas movement in the superheater chamber and the highest in the outlet flue leading from the said chamber.

13. In a steam-boiler furnace, a superheater chamber, an inlet flue through which a portion of the furnace gases pass to such chamber, in combination with an outlet flue leading from such chamber to the fire-box of the furnace, and means for forcibly discharging the gases from said outlet into the flame above the fuel bed in said fire-box.

In testimony whereof, I have signed this specification in the presence of two witnesses.

EDWARD D. MEIER.

Witnesses:
G. A. TAYLOR,
K. L. GRANT.