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AIR PREHEATING MEANS FOR STEAM BOILERS

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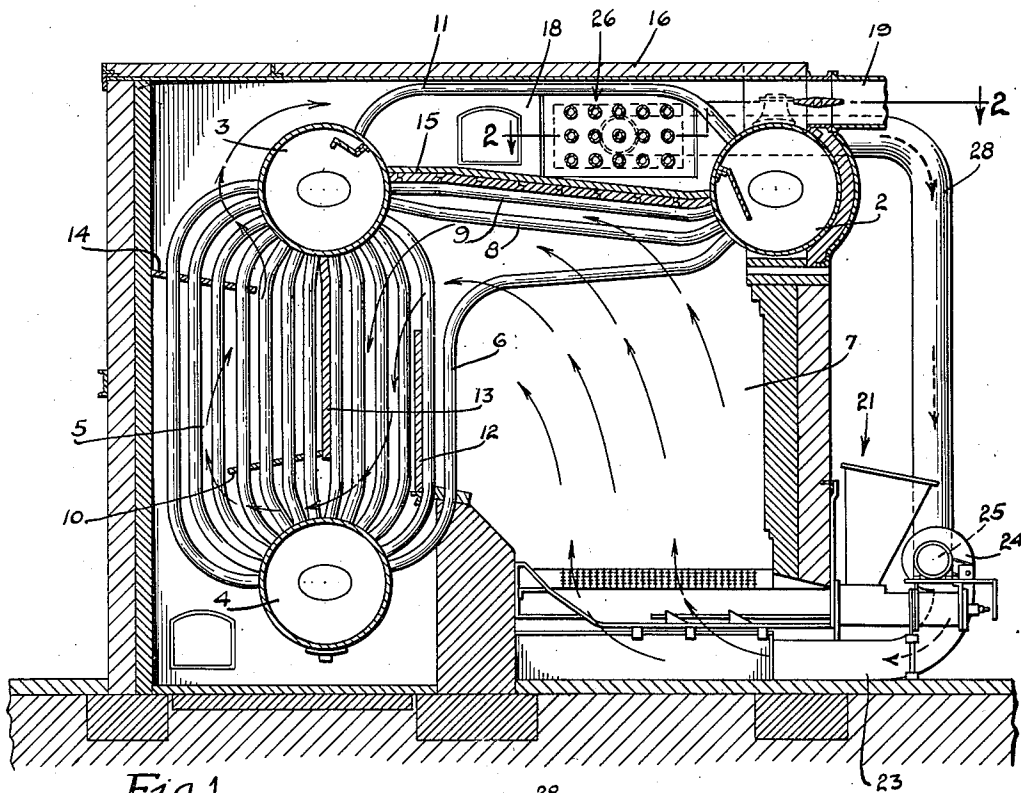


Fig. 1

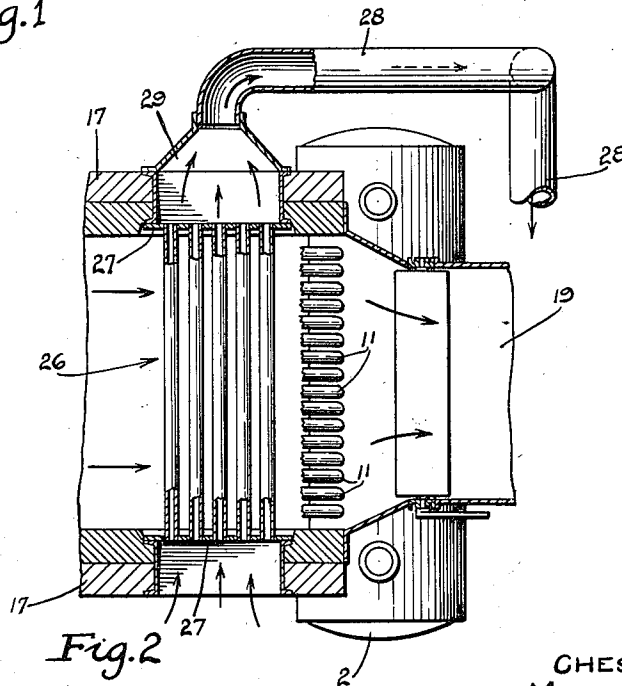


Fig. 2

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## UNITED STATES PATENT OFFICE

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## AIR PREHEATING MEANS FOR STEAM BOILERS

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7 Claims. (Cl. 122—336)

This invention relates to a new and novel apparatus supplying hot air to the stoker of a boiler to facilitate combustion and decrease flue gas temperatures so as to increase the overall efficiency of the boiler.

An object of the invention is to provide in combination with a water tube boiler comprising a furnace and a fuel feeding means, an air preheater including a plurality of air circulating tubes disposed within the casing of the boiler whereby they are exposed to the products of combustion passing from the furnace to the usual smoke outlet thereof, said air circulating tubes having a conduit connecting them with said fuel feeding means, whereby the air delivered into the stoker is drawn through said tubes and preheated to thereby facilitate combustion.

A further and more specific object of the invention is to provide in combination with a water tube boiler comprising front and rear steam drums, and a mud drum and a furnace having a fuel feeding means provided with an air intake, an air preheater comprising a bank of air circulating tubes disposed between the furnace and the smoke outlet thereof, whereby they are exposed to the products of combustion passing from the furnace to the smoke outlet, said tubes being open to the atmosphere at one end, and having a conduit connecting their opposite ends with the air intake of the fuel feeding means whereby the air delivered into the furnace will be drawn through said air circulating tubes and preheated.

A further object is to provide an air preheater adapted for use in connection with boilers of the general character disclosed in my pending application, Serial No. 682,817, filed July 29, 1933, without having to alter or change the construction thereof, and which comprises a bank of air circulating tubes so disposed that they will absorb the heat from the products of combustion which otherwise would be discharged through the smoke outlet as waste, and whereby said preheater may be operated without additional expense or equipment.

Other objects of the invention will appear from the following description and accompanying drawing and will be pointed out in the annexed claims.

In the accompanying drawing, there has been disclosed a structure designed to carry out the various objects of the invention, but it is to be understood that the invention is not confined to the exact features shown as various changes may be made within the scope of the claims which follow.

In the drawing:

Figure 1 is a sectional elevation of a boiler showing the invention applied thereto; and

Figure 2 is a detail sectional plan view on the line 2—2 of Figure 1, showing the preferred arrangement of the preheater in the upper portion of the boiler.

In the selected embodiment of the invention here shown, there is illustrated for purposes of disclosure, a boiler similar to the one disclosed in my above mentioned pending application. The boiler comprises front and rear steam drums 2 and 3, and a mud drum 4, shown disposed directly beneath the rear steam drum 3. Banks of water circulating tubes 5 connect together the rear drum 3 and the mud drum 4, and a bank of angular tubes 6 establishes communication between the mud drum and the front steam drum 2. These latter tubes provide water-cooled back and top walls for the furnace or combustion chamber 7. Other banks of tubes 8, 9, and 11 connect together the steam drums 2 and 3, as clearly shown in Figure 1.

Suitable baffles 10, 12, 13, and 14 are shown interposed between the tubes constituting the bank 5, and function to direct the products of combustion in a tortuous path, as indicated by the arrows in Figure 1.

A suitable wall 15 is shown interposed between the front and rear drums 2 and 3 and cooperates with the top wall 16 of the furnace casing and the side walls 17 thereof to provide a chamber 18 in which the upper bank of tubes 11 are disposed. The chamber 18 is connected at one end to the furnace 7 as will readily be understood by reference to Figure 1, and its opposite end is connected to a smoke outlet 19, shown disposed directly over the front drum 2. Thus, the products of combustion discharging from the furnace pass through the chamber 18 before it reaches the smoke outlet 19.

The furnace is shown provided with a suitable fuel feeding means, such as a conventional stoker, generally indicated by the numeral 21. This stoker is shown provided with the usual hopper 22, into which the fuel is delivered, and an air trunk 23 leading from a fan housing 24 provided with an air intake 25.

An important feature of this invention resides in the novel means provided for preheating the air delivered into the furnace 7 from the air trunk 23. As shown in the drawing, a bank of air circulating tubes 26 is disposed in the chamber 18 and have their ends suitably secured to plates 27 mounted in the side walls 17 of the furnace casing.

The air circulating tubes 26 are open to the atmosphere at one end, and their opposite ends are connected to one end of a conduit 28 by a suitable fitting 29. The opposite end of the conduit 28 is connected to the air intake 25 of the fan housing 24 so that when the stoker is operated, the air delivered into the combustion chamber 7 will be drawn through the air preheating tubes 26, by the fan 24, whereby it is preheated, as a result of the walls of said air circulating tubes being heated because of being disposed in the path of the products of combustion passing through the chamber 18.

Most boilers have the fault of too much draft rather than not enough, and the draft therefore has to be regulated by adjustment of the boiler damper. In a boiler of the type herein disclosed, the draft loss is very small so that continual use of the air preheater may be expected. By reason of the small size of this novel preheater, the air delivered to the furnace may be maintained at the desired temperature, about 200° Fahrenheit, without the use of additional draft equipment, such as an induced draft fan. Moreover, because of the low suction required, only a slight additional increase in the usual forced draft fan of the stoker is necessary. By utilizing the heat of the furnace gases for heating the preheater, and also by utilizing the hotter air from the top of the boiler room instead of the cooler air at the floor level thereof, an increase of 4% in the efficiency of the boiler is easily obtained. It will thus be seen that hot air is conveniently supplied to the furnace to facilitate combustion, at no additional expense. It is also to be noted that by thus connecting the preheater coils 26 to the fan intake 25 of the fan housing 24 of the stoker, no additional equipment or driving mechanism is required to operate the novel preheater herein disclosed.

It is a purpose of the invention to provide a small, inexpensive air preheater which may readily be utilized in connection with an ordinary tubular boiler at small additional cost, with a resultant increase in the efficiency of the boiler. The apparatus is very simple in construction and comprises few parts and does not require induced and special forced draft fans, which are costly to originally install, and also to operate. The invention is particularly applicable for use in connection with small and medium sized plants where a 4% gain in efficiency justifies a small expenditure, and where a multiplicity of equipment is undesirable.

The greatest effect in mounting the air preheating tubes in the path of the furnace gases traveling from the furnace to the smoke outlet is that they will absorb a substantial amount of the heat remaining in the exit flue gases, after the latter has passed over the boiler proper, whereby when the furnace gases eventually reach the smoke outlet 19, they will be comparatively cool, and a substantial amount of the heat of the products of combustion is thus utilized with a resultant increase in the efficiency of the boiler.

The apparatus is very simple and inexpensive in construction and may readily be applied to various types of boilers already in use without changing or altering the construction thereof.

I claim as my invention:

1. In a water tube boiler, a casing, a plurality of drums within said casing, two of which are disposed in the upper portion thereof, a furnace, a wall interposed between the drums in the upper portion of the casing and cooperating with

certain of the walls thereof to define a chamber communicating at one end with the furnace, a smoke outlet at the opposite end of said chamber, and a bank of air circulating tubes disposed in said chamber in the path of the products of combustion passing therethrough, said bank of tubes being open at one end to the atmosphere, means for feeding fuel into the furnace including an air supply means, and a conduit connecting the opposite ends of said bank of air circulating tubes with said air supply means, whereby the air delivered into the furnace is drawn through said air circulating tubes and preheated to thereby facilitate combustion.

2. In a water tube boiler, a casing, front and rear steam drums in the upper portion thereof, and a mud drum in the lower portion thereof, water circulating tubes interconnecting said drums, a furnace disposed beneath the steam drums and having means for feeding fuel thereto, a wall between said steam drums cooperating with certain walls of the casing to define a chamber communicating at one end with the furnace, a smoke outlet at the opposite end of said chamber and disposed substantially over the front steam drum, a bank of air circulating tubes mounted in said chamber transversely to the path of travel of the furnace gases therethrough, whereby the walls of said tubes are exposed to the heat of the furnace gases passing from the furnace to the smoke outlet, means for feeding fuel to the furnace, having an air intake, and means connecting said air circulating tubes to the air intake of said fuel feeding means, whereby the air delivered to the furnace is preheated to thereby facilitate combustion, and whereby a substantial amount of the heat of the furnace gases will be utilized before said gases reach the smoke outlet.

3. In a water tube boiler, a casing, front and rear steam drums in the upper portion thereof, a mud drum in the lower portion of the casing substantially directly below the rear steam drum, a furnace below and between said steam drums, a wall interposed between the steam drums and cooperating with the upper and side walls of said casing to define a chamber communicating at one end with the furnace, a front smoke outlet communicating with the opposite end of said chamber, means for feeding fuel to the furnace and having an air intake for supplying air thereto, a plurality of air circulating tubes disposed in said chamber and exposed to the products of combustion passing therethrough from the furnace to the smoke outlet, and a conduit connecting said air circulating tubes to the air intake of said fuel feeding means, whereby the air delivered to the furnace is preheated to facilitate combustion.

4. In a water tube boiler, a casing, front and rear steam drums in the upper portion thereof, a mud drum in the lower portion of the casing, a furnace below and between said steam drums, a wall interposed between the steam drums and cooperating with the upper and side walls of said casing to define a chamber communicating at one end with the furnace, a front smoke outlet communicating with the opposite end of said chamber, means for feeding fuel to the furnace and having an air intake for supplying air thereto, a plurality of air circulating tubes disposed in said chamber and exposed to the products of combustion passing therethrough from the furnace to the smoke outlet, said air circulating tubes being open at one end to the atmosphere, and a conduit connecting the opposite

ends of said air circulating tubes to the air intake of said fuel feeding means, whereby the air delivered to the furnace is preheated to facilitate combustion.

5 5. In a water tube boiler, a casing, front and rear steam drums in the upper portion thereof, a mud drum in the lower portion of the casing substantially directly below the rear steam drum, a furnace below and between said steam drums, 10 a wall interposed between the steam drums and cooperating with the upper and side walls of said casing to define a chamber communicating at one end with the furnace, a front smoke outlet communicating with the opposite end of said 15 chamber, a stoker for automatically feeding fuel to the furnace, said stoker having a fan for supplying air to the furnace, a plurality of air circulating tubes disposed in said chamber and extending from side to side thereof and open to 20 the atmosphere at one side of the boiler casing, said air circulating tubes being exposed to the products of combustion passing from the furnace to the smoke outlet, and a conduit connected to said air circulating tubes at the opposite side 25 of the boiler and to the air intake of the stoker, whereby when the latter is operating, said fan will deliver preheated air to the furnace chamber to thereby facilitate combustion.

30 6. In a water tube boiler, a casing, steam drums in the upper portion thereof, a furnace, a wall

interposed between said drums and cooperating with certain walls of the casing to define a chamber which communicates with the furnace, a smoke outlet at one end of the chamber, air circulating tubes in said chamber, open to the 5 atmosphere at one side of the boiler, and exposed to the products of combustion passing through the chamber, fuel feeding means including an air intake, and a conduit connecting said air intake to said tubes whereby preheated air is delivered 10 into the furnace from said tubes, when the fuel feeding means is operated.

7. In a water tube boiler, a casing, steam drums in the upper portion thereof, a furnace, a wall 15 interposed between said drums and cooperating with certain walls of the casing to define a horizontal chamber communicating at one end with the furnace and having a smoke outlet at its opposite end, air circulating tubes in said chamber, open to the atmosphere at one side of the 20 boiler and disposed in the path of the products of combustion passing through the chamber, fuel feeding means including an air intake, and a conduit connecting said air intake to said tubes 25 whereby preheated air is delivered into the furnace from said tubes, when the fuel feeding means is operated.

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