Jan. 19, 1943. J. KRUG ET AL 2,308,762

SUPERHEATER ARRANGEMENT AND SUPPORT THEREFOR

Filed March 5, 1940 2 Sheets-Sheet 1

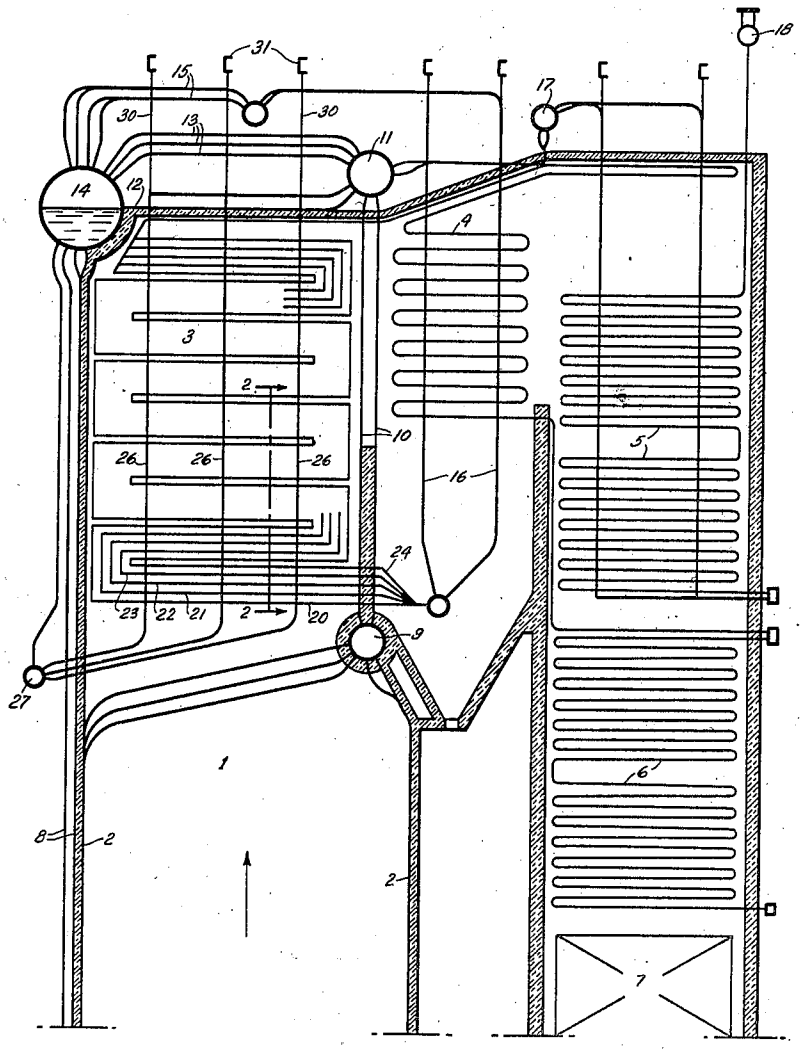

FIG. 1.

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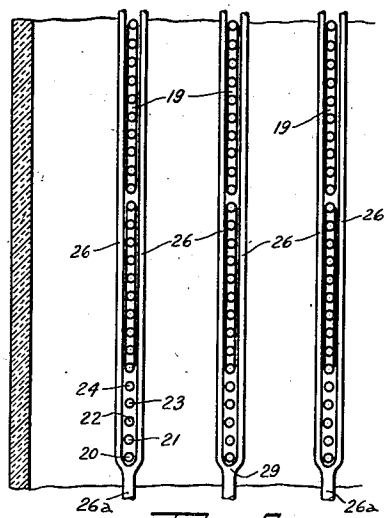

Fig. 2.

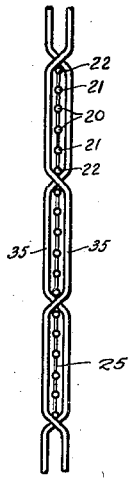

Fig. 5

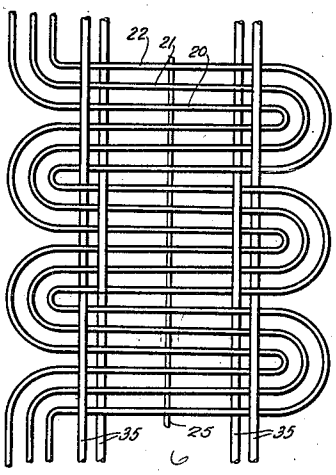

Fig. 6

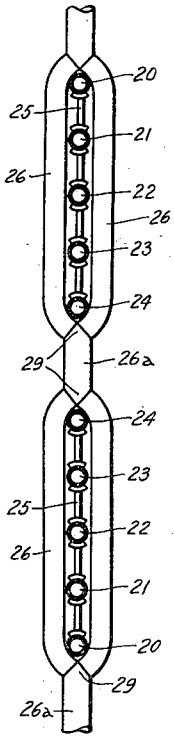

Fig. 3.

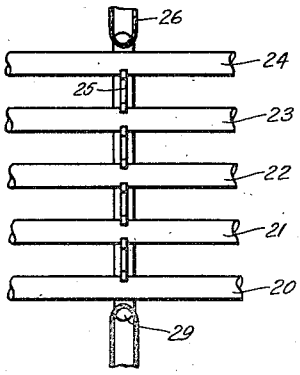

Fig. 4.

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UNITED STATES PATENT OFFICE

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SUPERHEATER ARRANGEMENT AND SUPPORT THEREFOR

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Application March 5, 1940, Serial No. 322,298
In Germany March 6, 1939

3 Claims. (Cl. 257—241)

The invention relates to superheaters for steam boilers and particularly those fired with pulverized fuel and having a furnace lined with water tubes.

In such boilers, especially those of high ratings, the usual convection type of superheater sometimes has insufficient heat absorbing surface to attain high superheat temperatures. Therefore, in some installations a portion of the superheater surface has been installed as a radiant heating surface, i. e., it has been located within the furnace. When this is done, however, complex pipe work is required outside of the boiler setting which occupies space and special heat resistant metals are required for the superheater. When firing certain kinds of coal in steam boilers, particles of fuel are carried up with the gas stream and deposit upon the heat absorbing surfaces of the boiler. It has now been discovered that within a certain temperature range of the furnace gases, the aforementioned fuel particles deposit particularly upon superheater tubes, while water tubes remain practically free. This may be because the outer surface of a water tube is too cold for an intimate building up of these fuel particles whereas the higher temperature of the superheater tubes is favorable to particle adherence thereon. It has also been found that the adhesion of these fuel particles no longer occurs when the fuel particles and likewise the carrying gas stream are cooled below a certain temperature.

According to this invention, more favorable circumstances are attained by locating the superheater, or a substantial part thereof, close to the furnace in the offtake therefor as a radiant superheater and arranged in the form of tube walls parallel to the flow of furnace gases and distributed across the flow of furnace gases in spaced relation at substantial distances apart. The remaining part may be retained as a convection superheater located in a zone where the gas has been cooled to such an extent that the fuel particles do not adhere thereto. In this way the furnace walls may be utilized for steam generating surfaces and this part of the boiler may be limited to the furnace. Even so a substantial portion of the heat will be transmitted to the superheater by radiation since between the superheater tube walls there flow gas layers of one-half meter or more in thickness. Also a substantial part of the heat is transmitted to the superheater tube walls by convection. By this arrangement the spaces between the superheater tube walls offer an opportunity for replacement and external cleaning thereof which is of importance when the boiler is being fired with pulverized fuel. The ash deposit on the tube walls when firing with pulverized fuel will be small in amount because the gas flow occurs in thick layers.

Structurally, each of the superheater tube walls is made up of several sinuous tube coils interwoven within a single vertical plane and connected in parallel with regard to steam flow. It is desirable to have the tube coils arranged substantially vertically in order to provide for draining the superheater.

It is of particular importance for this type of superheater arrangement and construction to have the superheater tube coils safely supported since the superheater tube walls are located in a gas stream of very high temperatures. According to the invention, this is accomplished in a very simple manner, the superheater tubes being carried by adjacent vertical riser tubes which are connected into the circulation system of the boiler. These carrier tubes, being simultaneously utilized as boiler surface, remain cool because of their capacity for heat absorption. They are arranged to embrace the tube walls at right angles to the superheater tubes, so that they prevent a sideward bowing of the superheater tubes. For this purpose the carrier tubes may consist of tube coils suspended from above and having vertical portions embracing the tube walls and bends passing under the tube walls. This type of carrier tube is particularly applicable when the boiler is a forced circulation or once-through type in which there is a forced water stream available for the carrier tubes. For boilers of natural circulation, it is recommended to use suspended carrier tubes which enclose the tube wall in pairs and which are bent across in pairs to the opposite sides of the tube walls so that the pair form a support for the tube coils. The carrier tubes may be built up as bifurcated tubes between which the superheater tubes are carried.

In all these means of support the lowermost superheater tube rests upon the bend of the carrier tube and the remaining tubes are supported from the lowest tube by intermediate spacers. In this way it becomes unnecessary to weld any kind of members, supports, etc., to either the superheater tubes or to the carrier tubes. The supported tube coils are free to expand upwardly and longitudinally. Likewise, the construction provides a simple assembly, since the tubes are

readily pushed into the needle eyes, as it were, of the carrier tubes.

These arrangements for supporting tube coils may be used also for the support of boiler coils or economizer coils.

The invention is illustrated in the accompanying drawings in which:

Figure 1 is a diagrammatic view, partly in vertical section, of the upper part of a steam boiler embodying the invention;

Figure 2 is a section on line 2—2 in Fig. 1;

Figure 3 is a sectional elevation of a modified form of tube support shown on an enlarged scale;

Figure 4 is a fragmentary side view corresponding to Fig. 3;

Figures 5 and 6 are a sectional side view of a further form of the superheater support.

The boiler shown in Fig. 1 consists of a furnace 1 provided with wall tubes 2, a radiant superheater 3, an economizer 4, a convection superheater 5, an economizer 6 and an air heater 7, all of which are heated by the furnace gases in the order named. The generating tubes 2 supplied with boiler water from downcomers 8, deliver to the intermediate drum 9 from which the steam-water mixture flows via tubes 10, drums 11, and tubes 12 and 13, to the steam and water drum 14. Tubes 15 and 16 convey the steam thence to superheater 3 from which the steam passes through header 17 and the convection superheater 5, to the steam off-take 18.

The radiantly heated superheater consists of several vertical tube walls 19, Fig. 2, arranged across the flow of furnace gases and spaced a substantial distance apart. Each wall 19 is made up of several sinuous tube coils 20—24 connected in parallel with respect to steam flow and interwoven or nested in a vertical plane as shown in Fig. 1. Generating tubes 26 rise upwardly at right angles to and closely adjacent the superheater tube walls and are arranged in pairs to embrace a superheater tube wall. Tubes 26 receive water from drum 14 via a header 27 and discharge into drum 11. By such connection a complete water circulation within tubes 26, from and back to drum 14 occurs in accordance with the amount of heat absorbed by the tubes 26 from the flue gases. At intervals the tubes 26 are arranged in bifurcated relationship, being joined to common connectors 26*a*. At points where the bifurcations are located a tube of one coil as 20, rests upon the bifurcation 29, and the remaining tubes, those of the coils 21—24 are supported on each other by means of the intermediate spacers 25 which may be loosely inserted. It is advantageous to have the spacers 25 located between the carrier tubes 26 so as to protect them from the hot gases by surrounding them on all sides with heat absorbing tubes. At their upper ends the carrier tubes 26 are suspended from the boiler framework 31 by means of hangers 30, so that the weight of the superheaters is carried by the frame work.

What we claim is:

1. A superheater comprising tubes interconnected by return bends and disposed in vertical rows spaced at intervals greater than twice the tube diameter; and a pair of water tubes lying alongside of and embracing each row of superheater tubes and having portions thereof offset to form a rest on which at least the lowest one of several superheater tubes in each row are supported.

2. A superheater in accordance with claim 1, characterized in that supporting tubes embrace the tube walls in pairs offset at intervals toward opposite sides of the tube wall so that a pair form a support for the tube wall.

3. A superheater in accordance with claim 1, characterized in that a superheater wall is supported by bifurcated tubes with superheater tubes resting in the crotches of the bifurcations.

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