April 18, 1939. V. W. MORAY 2,154,764

FLUID HEATER

Filed Feb. 3, 1937 2 Sheets-Sheet 1

Fig. 1.

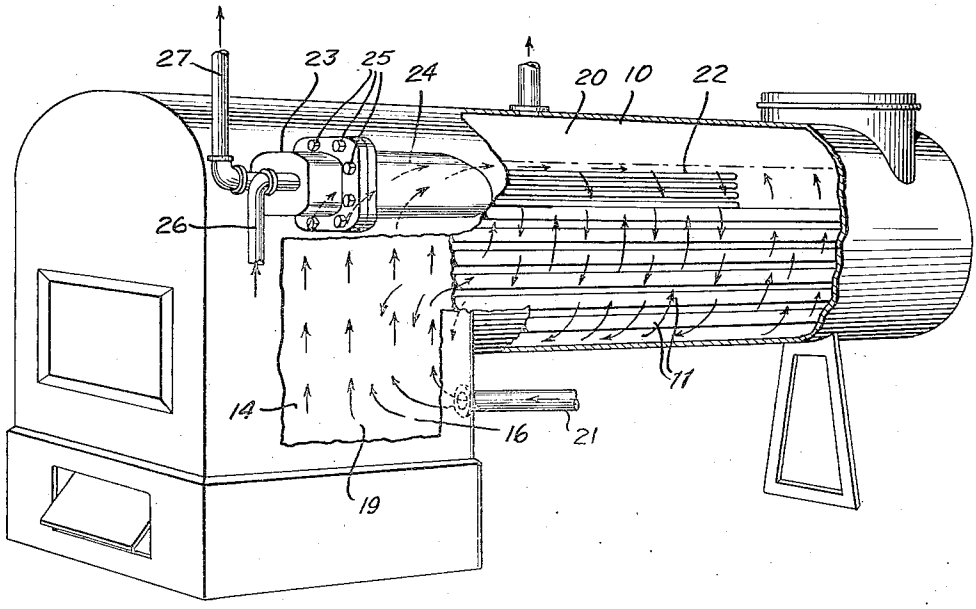
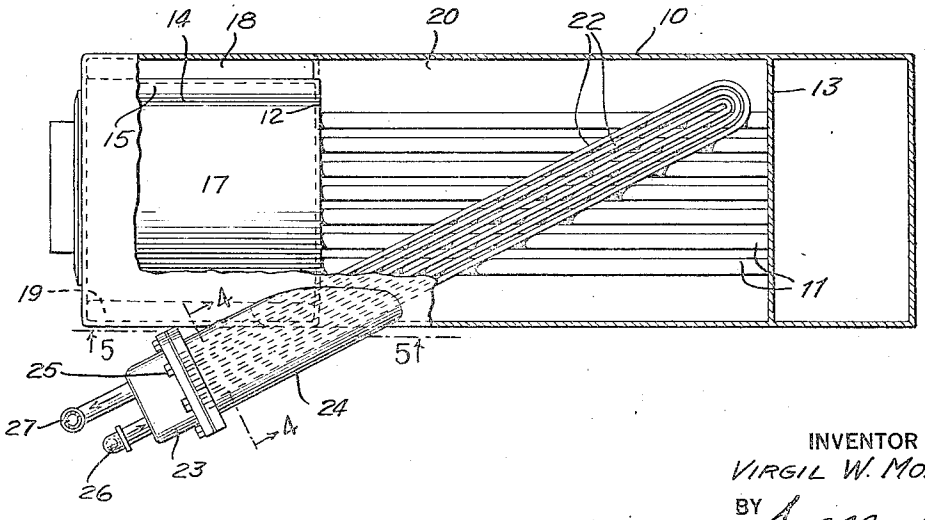


Fig. 2.



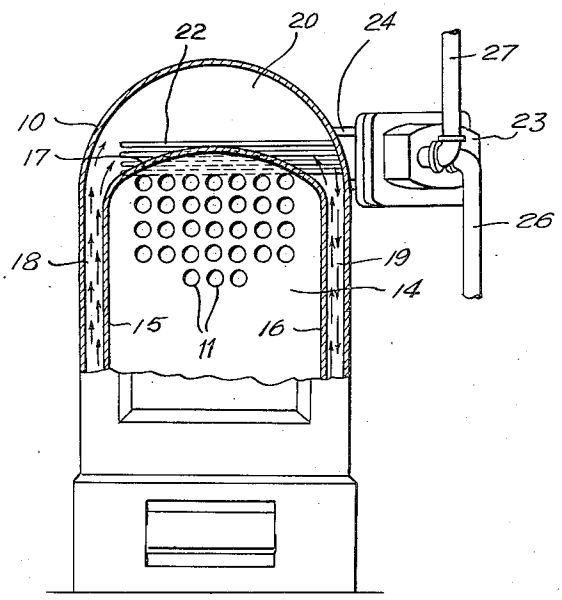
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Filed Feb. 3, 1937 2 Sheets-Sheet 2

Fig. 3.



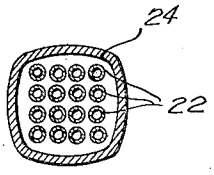


Fig. 4.

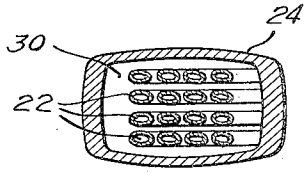


Fig. 5.

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2,154,764

FLUID HEATER

Virgil W. Moray, Bronx, N. Y., assignor to Akwa Heaters, Inc., New York, N. Y., a corporation of New York

Application February 3, 1937, Serial No. 123,794

5 Claims. (Cl. 122—32)

This application is a refile of my earlier application Serial No. 29,814, filed July 5, 1935.

The invention relates to fluid heaters and more particularly pertains to steam boilers and water heaters and to auxiliary means for heating water or other fluids.

The invention provides a novel arrangement of auxiliary fluid heating coils in steam boilers and the like, which provides certain advantages over arrangements heretofore in use. One of the important advantages is that the presence of the auxiliary coil in the steam boiler increases the boiler efficiency for the reason that the coil enhances the normal circulation of water in the boiler both in point of velocity and volume. Other advantages are: A relatively long heating coil may be installed from the side of the boiler; the heating load on the boiler is distributed over a large area within the boiler, thereby increasing the efficiency of the boiler; the coil may be installed from the side of a boiler notwithstanding the presence of walls or other obstructions disposed closely adjacent one or more sides of the boiler; a comparatively small sleeve adapter for the coil will be sufficient which will reduce the cost of the coil; the sleeve adapter may be so shaped and attached to the boiler shell that rapid circulation of boiler water is obtained, thereby materially contributing to the heating efficiency; the auxiliary coil may be readily removed for repair or other purpose merely by detaching the coil head from the sleeve adapter, and since the coil is installed from the side of the boiler, no protecting means are necessary to prevent corrosion of the coil head.

The invention will be understood from the following description considered in connection with the accompanying drawings forming a part thereof, which illustrate a preferred arrangement of a boiler and auxiliary fluid heating coil, and in which:

Fig. 1 is a perspective view with parts of the boiler shell broken away, of a fire tube boiler having a submerged fluid heating coil arranged and disposed in accordance with the present invention;

Fig. 2 is a plan view of the boiler shown in Fig. 1 with parts of the shell broken away;

Fig. 3 is a front end view of the boiler with part of the shell broken away;

Fig. 4 is a sectional view taken on line 4—4 of Fig. 2, and

Fig. 5 is a sectional view taken on line 5—5 of Fig. 2.

Like characters of reference refer to the same parts throughout the several views.

Referring to the drawings, reference character 10 designates the shell of a fire tube boiler having fire tubes 11 extending longitudinally thereof between spaced tube sheets 12 and 13. The front end of the boiler is provided with a fire box 14 having side walls 15 and 16 which are connected at their upper ends by a crown sheet 17. The side walls 15 and 16 are spaced from the shell 10 to provide water legs 18 and 19 which communicate at their upper ends with the steam and water space 20. The volume of water in the boiler is maintained substantially at the level L (Fig. 3) or at any other level which is sufficiently high to cover the tubes of the auxiliary heating coil to be described. A steam return line 21 is connected into the bottom of the rear water leg of the boiler.

In the arrangement shown, the tubes of the auxiliary heating coil are arranged obliquely at an angle of substantially 45° to the direction of extent of the boiler tubes. It will be understood however, that the tubes of the coil may be disposed at other oblique relationships, or at any desired acute angle to the boiler tubes between substantially right angular and substantially parallel positions.

The auxiliary fluid heating coil shown comprises a plurality of loop tubes 22, the ends of which are secured to a coil head 23 which is detachably secured to the flanged outer end of a coil sleeve adapter 24, the inner end of which is welded to the boiler shell 10. In this instance, the sleeve 24 is of substantially rectangular configuration in transverse cross-section with arcuate walls as shown in Fig. 5, but may be of other configurations, such as circular, if desired. The coil tubes 22 are inserted through the sleeve adapter 24 and the head 23 is bolted to the sleeve by a plurality of nuts and bolts 25. The sleeve adapter need only be long enough to permit the ready securement of the coil head to the sleeve, but it may be of any convenient or desired length. Fluid to be heated is supplied to the coil through a pipe 26 and the heated fluid is withdrawn through pipe 27. The coil may be arranged for a single pass of the fluid through the tubes thereof as shown, or it may be arranged for a plurality of passes. The coil tubes are made as long as is practically possible to provide the greatest possible area of heating surface for the coil within the boiler. The tubes of the auxiliary coil may rest upon the boiler tubes 11 or suitable

means may be employed for supporting the coil out of contact with the boiler tubes.

With the auxiliary heating coil arranged and disposed as illustrated in the drawings, the normal circulation of the water in the boiler is increased in point of velocity and volume and additional boiler water circulation is set up. This is due to the fact, as shown by the arrows on the drawings indicating the direction of flow of the water during operation of the boiler, that the auxiliary heating coil surface is so disposed that the hot water in the boiler upon coming in contact with the tubes of the coil and giving up part of its heat to the coil tubes and the fluid flowing therethrough, flows downwardly in the boiler in the rear part thereof due to thermosyphon action. This cooled, downwardly flowing water, makes for a greater temperature difference between the boiler water and the expanding gases within the boiler tubes, thereby increasing the absorption of heat by boiler water. This increased temperature difference is especially important because the gases within the tubes are relatively cool as compared with the temperature of the burning gases within the fire box. Also as indicated in the drawings, the downward circulation of boiler water in the rear portion of the boiler is in a direction toward the water legs and thereby increases the rate at which the water rises in the water legs. More specifically the auxiliary coil is not disposed directly above the crown sheet 17, so that there will be no fall of relatively cold water from the tubes of the coil onto the crown sheet. Since heat is transferred from the combustion gases through the crown sheet at a high rate, the normal circulation of water in the boiler will be upwardly and toward the rear of the boiler from the crown sheet. Should any substantial part of the auxiliary coil surface be disposed above this crown sheet, it will be apparent that counter-currents will be set up with respect to the normal boiler circulation which will adversely affect to a material extent the efficiency of the boiler. With the coil disposed as shown in the drawings, that part of the coil within the boiler which is in the vicinity of the crown sheet is disposed over the water leg 19 so that the boiler water which is cooled by contact with the coil will flow downwardly along the outside of the water leg, as indicated in Fig. 3, along with the water from the rear part of the boiler which flows toward the water legs. It will be observed, that the cool water in water leg 19 flows downwardly in contact with the outer shell 10 and the hot water flows upwardly in both water legs 18 and 19 along the inner portions thereof adjacent the side wall 16, so that cool water does not come in contact with the heated surfaces surrounding the fire box.

With the coil arrangement disclosed, it will be perceived that a relatively long coil may be installed in a boiler through the side of the boiler shell. Also, as will readily be seen from an inspection of Fig. 5, the area of the opening 30 between the coil sleeve 24 and the boiler 10 is comparatively large thus permitting rapid circulation of the boiler water through the coil sleeve and high efficiency of heating of the fluid in the coil. It will also be perceived that since the tubes of the heating coil extend through a large area of the boiler, the heating load on the boiler will be distributed with the result that greater boiler efficiency is obtained. Moreover, the heating coil may readily be installed in the boiler and removed therefrom when the boiler is flanked by walls disposed closely adjacent thereto. To remove the coil, it is only necessary to unbolt the head from the coil shell and the entire unit may be removed.

Although an auxiliary heating coil having straight tubes is disclosed, it will be understood that curved tubes may be utilized as well. For instance, the coil may be inserted through the side wall of the boiler shell with the portions of the coil tubes adjacent the head disposed obliquely to the boiler tubes and with the other portions of the tubes being curved so that the desired length of coil may be installed in the boiler. As an example of this arangement, the tubes of the coil may extend from the coil head obliquely to the boiler tubes adjacent the head and then may be curved so that the ends of the tubes remote from the coil head are parallel or substantially parallel to the boiler tubes.

By the expressions "oblique" or "obliquely" as used herein and in the claims, is meant the disposition of the coil tubes, or the portions thereof adjacent the head end, with respect to the boiler tubes so that the coil tubes are positioned at an angle to the boiler tubes between a substantially right angular position and a parallel position regardless of the particular direction in which the tubes of the coil extend. These expressions are also intended to include auxiliary fluid heating coils having curved tubes or curved portions of tubes as hereinbefore mentioned, wherein the tubes are installed through the side of the boiler shell obliquely to the boiler tubes.

In some instances, it may be desirable to arrange the coil so that part of the coil is above a part of the crown sheet of the fire box. One such arrangement would result from installing the coil so that it passed through the boiler shell at a point more forward of the boiler than illustrated in Fig. 2, in order that the coil would pass over a corner of the crown sheet. This arrangement would operate satisfactorily, but the boiler efficiency would not be quite as great, due to the fall of cool water from the coil onto the crown sheet. However, such an arrangement when the greater part of the area above the crown sheet is free of coil tubes, is within the scope of the invention.

It will be understood that auxiliary heating coils of the character disclosed may be installed in forms of boilers other than those herein described and illustrated and that forms of heating coils other than those included herein may be employed. Accordingly, it is intended that no limitation be placed upon the invention excepting by the scope of the appended claims.

What is claimed is:

1. A boiler comprising a shell, a fire box in the shell, fire tubes in the shell at least some of which extend substantially horizontally from one end of the fire box, and an auxiliary fluid heating coil having substantially horizontally extending tubes in the shell arranged obliquely to the fire tubes and disposed substantially entirely in the zone of the horizontally extending fire tubes.

2. A boiler comprising a shell, a fire box in the shell, fire tubes in the shell at least some of which extend substantially horizontally from the fire box, and an auxiliary fluid heating coil having substantially horizontally extending tubes in the shell arranged obliquely to the fire tubes and disposed above the fire tubes and substantially entirely within the zone of the horizontally extending fire tubes.

3. A boiler comprising a shell, a fire box in the

shell, fire tubes in the shell at least some of which extend substantially horizontally from one end of the fire box, and an auxiliary fluid heating coil having substantially horizontally extending tubes which extend through a side wall of the shell with portions thereof within the shell arranged obliquely to the fire tubes and disposed substantially entirely within the zone of the horizontally extending fire tubes.

4. A boiler comprising a shell, a fire box in the shell, fire tubes in the shell at least some of which extend substantially horizontally from one end of the fire box, and an auxiliary fluid heating coil having substantially horizontally extending tubes in the shell submerged in the water therein and arranged obliquely to the fire tubes and disposed substantially entirely in the zone of the horizontally extending fire tubes.

5. A boiler comprising a shell, a fire box in the shell, fire tubes in the shell at least some of which extend substantially horizontally from one end of the fire box, the shell having an opening in the side thereof above the fire tubes, a sleeve adapter secured to the shell so as to cover the opening and having its longitudinal axis disposed obliquely to the longitudinal axis of the boiler, and a fluid heating coil extending through the sleeve adapter into the shell and above the fire tubes and connecting with a coil head secured to the adapter, the tubes of the coil extending substantially horizontally and being disposed obliquely to the horizontally extending fire tubes.

VIRGIL W. MORAY.