April 18, 1933. W. H. ARMACOST 1,903,970

SUPERHEATER ARRANGEMENT FOR CYLINDRICAL SHELL BOILERS

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Fig. 1.

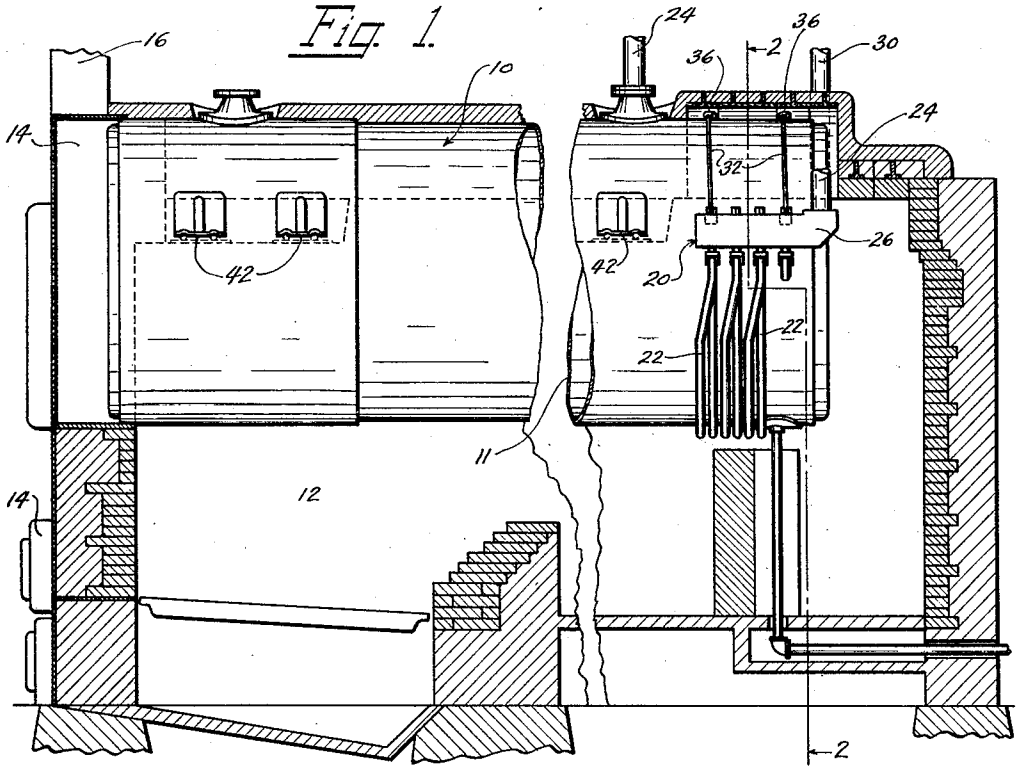

Fig. 2.

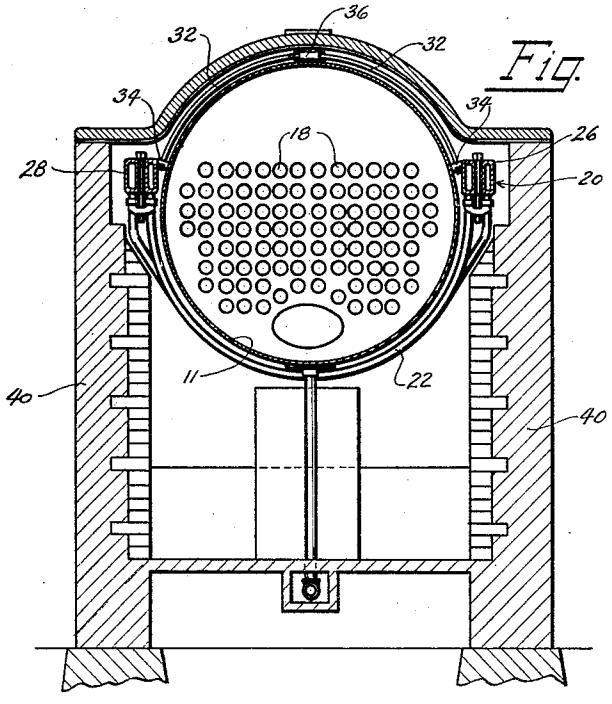

Fig. 2A.

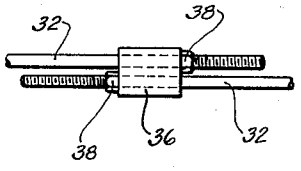

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Fig. 3.

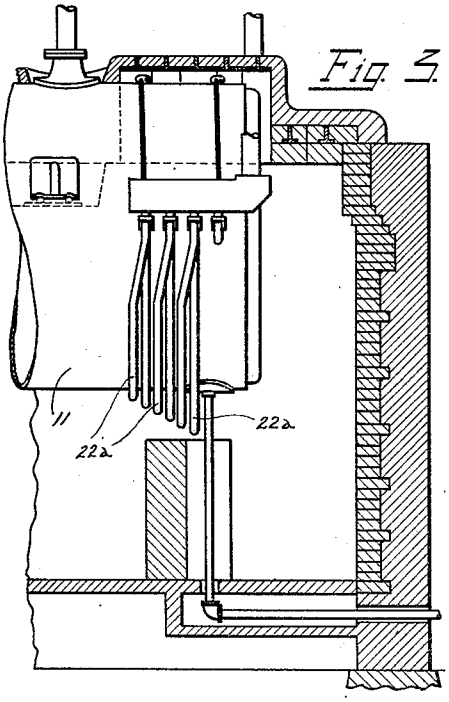


Fig. 4.

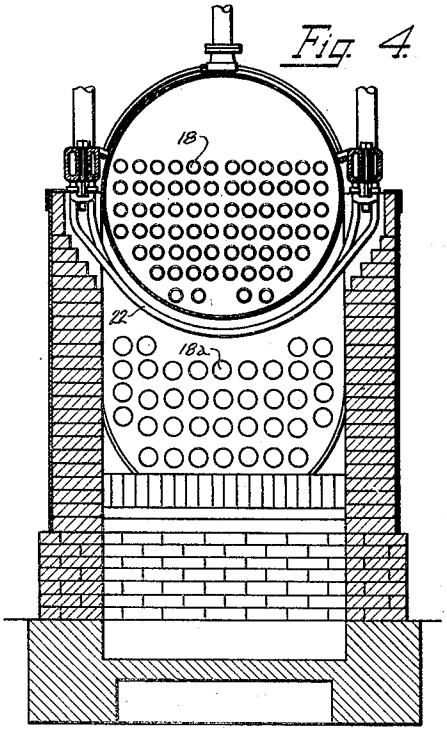
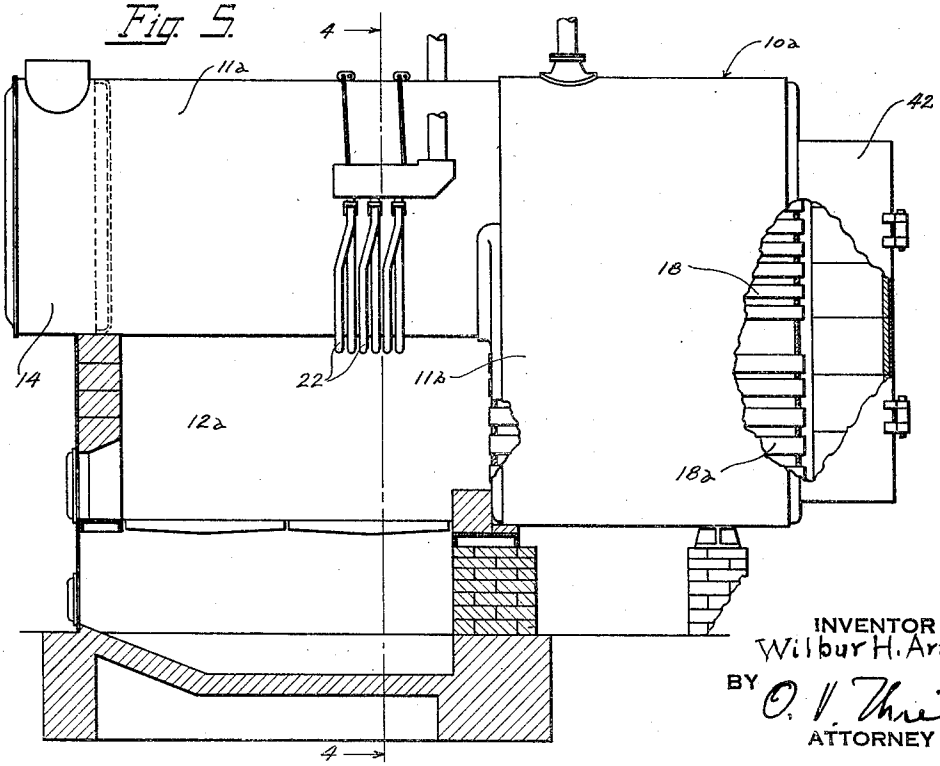


Fig. 5.



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Patented Apr. 18, 1933

1,903,970

UNITED STATES PATENT OFFICE

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SUPERHEATER ARRANGEMENT FOR CYLINDRICAL SHELL BOILERS

Application filed April 25, 1932. Serial No. 607,334.

A number of superheater arrangements have been proposed for boilers of the cylindrical drum type having one or more return fire-tubes and the fire-box beneath and outside the drum. The prior superheater arrangements for such boilers have either developed excessive metal temperatures when the boiler is being forced or have required a relatively large amount of tube surface to produce the desired degree of superheat. Many of such arrangements, moreover, have been difficult to apply to a boiler which may have been installed without a superheater.

It is the principal object of my invention to provide a superheater arrangement for externally fired drum type fire-tube boilers which shall avoid the above mentioned difficulties.

The novel features of my invention are pointed out in the appended claims. In order, however, that the invention, together with its objects and advantages, may be more clearly understood, I will now describe in detail and in connection with the accompanying drawings several arrangements of boiler and superheater selected by way of example from among a number of possible embodiments of my invention. In the drawings,

Fig. 1 is an elevational view of a horizontal return tube boiler having a superheater in accordance with my invention applied thereto.

Fig. 2 is a section on the line 2—2 of Fig. 1, looking in the direction of the arrows.

Fig. 2A is a detail plan view of one of the turnbuckles appearing in Fig. 1.

Fig. 3 is a fragmentary view of a boiler similar to that of Fig. 1 and having a modified form of superheater associated therewith.

Fig. 4 is a vertical sectional view on the line 4—4 of Fig. 5, of another form of boiler but having a superheater in accordance with my invention associated therewith.

Fig. 5 is an elevational view of the apparatus shown in Fig. 4.

Referring more particularly to Figs. 1 and 2, 10 is a boiler having a horizontal shell 11 of cylindrical form and having a furnace chamber 12 and a fire door 14 at the front end of the boiler setting. Heating gases from furnace 12 pass rearwardly from the furnace beneath the shell 11 to the rear end thereof and thence pass thru one or more fire tubes within the shell 11 to a breeching 14 at its front end and thence out thru stack 16. As appears in Fig. 2, boiler 10 has a large number of comparatively small fire tubes 18, 18, but I do not limit myself to this.

In accordance with one form of my invention, the superheater 20 is placed on the outside of the boiler shell somewhat to the rear of the furnace 12. Superheater 20 comprises a number of units 22, 22, each of which is bent to the same contour as the external surface of the shell 11. In the arrangement shown, steam passes from boiler 10 thru a pipe 24 to an inlet header 26 and thence thru the units 22 to an outlet header 28, from which the superheated steam is discharged to the point of use by a pipe 30. In such arrangement, the headers for the units are on opposite sides of the boiler drum, but I do not limit myself to this. Such an arrangement of the headers lends itself however to a method of supporting the superheater whereby its position can be very conveniently adjusted. In the arrangement shown, curved rods 32, 32 are connected to headers 26 and 28 at points 34, 34 and run upwardly parallel to the surface of the shell 11 to points at the top of such shell where the rods 32 pass thru turnbuckles 36, 36. One of turnbuckles 36 is illustrated in detail in Fig. 3. Rods 32 are threaded at their ends and extend thru and beyond the turnbuckles so that nuts 38, 38 on the rods 32 can be adjusted to not only cause rods 32 to support the superheater 20 on shell 11 but also to determine the distance of the elements 22 from the outer surface of the boiler shell. By changing the distance between the elements 22 and the drum, the temperature of the steam delivered from the superheater at a given load on the boiler will be varied due to the fact that the counter radiation from the

elements 22 to the water cooled shell 11 varies with such distance.

Preferably the headers 26 and 28 lie slightly above the horizontal central plane of the boiler so that they may be installed in an existing boiler plant with a minimum disturbance of the setting. The ordinary horizontal return tubular boiler has a setting which includes side walls 40, 40 and the boiler shell has brackets 42, 42 fixed thereto which transfer the weight of the boiler to side walls 40 at a level approximately that of the horizontal central plane of the shell. Therefore, a superheater in accordance with my invention can be adapted to an existing installation merely by tearing out two small holes in the setting on each side. After the headers and units have been put in place, such holes can be easily patched up with a minimum amount of labor.

Another advantage of bending the units 22 to the same contour as that of the boiler drum is that it makes it possible, when there is very little clearance, to install such units by first placing them in an inverted position over the top of the boiler and then sliding them around the drum.

The arrangement shown in Fig. 3 is the same as that in Figs. 1 and 2 except that the superheater units 22*a* are not all of the same length, some having a greater radius of curvature than others. As shown, the unit nearest the fire-box has the shortest radius and lies nearest the boiler shell 11, and those progressively farther from the fire-box are progressively longer and lie farther away from the shell 11, so that elements 22*a*, as shown, shield each only slightly from the gas flow. The arrangement of Fig. 3 therefore is well adapted to produce a high degree of superheat. Moreover, the unit 22*a* which is farthest from the furnace being also farthest from the shell 11, the metal and the several units 22*a* are at nearly the same temperature.

In the arrangement of Figs. 4 and 5, the boiler 10*a* has a cylindrical shell portion 11*a* beneath which is a furnace chamber 12*a*. At the rear of furnace 12*a* boiler 10*a* has a shell portion 11*b* having an oval cross-section, and within which is a group of fire tubes 18*a* for conducting hot gases from furnace 12*a* to a smoke chamber 42 at the rear of boiler 10*a*. From chamber 12*a*, the gases flow thru tubes 18 to a breeching 14 at the front of the boiler. In the arrangement illustrated in Figs. 4 and 5, the superheater lies beneath the boiler section 11*a* and above the fire-chamber 12*a*. The superheater elements 22 are preferably of exactly the same type as those illustrated in Fig. 1, but owing to their location, the superheater of Figs. 4 and 5 has a partly radiant characteristic. If desired, the superheater elements 22 of Figs. 4 and 5 may be placed adjacent the front wall of furnace chamber 12*a* to thereby produce a superheater having almost an entirely radiant characteristic.

It will be seen that the superheaters 20 have their units 22 connected to headers 26 and 28 in two parallel rows so that alternate units have their ends bent out away from the drum and into the same transverse plane as one of the other units. Also, pipes 24 and 30 connect into headers 26 and 28 respectively at the ends of the latter. Furthermore, the drawings show the units 22 as connected to the headers 26 and 28 by disconnectable joints. It will be understood, however, that I do not limit myself to any of these features.

It will be evident also that the adjustment of superheater units toward or away from the generating surface of the boiler as to which they lie in radiating relationship necessarily affects the final steam temperature. I find that a material change may be made in the final steam temperature by such an adjustment without shifting the superheater units so far away from the water cooled surface of the boiler as to cause too high a metal temperature in the superheater units due to insufficient re-radiation from the units to the boiler surface. However, I do not claim such adjustment herein, but have claimed it broadly in my co-pending application, Ser. No. 646,071, filed December 7, 1932, for superheater with adjustable counterradiation.

It is evident further that the ball joints shown between the superheater units and headers are adapted to permit the units to be swung somewhat in their seats and that such swinging or adjustment may be used to move the units closer together or farther apart to thereby vary the effective heating surface of the superheater. However, the units illustrated herein happen to be of such form that the resulting change is small and I have not claimed such feature in this application, but have so done in my co-pending application Ser. No. 653,254, filed January 24, 1933, for superheater boiler in which the units have a different contour.

What I claim is:

1. The combination with a boiler having a horizontal cylindrical shell portion, of means for passing heating gases along the lower outer surface of said portion, and a superheater having tubes running beneath said portion from side to side thereof and each substantially parallel to its outer surface.

2. The combination as set forth in claim 1 and in which the tubes of the superheater are arranged in a single layer.

3. The combination as set forth in claim 1 together with headers for the superheater tubes arranged on a plane above the horizontal plane thru the centre of the boiler.

4. The combination with a boiler having a horizontal cylindrical shell portion, of means for passing heating gases along the lower outer surface of said portion, and a

superheater having tubes running beneath said portion from side to side thereof and each substantially parallel to its outer surface but having said tubes progressively farther from said shell in the direction of flow of the heating gases.

In testimony whereof I affix my signature.

WILBUR H. ARMACOST.