

Sept. 8, 1936.

O. A. COLBY

2,053,423

VERTICAL TYPE BOILER HEATER

Filed June 14, 1934

2 Sheets-Sheet 1

Fig. 1.

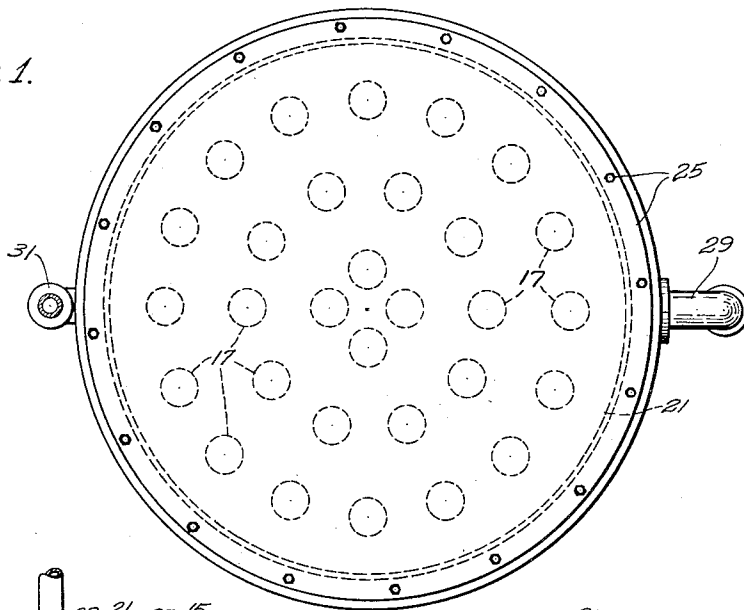
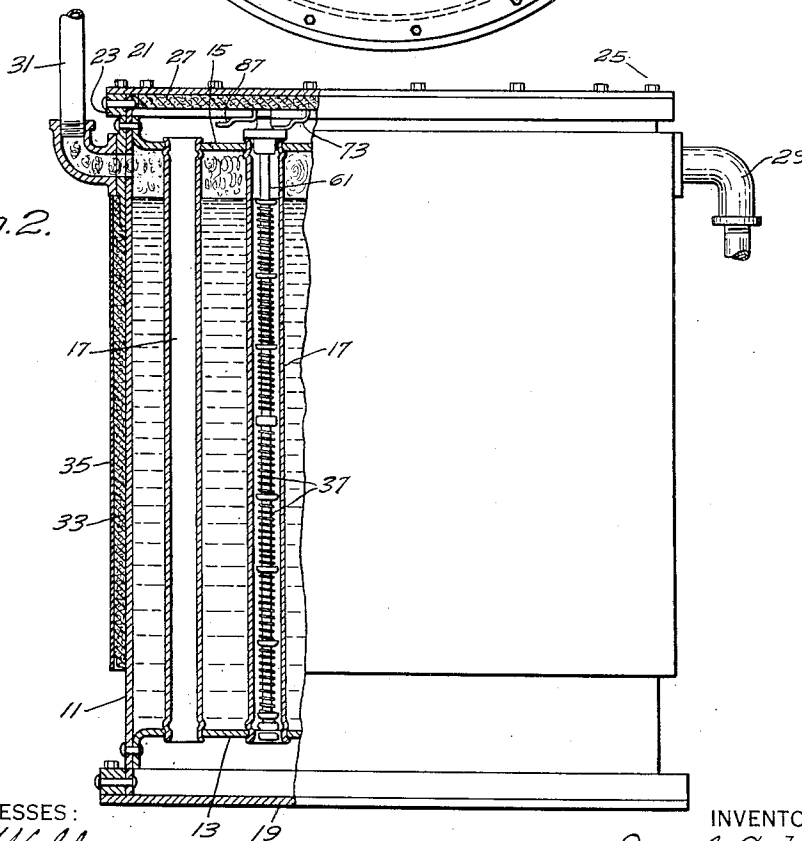


Fig. 2.



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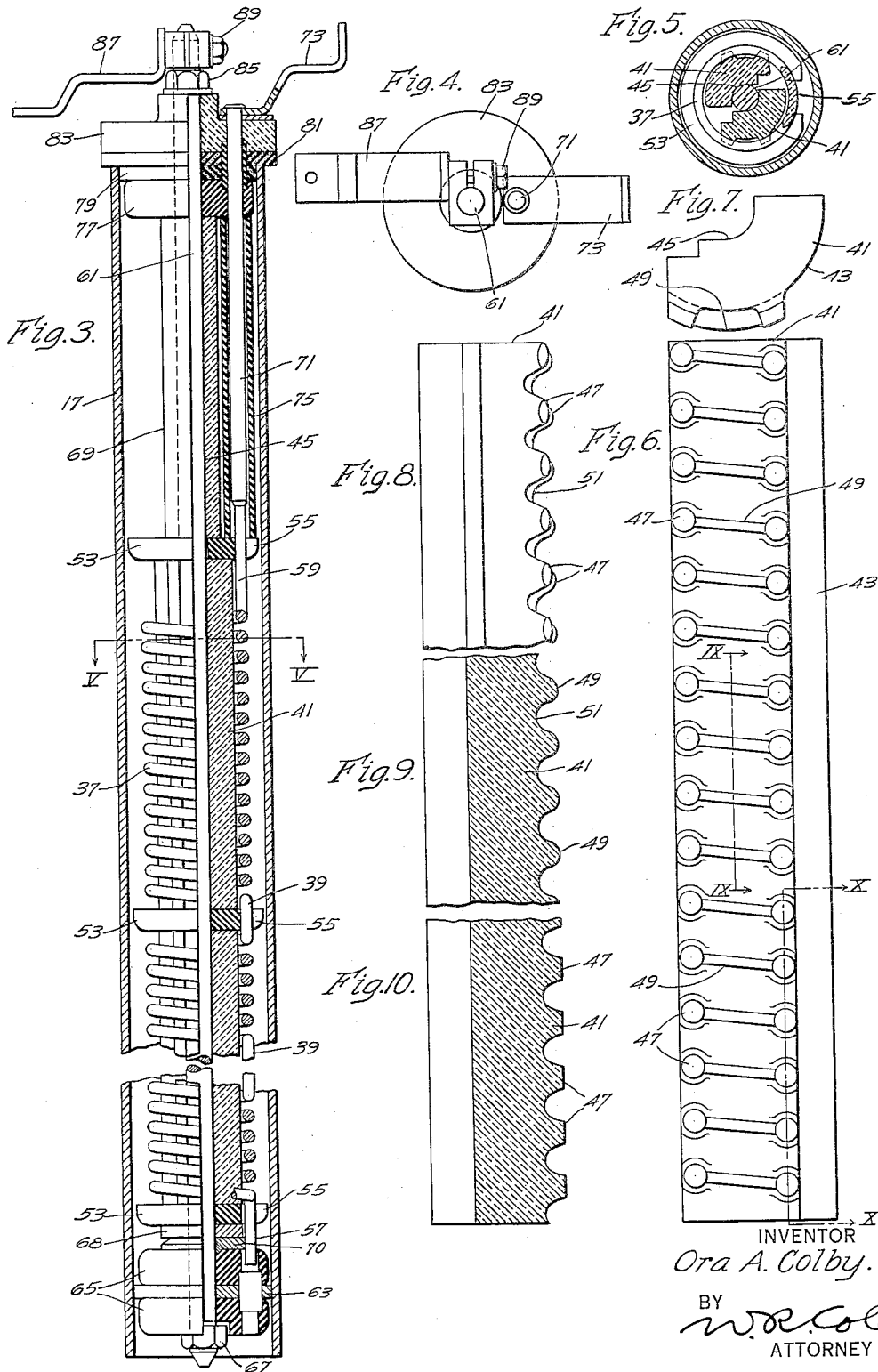
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UNITED STATES PATENT OFFICE

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VERTICAL TYPE BOILER HEATER

Ora A. Colby, Mansfield, Ohio, assignor to Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., a corporation of Pennsylvania

Application June 14, 1934, Serial No. 730,580

8 Claims. (Cl. 219—38)

My invention relates to water heaters and particularly to heating units for steam boilers.

An object of my invention is to provide a relatively simple and easily manufactured and assembled heating unit, having rugged parts which will withstand high temperatures and which will hold the resistor member out of contact with the surrounding metal parts, thereby permitting of energizing the resistor at relatively high voltage. Another object of my invention is to provide a heating element which can be removed and replaced without the necessity of cooling down the steam generator in which it is located.

Another object of my invention is to provide a high capacity electric heating unit having maximum heat concentration, located in a fire tube of a steam boiler and having both terminals of the resistor located at one end thereof.

Another object of my invention is to provide a heating unit having a cushioned mounting as a part of the unit.

Other objects of my invention will either be apparent from a description of a preferred embodiment of the device embodying my invention or will be pointed out specifically hereinafter.

In practicing my invention I provide a boiler casing having a plurality of fire tubes extending therethrough, the ends of which are secured to opposite walls of the boiler casing, together with heating units located in the respective tubes. Each heating unit includes a plurality of sets of helically wound turns of resistor wire connected by axial portions, pairs of externally grooved elongated refractory resistor supports, a metal rod extending between the externally grooved refractory supports, electric insulating washers between axially adjacent pairs of refractory supports, the metal rod holding the refractory resistor supports in proper operative positions within the helically wound turns and having its inner end electrically connected to the inner end of the relatively heavy resistor wire to constitute a terminal therefor.

In the drawings,

Figure 1 is a top plan view of a steam boiler embodying my invention,

Fig. 2 is a view in side elevation thereof with a part broken away to show the internal construction thereof,

Fig. 3 is a view in longitudinal section through a heating unit embodying my invention shown as being located in a fire tube,

Fig. 4 is a plan view of the structure shown in Fig. 3,

Fig. 5 is a view in lateral section taken on the line V—V of Fig. 3,

Fig. 6 is a view in side elevation of a refractory resistor supporting member,

Fig. 7 is a plan view of the device shown in Fig. 6,

Fig. 8 is a view in side elevation of a part of the refractory resistor support shown in Fig. 6 and taken at right angles thereto.

Fig. 9 is a fragmentary view in longitudinal section on the line IX—IX of Fig. 6; and

Fig. 10 is a fragmentary view through a part of the resistor support shown in Fig. 6 and taken on the line X—X thereof.

A boiler shell indicated generally by the numeral 11 in Fig. 2 of the drawings may be of circular shape and have a lower head 13, an upper head 15, together with any desired number of fire tubes 17 which are secured to the upper and lower casing walls in a manner well known in the art to provide a water-tight boiler structure. A bottom plate 19 may be provided in order to properly support the boiler and a top plate 21 is also provided which is secured to an annular ring 23 by a plurality of bolts 25. On the inside of the top cover 21, I provide a plate 27 of electric-insulating material not only to retain as much heat as possible within the boiler or rather to prevent it being conducted upwardly to the plate or cover 21, but also for another purpose to be hereinafter referred to. I provide a water inlet connection 29 and a steam outlet 31 in a manner well known in the art. I provide also a heat insulation 33 around the shell 11 and protect the same by an insulation jacket 35 of sheet metal. While I have illustrated and described specific forms of water inlet and steam outlets, I do not desire to be limited thereto and it is to be noted that other details or adjuncts of a steam boiler may be provided but since these constitute no part of my present invention, I have not illustrated or described the same.

Within each of the plurality of fire tubes 17, I locate a quickly removable electric heating unit which includes a resistor element 37. As my invention has particular reference to steam boilers of rather large steam generating capacity, I prefer to make the resistor element 37 of a relatively heavy resistor wire and pre-form the same to comprise a plurality of sets of helical turns located in spaced relation relatively to each other as is shown more particularly in Fig. 3 of the drawings, adjacent sets or groups of helically wound turns being connected by substantially axially extending integral portions 39.

In order to maintain the sets of helically wound turns of the resistor 37 in proper relative operative positions, I provide a plurality of elongated, externally-grooved refractory resistor supports individually designated by 41. These refractory resistor supports have outer arcuate surfaces 43 and inner arcuate surfaces 45, both of these extending longitudinally of the supporting elements. Each member 41 is of somewhat less than 180° peripheral extent and may, for instance, extend through substantially 135°. A part of the external arcuate surface 43 is provided with radially-extending pairs of projections or lugs 47 which, as may be seen more particularly by reference to Fig. 6 of the drawings, are spaced apart axially from each other and extend generally speaking helically along the outer surface of member 41. The effect of the lugs 47, which may be connected by ridges 49 is to provide helical grooves as shown at 51 in Figs. 8 and 9 of the drawings, which grooves extend partially only, peripherally of members 41 and are adapted to receive a corresponding part of the respective turns of resistor 37. While I have shown two cooperating supports 41, I do not desire to be limited thereto as I may use three such supports without departing from the scope of my invention.

The particular shape of the refractory resistor support 41 has been selected with a view of being able to axially and quickly assemble the entire heating unit and it is to be noted that resistor member 37 is pre-formed to comprise the plurality of sets of adjacent helical turns spaced apart by integral axially extending portions 39. The pairs of supports 41 are introduced into the helically wound resistor member first in a substantially axial direction, one refractory member at a time and temporarily held in such positions that they will be radially spaced from each other with the resistor 37 or parts of each turn thereof in the partial grooves 51. A plurality of electric-insulating spacers 53 are then introduced in a generally lateral direction so that a recess 55 in the periphery thereof will engage with or receive the respective axial portions 39 of the resistor or in the case of the end spacers or washers, they will receive end portions 57 at the inner end of the tube and an end portion 59 at the outer end of the tube.

I then introduce a metal rod 61 in a generally axial direction, the diameter of the rod 61 being such that it will engage the inner arcuate surfaces 45 of the two co-extensive refractory resistor supports, the relative positions of the three parts being shown particularly in Fig. 5 of the drawings. These refractory supports will, therefore, act to properly hold and space the helical turns of the resistor.

A spacing washer 63 is mounted on the inner end of rod 61 and has auxiliary washers 65 located one at each side thereof. The inner end of rod 61 is provided with a nut 67 thereon having a screw threaded engagement therewith. A resilient spacer 68 is located between a washer 53 and a metal washer 70, which is electrically connected, as by welding metal to the end portion 57 and the rod 61.

That part of the outer end of rod 61 which is not covered by refractory electric-insulating supports 41 is covered by a tubular member 69, also of electric-insulating material which is adapted to withstand relatively heavy compressive stresses. The inner end of tube 69 abuts against one spacer 53. The outer end portion 59 has

electrically secured thereto a relatively heavy lead 71, as by welding thereto, which extends axially outwardly and has connected thereto a terminal member 73. A tube 75 of electric insulating material surrounds lead or terminal 71.

A spacer 77 of electric insulating-material abuts against the outer end of tube 69 and may also abut against the outer end of tube 75. An auxiliary washer 79 is located adjacent to the outer face of spacer 77 and fits within the tube 17. A washer 81 of resilient electric-insulating material is located against the outer face of washer 79 and a relatively heavy washer 83 which may be of refractory material is located against the outer face of member 81. The outer end of rod 61 is provided with screw threads to receive a nut 85. A terminal 87, of strap form, may be clamped to the outer end of rod 61 as by a clamping bolt 89, the terminals 73 and 87 being therefore connected to the inner and the outer ends of the helically wound resistor member. It is to be particularly noted that washers 81 and 83 are of larger external diameter than tube 17 so that when the boiler 11 rests upon its bottom 19, it is possible to introduce the assembled heating unit substantially as shown in Fig. 3 of the drawings, into the tube 17 or to remove it therefrom very easily and quickly, the weight of the heating unit being carried by the resilient washer 81 resting upon the upper end of the tube 17 in which the particular heating unit is located.

Referring now to Fig. 2 of the drawings, attention is called particularly to the other use of the layer 27 of electric-insulating material which, as shown in that figure of the drawings, may either directly engage the upper end of rod 61 or the terminal structure including the terminal 87, in order to insure that the respective individual heating units will be held in their proper operative positions in the fire tubes 17 without rattle or noise if a boiler of this kind should be located on a moving vehicle such as an electric locomotive.

The resilient spacer 68 permits of unequal expansion and contraction of the aligned parts of the heating unit during operation.

If it is necessary to replace a damaged heating unit this can be done while the boiler is hot, by removing the top or cover 21 and the electric-insulating material 27 and disconnecting the terminal leads 73 and 87 of the damaged heating unit, after which the heating unit can be removed and a new one put in place, the electrical connections made and the cover put back in place.

The device embodying my invention itself provides a very simple construction of a steam boiler utilizing a plurality of elongated electric heating units located within a plurality of fire tubes in the boiler into which they may be introduced and from which they may be removed in a very quick and simple manner.

Various modifications may be made in the device embodying my invention without departing from the spirit and scope thereof and I desire, therefore, that only such limitations shall be embodied therein as are imposed by the prior art or set forth in the appended claims.

I claim as my invention:

1. A tube for water boilers having a heating unit therein including a helically wound resistor, a plurality of peripherally-grooved refractory resistor supports, each of less than 180° peripheral extent within the helically wound resistor and a metal rod extending between the refrac-

tory supports to force the same radially into the convolutions of the resistor.

2. A tube for water boilers having a heating unit therein including a preformed helically-wound relatively heavy resistor wire, a plurality of elongated peripherally grooved co-extensive refractory resistor supports, each of less than 180° peripheral extent within the helically-wound resistor and a metal rod extending between the refractory supports and engaging the same to cause the resistor to fit into the grooves in the supports.

3. A tube for water boilers having a heating unit therein including a relatively heavy resistor wire pre-formed to helical shape, a plurality of similar co-extensive externally grooved refractory resistor supports, and a metal rod located between the refractory supports to force them outwardly and cause the grooves therein to tightly receive the respective turns of the resistor wire, and an electrical connection between one end of the metal rod and the corresponding end of the resistor wire.

4. A tube for water boilers having a heating unit therein including a relatively heavy resistor wire pre-formed to comprise a plurality of sets of helically wound turns connected by short axial portions, a plurality of similar elongated co-extensive externally-grooved refractory supports in each set of helical turns of the resistor wire, refractory spacers between successive pairs of refractory supports, each of said spacers having a notch in its peripheral edge to receive the axial portion of the resistor, a metal rod extending inside the refractory resistor supports to space them apart and cause the grooves thereon to receive the resistor wire and an electrical connection between the inner end of the rod and the inner end of the resistor wire.

5. A tube for water boilers having a heating unit therein including a relatively heavy resistor wire pre-formed to comprise a plurality of sets of helically wound turns connected by short axial

portions, a plurality of similar elongated co-extensive externally-grooved refractory resistor supports in each set of helical turns of the resistor wire, refractory spacers between successive pairs of refractory supports, each of said spacers having a notch in its peripheral edge to receive the axial portion of the resistor, a metal rod extending inside the refractory resistor supports to space them apart and cause the grooves thereon to receive the resistor wire, an electrical connection between the inner end of the rod and the inner end of the resistor wire, and a pair of terminals at the outer end of the metal rod.

6. A tube for water boilers having a heating unit therein comprising a helically wound relatively heavy resistor member, externally-grooved elongated refractory resistor supports within the helically wound resistor, a metal rod extending between the resistor supports to cause the grooves to receive the turns of the resistor wire, spacers on the rod to hold the heating unit substantially coaxial with the tube in which it is located, an end washer on the outer end of the rod of larger diameter than the tube and abutting against one end of the tube and a covering sheet of electric-insulating material carried by the casing adjacent to said end washer to hold the heating unit in the tube.

7. A fire tube for water boilers having a heating unit therein of elongated shape and comprising a resilient washer of larger diameter than the tube and supporting the heating unit from and on one end of the fire tube.

8. A fire tube for water boilers having an elongated heating unit therein comprising a rod, refractory resistor supports on the rod, a resistor supported by the refractory supports, nuts on the rod at each end thereof and a resilient spacer on the rod intermediate the nuts to compensate for unequal expansion of the parts between the nuts relatively to the expansion of the rod.

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