Sept. 13, 1927. 1,642,197

P. L. FOWLER

CLAMP-ON ELECTRIC HEATER

Filed Nov. 10, 1925 2 Sheets-Sheet 1

Fig. 4.

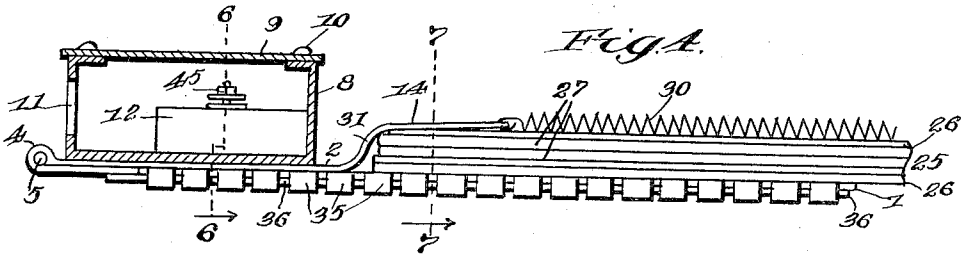


Fig. 5.
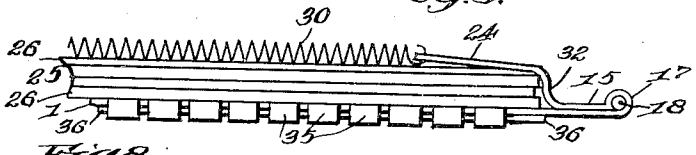


Fig. 8.

Fig. 6.

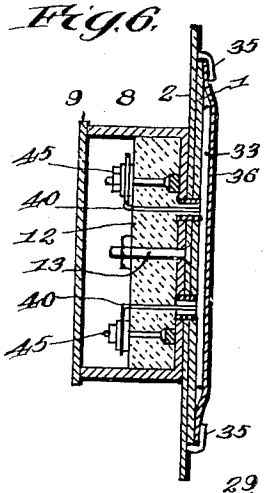


Fig. 7.

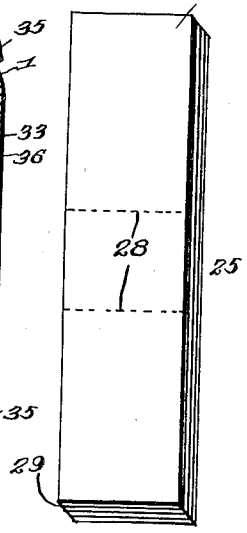


Fig. 9.

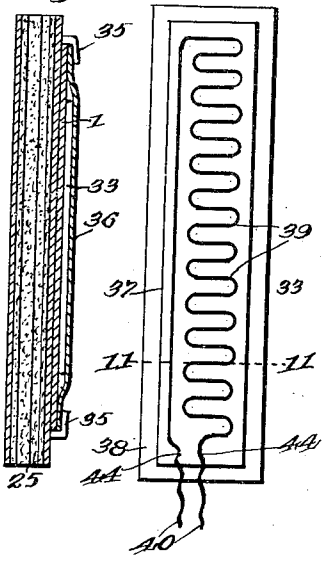


Fig. 10.

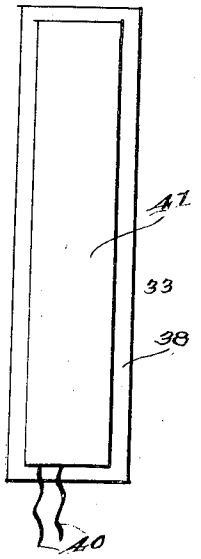
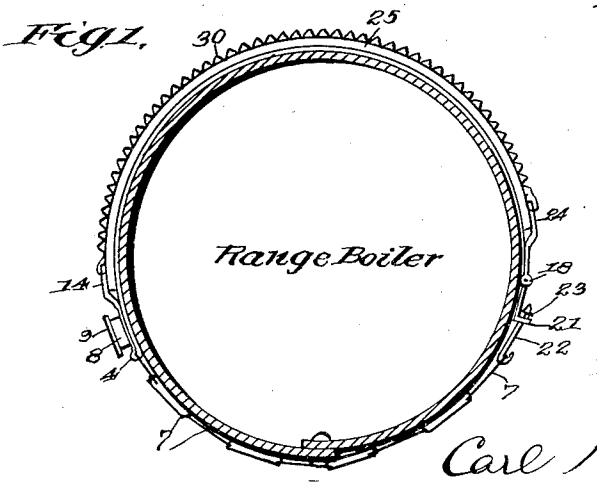


Fig. 1.



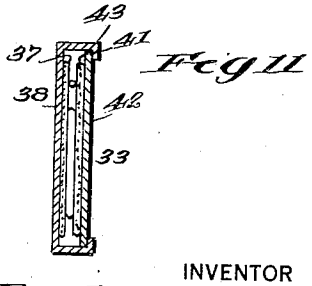


Fig. 11.

INVENTOR

Paul L. Fowler

BY

Carl H. Crawford

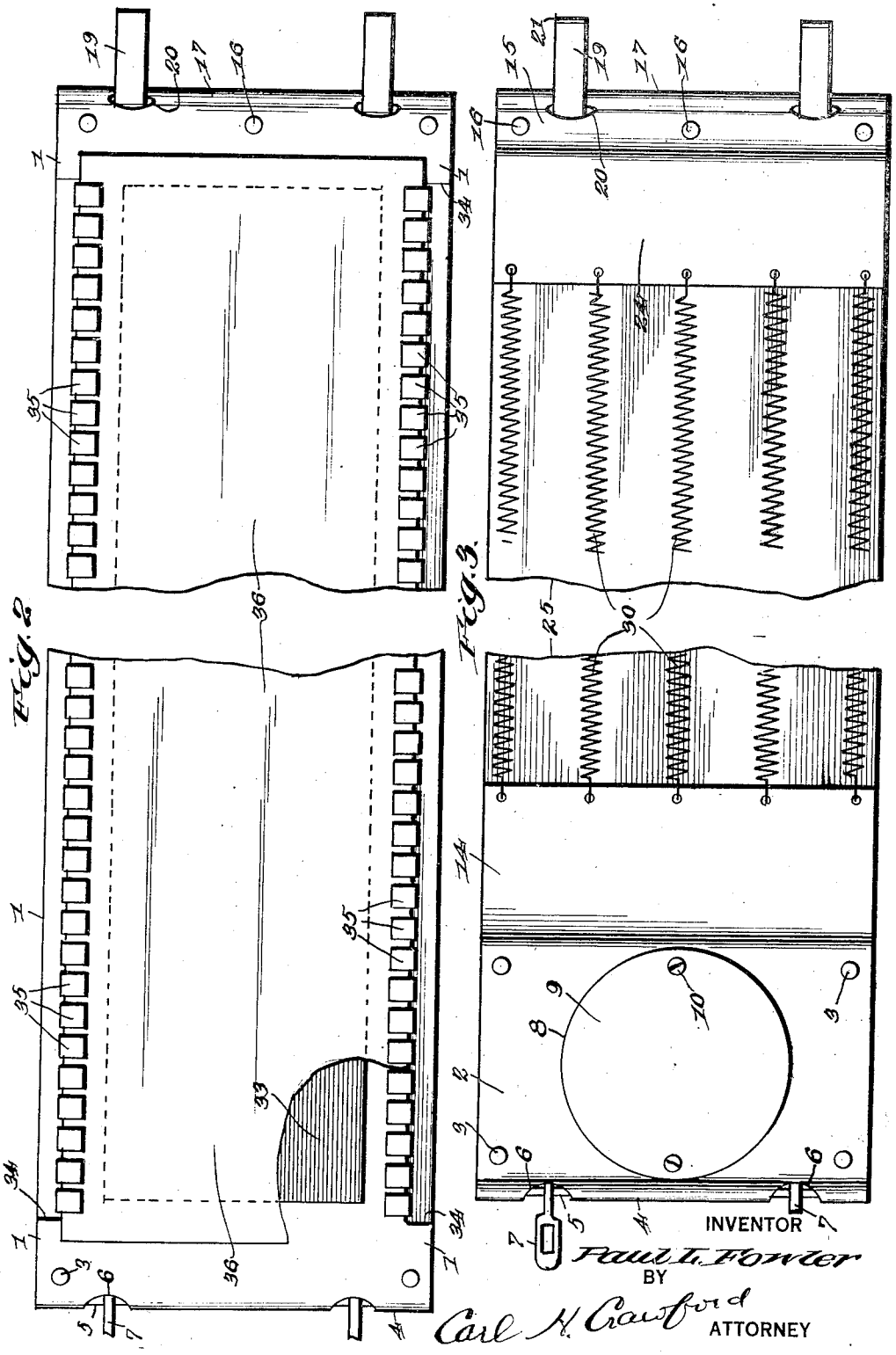
ATTORNEY

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CLAMP-ON ELECTRIC HEATER

Filed Nov. 10, 1925 2 Sheets-Sheet 2



Patented Sept. 13, 1927. 1,642,197

UNITED STATES PATENT OFFICE.

PAUL L. FOWLER, OF SPOKANE, WASHINGTON, ASSIGNOR TO ARTHUR-FOWLER CO., OF SPOKANE, WASHINGTON, A CORPORATION OF WASHINGTON.

CLAMP-ON ELECTRIC HEATER.

Application filed November 10, 1925. Serial No. 68,205.

This invention relates to improvements in electric water heaters for range boilers and has to do with that type of heater of this class which is clamped about the periphery of the boiler, and therefore, has no bearing on circulating heaters.

One of the features of my invention is to provide a novel form of supporting band for the heater, wherein a heating element and its protecting plate is disposed on one face of said band, and wherein a heat insulating structure is disposed on the remaining face of said band.

In a heater of this type, flexure without interference of parts, is a great desideratum for the reason that these heaters are initially made flat, and shipped and sold flat, and when they are installed, they are bent around and tensioned to firmly engage the periphery of the boiler. Now as the heater is made up of a plurality of band-like layers of material, it is a feature of my invention to connect these layers or integers in such a manner that they can bodily partake of relative longitudinal displacement, due to flexure, without interference. This feature of my invention also greatly facilitates assembling of the heater at the place of manufacture. This feature of my invention is also important by reason of the fact that the layers or integers of material of which the heater is made up, are all of different material.

It is a feature of my invention to provide a heating element which is completely insulated, and to completely enclose said element on the tank or boiler side of the supporting band and also provide the latter with a terminal box whereto the terminals of the element are connected and extended through the supporting band for this purpose.

It is a further object of this invention to make the heaters of a given or uniform length, irrespective of the heating capacity thereof, for boilers of different diameters, and to provide means whereby the heaters may be clamped onto any of the usual size boilers.

The invention has many other objects and features which will be more fully described in connection with the accompanying drawings, and which will be more particularly pointed out in and by the appended claims.

In the drawings:—

Fig. 1 is a horizontal sectional view of a range boiler showing the device of my invention clamped thereabout.

Fig. 2 is a view in elevation, on an enlarged scale, showing the heater flat, and looking toward the tank or boiler side of the heater.

Fig. 3 is a view of the heater looking toward the outside face thereof.

Fig. 4 is a top edge view of the terminal end portion of the heater looking downwardly on the left hand end portion of Fig. 2.

Fig. 5 is a similar view of the right hand end portion of Fig. 2.

Fig. 6 is a sectional view on line 6—6 of Fig. 4.

Fig. 7 is a sectional view on line 7—7 of Fig. 4.

Fig. 8 is a view in elevation on a small scale showing how the integers of the heat insulating structure are united.

Fig. 9 is a view in elevation, on a small scale, of the heating element showing the manner of coiling the same and disposing the terminals near the end of said element.

Fig. 10 is a view of the same after the inner envelope has been formed.

Fig. 11 is a sectional view on line 11—11 of Fig. 9.

Like characters of reference designate similar parts throughout the different figures of the drawings.

Referring to the specific form shown, a preferably metallic and flexible supporting band is employed having a central or main body portion 1. The terminal end 2, of said band is doubled or bent back upon or against the body portion 1, and secured in abutting relation as by means of rivets 3, thereby increasing the strength of the material at this point. In the bight of the bend, as at 4, I dispose a rod 5, and with suitable openings 6, I provide access for connection of clamp-on chains 7, two being shown. The bent over portion 2, is of sufficient length to accommodate a terminal box 8, having a lid 9, adapted to be removably secured by screws 10. In the wall of said box 8, is a suitable conduit opening 11, through which conductors may be extended for connection with terminals in the box. A block of insulating material 12, is disposed in said box 8, and may be anchored by screws 13 extending through the block and through the support-

ing band, as shown in Fig. 6. Thus, it will be seen that the terminal box is carried by the supporting band and preferably at the terminal end thereof. Hereinafter, I will refer to the manner in which the element is electrically connected with terminal posts in said box 8. As shown at 14, the extreme or terminal end of the supporting band is bent outwardly in spaced lateral relation to the body 1 to form therewith an end pocket, which is open at the upper and lower margins, speaking of the heater when installed. At what I will call the coupling end, the band is bent back onto itself as shown at 15, and secured as by rivets 16, to form a double thickness, and in the bight 17, I dispose a rod 18. Coupling members 19, extend through openings 20, and around rod 18, to distribute the strain throughout the width of the band. These coupling members are preferably hook-shaped and in the hook ends thereof, shown at 21, are openings 22, for receiving tightening bolts, the nuts 23, thereof, impinging on the ends 21. Said bolts have hooked ends for coupling engagement with chains 7. Thus, by tightening the nuts, I have afforded means for clamping on a heater of uniform length, about tanks of different diameters.

The extreme or terminal end 24, is bent outwardly into spaced relation to body 1, to form an end pocket, in a manner similar to end 14, said ends forming companion pockets for a purpose which I will next describe.

While heaters of this type are applied to tanks or boilers which are enclosed by blankets or other form of enveloping insulation against radiation of heat, still, it is an important feature to provide special insulation against heat radiation outwardly abreast of the electrical element. I therefore employ an insulating structure on the outside of band 1, which is generally indicated at 25. I preferably use asbestos, in this capacity, but in the event of any type being used, it is advantageous to employ a laminated or layer structure to obtain the benefit of air spaces intermediate the layers. Because of the outer cover with which the tanks are equipped, there is no air circulation, hence these intermediate air spaces are to all intents and purposes, dead air spaces, which form the best type against heat radiation. Now it is well known that asbestos, especially in thick band form, does not lend itself well to bending movement, and that it also has great friction against asbestos. Hence, the problem of using asbestos in a flexible heater that must be flexed, involves the necessity of provision for relative displacement of the layers, and I have solved this problem in the following manner.

As shown, I use four band-like strips of asbestos, the inner and outer bands 26, are relatively thin, and the two intermediate bands 27, are relatively thick. In practice, these bands are disposed in flat abutting relation and because they are floatingly supported, and also to afford relative displacement of the bands, I unite the same preferably by gluing them together substantially centrally between their ends, as indicated by dotted lines 28 in Fig. 8. Thus, all the integers are united to form a unitary insulating structure with the end portions 29, free from connection with each other. This structure 25, is disposed abreast of the outer face of supporting band 1, in the manner shown, with the ends of said structure in the open sided pockets formed by the supporting band ends 14 and 24. I preferably energize said ends 14 and 24, to impart a frictional grip on the structure 25, and as shown, this is accomplished by a plurality of tension springs 30, having their ends secured to the edges of parts 14 and 24. These springs 30, are under tension when the heater is flat or straight, and the tension of course increases when the heater is flexed about the boiler, and they bear substantially throughout their length against the structure 25, helping thus, to frictionally support the latter on the supporting band. When the heater is flat, the portions 31 and 32 impinge against the ends of the structure 25, to support the latter in place, and when the heater is flexed, the free end portions thereof move relatively to each other because of the greater radii about which the outer band bends, as regards the radii of the inner bands, and then tension is applied not only lengthwise by springs 30, and the friction of parts 14 and 24 is increased partly by reason of the resistance of said bands against bending movement. At any rate, I floatingly mount the structure 25, on said supporting band, and I frictionally and slidably support said structure thereon.

Before describing the structure of my improved heating element I will first refer to the same generally and will describe the means and manner of its mounting in the heater.

The element is designated at 33, and is disposed abreast of the inside face of band 1, the relative length and width of the two being shown in Fig. 2. The band 1, is shown reduced at 34, this reduction being the result of slitting the upper and lower margins of band 1, to form the series of lugs 35. It will be noted that the band 1 is slit to dispose the lugs 35 in spaced relation with respect to each other, their lateral and adjacent edges being free from engagement. I employ what I will term, a hard surface heat conducting contact band 36, preferably of copper, said band being longer and wider than the element 33, but of less width and length than body 1, of the supporting band.

This contact band 36, is disposed upon or against the element 33, and then the lugs 35 are bent over the upper and lower margins of band 36, to form a frictional and slidable mounting of the contact plate or band 36, on the heater. The lugs 35, are disposed endwise of body 1, sufficiently to hold end portions of band 36, in flat abutting relation against body 1, whereby the element 33, will be completely enveloped by body 1 and band 36. It will be noted from Fig. 6, that the upper and lower margins of band 36 extend inwardly over the edges of the element 33, so that the rectangular bulge formed in the band 36, by said element, may be uniformly pressed against the boiler without any interference on the part of the lugs 35.

When the heater is flexed about the boiler, the spaces between lugs 35, avoid interference, and not only the contact band 36, but also the element and supporting band 1, can partake of the relative longitudinal displacement necessitated by such flexure. If for any reason, it is necessary to remove or renew the element, it is an easy matter to withdraw the slidably mounted contact band 36, to render the element accessible, without totally dismantling the heater or even sending it back to the manufacturer or place of purchase, and without extreme delay in hot water service to the user. Further, the metallic band 36, will wear practically indefinitely and fully protects the element from wear, therefore, I consider it an important feature of my invention that the heating element is disposed inside or alongside a hard surface, high heat conducting or metallic contact band, and, as shown, between a hard surface or metallic supporting band and said contact band.

I will next refer to my improved heating element which I consider new, as an article of manufacture, and also in the combination set forth.

Referring to Figs. 9 to 11, 37 indicates a sheet of material, preferably asbestos, which is disposed in a sheet of mica 38, somewhat wider and longer than the sheet 37. The element 39 is disposed in the manner shown, and both terminals 40, are extended from one end of the structure. In practice, I shellac or otherwise fix the wire to the sheet 37, and then place thereover, a similar sheet of asbestos 41, so that the coil is enclosed, first, in an asbestos casing. I then add an additional sheet of mica 42, of less width than sheet 38, so that the edges 43, of sheet 38, can be bent over, as shown in Fig. 11. In the drawings, I have shown the thickness of the materials greatly exaggerated, for clearness of illustration, but the mica and asbestos sheets actually employed, are so thin that the resultant double envelope shown, practically has no projections and is to all intents and purposes substantially flat. I do not, in practice, secure the ends of the coils, which I will designate 44, and which are shown wavy in Fig. 9, but leave them loose, not only to afford an extra length for connection with the terminal box, but to insure that there shall be no such connection between the heating element and the heater such as would prevent the former from being truly floatingly mounted in the latter whereby the heater may thus participate in the relative displacement necessitated by flexure of the heater. It will be clear, especially by referring to Figs. 6 and 7, that the contact plate 36, is frictionally engaged against the element, and the latter is engaged against body 1, of the supporting band, throughout the length and width of the element. Thus, with this construction there is no difficulty in obtaining a firm and uniform engagement of the contact band against the boiler.

As will be seen by Fig. 6, the terminals 40, are extended through properly insulated openings in the supporting band and through the block 12, and are connected with binding posts 45, whereto the supply conducting wires may also be connected, as will be clear to those skilled in the art.

Now it will be clear, that my heating element coil is mounted, and substantially fixed to an inner envelope of asbestos, or the like, and the latter is encased in an envelope of mica, thereby providing a double insulation, which, in actual service, stands up under the devastating effects of lightning, with less loss of coils than any heater of this type known to me.

Further, this novel form of insulated heating element enables me to dispose the same between, and encase it in metal, with the heretofore described advantages of firm and uniform contact with the boiler. One great advantage of using an outer envelope of mica, is that it presents a hard finished surface to the metal and thereby facilitates movement of the parts under flexure of the heater.

While I have described one specific form of my invention, I do not wish to be limited thereto except for such limitations as the claims may import.

I claim:—

1. In a flexible clamp-on electric heater for range boilers, a band-like insulated heating element, a thin contact band adapted to be disposed against the inner face of said element and about the boiler and having a width and length in excess of that of said element, and a supporting band disposed along the outer face of said element and having means engaging the upper and lower margins of said contact band to hold the latter and said element in position, said means being disposed beyond the margins of said

element and flexing the end and side margins of said thin contact band against said supporting band to envelope said element.

2. In a flexible clamp-on electric heater for range boilers, a flexible electrically insulated band-like heating element, and a flexible supporting band having means for supporting said element abreast of the inside face of said band, and said band having flexible means for supporting a heat insulating structure abreast of the outside face of said band.

3. In a flexible clamp-on electric heater for range boilers, a flexible electrically insulated band-like heater element, a metallic contact band of greater length and width than said heating band, and a flexible supporting band having its upper and lower margins slit to form lugs adapted to be bent over and against the upper and lower margins of said contact band to dispose said margins and also the ends of said contact band in abutting relation against said supporting band to completely enclose said heating element.

4. In a flexible clamp-on electric heater for range boilers, a flexible supporting band equipped with an electric heater abreast of its inner face, heat insulating material abreast of the outer face of said band, and the ends of said band being bent outwardly to lap outside said material, and tension springs united with the ends of said band to cause said band ends to grip and hold said insulating material onto said supporting band.

5. In a flexible clamp-on electric heater for range boilers, a flexible supporting band provided with an electric heater abreast of its inner face, band-like integers of heat insulating material abreast of the outer face of said band disposed in abutting relation with the integers united between their ends, and said band having spring tensioned ends outwardly overlapping the ends of said integers to frictionally support said integers on said band and permit relative longitudinal displacement of the ends of said integers as the heater is flexed about the periphery of the boiler.

6. In a flexible clamp-on electric heater for range boilers, a flexible supporting band provided with an electric heater abreast of its inner face, end portions of said band being bent outwardly and back against and secured to the outer face of the body of said band, a rod disposed in the bights of said bent over ends, means connected with said rods for tightening said band and its heater into snug engagement against the periphery of a boiler, the terminal portions of said outwardly bent ends being disposed in spaced relation to the band, and a heat insulating structure abreast of the outer face of said band and the ends of said structure being interposed between said band and said spaced terminals.

7. In a flexible clamp-on electric heater for range boilers, a flexible supporting band, an electric heater element structure floatingly supported on the inside face of said band, and a heat insulating structure floatingly supported on the outside face of said band.

In testimony that I claim the foregoing as my own, I hereby affix my signature.

PAUL L. FOWLER.