April 1, 1941. C. M. OSTERHELD 2,237,110

TANK WATER HEATER

Filed Jan. 27, 1940 3 Sheets-Sheet 1

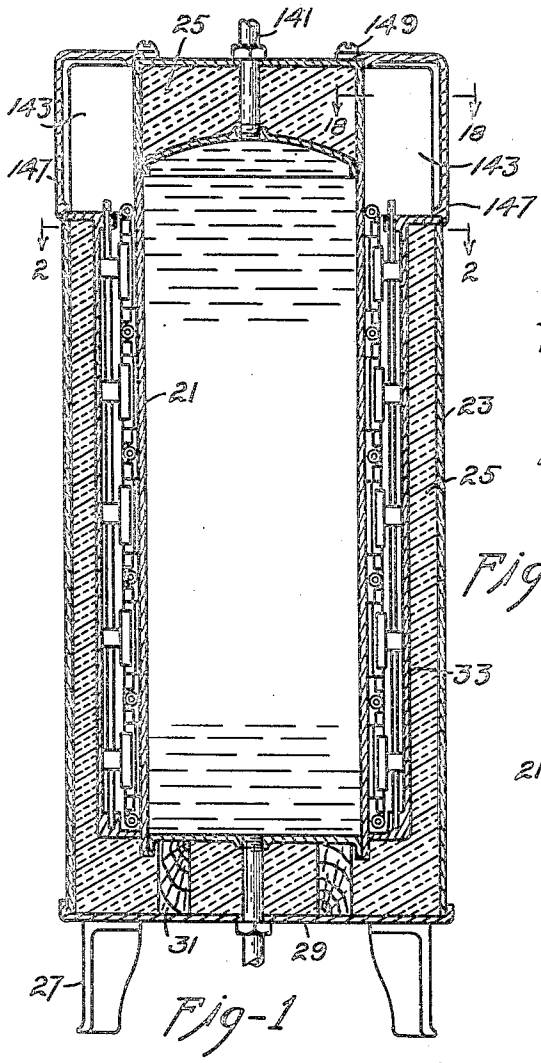

Fig-1

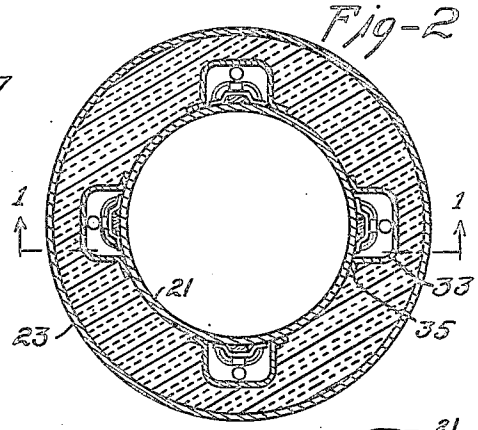

Fig-2

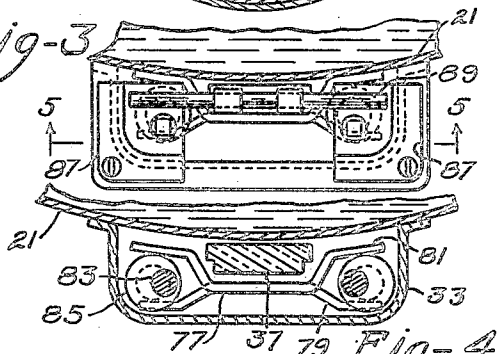

Fig-3

Fig-4

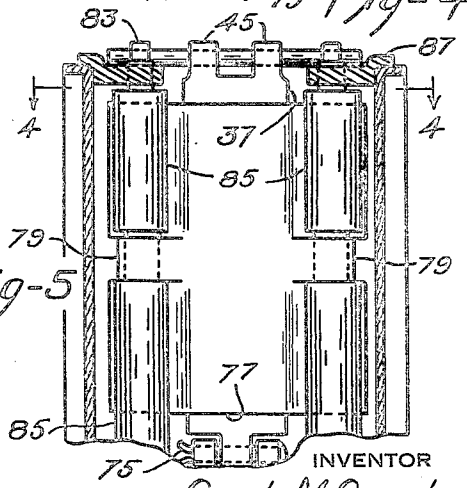

Fig-5

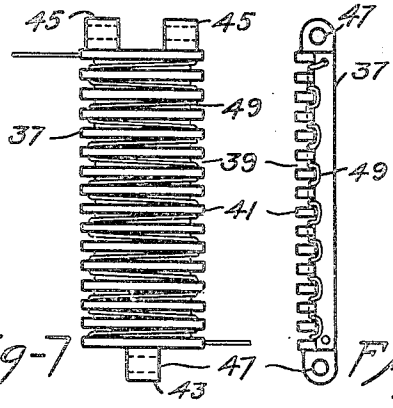

Fig-7

Fig-6

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TANK WATER HEATER

Filed Jan. 27, 1940 3 Sheets-Sheet 2

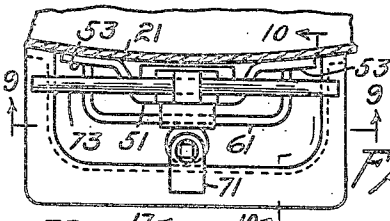

Fig-8

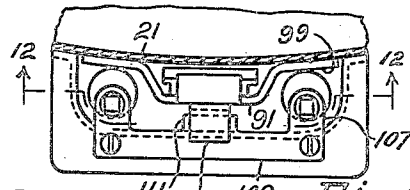

Fig-11

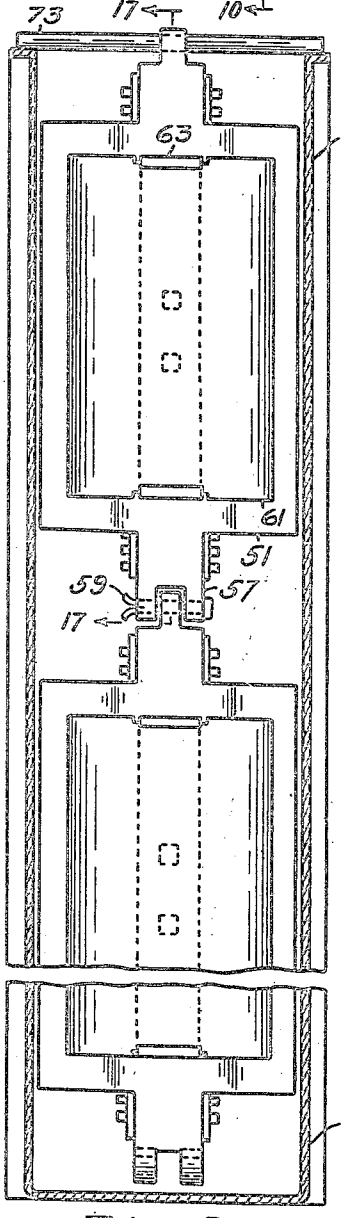

Fig-9

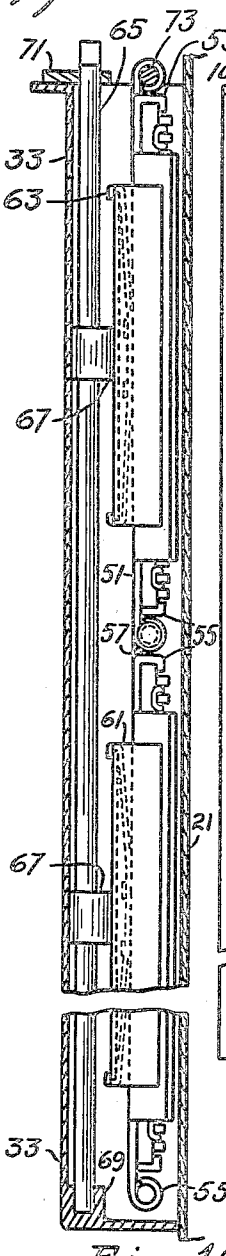

Fig-10

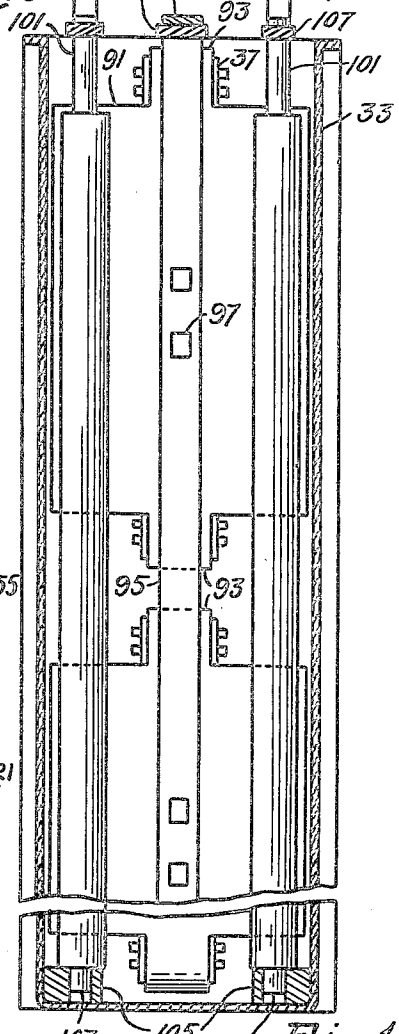

Fig-12

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TANK WATER HEATER

Filed Jan. 27, 1940 3 Sheets-Sheet 3

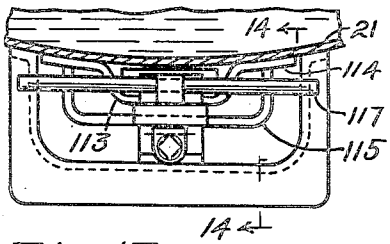

Fig-13

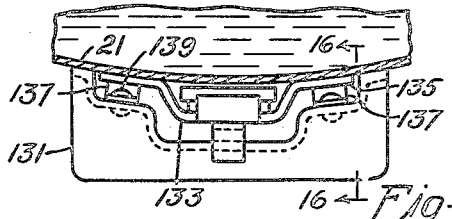

Fig-15

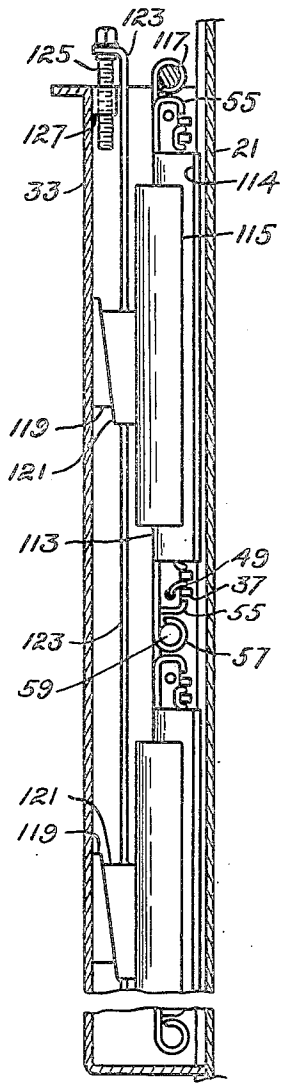

Fig-14

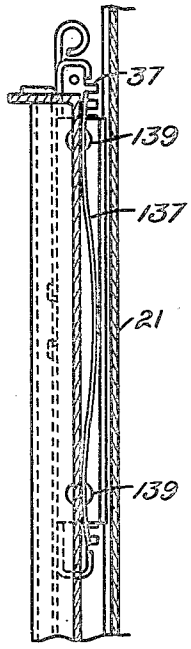

Fig-16

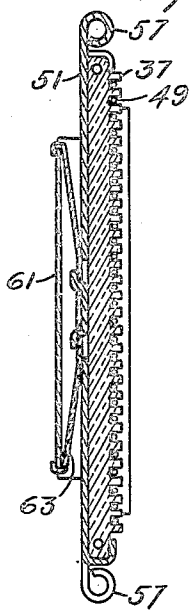

Fig-17

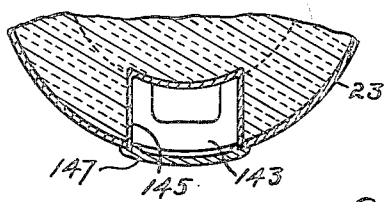

Fig-18

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Patented Apr. 1, 1941

2,237,110

UNITED STATES PATENT OFFICE

2,237,110

TANK WATER HEATER

Clark M. Osterheld, Stoughton, Wis., assignor to McGraw Electric Company, Elgin, Ill., a corporation of Delaware

Application January 27, 1940, Serial No. 315,890

9 Claims. (Cl. 219—39)

My invention relates to water heaters and particularly to externally mounted electric heating units for hot water tanks.

One of the objects of my invention is to provide a simple and highly efficient electric heating unit for mounting on the outside of a hot water tank.

Another object of my invention is to provide a flexible heating unit that is easily and quickly mountable in proper operative position against the outside of a tank and that is easily and quickly removable therefrom.

Other objects of my invention will either be apparent from a description of several forms embodying my invention or will be set forth in the course of such description and particularly in the appended claims.

In the drawings,

Figure 1 is a vertical sectional view through a hot water tank and electric heating unit embodying my invention, taken on the line 1—1 of Fig. 2,

Fig. 2 is a horizontal sectional view taken on the line 2—2 of Fig. 1,

Fig. 3 is a fragmentary top plan view showing one tunnel and an electric heating unit positioned therein in proper operative position,

Fig. 4 is a horizontal sectional view thereof taken on the line 4—4 of Fig. 5,

Fig. 5 is a fragmentary vertical sectional view thereof taken on the line 5—5 of Fig. 3,

Fig. 6 is a view in side elevation of an electric-insulating bar supporting the resistor,

Fig. 7 is a view in front elevation of the bar shown in Fig. 6,

Fig. 8 is a top plan view of the electric heating unit embodying my invention as shown in Figs. 1 and 2,

Fig. 9 is a vertical view taken in section on the line 9—9 of Fig. 8, the heating units being shown in front elevation,

Fig. 10 is a vertical sectional view taken on the line 10—10 of Fig. 8,

Fig. 11 is a top plan view of a still further modification embodying my invention,

Fig. 12 is a vertical sectional view thereof taken on the line 12—12 of Fig. 11,

Fig. 13 is a top plan view of a still further modification embodying my invention,

Fig. 14 is a vertical sectional view thereof taken on the line 14—14 of Fig. 13,

Fig. 15 is a top plan view of a still further modification embodying my invention,

Fig. 16 is a vertical sectional view taken on the line 16—16 of Fig. 15,

Fig. 17 is a section taken on the line 17—17 of Fig. 9 of the drawings, and

Fig. 18 is a fragmentary sectional view taken on the line 18—18 of Fig. 1.

The electric heating unit particularly embodying my invention as disclosed in the present application is particularly adapted for external mounting on the usual hot water tank 21 which hot water tank may be positioned within an outer casing 23, which may be of metal, and which is also provided with heat-insulating material 25 which may, for example, be of rock wool. The tank may be supported on legs 27 engaging a bottom plate 29, the tank 21 being spaced from the plate 29 by blocks 31 of heat-insulating material and made of any suitable or desired material, but shown in Fig. 1 of the drawings as being made of wood.

The tank is provided with a plurality of vertically extending tunnels 33 of which I have shown four, but I desire it to be understood that my invention is not limited to this specific number of tunnel members but that I may use either more or less depending upon the requirements of the installation or the demands of the purchaser desiring to operate a hot water tank of this general kind. I have shown the tunnel members as being of substantially channel shape in lateral section of widened edge portions 35 and I have also shown the tunnel members as open at the top and as closed at the bottom end thereof. I do not desire, however, to be limited to this since I may reverse the tunnels as to their open and closed ends and have the open end thereof at the bottom. While not limited thereto, I prefer to make the tunnel members 33 of metal and any suitable or desired means for securing the flange portions 35 of the tunnel members into close heat-conducting relation against the outside of the tank may be employed and as an example of such means, I may mention the use of welding seams or of separated spot welds. The tunnel members may also be of any desired shape in lateral section as may be desired.

I may here point out that the construction of the heating units shown in Figs. 1 and 2 is the same as that shown in Figs. 8, 9, 10 and 17 of the drawings.

A flexible electric heating unit assembly is positioned in each of the tunnel members and each unit includes an elongated bar 37 of a suitable electric-insulating material such as porcelain, lava or some other similar material. It is to be noted that the bars 37 are relatively thin and that they include a plurality of laterally-extend-

ing slots 39 spaced apart by portions 41 which may be considered, for example, as teeth which are longer laterally of the bar 37 than the rear portion thereof. In one form of the bars 37 one end is provided with a perforated central lug 43 while the other end of the bar is provided with two spaced apart lugs 45, each of the lugs 43 and 45 being provided with an opening 47 extending therethrough for a purpose to be hereinafter referred to. A resistor 49 is positioned in the lateral slots 39 and extends beneath or around the overhanging end portions of the teeth 41, all in a manner well known in the art.

A modified form of bar 37, without the end lugs 43 and 45, as shown in section in Fig. 17 with the resistor wire 49 wound thereon, is positioned within a shroud member 51, these shroud members being of substantially flat channel shape in lateral section with relatively wide flange portions 53, the general outline of the respective shrouds in top view being shown particularly in Fig. 8 of the drawings. It is to be noted that the bars 37 are supported within the shrouds 51 as by bent-over extensions 55 (see Fig. 10) although any other suitable or desired means for holding the bars in proper operative position within the shrouds may be used. While I have shown and described a specific form of heating element, I do not desire to be limited thereto as any other kind of heating element may be used.

The shrouds of channel shape may be provided with central curled end portions 57, one of these portions being provided at one end of the shroud and two spaced apart portions 57 being provided at the other end so that the adjacent heating units may be mechanically connected by means of a pin 59 extending through the registering curled portions 57.

I provide further a pressure-transmitting member 61 which is also of substantially channel shape with its side edges engaging the flanges 53 so that upon pressure being applied centrally of the pressure member 61, the flanges will be pressed into good heat conducting relation with the outside of the tank. The pressure-transmitting member 61 may be held in its proper operative position relatively to the shroud against which it is to be pressed by a vertically-extending metal bar 63 which interfits with the mid-portion of the shroud and the end portions of which are bent around the respective ends of member 61, reference being had to Fig. 17 of the drawings where such construction is shown in section.

Means for pressing the flanges 53 against the outside surface may include a vertically-extending shaft 65 having eccentrically mounted enlarged cam portions 67 thereon either integral therewith or secured thereto, the members 67 being positioned at about the mid-portion of the pressure members 61. The lower end of shaft 65 may fit into an opening in a boss 69 provided in the bottom portion of the tunnel member 33 while the upper portion thereof may extend through a small plate 71 extending from the outer portion of the upper end of the tunnel member 33 over the opening formed by the tunnel member and the extreme upper end of shaft 65 may be provided with a square end to permit of manual turning of the shaft to force the cam member 67 tightly between the inner surface of the wall of a tunnel member 33 and the outer surface of the pressure-transmitting member 61.

Any desired number of such electric heating elements each including a bar supporting a resistor, a shroud closely operatively associated therewith as shown particularly in Fig. 10 of the drawings, and a pressure member, may be supported from the upper edge of the tunnel member 33 as by the use of a rod 73 which rests upon the upper edge of the tunnel member 33.

Referring now to Figs. 3, 4 and 5 of the drawings, I have there illustrated a modified form of electric heating units each including a bar 37 having a heating resistor 49 mounted thereon as hereinbefore set forth in connection with the device shown in Figs. 8 to 10 inclusive, the bars 37 being provided with the projections 43 and 45 whereby they may be pivotally connected as by the use of a pin 75 shown more particularly in Fig 5 of the drawings. Shrouds 77 are provided, one for each bar 37, and it may be noted that each shroud is provided with rearwardly bent integral portions 79 cut out from the mid-portion of the flanges 81 of the shrouds at each side thereof.

Means for causing tank engaging movement of the shrouds 77 include shafts 83 having enlarged eccentric portions 85 thereon, a plurality of such portions being provided which are spaced apart a distance substantially equal to that of the width of the portions 79 whereby a shroud is supported on the upper ends of two portions 85 of the shafts 83, as is shown more particularly in Fig. 5 of the drawings. The shafts 83 may extend downwardly into the bottom end of the tunnel member in substantially the same manner as shown in Fig. 10 of the drawings while the upper ends of these shafts may extend through an opening in a corner plate 87, one of each such plates being provided at each outer corner of the tunnel member 33. This feature is shown particularly in Fig. 3 of the drawings. If, now, the squared upper ends of the shafts 83 are turned manually by an operator, the shrouds 77 which may originally be in the position shown in Fig. 4 of the drawings, will be moved into the position shown in Fig. 3 of the drawings where the flange portions 81 are in close operative engagement with the outside surface of the tank. The string of pivotally connected bars 37, pivotally connected with each other as hereinbefore described, may be supported as by a rod 89 shown in Fig. 3 of the drawings as resting on the corner plates 87.

Referring now to Figs. 11 and 12 of the drawings, I have there illustrated a further modification of the device embodying my invention adapted to be mounted in a tunnel member 33 and including a plurality of bars 37 of electric-insulating material, a resistor 49 wound thereon and supported thereby and shroud members 91 which are substantially the same as the shroud members 51 except that no curled-around end portions are provided at the respective ends thereof. However, the bars 37 are supported by extensions 93 of the shrouds at top and bottom in substantially the same manner as is shown in Fig. 10 of the drawings. A plurality of such heating units is held in proper operative longitudinal relation relatively to each other by a flexible band 95 of thin sheet metal having openings therein for receiving bent-over ears 97 punched from the shroud in substantially the same manner as is shown in Fig. 17 of the drawings for the first described modification.

Here I provide somewhat different means for exerting pressure on the flanges 99 of the shrouds, this means including a pair of eccentrically mounted vertical shafts 101 having short bottom end portions 103 fitting into a bearing and supporting lug 105 either integral with or secured to the tunnel member at its bottom end

while the upper end portions of the shafts 101 extend through end portions 107 of a bracket 109 which, in addition to holding the upper ends of the pair of shafts 101, is adapted also to support by a central extension 111, the flexible strip 95 whereby all of the series or string of heating units is suspended from the upper end of the tunnel member and supported thereby. It is obvious that turning movement of the extreme upper squared ends of the shafts 101 will cause engagement of the flanges 99 by the shafts 101 to press the flanges into close engagement with the outside surface of a tank and it is possible to obtain any desired degree of pressure against the outer surface of the tank.

Referring now to Figs. 13 and 14 of the drawings, I have there shown a still further modification of a device embodying my invention for pressing a plurality of shroud flanges against the outer surface of the tank. Each heating unit includes a bar 37, resistor wire 49 therein, a shroud 113, flanges 114 and a pressure-transmitting member 115 of the general kind hereinbefore described with the modification shown in Figs. 8 to 10 inclusive. The string of pivotally connected heating units is supported as by a rod 117 extending through the curled-up upper end of the uppermost shroud 113, which rod rests upon the upper end of the side portions of the tunnel member 33. I may provide a plurality of wedges 119 either secured in proper position in the tunnel member 33 as shown in Fig. 14 of the drawings, or I may connect these wedge members by any suitable means, such as a strip of metal, as may be thought desirable. I provide a second series of wedges 121 connected by a rod 123 secured thereto in any suitable or desired manner, the rod 123 extending either through the respective wedges and secured thereto or secured against say the flat vertical surface thereof. It is to be noted that the rod 123 should be relatively heavy since its upper end has an adjusting screw 125 secured or extending therethrough which screw extends through a lug 127 secured to the tunnel member adjacent its upper end so that turning movement of the upper end of screw 125 will force the string of wedges 121 connected by the rod 123, downwardly as shown in Fig. 14 of the drawings, against the pressure-transmitting members 115 respectively whereby the pressure members 115, each of substantially channel shape as hereinbefore described, will cause close heat-conducting engagement of the flanges 114 with the outside surface of the tank, the parts being shown in their proper operative position in top plan view in Fig. 13. I may also make the compression rod 123 in the shape of a tension strip and so arrange adjusting screw 125 that it will cause tensioning of the member connecting the wedges 121.

Referring now to Figs. 15 and 16, I have there shown a still further modification particularly with relation to means for pressing the flanges of the respective shroud members into close heat-conducting engagement with the outside surface of a hot water tank. I provide a tunnel member 131 which is of slightly different form than that of tunnel member 33 but is adapted to be secured against the outside surface of the tank in any suitable or desired manner and as a metal member is preferably used, the outer edges thereof may be secured as by spot welds or welding seams. Each heating unit includes a bar 37 having a resistor mounted therein as hereinbefore set forth and a shroud 133 having relatively wide flanges 135 of the same general character as hereinbefore described in connection with the other modification hereinbefore described. A pair of leaf springs 137 are provided, which leaf springs are initially bent to relatively flat U-shape and may have their end portions slidable relative to the tunnel member and held in proper operative position by pins 139 adjacent the upper and lower ends of each spring. It is obvious that if a string of heating units of the kind hereinbefore described is lowered, say into an open-top tunnel member 131, the respective flanges 135 of the shrouds 133 will be forced into close heat-conducting relation with the outside surface of the tank 21 by these springs so that a heat-conducting path of relatively low thermal reluctance will be provided between the flanges of the shrouds and the outer surface of the water tank.

As it may happen that a hot water tank of this kind is installed in the basement of a home with a relatively short distance between the upper end of the tank and the ceiling, which distance may be just sufficient to permit of attaching additional piping to the hot water outlet pipe 141, it is desirable to provide relatively simple means whereby a string of heating units in one or all of the tunnel members may be easily and quickly removed. For this purpose I provide additional heat-insulating material 25 over the upper end of the tank 21 and I provide a plurality of chambers 143 above the respective upper ends of the open-top tunnel members 33, the height of each of these chambers being slightly larger than the overall length of each of the hereinbefore described heating units. Each of the chambers 143 defined, for instance, by side and inner walls constituting say a channel shaped member 145 (see Fig. 18) is provided with an easily removable door member 147 which, for instance, may be held in place by a top screw 149 (see Fig. 1). Should it be found necessary or desirable to remove a string of heating units from one of the tunnel chambers, the door member 147 may be removed and after manipulation of the shroud pressing means in any one of the various forms hereinbefore described to release the shroud members from their close operative engagement with the outer surface of the tank, it is possible to raise the string of heating units through the distance of one unit, that is the uppermost heating unit is moved into the chamber 143. The connecting pin hereinbefore described as extending either through the electric insulating bars or through the end portions of the shrouds, may then be removed whereby the uppermost heating unit can easily be removed by simply cutting the connecting wire extending between the adjacent resistors. In the case of the modification shown in Figs. 11 and 12, it is only necessary that the heating unit first positioned in chamber 143 is moved into substantially horizontal position near the bottom of the chamber 143 after which the entire string may be raised so that the upper end of the next lower heating unit is adjacent to the upper end of the chamber when it will be possible to bend the strip 95, continuation of these steps permitting of removing the entire string through the opening in the chamber 143 formed by removal of the door 147.

While I described hereinbefore a method of disconnecting the uppermost heating unit when moved into the chamber 143, if desired, it is to be

understood that a string of such heating units connected by the flexible band 95 can be effected in the same manner as hereinbefore described in connection with the modification shown in Figs. 11 and 12, it being only necessary to remove the individual heating units in sequence from the band 95 as they are moved into the chamber 103.

While I have illustrated and described tunnel members which are open at the top to permit of insertion of heating units into the tunnel from the upper end of the tank and removal of the heating units through the upper end of the tunnel, I do not desire to be limited thereto since should it be found that the head room above the upper end of the tank is entirely too small, it is easily possible to so arrange the installation that the tunnel members are open at their bottom ends and the heating units may be inserted into the respective tunnel members from the bottom ends thereof and may be removed therefrom through the lower open ends thereof. The string of heating units may in this case be supported say by resting upon suitable means such as the bracket plate 109 of Fig. 11 which is secured against the bottom end of the tunnel member, or by suitable supporting means secured to the upper end of the tunnel members.

Certain elements shown in the present application have been shown in my co-pending application Ser. No. 284,881 filed July 17, 1939, but it will be noted that in my earlier application the resiliently connected electric heating units extend in a horizontal plane around a hot water tank while the present application shows them as extending substantially axially of a circular hot water tank. It is, of course, obvious that my invention is not limited to a circular tank but that a tank of square shape may have the heating units disclosed herein applied thereto and it is further obvious that the axis of the tank need not extend vertically but may also extend horizontally.

While I have shown several selected forms and modifications of electric heating units adapted for external mounting on a fluid tank, it is obvious that my invention is not limited thereto and I therefore desire that all further modifications coming clearly within the scope of the appended claims shall be covered thereby.

I claim as my invention:

1. An electric tank heater assembly comprising a metal tunnel member extending longitudinally of the tank and having relatively wide side edges secured against the outside surface of the tank in good heat-conducting relation therewith, a plurality of elongated electric heating units positioned longitudinally in said tunnel member, each unit comprising a thin flat block of electric insulating material having laterally-extending slots in that face thereof adjacent to the tank, a bare resistor conductor in said slots, a metallic shroud of flat channel shape at the back and the sides of the block, relatively wide flanges on the shroud at each side thereof, means for supporting all of said units from the tunnel member and means carried by the tunnel member and adjustable at one end of the tunnel member for pressing the flanges of all of the shrouds into good heat-conducting contact with the outside surface of the tank to increase the effective surface area of the tank receiving heat from the resistor to a value appreciably greater than the area of the resistor-supporting block.

2. An electric tank heater assembly comprising a metal tunnel member extending axially of the tank and having its side edges secured against the outside surface of the tank in good heat-conducting relation therewith a plurality of elongated electric heating units extending longitudinally in said tunnel member, each unit comprising a thin flat block of electric insulating material having laterally-extending slots in one face thereof adjacent to the tank, a bare resistor conductor in said slots, a metallic shroud of flat channel shape at the back and the sides of the block and having lateral longitudinally-extending relatively wide flanges, means mechanically connecting said heating units in end-to-end relation whereby angular movement of the heating units relative to each other is effected, means for supporting all of said units from one end of the tunnel member and means operatively interposed between the tunnel member and the flanges for pressing the flanges of the several shrouds into good heat conducting contact with the outside surface of the tank whereby heat received by the shroud from the block is conducted to the tank.

3. An electric heater assembly for mounting on a hot water tank comprising a straight tunnel member of substantially channel shape in lateral section extending vertically longitudinally of a tank against its outer surface, means securing its edges against the outer surface of a tank, a plurality of electric heating units in said tunnel member, each unit comprising a relatively thin bar of electric insulating material having laterally-extending slots in the face adjacent the outer surface of the tank, a bare resistor conductor in said slots, a metallic shroud of flat channed-shape at the back of said bar, the shroud having a longitudinally-extending relatively wide flange at each side thereof adapted to have flat face engagement with the tank, flexible means connecting said plurality of units in end-to-end series, means supporting said series of heating units from the upper end of the tunnel member and means supported by the tunnel member for pressing the flanges of the shrouds into good heat-conducting engagement with the outside surface of the tank.

4. A heater assembly for use on a hot water tank and comprising a straight tunnel member of substantially channel shape in lateral section extending longitudinally of the tank secured to the outside of the tank and having at least one open end, a chamber structure adjacent the open end of the tunnel having a removable side door, alined with the open end of the tunnel member, a plurality of elongated electric heating units extending longitudinally in said tunnel member, each unit comprising a relatively thin bar of electric insulating material, a resistor carried by the bar adjacent to the outside surface of the tank, a metallic shroud of relatively flat channel shape and having lateral longitudinally-extending relatively wide flanges, located between the bar and the tunnel member, the length of each heating unit being less than the axial length of the chamber and disengageable flexible means connecting end portions of the heating units into a series to effect removal of part or all of the units of a series one at a time through the chamber.

5. A heater assembly for use on a vertical hot water tank and comprising a tunnel member of substantially channel shape in lateral section secured to and extending vertically along the outside surface of the tank and having at least one open end, a chamber structure adjacent to the tank and to the open end of the tunnel mem-

ber having a removable side door, a plurality of electric heating units suspended in said tunnel member and supported thereby, each unit comprising a relatively thin bar of electric insulating material, a resistor conductor carried by the bar adjacent to but spaced from the outside surface of the tank, a metallic shroud of flat channel-shape at the back of the bar and having side flanges for engaging the surface of the tank, flexible means connecting the heating units in an end-to-end series and means operatively interposed between the tunnel member and the flanges of the shrouds for pressing the flanges into close heat-conducting engagement with the tank surface.

6. A device as set forth in claim 5 and including a pressure-transmitting member of substantially channel shape having its longitudinal edges engaging the side flanges of the shroud and in which the pressing means comprises a single eccentric shaft.

7. A device as set forth in claim 5 and including a pressure-transmitting member of substantially channel shape having its longitudinal edges engaging the side flanges of the shroud and in which the pressing means comprises a plurality of cooperating pairs of relatively-movable wedges between the tunnel member and the pressure-transmitting member.

8. A device as set forth in claim 5 in which the means for pressing the flanges of the shrouds against the tank includes a pair of eccentric shafts.

9. An electric tank heater assembly comprising a plurality of heating units, each comprising an elongated thin flat bar of electric-insulating material having slots in one face theerof, a resistor conductor in said slots in direct and close heat radiating relation to the outside surface of the tank, a metal shroud of high heat conductivity adjacent to the outer face of each bar having a relatively wide flange at each side positioned in flat face engagement with the outside surface of the tank, means pivotally connecting said heating units in an end-to-end series located axially of the tank, a metal tunnel member extending axially of the tank outside of said series of heating units and having relatively wide side edges held in flat face close heat conducting relation to the outside surface of the tank, means supported at one end of the tunnel member for supporting the series of heating units and means interposed between the tunnel member and the flanges for pressing the flanges tightly into close heat-conducting engagement with the outside surface of the tank.

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