

May 29, 1956

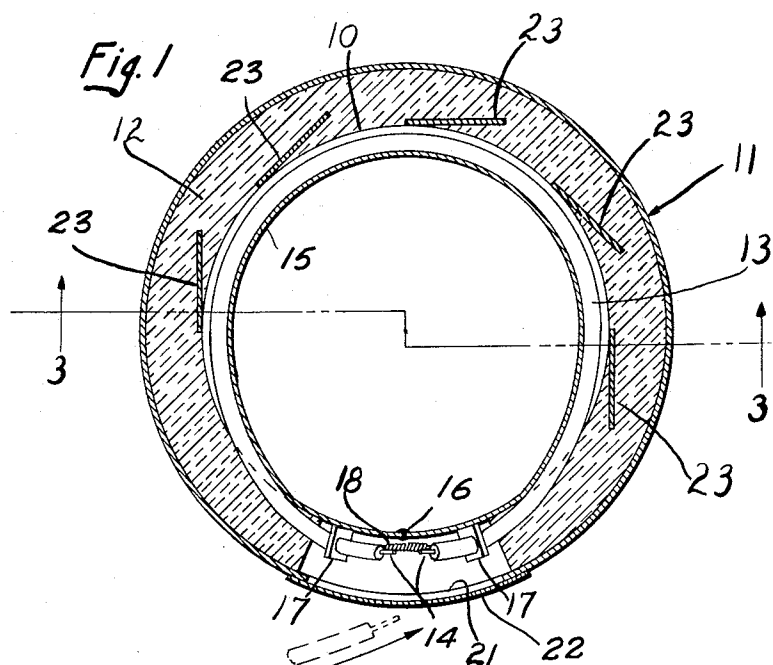
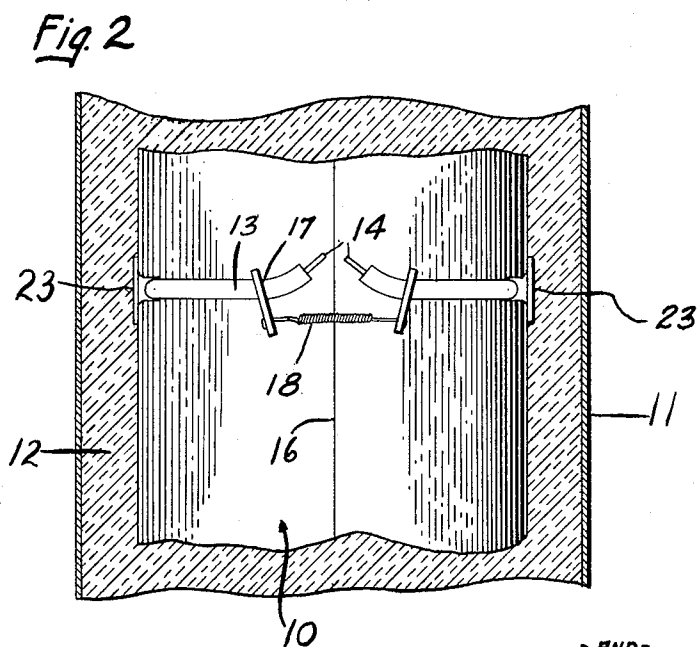
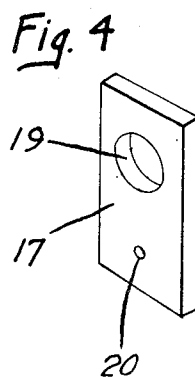
M. WILLIAMS ET AL

2,748,252

WATER HEATERS

Filed Oct. 4, 1954

4 Sheets-Sheet 1



INVENTORS
- AND -
MICHAEL WILLIAMS
GERALD H. KRESKE
By *Michael Williams*
Attorney

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WATER HEATERS

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4 Sheets-Sheet 2

Fig. 3

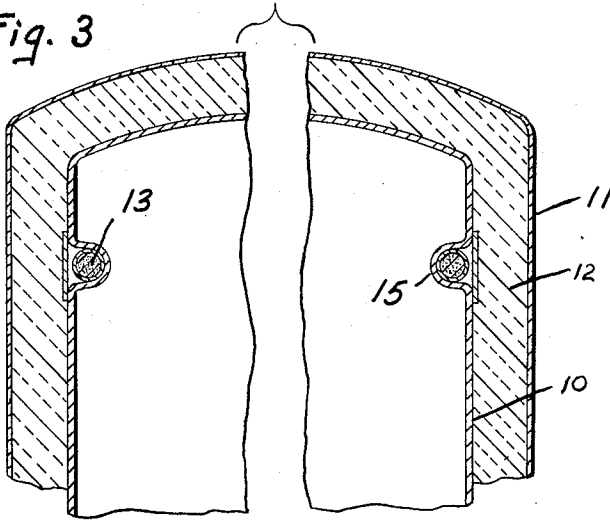


Fig. 12

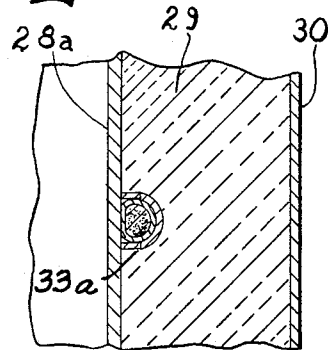


Fig. 13

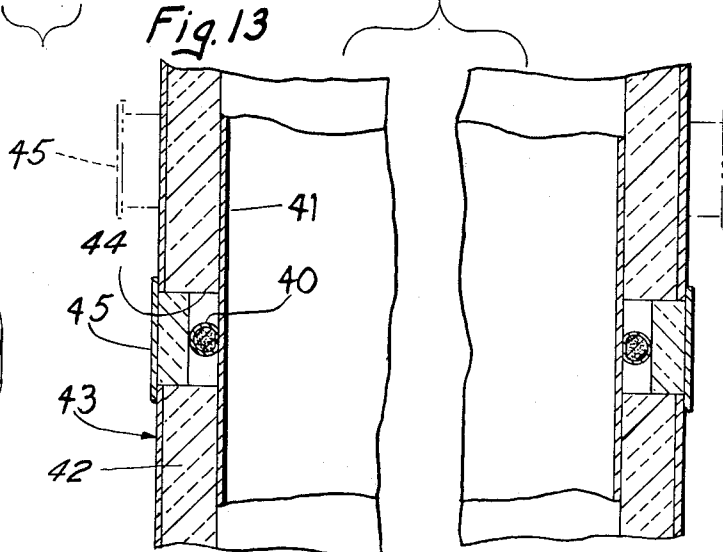


Fig. 14

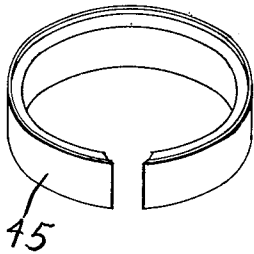
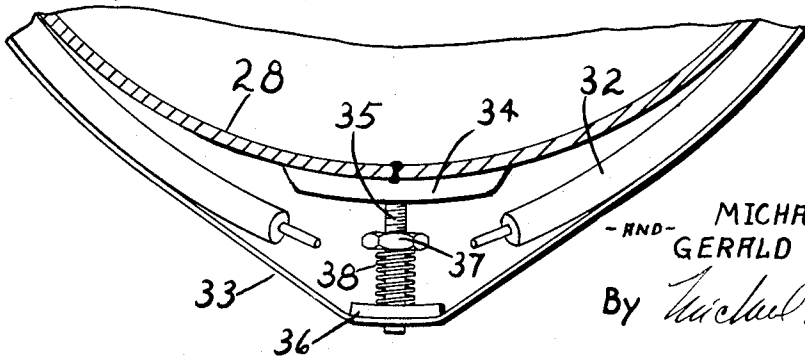


Fig. 9



INVENTORS
MICHAEL WILLIAMS
-AND-
GERALD H. KRESKE

By *Michael Williams*
Attorney

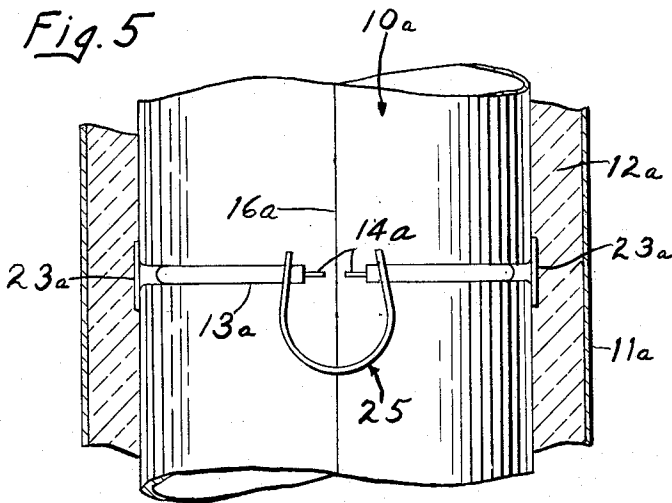
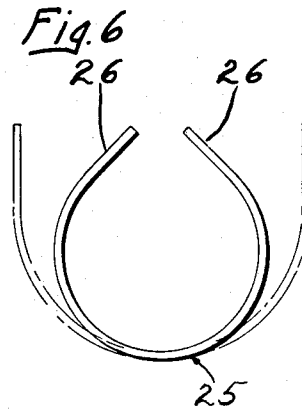
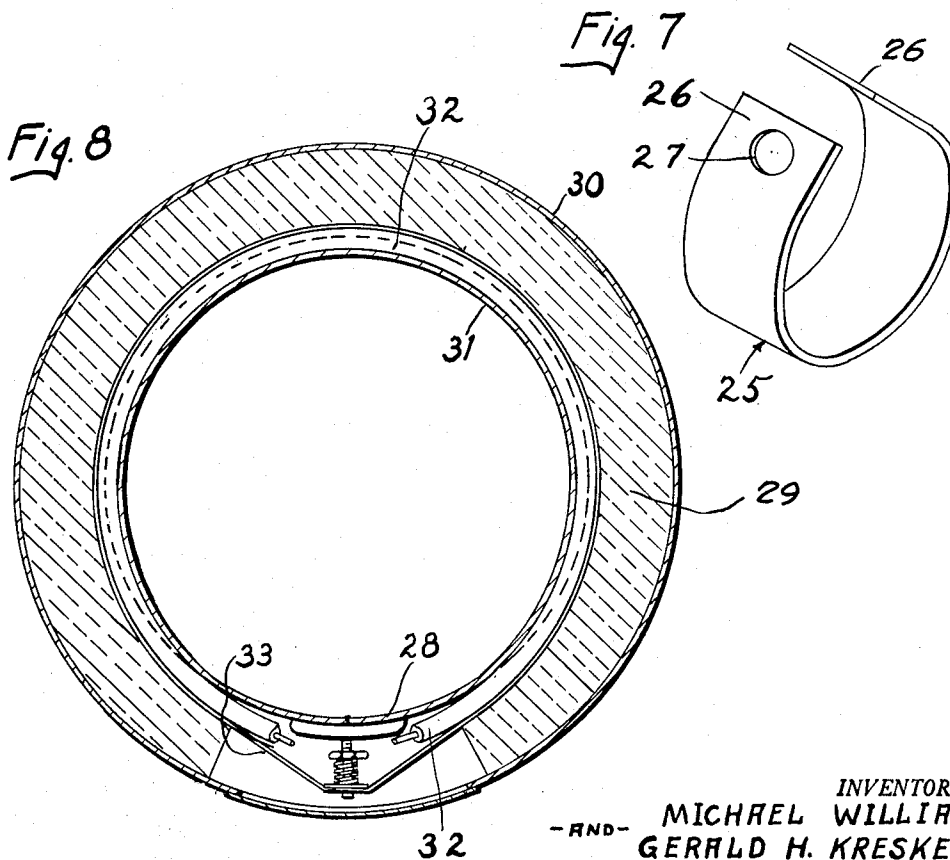
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4 Sheets-Sheet 3



INVENTORS
MICHAEL WILLIAMS
GERALD H. KRESKE

By *Michael Williams*
Attorney

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WATER HEATERS

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4 Sheets-Sheet 4

Fig. 11

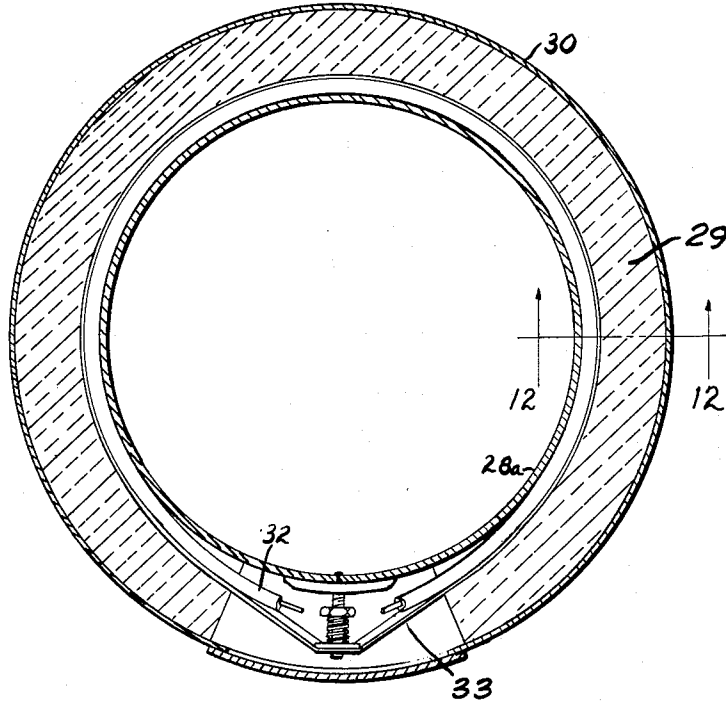
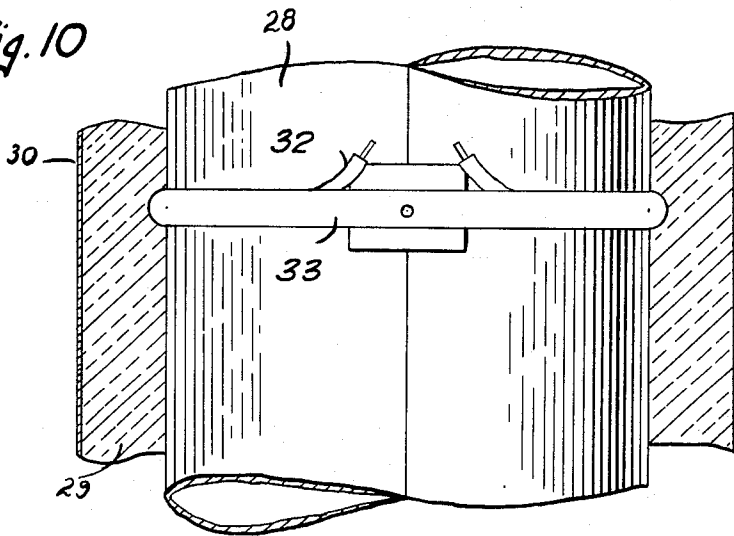


Fig. 10



INVENTORS
- AND - MICHAEL WILLIAMS
GERALD H. KRESKE
By *Michael Williams*
Attorney

1

2,748,252

WATER HEATERS

Michael Williams and Gerald H. Kreske, Warren, Ohio,
assignors to Edwin L. Wiegand Company, Pittsburgh,
Pa., a corporation of Pennsylvania

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15 Claims. (Cl. 219—38)

The present invention relates to water heaters, more particularly to water heaters of the type having a water storage tank about which is disposed an electric resistance heating element, and the principal object of our invention is to provide new and improved water heaters of the character described.

Water heaters of the type having one or more electric resistance heaters disposed about the exterior of a water storage tank have been known for a considerable time. However, this particular type of water heater has not achieved wide commercial success over the more common type in which an electric heater is immersed within the tank, in spite of the fact that the so called wrap-around heater eliminates the problem of element corrosion which has plagued the immersion type of heater.

One of the factors that limited wide-spread use of wrap-around water heater constructions has been the inability of the trade to devise an efficient yet economical construction for fastening the electric heater to the wall of the tank wherein good thermal conductivity between the tank and the heater will be maintained and wherein the electric heater may be replaced, when necessary, without dismantling the water heater.

The present invention provides efficient wrap-around water heaters which are economical to manufacture and to maintain in operation. These and other advantages will become apparent from a study of the following description and from the drawings appended hereto.

In the drawings accompanying this specification and forming a part of this application there are shown, for purpose of illustration, several embodiments which our invention may assume, and in these drawings:

Figure 1 is a transverse sectional view of a water heater constructed in accordance with one embodiment of our invention,

Figure 2 is a fragmentary elevational view, partially in section, of the embodiment illustrated in Figure 1,

Figure 3 is a fragmentary, enlarged longitudinal sectional view generally corresponding to the line 3—3 of Figure 1,

Figure 4 is an enlarged, perspective view of a detail employed in the embodiment shown in Figures 1, 2 and 3,

Figure 5 is a fragmentary elevational view of a water heater, partially in section, illustrating a modified construction,

Figure 6 is an enlarged elevational view of a detail employed in the embodiment illustrated in Figure 5, this detail being shown in one position in full lines and in another position in dot dash lines,

Figure 7 is a further enlarged, perspective view of the detail shown in Figure 6,

Figure 8 is a transverse sectional view of a water heater illustrating another embodiment of our invention,

Figure 9 is a fragmentary view similar to Figure 8 but considerably enlarged and omitting certain parts in the interest of clarity.

2

Figure 10 is a fragmentary elevational view, partially in section, of the embodiment shown in Figure 8,

Figure 11 is a transverse sectional view of a water heater illustrating still another embodiment of our invention,

Figure 12 is a fragmentary enlarged sectional view generally corresponding to the line 12—12 of Figure 11,

Figure 13 is a fragmentary longitudinal sectional view of a water heater illustrating a further embodiment of the invention, and

Figure 14 is a reduced size perspective view of a detail employed in the embodiment shown in Figure 13.

In the embodiment illustrated in Figures 1, 2 and 3, there is shown a water storage tank 10 which is encased in the usual jacket 11. The space between the jacket 11 and the tank 10 is adapted to be filled with the usual heat insulating material 12 such as fiberglass or the like. Although not shown, the usual means will be provided whereby the interior of the tank 10 may be connected to the lines which supply it with water to be heated and also to the lines which carry hot water from the tank to the various places where such water will be used.

In accordance with the present invention, the tank 10 is adapted to be heated by means of an electric resistance heater 13, of the tubular sheathed embedded type, which encircles the tank. It is a feature of the present invention and as will later be pointed out, the heater is resiliently held against the tank so that good thermal conductivity will be maintained therebetween under differential expansion and contraction.

Briefly, the type heater employed comprises an elongated tubular metallic sheath filled with compacted powdered electric-insulating, heat-conductive refractory material in which is embedded a resistor conductor. Terminal pins 14 are electrically and mechanically connected to respective ends of the resistor and such pins usually extend beyond respective ends of the sheath to provide for the necessary electrical connections to the resistor. The sheath of the heater will ordinarily be formed of such material, or will be so annealed, that it may easily be bent about the tank.

While the present invention is not limited to the specific type electric heater herein disclosed, it is preferable, at the present time, to employ heaters of this general type since they are economical to manufacture, have high watt density and long trouble-free life.

In order to improve thermal conductivity between the water stored within the tank and the electric heater, the tank shown in Figures 1, 2 and 3 is indented along a transverse axis to provide a groove 15 in which the heater is adapted to be seated. Since the heater disclosed in this embodiment is round in cross section, groove 15 has a rounded bottom to accommodate the heater.

In order to simplify manufacture of the water tank 10 and for other reasons which will later appear, it is preferable that groove 15 not extend completely around the tank. Since most tanks are made by forming a flat sheet of metal to a tubular form wherein opposed edges of the sheet are in juxtaposed relation and then welding or otherwise securing such edges together to provide a liquid-tight joint, it will be clear that considerable difficulty would arise if the groove intercepted the joint in the tank.

It is contemplated that the tank of the present embodiment will be constructed by forming a groove in the flat sheet of metal before it is formed to a tubular shape. This groove will not extend completely across the sheet but will terminate short of the respective edges which are to be joined. The sheet will then be formed to a tubular shape in the usual manner and the juxtaposed edges welded or otherwise secured together with no interference from the groove.

As best seen in Figure 1, groove 15 runs out, or terminates, short of the tank seam 16 and the electric heater 13 is so positioned therein that its ends extend beyond the respective ends of the groove. In the present embodiment, terminal pins 14 extend inwardly of the ends of the sheath some distance and, since the resistor is confined to that portion of the heater intermediate the inner ends of the terminal pins, the heat generating portion of the heater is confined to that portion which is disposed in groove 15. Means are provided for tensioning the heater 13 about the tank to insure good thermal conductivity therebetween, such means comprising clips 17 engageable with respective ends of the heater (but removable for a purpose to be disclosed) and a spring 18 for pulling the clip toward each other.

Each clip 17 (see Figure 4) comprises a metal plate having an aperture 19 of a size to just pass a respective end of the heater, and an aperture 20 in which the spring 18 is adapted to be anchored. At assembly, each clip 17 is adapted to be slid over a respective end of the heater and the clips pulled toward each other by means of spring 18 anchored to and extending between the clips. As a result of the pull of spring 18, each clip will be tilted slightly with respect to the axis of the heater (see Figure 2). This will cause the aperture defining portion of the clips to tightly engage the heater and, in effect, lock the clips thereto. Accordingly, the pull of spring 18 will be transmitted to the heater to tension it about the tank.

With the heater clamped about the tank, the ends will preferably be bent upwardly (see Figure 2) to facilitate making the usual (not shown) electrical connections to the projecting portions of the terminal pins 14.

As shown in Figure 1, the jacket 11, which encases the tank 10, is provided with an opening 21 adjacent the ends of the heater 13 to provide access to the latter and an opening is also provided in the insulating material 12 at this point. A cover 22 normally overlies the opening 21 in the jacket 11, this cover being secured in place by any suitable means but being removable to provide access to the ends of the heater.

In order to facilitate assembly of the heater 13 with the tank 10, particularly after the tank is encased by the jacket 11 and the insulating material 12, a plurality of plates 23 (herein shown to five) are welded or otherwise secured to the exterior of the tank so that they extend tangentially thereof (see especially Figure 1). Each plate 23 spans the groove 15 (see Figures 2 and 3) and serves to guide the heater 13 to position as it is fed about the tank.

When it becomes necessary to replace the heater 13, it is only necessary to remove the cover 22, remove the electrical connections (not shown) from the terminal pins 14, unhook spring 18 from the clips 17, remove the clips 17 from the heater and grasp the heater by one end and draw it from around the tank. Another heater will then be fed, as shown by the dot dash lines and by the arrow, to position within the groove and about the tank. It will be clear that the tangentially projecting plates 23 will serve to guide the leading end of the heater as it is fed about the tank through opening 21 and it will also be clear that the heater will preferably be somewhat curved, prior to assembly, to facilitate this operation.

With the heater positioned within the groove 15, the clips 17 and spring 18 will be assembled with the heater in the manner heretofore disclosed, the electrical connections made to the terminal pins 14 and cover 22 replaced over opening 21.

In the interest of simplicity, the water heater disclosed in Figures 1, 2 and 3 employs but a single electric heater 13; however, it is to be understood that as many heaters as desired may be disposed about the tank.

The embodiment of the invention disclosed in Figure 5 is similar to that shown in Figures 1, 2 and 3; accordingly, similar parts are identified with the same reference numerals but with the suffix "a" appended. However,

in this embodiment, clips 17 and spring 18 have been replaced by a spring member 25.

As shown in Figure 7 and in full lines in Figure 6, spring member 25 comprises a semi-circular band of spring steel or the like having terminal portions 26 normally disposed in adjoining relation. Each portion 26 has an aperture 27 of a size to just pass a respective end of the heater 13a. To assemble the spring member 25 with the heater 13a and assuming that the heater is disposed about the tank 10a with its ends in adjoining relation, the portions 26 of the spring member will be sprung apart, by any suitable means, to approximately the position shown by dot dash lines in Figure 6. Each portion 26 will then be slid over a respective end of the heater 13a and the portions thereafter allowed to return toward their normal positions. As the resiliency of member 25 attempts to return portions 26, such portions will be tilted, with respect to the axis of the heater, thus forcing the aperture defining portions of the member 25 into gripping engagement with the heater. With the portions 26 of member 25 tightly engaged with the heater, the resiliency of the member will draw the heater closely about the tank.

The water heater illustrated in Figure 8 is somewhat similar to that disclosed in Figures 1, 2 and 3 and comprises a water storage tank 28 surrounded by heat insulating material 29 and encased in a jacket 30. Tank 28 is provided with a groove 31 which is similar to groove 15 in tank 10 (Figure 1). However, in this embodiment, the groove is not as deep as in the one in tank 10 for a purpose to appear.

An elongated electric heater 32, similar in all respects to heaters 13, 13a of the heretofore disclosed embodiments, is adapted to be disposed in groove 31 in manner so that the ends of the heater extend beyond the respective ends of the grooves. In this embodiment, the means for holding the heater 32 within the groove and about the tank comprises a flexible band 33 of metal or other suitable material. Band 33 is herein disclosed to be a ring-like, single piece of thin metal having a diameter somewhat greater than the diameter of the tank 28 and a width somewhat greater than the cross sectional diameter of the heater 32. It is to be understood, however, that band 33 may be formed of an elongated strip having its ends fastened together by welding, riveting or the like.

Band 33 is adapted to be tightened about the heater 32 by urging a portion of the band away from the tank. This will force the remainder of the band tightly against the heater.

As most clearly shown in fragmentary, enlarged view Figure 9, but as also shown in Figures 8 and 10, a plate 34 having a threaded stud 35 extending therefrom is adapted to seat against the wall of tank 28 adjacent the adjoining ends of the heater 32. If desired, plate 34 may be welded or otherwise secured to the tank; however, in the present embodiment, plate 34 merely rests against the wall of the tank and is held in position by the taut band 33.

Band 33 is apertured to pass stud 35 and a thrust plate 36 is slideable along the stud 35 and is engageable with the inside of the band. A nut 37 is threaded on stud 35 and a compression spring surrounds the stud and is interposed between the nut and the thrust plate. It will be understood that as nut 37 is shifted along stud 35 in a direction away from the tank, force will be exerted through spring 38 to urge a portion of the band away from the tank and to urge the remainder of the band tightly about the heater. As best shown in Figure 10, the ends of the heater may be bent upwardly to facilitate making the necessary electrical connections thereto.

Replacement of heater 32 requires that nut 37 be shifted toward the tank to release the pressure exerted against band 33 and the heater grasped by one end and pulled from around the tank. The end of another heater will then be inserted between the tank and the band and

5

the heater fed around the tank until the ends thereof are positioned together at the opening in the jacket 30 as shown. The band will then be tightened once again in the manner hereinbefore disclosed.

It will be noted that the groove 31 and the band 33 together provide a passage about the tank through which the heater may easily be fed. It is contemplated that the insulating material 29 will prevent shifting of band 33 when it is loosened; however, if desired, one or more clips may be secured to the tank to maintain the band in position.

The water heater illustrated in Figure 11 is similar to the embodiment shown in Figures 8, 9 and 10; accordingly, similar parts are identified with the same reference numerals but with the suffix "a" appended. The embodiment disclosed in Figure 11 differs from that heretofore disclosed in that the groove in the tank has been eliminated and the heater merely wrapped about the periphery of the tank. In order to increase thermal conductivity between the heater and the tank, a portion of the heater may be flattened, prior to assembly with the tank (see Figure 12). Additionally, since there is no groove to guide the heater as it is fed about the tank, band 33a may be curved transversely (see Figure 12) to provide such a guide.

In the embodiment disclosed in Figure 13, an electric heater 40 encircles a water storage tank 41 which is surrounded by heat insulating material 42 and encased in a jacket 43. Heater 40 may be flattened to improve its thermal conductivity with the tank and the heater may be held about the tank by any suitable means. By way of example, heater 40 may be held about the tank by means of the clips 17 and spring 18 employed in the embodiment disclosed in Figures 1, 2 and 3 or by means of the spring member 25 disclosed in Figures 5, 6 and 7.

In order to provide for assembly and/or replacement of the heater in the embodiment of the invention illustrated in Figure 13, an annular opening 44 is provided adjacent the heater 40 in the jacket 43 and in the insulating material 42. Normally, opening 44 is closed by a discontinuous, generally ring-like band 45 (see also Figure 14) which overlies the opening. Insulating material may be cemented or otherwise secured to the band 45 and this band will be held in place over the opening 44 by any suitable means.

By way of illustration, band 45 may have sufficient resiliency to maintain itself in position closing opening 44. However, if desired, any suitable means may be employed to hold the band in position by drawing its adjoining ends together.

Replacement of heater 40 may easily be effected by springing band 45 and sliding it to the dot dash line position wherein it is spaced from opening 44. Access to all portions of the heater 40 will thus be effected to permit removal of the old heater and installation of a new one. After the heater is clamped about the tank and the necessary electrical connections made, band 45 will be returned to its full line position wherein it overlies opening 44.

In view of the foregoing it will be apparent to those skilled in the art that we have accomplished at least the principal object of our invention and it will also be apparent to those skilled in the art that the embodiments herein described may be variously changed and modified, without departing from the spirit of the invention, and that the invention is capable of uses and has advantages not herein specifically described, hence it will be appreciated that the herein disclosed embodiments are illustrative only, and that our invention is not limited thereto.

We claim:

1. A water heater construction, comprising a water storage tank generally circular in cross section and having its wall indented along a transverse axis to provide an inwardly directed, discontinuous groove, an elongated sheathed electric resistance heater having an intermediate portion positioned within said groove and having end portions extending beyond respective terminal portions of

6

said groove, and means resiliently holding said heater in seated relation within said groove to insure good thermal conductivity between said heater and said tank.

2. A water heater construction, comprising a water storage tank generally circular in cross section and having its wall indented along a transverse axis to provide an inwardly directed groove, an elongated sheathed electric resistance heater positioned within said groove, and means for tensioning said heater longitudinally about said tank to insure seating thereof within said groove and to provide good thermal conductivity between said heater and said tank.

3. A water heater construction, comprising a water storage tank generally circular in cross section and having its wall indented along a transverse axis to provide an inwardly directed groove, an elongated sheathed electric resistance heater positioned within said groove, and means engageable with respective end portions of said heater and urging such portions in a direction to tension said heater longitudinally to insure seating thereof within said groove and to provide good thermal conductivity between said heater and said tank.

4. A water heater construction, comprising a water storage tank generally circular in cross section and having its wall indented along a transverse axis to provide an inwardly directed, discontinuous groove, an elongated sheathed electric resistance heater having an intermediate portion positioned within said groove and having end portions extending beyond respective terminal portions of said groove, and means connecting the end portions of said heater together and yieldably urging such portions in a direction to tension said heater longitudinally to insure seating thereof within said groove and to provide good thermal conductivity between said heater and said tank.

5. A water heater construction, comprising a water storage tank generally circular in cross section and having its wall indented along a transverse axis to provide an inwardly directed, discontinuous groove, an elongated sheathed electric resistance heater having an intermediate portion positioned within said groove and having end portions extending beyond respective terminal portions of said groove, a flexible ring-like band completely encircling said tank and having one portion adjacent the end portions of said heater and another portion adjacent and overlying the intermediate portions of said heater, and resilient means interposed between said one portion of said band and the portion of said tank adjacent the terminal portions of said groove and yieldably urging said one band portion away from said tank thereby drawing said other band portion about said heater to insure seating thereof within said groove and to provide good thermal conductivity between said heater and said tank.

6. A water heater construction, comprising a water storage tank, an elongated sheathed electric resistance heater disposed about said tank, and means engageable with respective end portions of said heater and urging such portions in a direction to tension said heater longitudinally to insure good thermal conductivity between said heater and said tank.

7. A water heater construction, comprising a water storage tank, an elongated sheathed electric resistance heater disposed about said tank and having end portions positioned in adjoining relation, and means connecting such end portions together and urging such portions in a direction to tension said heater longitudinally to insure good thermal conductivity between said heater and said tank.

8. A water heater construction, comprising a water storage tank, an elongated sheathed electric resistance heater disposed about said tank and having respective end portions positioned in spaced-apart, adjoining relation, and resilient means connecting such end portions together and yieldably urging such portions in a direction toward each other to tension said heater longitudinally to insure

good thermal conductivity between said heater and said tank.

9. A water heater construction, comprising a water storage tank, an elongated sheathed electric resistance heater disposed about said tank and having end portions positioned in adjoining relation, and means engageable with respective end portions of said heater and yieldably urging such portions in a direction to tension said heater longitudinally to insure good thermal conductivity between said heater and said tank, said means including clip portions each apertured to pass a respective heater end portion and each adapted to be tilted to urge an aperture defining portion of each clip portion into gripping engagement with said heater, said means also including a resilient portion for tilting said clip portions and for yieldably urging such portions toward each other.

10. A water heater construction, comprising a water storage tank, an elongated sheathed electric resistance heater disposed about said tank and having end portions positioned in adjoining relation, a clip member being adapted to be tilted to urge the aperture defining portion thereof into gripping engagement with said heater, and resilient means engageable with said clip members to effect tilting thereof and yieldably urging the latter and respective end portions of said heater in a direction to tension said heater longitudinally to insure good thermal conductivity between said heater and said tank.

11. A water heater construction, comprising a water storage tank, an elongated sheathed electric resistance heater disposed about said tank, a flexible band completely encircling said tank and overlying said heater, and means interposed between said tank and one portion of said band and urging said one portion away from said tank thereby drawing another portion of said band about said heater to insure good thermal conductivity between the latter and said tank.

12. A water heater construction, comprising a water storage tank, an elongated sheathed electric resistance heater disposed about said tank, a flexible ring-like clamping band completely encircling said tank and overlying said heater, and resilient means interposed between said tank and one portion of said band and yieldably urging said one portion away from said tank thereby drawing

another portion of said band about said heater to insure good thermal conductivity between the latter and said tank.

13. A water heater construction, comprising a water storage tank, an elongated sheathed electric resistance heater disposed about said tank, means holding said heater closely against said tank to insure good thermal conductivity therebetween, a protective casing surrounding said tank, said casing being open adjacent said heater and providing access to the major portion of the latter to facilitate its replacement, and cover means normally closing said casing.

14. A water heater construction, comprising a water storage tank generally circular in cross section, an elongated electric heater disposed along a transverse axis about said tank, means holding said heater closely against said tank to insure good thermal conductivity therebetween, a protective casing surrounding said tank, said casing having a transverse opening adjacent said heater and providing access to the major portion of the latter to facilitate its replacement, and cover means including a band-like member normally encircling said casing and overlying and closing the opening therein.

15. A water heater construction, comprising a water storage tank generally circular in cross section, an elongated sheathed electric resistance heater wrapped about said tank, a flexible band completely encircling said tank and overlying said heater and having an internal size materially larger than the cross-sectional size of said tank to provide for ease of assembly, and means for urging a portion of said band radially outwardly of said tank to tighten the remainder of said band about said heater to force the latter against said tank and provide good thermal conductivity therebetween.

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