

- [54] **SHEATHED HEATING ELEMENT
INSTALLATION**
- [75] Inventor: **Johnny W. Yartz**, Anchorage, Ky.
- [73] Assignee: **General Electric Company**,
Louisville, Ky.
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- [52] **U.S. Cl.** **219/536; 174/78; 174/153;**
219/336; 339/130 R
- [51] **Int. Cl.²** **H05B 3/06**
- [58] **Field of Search** 219/336, 481, 536, 537;
29/421 M; 113/116 UT; 339/130 R, 130 C;
174/78, 153

[56] **References Cited**

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2,528,966	11/1950	Moore et al.	219/481
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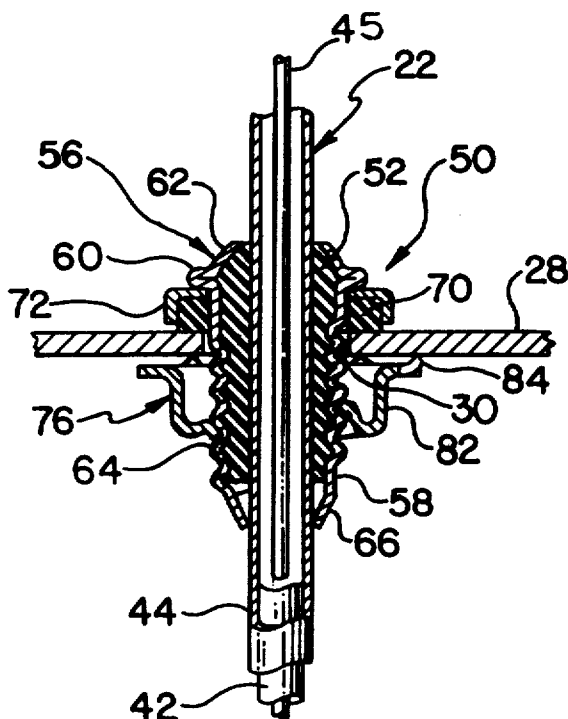
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Primary Examiner—Volodymyr Y. Mayewsky

[57] **ABSTRACT**

There is disclosed a dishwasher having an improved arrangement for sealing a sheathed heating element to the tub bottom and for grounding the sheath to the tub. The sealing and grounding arrangement comprises a deformable sleeve surrounding the sheath, a metal sleeve surrounding the deformable sleeve, a sealing member disposed between one end of the sleeve and the tub bottom, and a fastener threaded onto the opposite end of the metallic sleeve.

4 Claims, 3 Drawing Figures



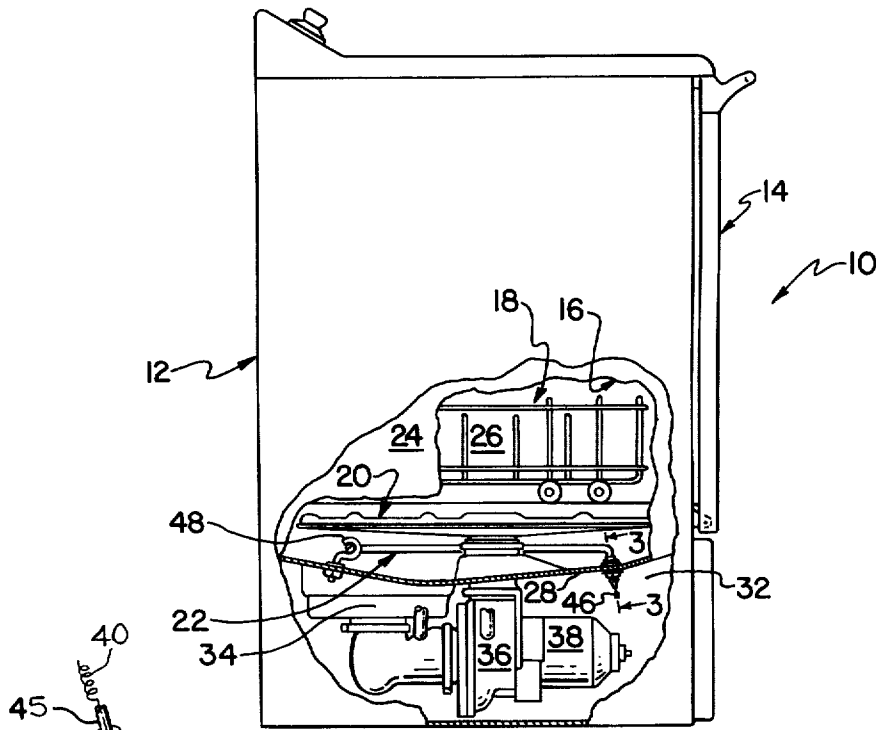


FIG. 1

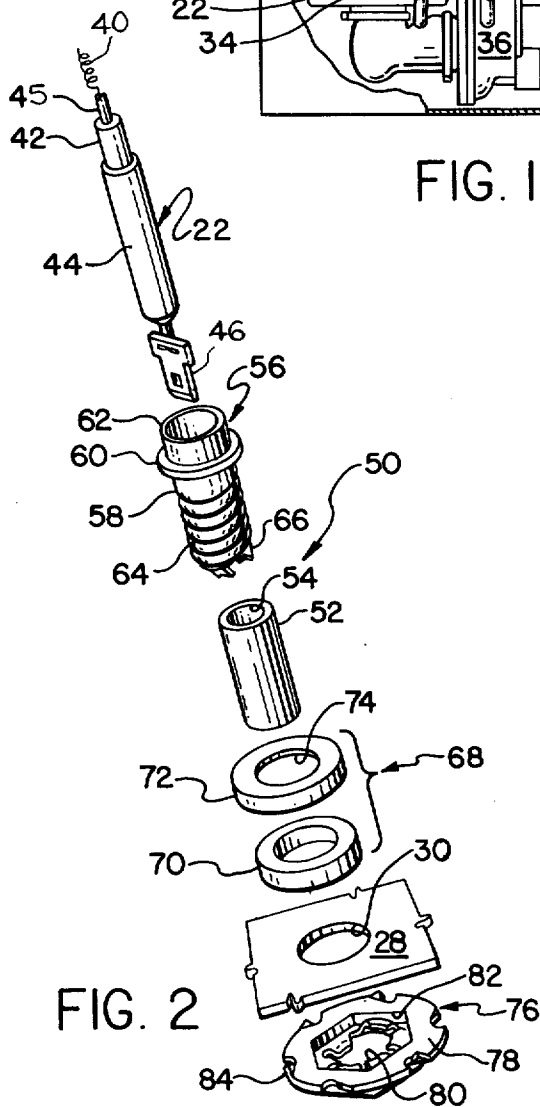


FIG. 2

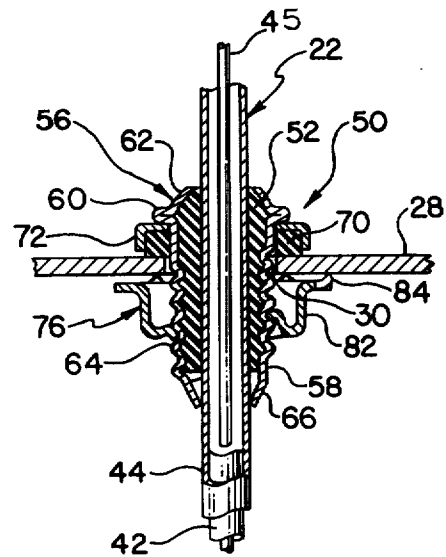


FIG. 3

SHEATHED HEATING ELEMENT INSTALLATION

BACKGROUND OF THE INVENTION

Dishwashers are commonly equipped with a sheathed heating element adjacent the tub bottom. Such heating elements are commonly used during the drying segment of the operating cycle to provide a heat source for drying tableware in the dishwasher. Such heating elements are also often activated during the wash cycle for maintaining or achieving a desired water temperature. These heating elements are typically, in plan, horse-shoe shaped. The opposite ends of the heating element commonly pass through spaced apertures in the tub bottom for connection with electrical wiring for energizing the heater. Since the heating element passes through the tub bottom, which is wet during the wash cycle, some means are provided to seal the aperture to prevent water passing into the pump-motor compartment. The sheath of the heating element has been heretofore typically grounded to the tub bottom by brazing or soldering an exteriorly threaded metallic connection to the sheath, then securing the threaded metallic connection to the tub by a mechanical means, such as a threaded nut, that fits the connection so that electrical continuity is established between the tub and sheath. Soldering or brazing, however, is a relatively expensive operation and the integrity of the joint is not reliable. It is highly desirable to eliminate this type of joining operation yet have electrical continuity between the tub and the sheath.

Another arrangement for establishing electrical continuity between the tub and sheath is shown in U.S. Pat. No. 3,657,519 — FIG. 4. This type of arrangement requires a threaded fitting to have the same inner diameter as the heating element sheath so that it is in contact with the sheath and then a tubular nut is fastened to the threaded fitting and soldered or welded to the tub. This type of arrangement in production is troublesome because very close manufacturing tolerance is required to assure electrical continuity between the fitting and sheath. Also, a soldering or welding operation is again required. Moreover, dishwasher tubs almost always have a corrosion resistive coating making a good soldering or welding joint difficult to achieve.

Other arrangements for a sheathed heating element installation are disclosed in U.S. Pat. Nos. 3,118,124; 3,210,526; and 3,354,294.

Other electric insulating devices are disclosed in U.S. Pat. Nos. 2,030,460; 2,446,317; 2,872,506; 2,931,007; 3,118,124; 3,206,539; 3,444,313 and 3,514,529.

SUMMARY OF THE INVENTION

In the practice of this invention, the sealing arrangement provided about the sheathed heating element inherently provides the ground connection during assembly of the sealing arrangement.

In summary, this invention comprises a tub, having first and second apertures therethrough and a metallic section adjacent the first aperture, providing together a chamber; a resistive heating element in the chamber having opposite ends extending through the apertures and including a core, an insulator around the core, a metallic sheath around the insulator and terminals exterior of the tub; and means sealing the sheath to the tub interior and grounding the sheath to the metallic section, the sealing and grounding means including a seal in surrounding sealing engagement with the sheath;

a metallic sleeve in surrounding sealing engagement with the seal, extending through the first tub aperture and having a first end and a second threaded end disposed adjacent the interior and the exterior respectively of the tub, a projection on the first sleeve end, and an element bearing against the sheath in electrical connection therewith; a seal member including a resilient washer disposed between the projection and the interior of the tub in sealing engagement therewith; and a metallic rotatable fastener treadably connected to the second end of the metallic sleeve bearing against the outside of the tub wall and binding the sleeve projection against the seal member, the fastener also providing electrical continuity so that the grounding means defines a ground path between the sheath and the metallic section including the sleeve element, the metallic sleeve, and the rotatable fastener.

It is an object of this invention to provide a dishwasher having a sheathed heating element therein and improved means for sealing the heating element to the tub and providing a ground connection therebetween.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevational view of a dishwasher constructed in accordance with the principles of this invention, certain parts being broken away for clarity of illustration.

FIG. 2 is an exploded isometric view of the connection, in unassembled condition, between the sheathed heating element and the tub.

FIG. 3 is an enlarged cross sectional view of FIG. 1 taken substantially along line 3—3 thereof as viewed in the direction indicated by the arrows.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 1, there is illustrated a dishwasher 10 comprising as major components a cabinet 12, a door 14 hinged about the lower end thereof, a tub 16 providing with the door 14 a wash chamber 18, means 20 for distributing washing liquid in the wash chamber 18 and a sheathed heating element 22.

The tub 16 may be of any suitable type and typically includes side walls 24, 26, a top wall (not shown), a back wall (not shown), and a bottom wall 28. The tub 16 may be of any suitable type including a corrosion resistant metallic structure, a non-corrosion resistant metallic structure having a suitable corrosion resistive coating on the interior thereof or a unipartite plastic structure. The tub bottom 28 is typically provided with a pair of apertures 30 adjacent the door 14 for passing the ends of the heating element 22 into a pump-motor compartment 32.

The liquid distributing means 20 typically includes a sump 34 in fluid communication with the inlet of a pump 36 driven by a motor 38. The outlet of the pump 36 is in fluid communication with a spray arm for spraying washing liquid into the wash chamber 18 in a typical fashion.

The heating element 22 is best illustrated in FIGS. 2 and 3 and includes a central electrically resistive core 40, a thermally conductive electrically insulating section 42 surrounding the core 40 and a metallic sheath 44 around the insulator 42. A low resistance terminal pin 45 connects the core 40 and a terminal fitting or connector 46. Heating elements of this type are widely used and are sold by the assignee of this invention

under the trademark Calrod. In plan, the heating element 22 is generally horseshoe shaped having terminal fittings 46 at each end thereof. One or more brackets 48 may be spaced about the periphery of the heating element 22 to maintain the same in a predetermined position in the wash chamber 18.

Referring to FIGS. 2 and 3, there is illustrated an arrangement 50 for sealing the heating element 22 to the tub bottom 28 adjacent the aperture 30. The sealing arrangement 50 includes a deformable or resilient sleeve 52 which is typically a rubber like insulator. The sleeve 52 provides a central opening 54 having a diameter sufficient, in a relaxed condition of the sleeve 52, to accept freely the heating element 22. In the assembled and deformed condition, the sleeve 52 is in surrounding sealing engagement with the sheath 44 of the heating element 22.

A rigid electrically conductive sleeve or fitting 56 surrounds and captivates the deformable sleeve 52 in the assembled condition of FIG. 3. The sleeve 56 is conveniently of constant or substantially uniform thickness formed by drawing and deforming sheet metal and includes a generally cylindrical body 58 having a peripheral flange or projection 60 extending away from the body 58 at one end thereof. As shown in FIG. 3, the upper end 62 of the body 58 is deformed against the upper end of the sleeve 52 for compressing the same against the sheath 44. The opposite end of the sleeve 56 is formed with a suitable rolled helical screw thread 64. Depending from the lower end of the body 58 are one or more elements 66 which provide one link of a ground path between the sheath 44 and the tub bottom as will be explained more fully hereinafter. The elements 66 may be configured as prongs as illustrated in FIGS. 2 and 3 or may comprise a swaged collar.

The sealing arrangement 50 also comprises a seal member 68 including an annular resilient member 70 and a rigid cup-shaped member 72 having an opening 74 therethrough for passing the body 58 of the sleeve 56. As is apparent from FIG. 3, the opening 74 is too small to pass the projection 60 of the sleeve 56. It will be apparent that engagement of the projection 60 with the rigid member 72 acts to compress the resilient member 70 against the inner side of the tub bottom 28.

The sealing arrangement 50 also comprises a fastener or nut 76 for cinching the sleeve 56 in the assembled position of FIG. 3 and for establishing an electrical ground contact or path between the sheath 44 and the metallic sleeve 56. The fastener 76 conveniently comprises a stamped sheet metal body 78 providing a helically threaded opening 80 for cooperation with the screw threads 64 of the sleeve 56. The fastener 78 includes a wrench receiving section 82 which is conveniently hexagonal. While it is possible to provide separate fastener elements, one for tightening and one, such as a washer, for contacting the tub and scribing it if necessary, it is desirable to provide for both functions in one fastener device.

In the provision of a grounding path from the sheath 44 to the exterior of the tub bottom 28, it is quite important that good electrical contact be made between each of the metallic components comprising the ground path. It will be apparent that the prongs 66 are forced against the sheath 44 thereby establishing good electrical contact therewith. There is little or no difficulty in achieving good electrical contact between the screw threads 64, 80 since frictional contact therebe-

tween during rotation of the fastener 70 tends to remove any electrically insulating coatings from between the threads. It has been learned that there is some difficulty in assuring good electrical contact between the fastener 76 and the exterior of the tub bottom 28. It appears that the tub exteriors typically have an electrically insulating coating thereon. With the tub 16 made of a non-corrosion resistant metallic structure, the coating appears to be a lacquer applied to the sheet metal from which the tub 16 is made. Since many corrosion resistant alloys form an adherent oxide coating thereby providing the corrosion resistant feature, a similar problem occurs if the tub 16 is made of a corrosion resistant alloy. It is accordingly desirable to remove any electrically insulating coating on the exterior of the tub 28.

To this end, at least one pointed prong and preferably a plurality of prongs 84 project from the fastener 76 and scribe the exterior of the tub bottom 28 as the fastener 76 is tightened by rotation on the sleeve 56. The prongs 84 accordingly scratch and penetrate any coating on the exterior of the metallic tub bottom 28 in order to provide good electrical communication between the fastener 76 and the tub bottom 28. In the event the tub 16 comprises a unipartite plastic structure, it will be apparent that a metallic plate may be secured to the underside of the tub bottom in order to provide a link in the grounding circuit.

Assembly of the sheathed heating element 22 in the dishwasher 10 is divided into two operations: securing the sleeves 52, 56 to an intermediate portion of the heating element 22 and fastening the sleeve 56 to the tub bottom 28. As will be apparent to those skilled in the art, the heating element 22, is, in plan, of generally horseshoe configuration with the horseshoe defining a plane. The terminal ends of the heating element 22 are turned down out of the plane from the horseshoe as may be seen from FIG. 1. In its relaxed or undeformed condition, the opening 54 of the sleeve 52 is of sufficient size to pass the terminal connection 48 and the sheath 44 of the heating element 22. The sleeve 52 is accordingly placed adjacent each end of the heating element 22. The sleeve 56 is then passed onto each sleeve 52. A metal deforming operation is then conducted to turn the upper body end 62 of the sleeve 56 inwardly toward the sheath 44 as suggested by a comparison of FIGS. 2 and 3. Similarly, the prongs 66 are urged or pressed radially inward toward the sheath 44 into firm engagement therewith. It will be seen that the upper body end 62 acts to compress the deformable sleeve 52 thereby captivating the sleeve 56 to the heating element 22 and providing a watertight seal around the periphery of the heating element 22. Compression of the sleeve 52 also effects a watertight seal about the inner diameter of the sleeve 56.

With the heating element 22 in the partially assembled condition above described, it is ready for attachment in the dishwasher 10. The seal member 68 is passed over the terminal fitting 46, the fitting 46 is then passed through the opening 30 in the tub bottom 28 and the fastener 76 is assembled on the screw threads 64. A suitable wrench is applied to the section 82 in order to scribe the underside of the tub bottom 28 with the prongs 84 and to advance the sleeve 56 downwardly through the opening 30 for compressing the resilient member 70. The resilient member 70 thus pro-

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vides a seal between the sleeve exterior and the inside of the tub bottom 28.

It is now apparent that the assembly of the sealing arrangement 50 on the tub bottom 28 acts to complete a grounding path from the sheath 44 to the tub bottom 28. The prongs 66 provide an electrical connection between the sheath 44 and the sleeve body 58. An electrical connection between the fastener 76 and the sleeve 56 is afforded by the cooperating helical screw threads. The prongs 84 scratch off any coating on the underside of the tub bottom 28 in order to make good electrical contact therewith. It will accordingly be seen that the practice of this invention provides a watertight seal between the heating element 22 and the tub bottom 28 as well as providing a ground path inherent in the assembly of the sealing arrangement 50.

It is to be understood that this invention is not limited in its application to a dishwasher tub, but the assembly described above is applicable wherever it is desirable to provide both a liquid tight seal between the interior and exterior of an enclosure or tub when a heating element is passed therethrough and a ground path therebetween.

I claim:

1. In a dishwasher comprising a door and a tub, having first and second apertures therethrough and, an exterior coated metallic section adjacent said apertures, providing together a wash chamber; the improvement being a resistive heating element in the chamber having opposite ends extending through the apertures, each end including a core, an insulator around the core, a metallic sheath around the insulator and terminals exterior of the tub; and means sealing the sheath to the inside of the tub and grounding the sheath to the metallic section, said sealing and grounding means comprising: a first resilient seal in surrounding sealing relationship with each of the ends of said sheath; a rigid metallic sleeve, in surrounding sealing engagement with each of said first seals, each rigid sleeve extending through

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one of said apertures and having a first end including a radially outwardly projecting flange and a second threaded end having an element bearing against the sheath in electrical connection therewith, said ends being disposed adjacent the interior and the exterior, respectively, of the tub and said first resilient seals each underlying and extending from said first end to said second end of its respective rigid sleeve; a second seal member including a rigid cup-shaped washer abutting said flange of said first sleeve end; and, a resilient washer disposed between said cup shaped washer and the interior of the tub in sealing engagement therewith, said rigid cup-shaped washer partially enclosing and deforming said resilient washer; a metallic rotatable fastener threadably connected to each second sleeve end and bearing against the exterior of the tub and binding said flange against the seal member, the fastener comprising at least one pointed element projecting in bearing engagement with the metallic section for scratching the coating therefrom upon rotation of the fastener against the tub exterior and effecting grounding; the sealing and grounding means providing a ground path between the sheath and the metallic section through the sleeve element bearing against the sheath, the metallic sleeve and the rotatable fastener.

2. The dishwasher resistive heating element of claim 1 wherein the metallic sleeve includes means deforming its corresponding underlying first resilient seal into sealing engagement with the sheath.

3. The dishwasher resistive heating element of claim 1 wherein the threaded end of the metallic sleeve comprises rolled threads.

4. The dishwasher resistive heating element of claim 1 wherein said first resilient seals provide central openings having a dimension in a relaxed condition sufficient to pass the sheath, the corresponding metallic sleeves compressing its underlying first resilient seal into tight fitting engagement with the sheath.

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