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I. JEPSON

3,259,732

WATERPROOF TERMINAL CONSTRUCTIONS AND ELECTRICAL
HEATING ELEMENTS INCLUDING SAME

Filed Oct. 28, 1963

2 Sheets-Sheet 1

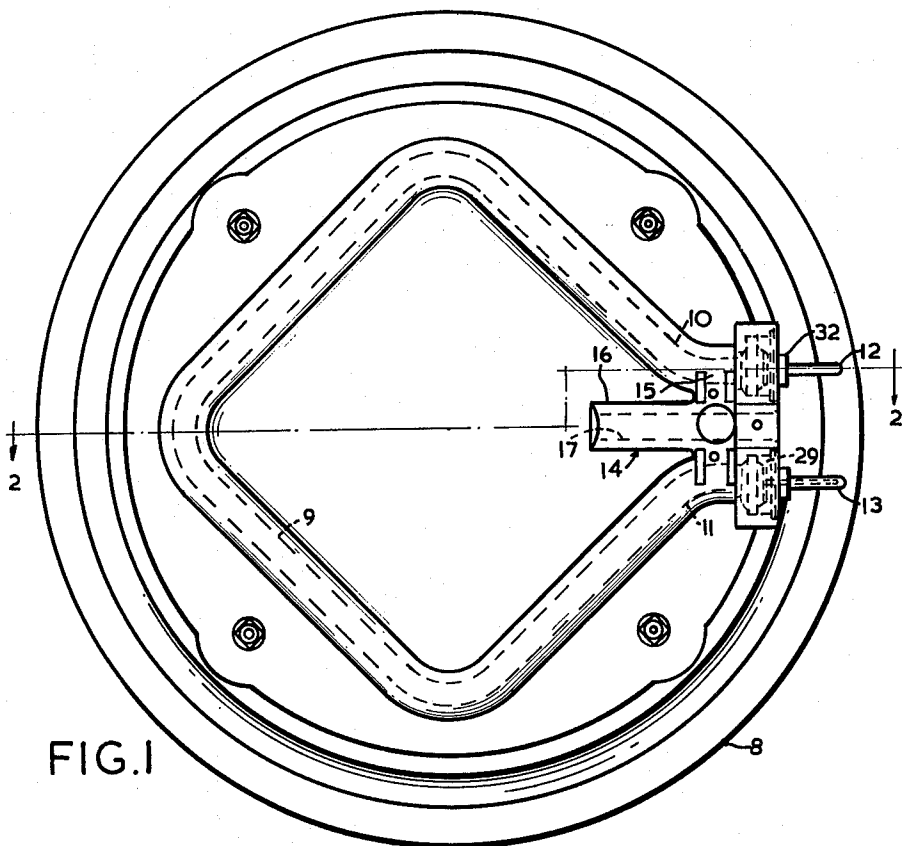


FIG. 1

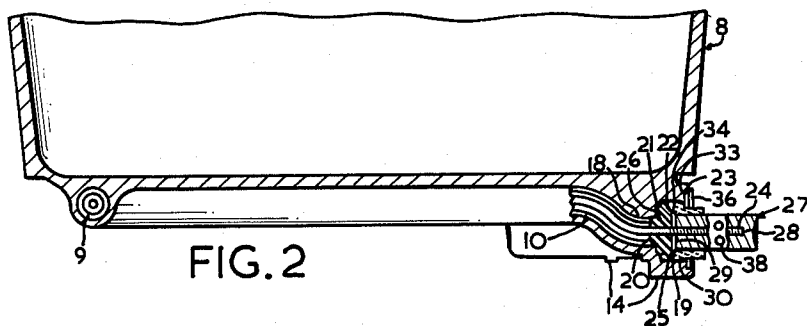


FIG. 2

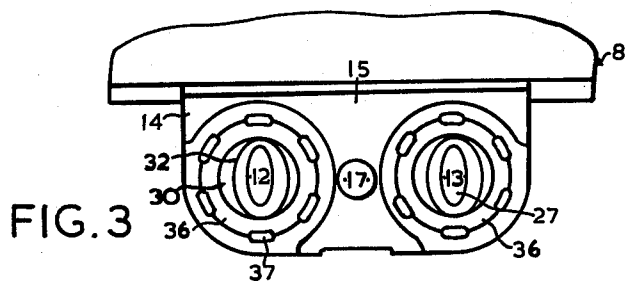


FIG. 3

July 5, 1966

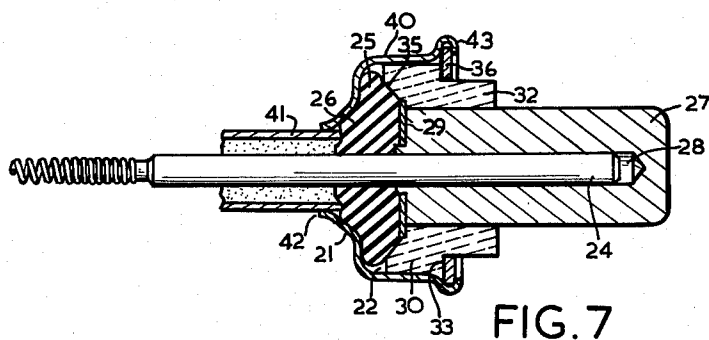
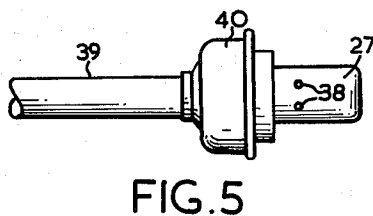
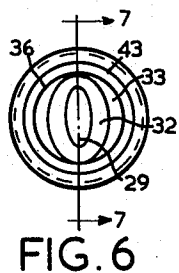
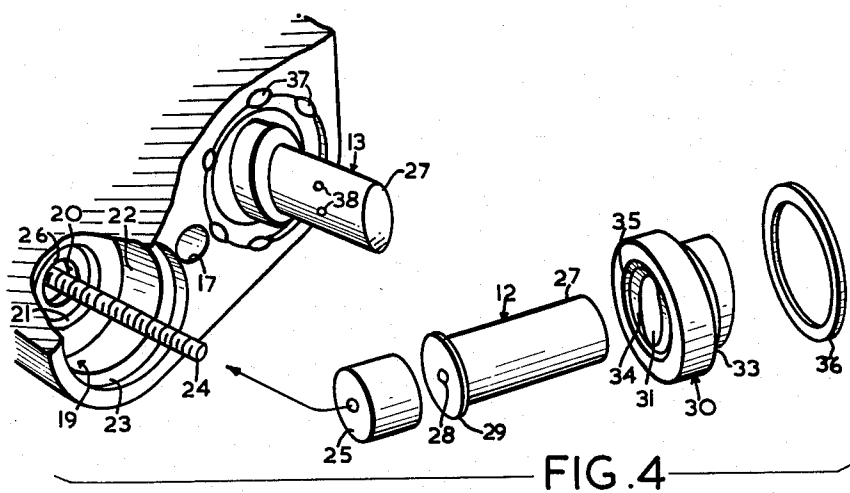
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1

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WATERPROOF TERMINAL CONSTRUCTIONS AND ELECTRICAL HEATING ELEMENTS INCLUDING SAME

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6 Claims. (Cl. 219-436)

This invention relates to a waterproof terminal construction which may be used to terminate electrical heater elements of the sheathed type, and to sheathed electrical heating elements terminated by such waterproof terminals.

The terminal construction of the present invention is equally applicable to heating elements which have been cast into the base of, say, a cooking vessel, and to radiant heating elements such as may be used in the cover of an electric frying pan.

According to this invention a waterproof terminal construction for a sheathed type electrical heating element comprises an annular sealing element of a heat-resistant flexible material surrounding the central terminal lead of the heating element and abutting against the end of the sheath, an elongated hollow terminal enclosing the said central terminal lead and having an enlarged end between which and the end of the sheath the sealing element is compressed, an insulator surrounding the lower end of the terminal and having a well in its base enclosing the enlarged end of the terminal, and a retaining washer surrounding the insulator, the washer being held within a well at the end of the heating element whereby the sealing element is held in the compressed state.

Reference will now be made to the accompanying drawings in which:

FIGURE 1 is an underneath view of portion of an electric frying pan including waterproof terminal constructions according to the invention,

FIGURE 2 is a section along the line 2-2 of FIGURE 1,

FIGURE 3 is a side view of portion of the frying pan including the terminals,

FIGURE 4 is a perspective view of the waterproof terminal construction before assembly,

FIGURE 5 is a side elevation of a modified terminal construction,

FIGURE 6 is an end view of the construction of FIGURE 5 and

FIGURE 7 is a section along line 7-7 of FIGURE 6, but to a larger scale.

The frying pan shown in FIGURES 1 to 3 is of the type having a cast aluminum pan 8, the sheathed heating element 9 being cast into the base of the pan with its two ends 10, 11 brought out in parallel relationship at one side of the pan, terminals 12, 13 being secured to the ends of the heating element whereby an electrical socket can be removably connected to the heating element. The base of the pan is thickened at the terminal end portions to form a heating element terminal support including a cross-shaped casting 14 with its short arm 15 joining the casting portions which surround the heating element ends and its long arm 16 parallel to the ends of the heating element. A longitudinal hole 17 is bored through the long arm of the cross to receive the probe of a probe type combined thermostatic control and connecting unit. This general type of frying pan is well-known.

In order that the frying pan may be immersed in water for washing after the thermostatic control and connecting unit has been disconnected, the terminal ends of the heating element must be made waterproof, and also

2

there should be sufficient insulating surface between the exposed terminals and the metallic pan body to prevent tracking. To effect this each end 18 of the sheath of the heating element is made to terminate at the base of an annular well 19 formed in the casting. The well is of a stepped construction. The deepest portion of the well, corresponding to the end of the sheath, has a chamfered edge 20 merging into a larger diameter shallow well. The edge of this shallow well is also chamfered at 21 and merges into a larger and comparatively deep well 22. At the top of the well it is enlarged yet again to form a larger diameter shallow annulus 23.

The heating element spiral wire ends in a threaded terminal lead 24 which extends out of the sheath and the well along their common axis. A silicone rubber terminal seal 25, which is initially cylindrical as shown in FIGURE 4, is provided having an axial opening which is a tight fit on the terminal lead 24 and an outer diameter which enables the lower end of the terminal seal, when fitted over the terminal lead, to seat in the lower shallow part of the well 26. A hollow terminal 27 is provided having an axial bore 28 from its lower end to near its other end which is a loose fit over the terminal lead. The terminal is suitably shaped over its length, for example it may be cylindrical but preferably is elliptical in cross-section; its shape is such as to match the female connectors in the combined thermostat and connecting unit. In any case it is formed with a flat circular enlarged base 29 of a diameter slightly greater than that of the cylindrical sealing element 25 in its uncompressed state. A ceramic insulator 30 is provided which is generally cylindrical in shape with an axial opening 31 such that it may be slipped over the terminal, and has an upper portion 32 whose diameter or major diameter is less than the diameter of the bottom portion to form a step 33. The underside of the base of the insulator is formed as a shallow well 34 whose diameter at the closed end is slightly greater than the diameter of the base of the terminal, and widens toward the major opening by having a chamfered side wall 35. The largest outer diameter of the ceramic insulator is such that it seats easily and neatly within the deep portion 22 of the well in the terminal support. A flat stainless steel ring 36 seats over the external step in the ceramic insulator and has an outside diameter larger than that of the ceramic insulator.

To make the waterproof seal the silicone rubber sealing element 25 is compressed between the enlarged base 29 of the terminal and the bottom of the well by pressure on the terminal, insulator, and ring. The silicone rubber expands radially as it is compressed and nearly completely fills the base of the well in the terminal support and the underside of the well in the insulator 30 to form the seal. The annular ring 36 seats in the uppermost annular step in the well in the terminal support the edges of which are then staked over the ring at 37 to secure it in position. Thereafter the terminal 12 is secured to the terminal lead 24 to provide a good electrical connection thereto by crimping at two points 38 on each side of the terminal lead.

In the form of the invention shown in FIGURES 5 to 7 the seal is formed on the end of an exposed type sheathed heating element 39. For example the heating element may be one which is secured to the underside of a deep cover for a frying pan, and is used for grilling in the frying pan. In such an application the sheathed heating element is bent into a convoluted shape and its two ends brought out parallel to each other. A bracket joins the two parallel portions near the ends of the sheath. The bracket has two openings through which the sheath ends pass and is brazed or welded to the sheath at those points. Outward extensions of the brackets are bent backwardly parallel to the parallel portions of the sheath to provide

means by which the heating element is removably secured to the cover. The portion of the bracket between the sheath portions has a central hole, and two wings which are bent backwardly above and below respectively the plane of the sheath portions. Openings are provided in the wings and a strip spring is secured to one wing, passing through the opening, up to and having a bend received in the opening in the other wing, and back to the other wing. The spring is shaped to receive and make electrical contact with the probe of a thermostat connector inserted through the hole in the front face of the bracket.

A well or cup shaped member 40 is brazed or welded to each end of the sheath 41. The internal end 42 of the sheath being chamfered. The construction then is as in the previously described construction, with the cup-shaped member replacing the case well: the same numerals have been used as in FIGURES 1 to 4 for corresponding elements. Thus the cylindrical silicone rubber sealing element is compressed between the end of the sheath and base of the well on the one hand and the enlarged terminal end and underside of the insulator on the other. The washer 36 is held in the cup-shaped member by rolling its edge 43 over the washer and crimping.

What we claim is:

1. A waterproof terminal construction comprising a sheathed type electric heating element having an elongated tubular sheath, a central terminal lead for said heating element, an annular sealing element of a heat-resistant flexible material surrounding the terminal lead and abutting against one end of said sheath, an elongated hollow terminal enclosing the said central terminal lead, an enlarged end to the hollow terminal, an insulator surrounding the inner end of the terminal, a well in the base of the insulator enclosing the enlarged end of the terminal, means defining a further well at the end of the heating element sheath, a retaining ring surrounding the insulator and means for securing the retaining ring within the said further well whereby the sealing element is compressed between said one end of said sheath and the said enlarged end of the terminal and said insulator.

2. A waterproof terminal construction comprising a sheathed type electric heating element having an elongated tubular sheath, a central terminal lead for said heating element, a sealing element of a heat-resistant flexible material which element is cylindrical in its unstrained state, an axial bore through the sealing element, the terminal lead extending through the axial bore with one face of the sealing element against one end of said sheath, an elongated hollow terminal enclosing the said central terminal lead, an enlarged end to the hollow terminal abutting the other face of the sealing element, an insulator surrounding the inner end of the terminal, a well in the base of the insulator enclosing the enlarged end of the terminal, a circumferentially extending step on the outer surface of the insulator, means defining a further well at the end of the heating element sheath, a retaining washer seated on the step of the insulator, and means for securing the retaining washer within the said further well whereby the sealing element is compressed axially between the base of the further well and the said enlarged end of the terminal and insulator and expands radially to fill the greater part of the base of the well.

3. In a cooking vessel a waterproof terminal construction for a heating element comprising a cast metal cooking vessel, a sheathed type heating element cast in the cooking vessel, said element including a tubular sheath, means on said vessel defining a well at one end of said sheath, a central terminal lead for the heating element, a sealing element of a heat-resistant flexible material which element is cylindrical in its unstrained state, an axial bore through the sealing element, the terminal lead extending through the axial bore, an elongated hollow terminal enclosing the said central terminal lead, an enlarged end

to the hollow terminal, an insulator surrounding the inner end of the terminal, a well in the base of the insulator enclosing the enlarged end of the terminal, a circumferentially extending step on the outer surface of the insulator, a retaining washer seated on the step of the insulator and means for securing the retaining washer within the well in the casting to compress the sealing element axially between the base of the well in the casting and the enlarged end of the terminal, the sealing element expanding radially to fill the greater part of the base of the well in the casting.

4. A waterproof terminal construction for a heating element comprising a sheathed type heating element including an elongated tubular sheath, a cup shaped member secured to one end of said sheath, a central terminal lead for the heating element, a sealing element of a heat-resistant flexible material element is cylindrical in its unstrained state, an axial bore through the sealing element, the terminal lead extending through the axial bore, an elongated hollow terminal enclosing the said central terminal lead, an enlarged end to the hollow terminal, an insulator surrounding the inner end of the terminal, a well in the base of the insulator enclosing the enlarged end of the terminal, a circumferentially extending step on the outer surface of the insulator, a retaining washer seated on the step of the insulator and means for securing the retaining washer within the cup-shaped member to compress the sealing element axially between the base of the cup-shaped member and the enlarged end of the terminal, the sealing element expanding radially to fill the greater part of the base of the cup-shaped member.

5. A waterproof terminal construction comprising a sheathed type electric heating element having an elongated sheath, means defining a well into which one end of said sheath of the heating element intrudes, a terminal lead for the heating element extending axially of the well, a silicone rubber sealing element which surrounds the inner end of the terminal lead and which is cylindrical in its unstrained state, an elongated hollow terminal enclosing the said central terminal lead, an enlarged end to the hollow terminal, an insulator surrounding the inner end of the terminal, a retaining washer surrounding the insulator, and means for securing the retaining washer within the well to compress the sealing element axially between said one end of said sheath and the said enlarged end of the terminal and said insulator.

6. A waterproof terminal construction comprising a sheathed type electric heating element having an elongated tubular sheath, means defining a well into which the end of the sheath of the heating element intrudes, a terminal lead for the heating element extending axially of the well, a silicone rubber sealing element which surrounds the inner end of the terminal lead and which is cylindrical in its unstrained state, an elongated hollow terminal enclosing the said central terminal lead, an enlarged end to the hollow terminal, an insulator surrounding the inner end of the terminal, a circumferentially extending step on the outer face of the insulator, a retaining washer seated on the step of the insulator, and means for securing the retaining washer within the well to compress the sealing element axially between the base of the well and the said enlarged end of the terminal.

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