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L. E. ASKE
SEALING APPARATUS

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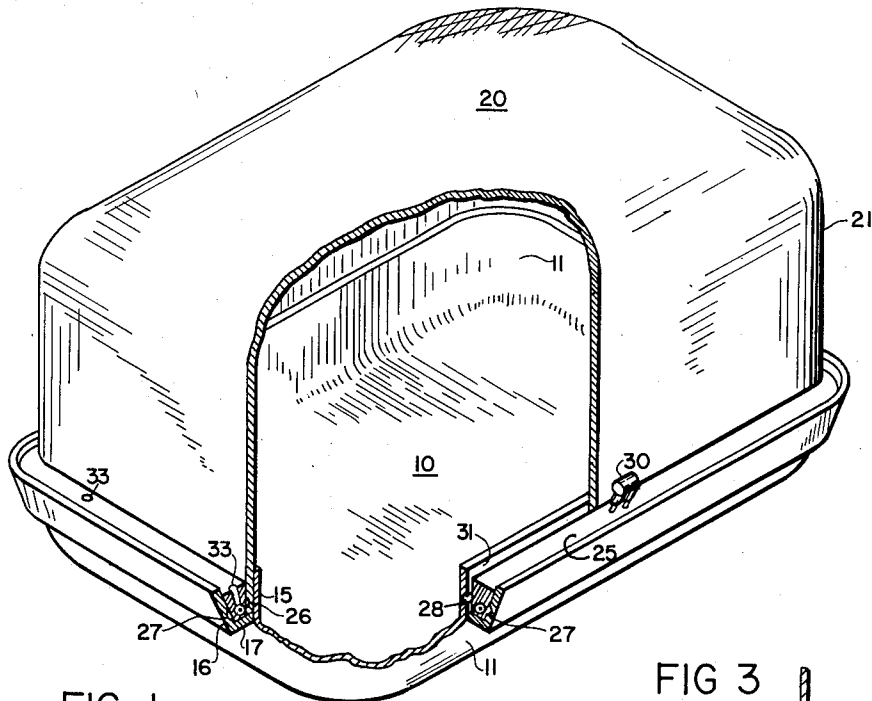


FIG 1

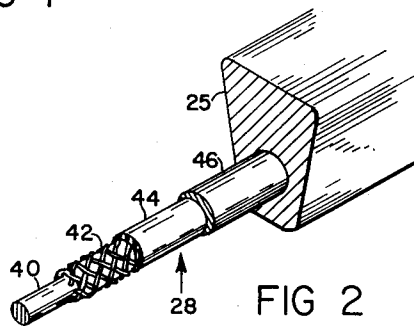


FIG 2

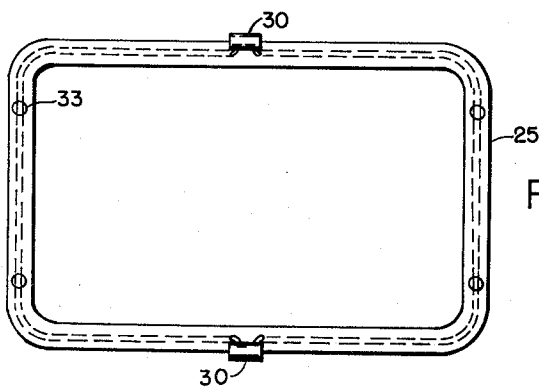


FIG 4

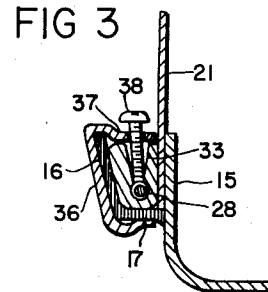


FIG 3

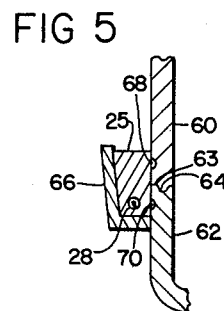


FIG 5

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3,047,703

SEALING APPARATUS

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This invention relates to sealing apparatus and more particularly to novel apparatus for sealing containers by use of thermoplastic or fusible material. Briefly, the invention is an improvement over the Eliel Patent 1,369,919 and comprises a preformed meltable element having a heater imbedded therein which is shaped to fit around the junction line of two parts of a container. Current may then be applied to the heater which in turn melts the element so that it flows over the junction of the two parts of the container. When the current is shut off, the meltable material re-solidifies and effects a seal of the junction and secures the two parts of the container in closed relationship. If it is desired to open the container, current may again be applied to the heater to re-melt the material so that the container may be opened. Later, the container may be re-sealed by again applying current to the heater. Thus the container may be opened or sealed as often as desired merely by applying a source of electrical energy to the heater element.

It is therefore an object of the present invention to provide a rapid and efficient seal for a container which may be easily unsealed and resealed without special equipment.

This and other objects will become apparent upon a reading of the specification, claims and drawings in which:

FIGURE 1 is a cut away view of a container embodying the invention,

FIGURE 2 is an illustrative view of the fusible element,

FIGURE 3 is a cross-sectional view of one embodiment of the invention,

FIGURE 4 is a top view of the preferred fusible element, and

FIGURE 5 is a cross-sectional view of an alternate embodiment of the invention.

Referring to FIGURE 1, a container is shown having a bottom or base portion 10 having upwardly extending flanges or sides 11. Near the upper part of the sides 11 a generally rectangular groove or channel is formed having side walls 15 and 16 and a bottom 17. This channel may be an integral part of the container or may comprise a removable gasket.

A top 20 is shown for the container having downwardly extending sides 21. The top 20 is made to fit in the channel adjacent the side wall 15. The remainder of the channel contains an element made up of meltable material 25 which may be fusible metal such as solder or may be a suitable thermoplastic organic material and which is used for sealing the container. If only a mechanical connection is desired deformations such as bumps or, as shown, grooves 26 and 27, may be placed in the channel for the fusible material to flow into, and when the material then solidifies a mechanical lock is provided. A mechanical seal may also be provided by use of a fusible material such as a high bismuth alloy, which expands into the grooves 26 and 27 when it solidifies and thus may mechanically seal the top and bottom together. To assure lateral expansion, in this case pressure may be applied to the fusible material from the top when it is melted.

The meltable material 25 is cast, extruded or otherwise formed around a heater element 28 which is capable of generating enough heat to melt the meltable material when electrical current is applied thereto. A pair of contacts or terminals 30 are connected to the heater element 28 as best seen in FIGURE 4. The heater element 28 extends out of the meltable material at points just below the ter-

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minal 30 so that electrical contact may be made and runs between the terminals 30 in parallel paths around the container. When voltage is applied to the terminals 30 current passes through the heater element 28 and enough heat is generated to melt the meltable material. In practice, the heater element 28 carries about 100 amperes of current when 17 volts is applied. 1700 watts of heat is thus generated which will melt an element made of solder in 20 to 25 seconds. This quick melting is desirable so as to prevent excessive heating of the container which might cause damage to the contents. Of course, with such a large power output, it is necessary that good heat transfer exist between the heater element and the solder or otherwise heater element might burn out.

In order to prevent solder from entering the container when the top 20 is removed, the surface 31 of wall 15 is treated to be non-wettable by the solder. Likewise, the lower inside surface of the sides 21 are made non-wettable so that as the top is removed, the solder will not adhere to these surfaces and will not creep up and over the wall 15 into the container.

Normally, the density of the heater element 28 is less than that of the meltable material 25 so that when the material 25 is melted, the heater element may float. If this were permitted the heater would be partly exposed to the air and the heat conductivity away from the heater element would be reduced possibly causing burn out of the element. In many cases, the terminals 30 may be held down which will hold the element near the bottom, but often it is desirable to hold the element down at places other than at the terminals 30. To accomplish this a plurality of holes 33 are formed in the fusible material 25 and extend therethrough to the heater element 28. When the fusible material is to be melted, any convenient rod may first be inserted in each of the holes 33 which will hold the heater element in place during the melting. After the solder has cooled again the rods may be removed. Of course, the container could carry a permanent holding fixture for the element and the rods could always remain in the solder. For example, as shown in FIGURE 3, a snap member or clamp 36 is snapped into place around the channel and has an extension 37 above the hole 33. A set screw 38 is screwed into place through the extension 37 and into the hole 33 until it presses against the heater element 28. The heater will thus remain submerged in the meltable material 25 even when melted and the possibility of burn out from this cause is eliminated. The clamp 36 and screw 38 may be removed from the channel if desired after the meltable material has resolidified, or it may remain as a permanent part of the container.

Referring to FIGURE 5, an alternate embodiment of the invention is shown. The top portion of the container 60 is shown mating with the bottom portion 62 to form a smooth surface across the junction 63. The two portions are shown as meeting in a tongue and groove arrangement 64. An L-shaped member 66 which may be composed of silicone rubber is placed around the container so that it extends upwardly across the junction line 63. This member is resilient enough to expand to fit the container. The meltable element 25 is placed in the groove and is supported by the L-shaped member 66. When current is applied to the heater 28, the meltable element melts and adheres to the outside surfaces of the top 60 and the bottom 62. The L-shaped member 66 is non-wettable by the meltable material so that when the current to the heater 28 is removed, the L-shaped member 66 may be removed leaving the element 25 adhering to the container across the junction to effect a seal. If desired, grooves 68 and 70 may be cut near the rims of the top 60 and the bottom 62 so that the meltable material will flow therein and provide a me-

chanical lock. Of course, bumps or other abutments could be substituted for the grooves 68 and 70.

The heater element 28 has novel design features and will now be described. Referring to FIGURE 2, the heater element 28 is shown composed of a length of high resistance heater wire 40 such as Nichrome having a web 42 of mechanically strong material such as glass braided around it. Suitable electrically insulative material 44 such as Teflon is extruded over or wrapped around the web and then fused thus surrounding and impregnating it. Over the Teflon impregnated glass web 44 a sheath of material 46 such as copper is drawn and the whole assembly is cast in the meltable material 25. The sheath of material 46 is wettable by the meltable material since otherwise air pockets might form around the heater element 28 reducing the heat conductivity to the meltable material and thus causing hot spots and possible burn out. The web of mechanically strong material 42 is needed since Teflon alone is not strong enough for the drawing of the copper sheath 46 which might cut through the Teflon and short out the heater wire 40. The material 42 is in the form of a web so that the fusible element 25 can be bent and formed in a predetermined shape without breakage. Teflon is found to be a good electrical insulator while at the same time a fair conductor of heat and hence its use is desirable. In addition it has a slippery surface so that it will slide with respect to the copper sheath when bent and reduce the possibility of breakage. Of course, other equivalent materials could be substituted without departing from the spirit of the invention. By the above outlined method the heating element may be made very small. A copper sheath having an outside diameter of .010 inch has been achieved which contains all the internal parts above described.

As seen, a novel and useful means for sealing a container has been presented in which the sealing material may be quickly melted and remelted without danger of burn out or of overheating the container. Many substitutions will be apparent to those skilled in the art and I do not wish to be limited by the specific structure described here. I wish only to be limited by the following claims.

I claim:

1. Apparatus of the class described comprising, in combination: a container having a top portion and a bottom portion, the bottom portion having a peripheral groove to receive the top portion; a sealing element preformed to fit the groove, said sealing element comprising a tube of fusible material adapted when melted to join the top and bottom portions of said container and provide a seal for said container; an elongated heater element; electrically insulating material covering said heater element; a sheath of material which is wettable by the fusible material surrounding said insulating material, said sheath being imbedded in the tube of fusible material in good heat conducting relationship; a pair of electrical terminals connected to the ends of said heater element and located external to the tube of fusible material so that current may be applied to said heater element without applying current to said fusible material; a plurality of holes formed in said fusible material extending to said sheath; and means extending through said holes to hold said sheath to prevent floating thereof when the fusible material is melted.

2. Apparatus of the class described comprising, in combination: a container having a top portion and a bottom portion, the bottom portion having a peripheral groove to receive the top portion; a sealing element preformed to fit the groove, said sealing element comprising a tube of fusible material adapted when melted to join the top and bottom portions of said container and provide a seal for said container; an elongated heater element; electrically insulating material covering said heater element; a sheath of material which is wettable by the

fusible material surrounding said insulating material, said sheath being imbedded in the tube of fusible material in good heat conducting relationship; a pair of electrical terminals connected to the ends of said heater element and located external to the tube of fusible material so that current may be applied to said heater element without applying current to said fusible material; and means to prevent floating thereof when the fusible material is melted.

3. Apparatus of the class described comprising, in combination: a container having a top portion with downwardly extending sides and a bottom portion, with upwardly extending sides, the bottom portion having a peripheral groove to receive the downwardly extending sides of the top portion; a sealing element comprising a tube of fusible material preshaped to fit the groove after the top portion has been placed therein, the portion of the groove external to the downwardly extending sides of the top portion and the lower external portion of the downwardly extending sides of the top portion being wettable by the fusible material while the portion of the groove internal to the downwardly extending sides of the top portion and the lower internal portion of the downwardly extending sides being non wettable by said fusible material, and a heater element in the tube of fusible material adapted when current is applied thereto to melt the fusible material so that it adheres to the lower external portion of the downwardly extending sides and to the external portion of the groove to effect a seal of said container.

4. Apparatus of the class described comprising, in combination: a container having a top portion with a downwardly extending peripheral flange and a bottom portion with a peripheral channel having a first upwardly extending side near the inside of said container and a second upwardly extending side remote from the inside of said container, a portion of the channel seating the flange; a sealing member comprising a tube of fusible material preformed to fit in the channel externally adjacent the flange; and a heater element imbedded in the tube of fusible material adapted to melt the fusible material when current is applied thereto, the lower internal surface of the flange, and the outside surface of the first side of the channel being non-wettable by the fusible material while the lower external surface of the flange and the inside surface of the second side of the channel being wettable by the fusible material so that, when melted, the fusible material adheres to the wettable surfaces to effect a seal of the container.

5. Apparatus for mechanically connecting two members together comprising, in combination: a tube of meltable material which contracts when melted and which expands when solidified; a heater element imbedded in the tube to melt the meltable material when electrical current is applied thereto; and deformations on each of the two members proximate the point of connection, the meltable material being placed near the deformations so that when melted the material flows around the deformations and when re-solidified, expands so as to lock the two members together.

6. The method of mechanically closing two parts of a container comprising the steps of: forming an abutment near the rim of each of the two parts of the container; placing a detachable channel adjacent the junction of the two parts; placing a meltable element having a heater embedded therein in the channel; applying current to the heater to melt the element so that it flows over the junction and the abutments, and removing the source of current from the heater so that the element resolidifies.

7. The method of mechanically closing two parts of a container comprising the steps of: placing a channel adjacent the junction of the two parts; placing a meltable element having a heater embedded therein in the channel; applying current to the heater to melt the element so that it flows over the junction; removing the source of

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current from the heater so that the element resolidifies; and removing the channel.

8. The method of forming an element for use in sealing comprising the steps of: braiding a web of glass over a heater wire; extruding a layer of electrical insulation over the glass web; drawing a good heat conductive metal over the layer of insulation and casting the resulting structure in a form of fusible material.

9. Apparatus of the class described comprising, in combination: a tube of fusible material preformed in the shape of a closed loop; a first heater element having first and second ends and embedded in a first portion of said tube; a second heater element having first and second ends and embedded in a second portion of said tube, said first and second heater elements extending in separate paths around the loop; first and second terminal means located external to said tube; means connecting the first ends of said first and second heater elements to the first terminal means; and means connecting the second ends of said first and second heater element to the second terminal means.

10. Apparatus for use with a container having a junction formed by two parts of the container comprising, in combination: a first heater element surrounded by fusible material and extending around a first portion of the junction; a second heater element surrounded by fusible material and extending around a second portion of the junction; first terminal means connected to one end of said first and second heater elements; and second terminal means connected to the other end of said first and second heater elements, said first and second terminal means adapted to receive electrical energy to cause said first and second heater elements to melt the fusible material over the two portions of the junction.

11. A self-contained sealing apparatus for hermetically sealing two portions of a container, comprising:

a central heating element, having terminals for the application of electric power;

a composite first annular layer consisting of a mechanically strong, flexible glass web surrounded by and impregnated with Teflon, said composite layer providing a smooth, highly abrasion resistant, heat conducting, electrical insulator;

a continuous second annular layer of material total surrounding said first layer in an unbroken manner so as to prevent liquid penetration of a predetermined fusible material when melted, said second annular layer of material having a high conductivity and capable of being wetted by the predetermined fusible material;

and a third annular layer of the predetermined fusible

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material completely surrounding said second layer, said third layer capable of hermetically sealing together two portions of a container.

12. A self-melting formable composite wire, comprising:

a flexible central heater element having means for the application of electrical power, said heater wire, when energized, capable of producing enough heat to melt a predetermined fusible material;

a first annular layer of flexible, mechanically strong webbing surrounding said heater element;

a continuous second annular layer of pliant material which is an electrical insulator having a relatively high coefficient of thermal conductivity and a relatively low coefficient of friction totally surrounding and impregnating said first layer, said first layer and said second layer forming a composite layer possessing flexibility, mechanical strength, resistance to abrasion and a smooth surface;

a continuous third annular pliable layer of material having a high coefficient of thermal conductivity completely surrounding said second layer, said third layer rapidly conducting the heat produced by said heater wire away from said first and second layers, said third layer being impervious to the predetermined fusible material when melted so as to prevent the melted fusible material from reaching said first and second annular layers of material;

and a continuous fourth annular layer of the predetermined fusible material completely surrounding said third layer, thereby forming a composite wire consisting of said central heater element, first annular layer, second annular layer, third annular layer and fourth annular layer, which is pliable and capable of retaining a predetermined shape.

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