

[54] **HEAT RECOVERABLE CLOSURE ASSEMBLY**

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[58] Field of Search..... 220/3.8, 354, 359; 174/17.04, , 17.05, 17.06, 17.07, 17.08, 50, 50.5-50.64; 215/232, 246

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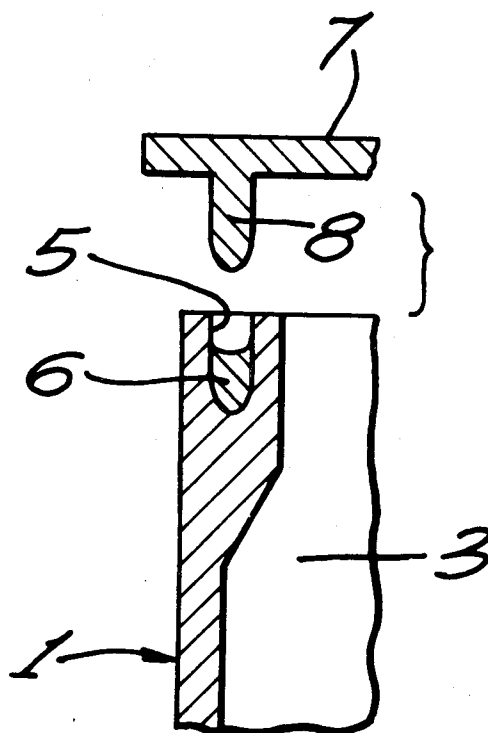
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[57]

ABSTRACT

A closure assembly consisting of a container and a closure member wherein the container has a heat recoverable portion which cooperates with said closure member to close and seal said assembly. A flange is provided on the closure member which is wider than a corresponding groove on the container. The groove is defined by heat recoverable material and is presented in an expanded state. The closure member may then be heated and inserted in the groove causing the heat recoverable material to shrink about the flange to provide positive closure of the assembly. An adhesive may be incorporated within the groove to further seal the assembly. The closure member most conveniently is a material having a high thermal conductivity to enhance the heating of the heat recoverable material.

11 Claims, 4 Drawing Figures



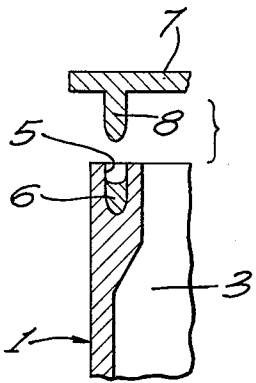
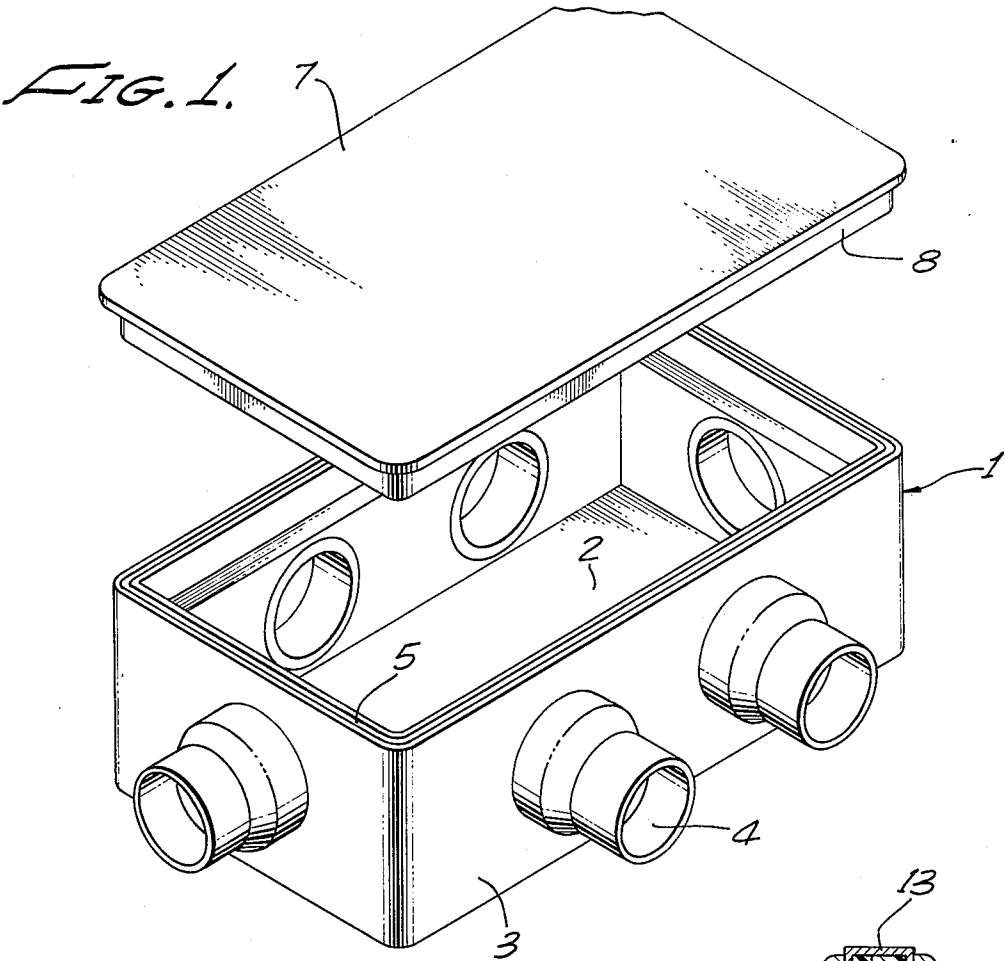


FIG. 2.

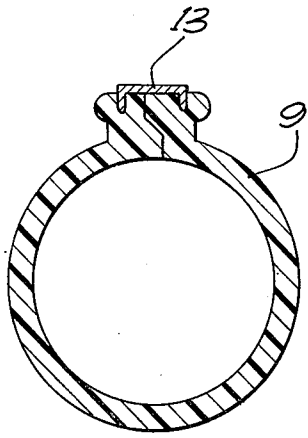


FIG. 3.

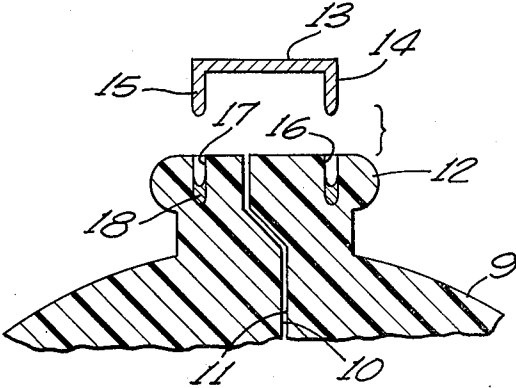


FIG. 4.

HEAT RECOVERABLE CLOSURE ASSEMBLY

This invention relates to heat recoverable closure assemblies, especially to containers having a heat recoverable portion cooperating with a closure member such as a top or clamp.

It is known to provide closure assemblies incorporating a container and a closure member such as a top or clamp wherein a flange and groove arrangement is provided between the closure member and the container. The flange and groove in such assemblies generally has an interference fit or other conventional arrangement whereby a seal or resistance to opening is achieved. However, in many applications, it is impractical to provide such a juncture because of difficulties in fabrication, in assembly and in maintaining integrity of the seal. Further, quite often such systems are incapable of being re-entered and then re-closed.

One such application where a waterproof box is required which can later be re-entered and then re-sealed is for junction boxes used in cable television systems. The junction boxes must be re-enterable in order to attach a further cable for supply to a new subscriber after the system has been laid under ground. Junction boxes for this purpose typically have an orifice, usually with a flange, for the input line and a similar orifice for each output line. Like junction boxes used elsewhere in the electronics industry, the boxes are typically rectangular having a flat lid through which the box may be entered for inspection or servicing.

In the past, such junction boxes have been made of many materials, for example, aluminum or polyethylene. More recently polyethylene has become popular to allow the flanges around the orifices to be made heat recoverable so that sealing of the overlap between the box and the cable can be facilitated. The internal surfaces of the flanges are covered with mastics or hot melt adhesives. Orifices which are not in use can be plugged or formed with a readily removable end cap so that a new subscriber's line can be easily fitted.

It will be apparent that sealing against ingress of moisture, both through the overlap between the orifices and the cables and through the joint between the box and the lid is a necessary feature when the box is to be used outdoors, especially underground.

Similarly, certain underground cable assemblies must provide a closure assembly that can be easily re-entered and then closed again and still provide a seal capable of preventing moisture intrusion into the cables or other easily damaged components. It has likewise become desired and often beneficial to employ polyethylene or other plastic material in the form of cylindrical containers for such cables. However, it is normally necessary to cut the container in order to re-enter the conduit. Thus, it is necessary to re-assemble a container about the conduit after service has been completed.

The present invention provides a means for providing a sealable container which may be easily re-entered. It is also possible to re-seal the container at a later time. To accomplish this, a container is provided with a heat recoverable portion about the opening therein. A closure member of high thermal conductivity cooperates with the heat recoverable material in the container to seal the container. A flange and groove arrangement is provided wherein the groove is of heat recoverable material and the flange is of material having a high thermal

conductivity. In this way, the groove may be expanded and held in that state before the flange associated with the closure member is placed on the container. The flange may then be heated and positioned in the groove, thus resulting in a shrinking of the groove about the flange to create a sealed container.

Accordingly, it is an object of the present invention to provide an improved closure assembly.

It is another object of the present invention to provide an improved process for securely enclosing a container.

It is a further object of the present invention to provide a closure assembly employing heat recoverable material for securely closing the assembly.

Moreover, an object of the present invention is to provide a waterproof junction box capable of being re-entered and closed.

It is yet another object of the present invention to provide a cylindrical container for conduits which may be re-entered through an application of heat.

Other and further objects and advantages will appear hereinafter.

FIG. 1 is a perspective exploded view of a box and top according to the present invention.

FIG. 2 is a fragmentary section through a side wall and part of the top of FIG. 1.

FIG. 3 is a cross-sectional view of a conduit employing an enclosure member according to the present invention.

FIG. 4 is a fragmentary exploded section showing the closure of FIG. 3.

Referring now to the drawings, specifically FIGS. 1 and 2, a container or box, generally designated 1, includes a base 2, and side wall 3. The box is designed for incorporation as a junction box for cable television systems or other electrical systems and includes a plurality of flanged apertures 4 through which cables may extend to various receiving locations. The container 1 is made of a thermoplastic material which is most conveniently of a type having heat recoverable properties. Alternately, it is only necessary that the upper portion of each side wall is of a heat recoverable nature. The heat recoverable material of the box is preferably a cross-linked thermoplastic material, for example, one specified in British Pat. No. 990,235. The box may be formed, for example, by molding. Cross-linking may be achieved by any of the known methods, for example, by the use of chemical cross-linking agents.

The free end of the side walls, as best seen in FIG. 2, is in the form of a generally U-shaped cavity or groove 5. The groove 5 may be partially filled with a hot melt adhesive 6. The grooves extend completely about the opening or aperture formed in the box as is defined by the free ends of the side walls 3. Thus, a seal may be achieved completely about the opening as will be seen below.

A closure member or top 7 is provided as a means for closing the opening in the upper portion of the container 1. The closure member 7 includes a flange 8 extending downwardly from the lower surface thereof about the outer edge of the closure member 7. This flange 8 is substantially the same shape and dimension as the corresponding groove 5 located in the container 1. However, the width of the flange 8 is larger than the width of the groove 5 when the heat-recoverable material forming the grooves is in a heat-stable state. The closure member is relatively rigid and is of a material

which will remain rigid at the recovery temperature of the heat recoverable material of the container. Further, as will be discussed below, the closure member 7 is preferably of a material having a high thermo conductivity, such as brass.

To prepare the container 1 for assembly, the groove 5 and the immediately surrounding area of the container 1 is heated to a temperature where the heat recoverable material is in a dimensionally heat-unstable state. In this condition, the groove 5 is expanded and held in the expanded position. While being held in the expanded position, the container 7 and groove 5 are cooled thereby causing the groove 5 to remain in the expanded state. Once the components are established within the container 1, the closure member 7 may be heated. Once heated, the closure member is pressed onto the top of the container 1 so that the flange 8 is positioned within the groove 5. The heat from the closure member 7 is then quickly transferred to the heat recovery material defining the groove 5 causing it to shrink to its original configuration and thereby securely hold and seal the closure member.

Where a hot melt adhesive 6 is employed in the groove 5, a further bond is provided thereby. The heated closure member 7 will cause the hot melt adhesive 6 to melt during the recovery of the heat recoverable material. Consequently, the heat recoverable material forming the groove 5 will close about the flange 8 and also spread or squeeze the hot melt adhesive 6 about the flange 8 to form a tight joint between the container 1 and the closure member 7.

Thus, using the art and process of the invention as applied to the first embodiment, the portion of the container 1 that needs to be heated to cause recovery may be raised to the appropriate temperature without heating the remainder of the container 1 to any great extent. In general, it is undesirable to subject the remainder of the container 1 to heating. Also, because of the low thermoconductivity of thermoplastics, the present invention allows heat to be applied only where it is needed. By properly choosing a closure member 7, for example a metal top of high thermoconductivity, there is also achieved the advantage that when the container 1 needs to be reopened, all that is necessary is the top 7 to be heated again. Heat is then conducted through the flange 8 to those portions of the container which needs to be reheated to release the top. Where there is hot melt adhesive, this is softened and in all cases the recoverable portion receives sufficient heat to begin to reach recovery temperature before heat is transferred to the remainder of the container. If the closure member 7 is then pried loose from the container, the heat source is immediately removed from the groove 5. With care, recovery can be averted before it is complete. Thus, the groove 5 is left in a partially recovered state so that the closure member 7 can be readily replaced as desired. In any case, even if recovery is complete, the use of a rigid metal top 7 enables the recoverable portion of the container 1 to be reopened on reheating simply by pressure applied to the top 7. This is, of course, facilitated by having the flange 8 tapered. Once again, when the closure member 7 and groove 5 cool, the container 1 is again resealed.

Turning to the second embodiment, as shown in FIGS. 3 and 4 of the drawing, a container 9 is formed in a sheet like arrangement having two mating edges 10 and 11 formed at opposite ends of the sheet. A raised

portion 12 is provided adjacent either edge 10 and 11 to further strengthen the container member 9. A closure member 13 formed into a channel member including two flanges 14 and 15 which may be positioned in grooves 16 and 17. The grooves 16 and 17 are positioned in raised portions 12 and typically extend the length of the sheet. Hot melt adhesives 18 may also be provided.

To assembly this second embodiment, the container member 9 is flexed to place the two mating edges 10 and 11 in abutting relationship to close the opening there between. The grooves 16 and 17, having been previously expanded through the process described above, are then positioned to receive the closure member 13. The closure member 13 is heated and then placed with the container 9 so that the flanges 14 and 16 are positioned in the corresponding grooves 16 and 17. The grooves 16 and 17 then shrink about the flanges 14 and 15 respectively as the entire assembly cools. Thus, a second closure member is provided to open this second embodiment, the closure member 13 is again heated and easily withdrawn from the container 9. The container 9 may then be unwrapped from about the cables, splices or other components contained therein.

Thus, apparatus and procedure is provided for erecting a closure assembly which is advantageous for applications where a positive seal is required. Further, by heating the closure member, the assembly may be easily opened and later closed. While embodiments and applications of this invention have been shown and described, it would be apparent to those skilled in the art that many more modifications are possible without departing from the inventive concepts herein described. The invention, therefore, is not to be restricted except by the spirit of the appended claims.

What is claimed is:

1. A heat recoverable closure assembly comprising: a container, said container including an opening into said container and a groove adjacent said opening, said groove being defined by heat recoverable material; and

a closure member of high thermal conductivity, said closure member including a flange capable of coextensive arrangement with said groove, said flange being wider than said groove when said groove is in its heat stable state.

2. The heat recoverable closure assembly of claim 1 wherein said opening constitutes a substantially fixed aperture and said groove extends about said aperture.

3. The heat recoverable closure assembly of claim 1 wherein said container comprises a sheet extending to two mating edges, said sheet being capable of being flexibly arranged to place said two mating edges in abutting relationship, said groove extending adjacent each of said two mating edges to receive said closure member.

4. The heat recoverable closure assembly of claim 1 wherein adhesive is provided within said groove.

5. The heat recoverable closure assembly of claim 1 wherein said closure member is metallic.

6. The heat recoverable closure assembly of claim 1 wherein said container comprises a sheet extending to two mating edges, said mating edges defining said opening and being flexibly arranged in abutting relationship, said groove extending adjacent each of said two mating edges to receive said closure member.

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7. A heat recoverable closure assembly comprising:
a container, said container including an access aper-
ture and a groove in said container extending about
said aperture, said groove being formed from heat
recoverable material; and
a top of high thermal conductivity, said top including
a flange capable of co-extensive arrangement with
said groove, said flange being wider than said
groove when said groove is in said heat stable state.
8. The heat recoverable closure assembly of claim 7

wherein said top is metallic.

9. The heat recoverable closure assembly of claim 7
wherein said container is capable of providing a subter-
anean junction box for electrical components.

10. The heat recoverable closure assembly of claim
7 further comprising adhesive placed within said
groove.

11. The heat recoverable closure assembly of claim
10 wherein said adhesive is a hot melt adhesive.

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