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[54] **ELECTRICALLY INSULATIVE THIMBLE WITH
 CONFINED VISCOUS BONDING MEDIUM**
7 Claims, 19 Drawing Figs.

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 174/87, 174/138

[51] Int. Cl..... **B65d 85/72;**
 H02g 15/08

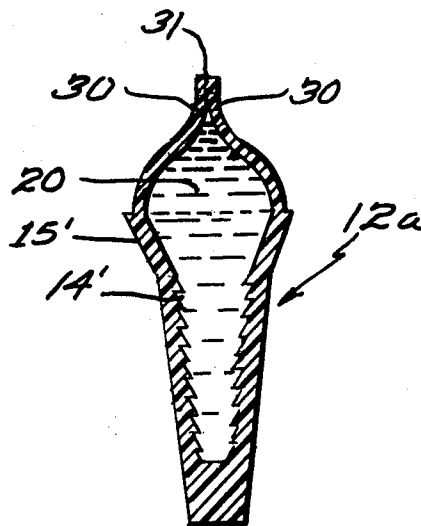
[50] Field of Search..... 174/87, 84,
 84.1, 90, 76, 77, 138.4; 206/46, 46Misc., 47A

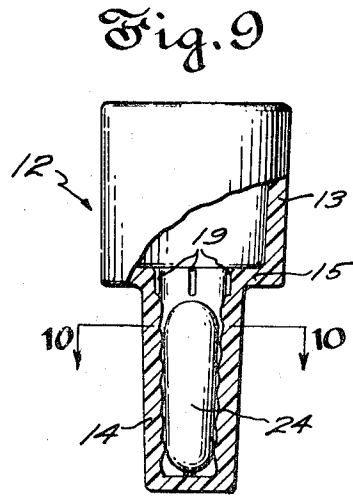
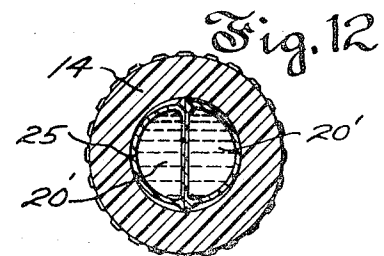
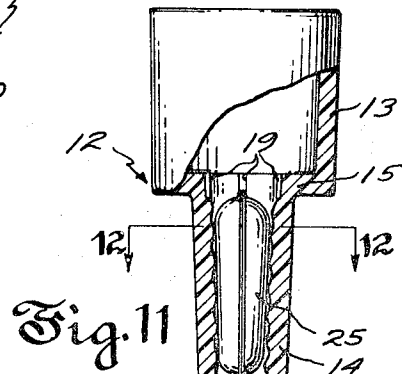
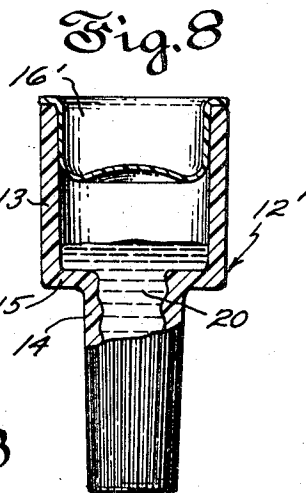
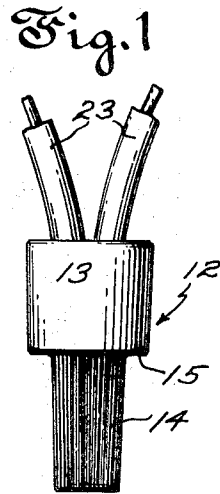
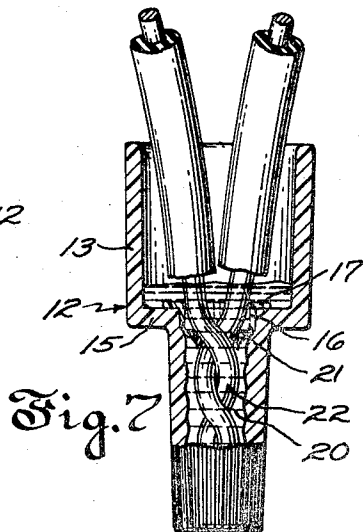
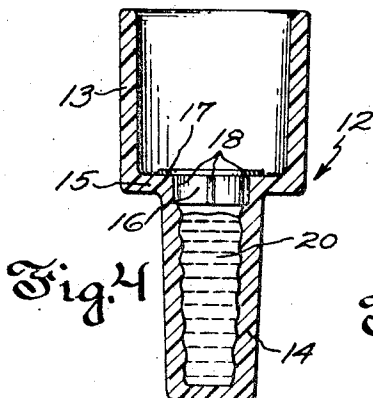
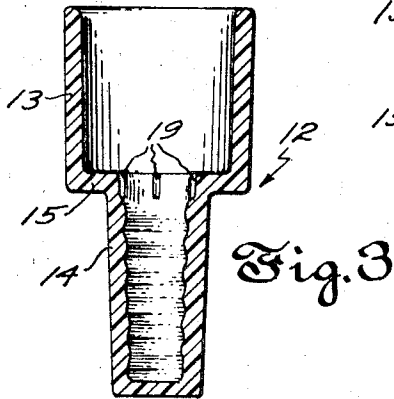
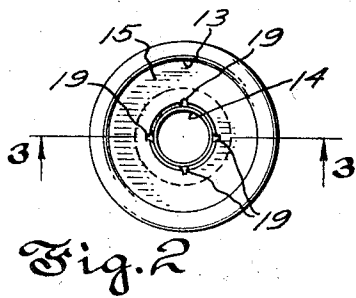
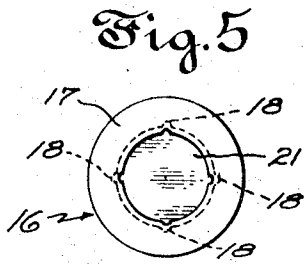
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3,083,260	3/1963	Bird.....	174/87
3,087,606	4/1963	Bollmeier et al.....	174/87UX
3,312,929	4/1967	Shannon.....	174/84(.1)X

ABSTRACT: An insulative thimble for capping the bared terminal of an electric conductor. As furnished to the consumer there is contained within the hollow of the thimble prior to its application to the conductor terminal a charge of viscous or flowable substance such as an uncured cement which will solidify or harden and thus become a permanent bonding medium when exposed to a setting agent without the use of heat. The setting agent may be merely ambient air or some more specialized material such as a component of epoxy adhesive. The bonding charge is initially isolated from the setting agent or ambient air by means of an imperforate flexible thin wall joined with or forming part of the tubular wall of the thimble. Such wall is rupturable or removable when the thimble is about to be applied to the conductor terminal thereby to admit the bared conductor terminal to immersion in the thimble-contained charge before the latter is exposed to the setting agent. The thimble-closing wall can have a variety of structural forms illustrated in different views of the drawings.





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Fig. 13

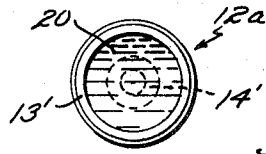
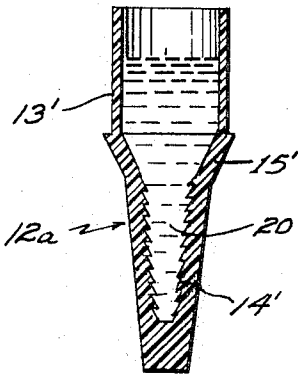


Fig. 14

Fig. 15

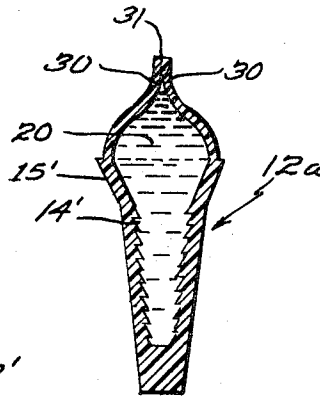
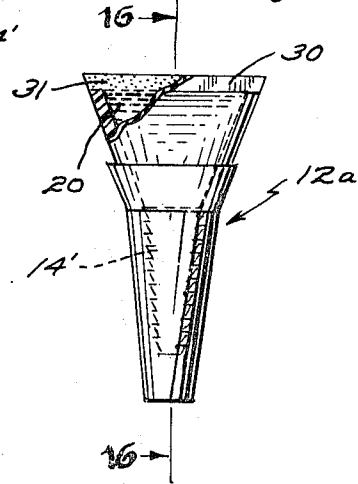


Fig. 16

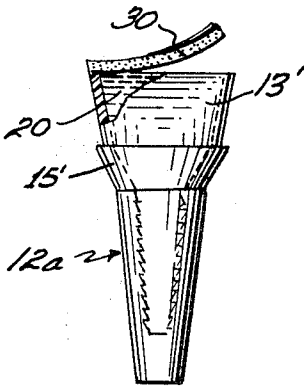


Fig. 18

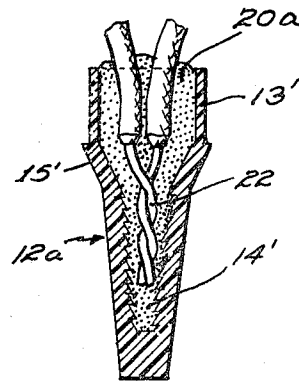


Fig. 19

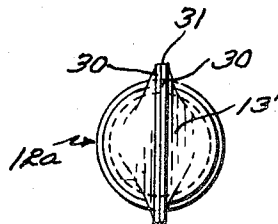


Fig. 17

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ELECTRICALLY INSULATIVE THIMBLE WITH CONFINED VISCOUS BONDING MEDIUM

This invention relates to ways and means for covering and insulating and/or coupling conductively together the bared terminals of insulated electric current conductors either singly or in side-by-side relation or more usually when twisted together into pigtail form with approximately flush ends.

An old practice of covering and insulating bared terminals of insulated electric wires has been to screw thereonto a capnut of insulative material provided internally with conical screw threads of hard enough material to cut or indent their way into the surface of the wires as does a self-threading nut. Sometimes such self-threading capnuts have been lined with metallic internally threaded sleeve inserts fixed to the surrounding insulated material of the capnut. This is illustrated in U.S. Pat. No. 1,419,523 and results in undesirable complication of structure and high cost.

Other methods and devices proposed to serve a similar purpose have involved the use of solder combined with a flux contained, when sold, in a thimble of refractive insulative material and designed to be melted so that wire terminals can be pressed into the heat softened solder. Such heat must reach the solder by penetrating the walls of the thimble which therefore must be made of a highly refractive material. It has been proposed to supply the heat by coating the external surface of the thimble with a flammable substance which in the course of burning off will give off enough heat to cause the solder to melt. Danger of fire arises from this manner of securing an insulative thimble to the bared ends of electric conductors because the process involves an open flame in close proximity to combustible material used in building construction.

An object of the present improvements is to do away with the high cost, complexity of structure and dangers of use of insulative thimbles for the purpose indicated by enabling the thimble to be made of lower cost, nonrefractive material with relatively thinner walls devoid of self-cutting threads or threaded inserts and not requiring the assemblage of diverse parts or materials, the use of solder or the application of heat to effect a quick, secure and permanent bonding of the thimble to the wire terminals capped thereby.

These and other related objects of the invention will appear in fuller particular in the following description of the successful embodiments of the invention having reference to the appended drawings wherein:

FIG. 1 is an outside view drawn in larger than usual actual size showing my improved insulative thimble assembled with bared electric wire terminals covered thereby and bonded thereto;

FIG. 2 is a plan view looking into the open mouth of the thimble of FIG. 1 with the electric conductors absent;

FIG. 3 is a view taken in section on the plane 3-3 in FIG. 2;

FIG. 4 shows the thimble of FIG. 3 loaded with a charge of air drying adhesive retained, before use, in the well of the thimble by a puncturable closure cap;

FIG. 5 is a plan view of the closure cap detached from the thimble;

FIG. 6 is an elevation of the closure cap with its wall partly broken away;

FIG. 7 shows the closure cap of FIG. 4 punctured by wire terminals to be manually thrust endwise therethrough into the contained body of adhesive;

FIG. 8 is like FIG. 4 showing a modified location for the closure cap;

FIG. 9 is a further modified construction of the thimble wherein the adhesive is hermetically sealed within a capsule lodged in the well portion of the thimble;

FIG. 10 is a view taken in section on the plane 10-10 in FIG. 9;

FIG. 11 shows a still further modified construction wherein the adhesive capsule incorporates two separate noncommunicating chambers for components of adhesives required to be mixed at the time applied such as epoxy resin and a dryer;

FIG. 12 is a view taken on the plane 12-12 in FIG. 11 drawn on a much enlarged scale;

FIG. 13 shows in central longitudinal section a modified shape of the thimble of FIG. 8 nearly full of its charge of flowable bonding substance and whose skirt wall is flexible for conversion to the thimble-closing shape shown in FIG. 15;

FIG. 14 is a plan view of the top end of the thimble of FIG. 13;

FIG. 15 shows the cylindrical skirt wall 13a of the thimble in FIG. 13 flattened along a thimble closing seam 30, hermetically to seal the thimble contained bonding charge 20 and isolate it from ambient air;

FIG. 16 is a view in section on the plane 16-16 in FIG. 15;

FIG. 17 is a plan view of the closed top end of the thimble of FIG. 16;

FIG. 18 shows the bonded together flattened half portions of the skirt wall of the thimble partially torn or cut off to permit them to resume their original cylindrical shape as in FIGS. 13 and 14 with the bonding charge still in flowable condition; and

FIG. 19 shows bared conductor terminals inserted into the reopened end of the thimble of FIGS. 13 and 14 and permanently secured thereto by air hardening of the bonding charge.

The thimble 12 in FIGS. 1 to 7, inclusive, of the drawings has solid walls of insulative material and comprises an open-mouthed skirt portion 13 and a dead ended, chamber-forming well portion 14 relatively small in cross section and open to the hollow in the skirt portion 13 at the annular shoulder 15 of the thimble. The well chamber 14 can be hermetically isolated from the hollow in the skirt portion 13 by a cover cap 16 that nests with a snug fit into the open end of well chamber 14 so that its flange 17 seats on the shoulder 15.

Both the thimble 12 and the cover cap 16 may be of plastic material and shaped to assemble with a conically tapering fit so that they can be pressed and/or bonded together to form an airtight closure for the well chamber 14. If made of suitable plastics they can be bonded by heat with or without the presence of a flux or adhesive, and the heat that produces the bonding may be applied externally or produced by friction resulting from the spinning process disclosed in my U.S. Pat. No. 2,942,748. Where rotary motion is not to be employed for bonding the cover cap 16 to the thimble, the cap can comprise a hollow, thin-walled insert of plastic or metal or metallic foil, preferably provided with a plurality of external, axially directed ridges 18 fitting into grooves 19, respectively, which are indented in the internal surface of well chamber 14 in tapering fashion so that wedging conformity of the cover cap to the chamber wall constitutes and airtight seal.

Before applying the cover cap 16 as an insert in the well chamber, this chamber is filled completely or to suitable extent with an air-drying adhesive substance 20 whose exposure to the drying effect of ambient air will be prevented by the cover cap 16 thus to maintain the adhesive substance 20 in a viscous, liquid or unset state until the thimble is to be used for its intended purpose.

Types of adhesive substance 20 that may be used include the epoxy resins exemplified by those explained as to composition and use in the following U.S. Pat. Nos.:

2,324,483 (1943)
2,444,333
2,503,726 (1950)
2,558,949 (1951)
2,582,985 (1952)
2,615,007 (1952)
2,615,008 (1952)
2,592,560 (1952)
2,456,408 (1948)
2,521,911 (1950)
2,521,912 (1950)
2,528,359-60 (1950)
2,510,885 (1950)
2,258,932-3-4 (1950).

A further exposition of epoxy resins will be found in a work on the subject by Irving Skeist entitled "Epoxy Resins" published by Reinhold Publishing Corporation of New York.

Other cold setting, air drying, rubber base cements or lutes that are usable for the purpose concerned and that will maintain a viscous or flowable state while sealed away from air, but which will set or solidify to a permanent hard state as soon as exposed to air at room temperature, are commercially available including a variety of such materials sold and identified as Duro Plastic, a registered trademark of The Woodhill Chemical Corporation of Cleveland, Ohio. Brand names of such are "Plastic Aluminum" which is an atomized aluminum metal in putty form claimed to be impervious to oil, water, gasoline, etc. and resistant to heat up to 600° F. as well as adherent to most surfaces. Other useful products from the same source are known as "Plastic Lock Washer" and "Gasket Cement." It is preferable that the bonding substance be not appreciably conductive of electric current. The composition of lutes is dealt with fully in an article by Albert A. Hopkins appearing as Chapter 6 in the 1914 edition of The Scientific American Encyclopedia of Formulas, published by Munn & Co., Inc. New York, N.Y.

At least the web wall 21 of cover cap 16 is thin enough to be puncturable by thrusting endwise therethrough the bared terminal of an electric current conductor or conductors 22 which in usual manner may be twisted together before their insertion into the thimble. After such insertion the insulating jackets or coverings 23 of the electric current conducting wires will be housed and protected from fraying by the skirt portion 13 of the thimble.

The insertion of the bared wire terminals and the puncturing of the web wall 21 of cover cap 16 thereby will admit air to the well chamber 14 of the thimble as the twisted wires penetrate into the soft and unset body of adhesive 20 whereupon the adhesive will steadily set into a hardened and solid state through exposure to the air thus admitted. The hardening may take place in the absence of any high temperatures as are required to melt solder and within the principles of this invention no heat need be employed save for the purpose of hastening the hardening of some of the air-drying adhesives that might be employed.

FIG. 8 shows that a cover cap 16' may be modified in size and location to fit and fill the open mount of the skirt portion 13 of thimble 12' instead of only the well chamber 14.

In the further modification shown in FIGS. 9 and 10 a homogeneous air-drying adhesive 20' may first be encapsulated to exclude air from a charge of the adhesive. A capsule 24 containing the adhesive may be lodged in the well chamber 14 and imprisoned therein either by being a wedging fit within the well chamber or if preferred by the application of the cover cap 16 as in FIGS. 4 or 8.

FIGS. 11 and 12 show a modified form of capsule 25 containing two isolated cells in which are carried respectively two components of an epoxy adhesive which must be kept separated until they are ready for use, at which time they are to mingle and begin to set by chemical action resulting from their union. In both FIGS. 9 and 11 and the bared wire terminals 22 when thrust into the well chamber will puncture either the single cell capsule 24 or the double-cell capsule 25 and thus liberate the contents of the capsule for exposure to air. If a cover cap such as 16 is in place the liquid or plastic contents of the capsule will be squeezed by expansion into full conformity with the thimble walls surrounding well chamber 14 whose surface may have undulations shaped therein or be roughened into any suitable configuration for producing a mechanical cling upon the adhesive when set, thus mechanically preventing its withdrawal from the thimble when the wire terminals are encased therein.

In FIGS. 13—19 the wall of skirt 13' of a modified shape of thimble 12a is made thin, flexible and resilient, so that it can be deformed and later torn as in FIGS. 15—19. A suitable thickness of skirt wall for this purpose is 0.025 inches if the skirt diameter is about seven-sixteenth inch and if the wall of the thimble surrounding the well 14' is about one-sixteenth inch thick. These are merely suggested dimensions for a thim-

ble molded from such plastics as are hereinafter mentioned. These dimensions will enable opposite halves of the annular rim or marginal edge 30 of the skirt wall to collapse and be squeezed together and bonded in a flat seam 31 as shown in FIGS. 15—19 which closes the thimble and seals off the charge of flowable bonding substance from ambient air.

Among conventional ways in which the bonding together of the flattened margins of the skirt can be effected is the ultrasonic method applicable to many plastics including polyethylene, polypropylene, etc. The sealing of the seam can be done by the use of an electrically activated horn whose smooth flat face containing an overflow groove is pressed against the knurled flat face of an anvil containing a mating groove bordering on the knurled area of the flat face. Other examples of ultrasonic welding are disclosed in U.S. Pat Nos. 3,224,915 and 3,224,916.

The thimble, closed and sealed as above, will endure for an unlimited time with the bonding charge 20 remaining in viscous state until furnished by the supplier to the user. To condition for use, the bonded together flat skirt margins 30 can be cut off or torn apart as in FIG. 18 while the thimble is full or nearly full of the viscous bonding charge 20 whose softness permits the skirt walls to return to their molded cylindrical shape as in FIGS. 14 and 19 thus conditioning the thimble to receive the bare, twisted together or "pigtail" terminals of electrical conductors 22 without any screwing action. Simultaneously the exposure of the viscous substance 20 to air will cause the charge to set and and harden so that the conductor terminals will become solidly embedded therein while the charge fills and conforms to the furrowed shape of the well 14'. Thus without the use of heat the thimble becomes mechanically secured to the conductor terminals because the hardened charge fills all of the space between the latter and the circularly indented walls of the thimble.

The foregoing and many other embodiments of the basic conception of a precharged protective thimble for the incarceration of electric terminals, especially of the pigtail type, without the application of heat will be suggested by the disclosure hereof.

I claim:

1. A thimble for covering and insulating the bared terminal of an electric current conductor comprising, a continuous tubular wall of insulating material forming along a common axis a relatively rigid dead ended well of small girth and a relatively flexible skirt portion of substantially larger girth having a marginal edge, an annulus of said material extending from and connecting said well to said skirt portion, and a charge of flowable uncured settable substance contained in the hollow of said well, said wall being thin and flexible on the skirt side of said annulus, said marginal edge being collapsed and sealed together enclosing said charge within said well.

2. The thimble defined in claim 1, in which the said marginal edge is flat where sealed together.

3. The thimble defined in claim 2, in which the said marginal edge of the said skirt portion forms a circuitous rim thereof most remote from the said well of the said thimble.

4. The thimble defined in claim 1, in which the said collapsed marginal edge of the said skirt portion projects from the said tubular wall in a manner exposing the former to be severed and detached thereby to open the thimble for the insertion of an electrical conductor into the said charge of bonding substance.

5. The thimble defined in claim 4, in which the said wall of the said skirt portion is resilient and urges said wall to assume a tubular shape whereby said skirt will automatically assume said tubular shape when the said collapsed marginal edge is severed and detached.

6. The thimble defined in claim 1, in which the said tubular wall forming the said skirt portion is substantially no more than 0.025 inch thick and composed of flexible resilient polyethylene.

7. The thimble defined in claim 1, in which the said annulus terminates axially at a shoulder formed in the outer contour of the said thimble.