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2,321,731

METHOD OF MAKING REPAIRS AND JOINTS IN CABLE SHEATH

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FIG. 1

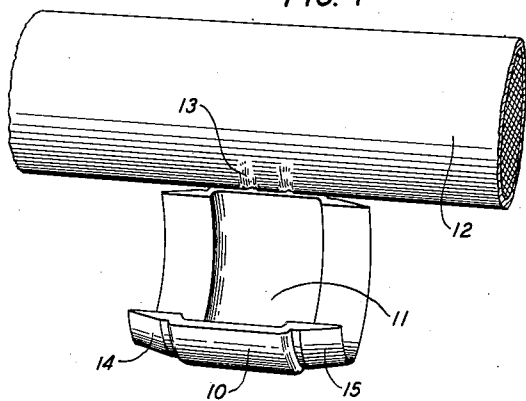


FIG. 2

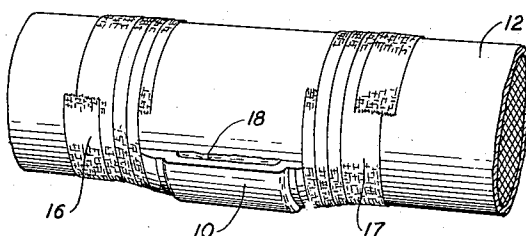


FIG. 3

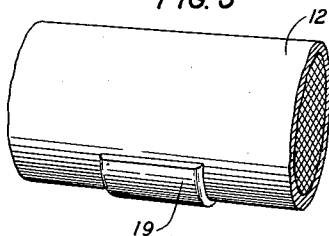


FIG. 4

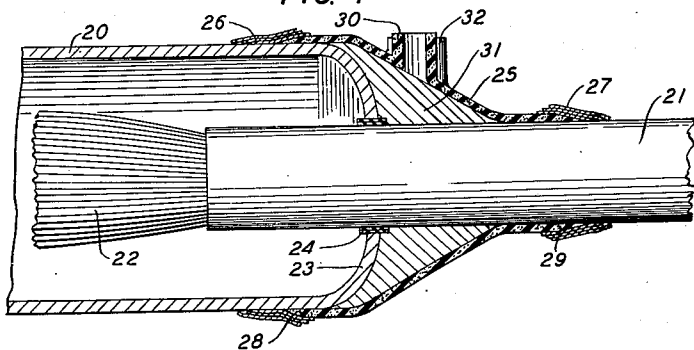
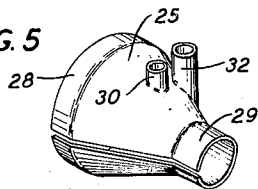


FIG. 5



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METHOD OF MAKING REPAIRS AND JOINTS
IN CABLE SHEATHS

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2 Claims. (Cl. 22-203)

This invention relates to a method of making repairs or joints in lead-antimony and other cable sheath such as is used, for example, in telephony.

Such repairs and joints are now made by hand wiping methods which require skilled operators and the repairs and joints so made result in certain deleterious effects on the lead-antimony or other precipitation hardened sheath. These harmful effects are due to the solution and coalescence of the hardening ingredient caused by the heating of the sheath above the eutectic point 183.3° C. of the lead-tin solders. In fact, sheath temperatures under wiped joints may reach over 300° C. during wiping.

Such heating of, for example, old lead 1 per cent antimony sheath causes partial solution of the precipitated antimony, the amount redissolved depending on the time and temperature of heating and the size of the precipitated particles. Unfortunately, the finer particles which are responsible for most of the dispersion hardening dissolve most readily and leave the alloy mechanically weak. The larger particles of precipitated and coalesced antimony which, because of their size, do not dissolve completely during the brief heat treatment contribute practically nothing to the strengthening of the cable sheath alloy. Their presence, on the other hand is distinctly harmful when the antimony which was dissolved by the heat treatment starts to reprecipitate. These large particles act as nuclei upon which the antimony precipitates and loses most of its strengthening effect instead of carrying out as an evenly dispersed phase throughout the alloy and thereby producing dispersion hardening. Although heating partially coalesced lead-antimony sheath causes some antimony solution at all temperatures, the rate of solution becomes rapid above 175° C. Laboratory study has shown that the tensile strength drops from about 3400 per square inch to about 2400 per square inch after heat treatment. Similar effects can be noted when using other cable sheathing alloys such as lead-calcium.

The method of this invention produces repairs and joints in which the sheath adjacent to the repairs is as durable as untreated sheath.

When any physical discontinuity is placed on sheath which, because of its environment, is subject to cyclical stress an added strain is put on the sheath directly adjacent to the discontinuity. Thus it becomes doubly important that the sheath in the immediate vicinity of the repairs, should in no way have its mechanical strength impaired.

Full size sheath having repairs made in this

new method has been compared directly with sheath repaired by old conventional methods by subjecting both to mechanical tests closely simulating field environment. The new method was demonstrated to be greatly superior to the old method.

In practicing the method of this invention the surface of the cable to be repaired is cleaned in any suitable manner as, for example, by means of a wire brush, is then coated with stearin or some other suitable flux and covered with a preshaped flexible mold, which may be made of rubber or canvas. If the repair is a ring cut, only the lower half of the sheath is covered by the mold, leaving the open ends exposed on either side. The mold is secured to the cable sheath by means of friction tape, for example. Solder is then poured alternately into each side of the mold so as to give overflow of solder from the joint until the sheath is heated to a satisfactory wetting temperature. After a definite amount of solder has been poured into the mold, the joint is allowed to solidify and the mold removed.

The character of the solder is important. Among the requirements of a solder for casting are:

A low enough melting point to allow fluid casting with overflow without heating the sheath at the edge of the joint above 175° C.

A high affinity for the lead sheath to insure easy and complete wetting.

The oxides of the alloy must be readily reduced by some acceptable relatively non-corrosive flux.

The alloy should be chemically stable.

A suitable solder which most nearly meets the above requirements is a lead-tin-cadmium eutectic falling within the range of 30 to 34 per cent lead, 16 to 20 per cent cadmium and 48 to 52 per cent tin, for example 32 per cent lead, 18.2 per cent cadmium and 49.8 per cent tin. This solder melts at 145.5° C., possesses excellent fluidity slightly above this temperature, and readily wets the cable sheath. Its chemical stability is of the same order as that of lead-tin solders. At soldering temperatures a stearin flux, which is acceptable for cable use, was found to reduce effectively any oxide formed by this solder.

Measurements of the sheath temperature at the edge of a repair during casting has shown that with the sheath at room temperature, the alloy can be cast at 240° C. without heating the sheath at the edge of the joint over 175° C., the critical solution temperature for precipitates such as antimony. Microscopic examination of adjoining solder and sheath sections has shown

that the alloy wetted the sheath well and uniformly. Further examination of the sheath near the edge of the joint has shown no discernible evidence in the case of antimonial-lead alloy of antimony solution thus indicating no damage has been done to the sheath. Under commercial conditions the casting temperature and the quantity of solder to be overflowed through the mold can be adjusted according to the sheath temperature.

Although a mold which is pliable and can be made to conform to the sheath surface is preferable, thin metal molds can be used. Since the solder is relatively heavy, some rigidity is necessary in the mold if a uniform joint thickness around the sheath is to be maintained.

Referring to the drawing:

Fig. 1 is a fragmentary perspective view of a portion of a lead-antimony sheath cable with the flexible mold about to be positioned over the ring cut or damaged portion;

Fig. 2 shows the mold in position on the underside of the cable and secured thereto by means of suitable tape and the cavity of the mold filled with molten solder;

Fig. 3 shows the cast boss on the bottom of the cable sheath after the mold has been removed;

Fig. 4 is a fragmentary view, partly in section, illustrating a modified form of the invention in which a flexible mold is used to cast a joint between the sleeve and the cable sheath;

Fig. 5 is a reduced perspective view of the flexible mold used for making the joint shown in Fig. 4.

As shown in Figs. 1 and 2, a flexible mold 10 having a depression 11 therein is secured in position on the cable sheath 12 so that the damaged portion 13 is approximately centrally located with respect to the depression 11. The mold 10, which is provided with feather edges 14 and 15, is secured in place on the cable sheath 12 by means of the tapes 16 and 17 which are wrapped around the feathered edged portion of the mold and around the cable sheath. This provides a tight fit for the mold and prevents the escape of any solder from the sides of the mold during the casting operation.

After the mold 10 has been secured in place, the cavity between the sheath and mold is filled with molten solder 18 as shown in Fig. 2, and overflowed sufficiently to heat the sheath to the desired wetting temperature. When this operation is completed and the solder cooled, the mold is removed and a lug or boss 19 as shown in Fig. 3 is the result.

In the modified form of our invention shown in Fig. 4, a lead sleeve 20 is positioned over the cable sheath 21 and the exposed conductors 22 and the end portion 23 is beaten down in the customary manner. However, to form a tight closure there is interposed between the beaten ends of the sleeve 20 and the cable sheath 21 an

elastic wrapping or gasket 24 of suitable heat resisting material. After the sleeve 20 has been beaten down the gasket 24 positioned and the surfaces to be soldered, cleaned and fluxed, a flexible mold 25, shown in Fig. 5, is positioned over the end of the sleeve 20 and in contact with the cable sheath 21. The mold 25 is secured in place by means of the tapes 26 and 27 which tightly bind the feather edges 28 and 29 of the mold 25 to the sleeve 20 at the cable sheath 21.

After the mold 25 has been secured in position, molten solder is introduced into the interior of the mold through the port 30 to completely fill the interior thereof with solder as shown at 31 in Fig. 4. An additional port 32 is provided for the escape of air as the molten solder is poured into the mold and to permit the desired amount of overflow. After the solder has cooled, the mold is removed and a perfect joint is the result.

We do not wish to limit our invention to the exact details of construction herein set forth, as various modifications thereof may be made without departing from the scope of the appended claims. For example, in place of the rubber mold illustrated, baked varnished canvas, wire cloth or other reenforced textiles could be used. In fact the mold may be made of any material which will result in its being flexible within relatively narrow limits and resistant to chemical change at the casting temperature.

What is claimed is:

1. A method of making joints or repairs in dispersion hardened lead cable sheaths which consists in securing a preformed flexible mold to the cable where the joint or repair is to be made, pouring into said mold, a molten solder comprising 30 to 34 per cent lead, 16 to 20 per cent cadmium and 48 to 52 per cent tin, said solder having a melting point low enough to permit fluid casting without heating the sheath at the edge of the joint above the temperature which would cause appreciable quantities of the precipitated and partially coalesced antimony particles in the lead sheath to go into solution.

2. A method of making joints or repairs in dispersion hardened lead antimony cable sheaths which consists in securing a preformed flexible mold to the cable where the joint or repair is to be made, pouring into said mold a molten solder having a high affinity for the sheath, said solder comprising 30 to 34 per cent lead, 16 to 20 per cent cadmium and 48 to 52 per cent tin, said solder having a melting point low enough to permit fluid casting without heating the sheath at the edge of the joint above the temperature which would cause appreciable quantities of the precipitated and partially coalesced antimony particles in the lead sheath to go into solution.

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