March 21, 1950 G. W. THELIN 2,501,457

FIRE DETECTOR CABLE

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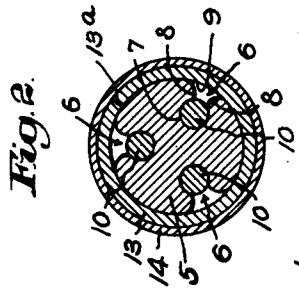


Fig. 2.

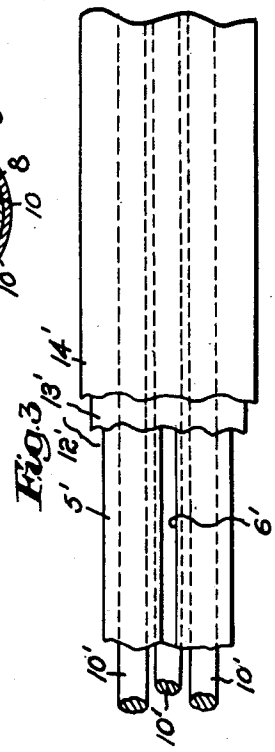


Fig. 3.

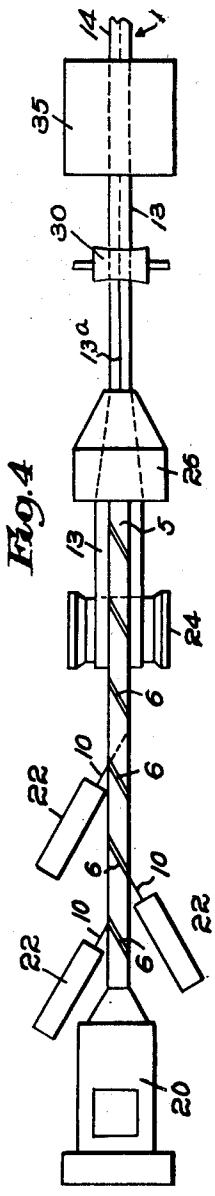


Fig. 4.

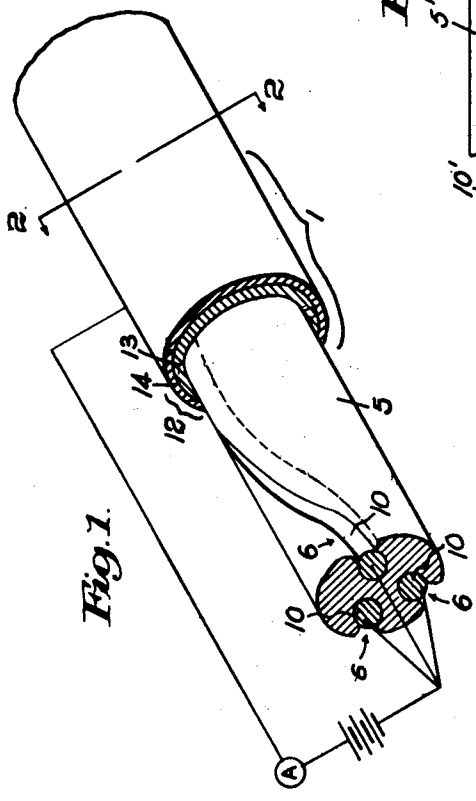


Fig. 1.

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FIRE DETECTOR CABLE

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4 Claims. (Cl. 200—143)

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This invention relates to the manufacture of electrically conductive fire-detector cables adapted to establish a circuit at any point along them where subject to fire and/or undue heating. It aims to provide a simplified and otherwise improved construction for such cables and to improve the method of manufacture thereof.

In the drawings illustrating by way of example certain embodiments of the invention together with means for the manufacture of the articles concerned:

Fig. 1 is an enlarged and partly diagrammatic perspective view of a short length of cable, with the outer conductor broken away in part;

Fig. 2 is a cross-section of the cable of Fig. 1;

Fig. 3 is an elevation of a modified form of the cable; and

Fig. 4 represents schematically one manufacturing method.

In the manufacture of a fire-detector cable as typified in the patent to Turenne 2,275,873, dated March 10, 1942, the placing of a multiplicity of separate members of insulating material along a supporting conductor involves supply and production problems which it is an object of the present invention to eliminate. To that end I provide for the cable an insulating or conductor-spacing means of an endless formation, of indeterminate length, preferably by the continuous extrusion of a synthetic resinous material.

Accordingly, in the example of Figs. 1 and 2, in which the cable as a whole is indicated generally at 1, I have represented at 5 a continuously extruded length of a plastic or plasticizable substance which is non-conductive electrically, is normally flexible at ordinary temperatures, and is adapted to withstand relatively high temperatures, without undue softening or fusing, that is, subsequent to extrusion in the desired form. Otherwise stated, the selected material is thermally stable at least up to the critical temperature of responsive operation for the cable in the particular circumstances of the intended use. Various suitable materials for the purpose, which, subject to the requirements noted, may be either thermo-plastic or extrudably thermo-setting, may be selected from the commercially available flexible plastic compounds.

This elongated plastic strand, body or core element 5 is longitudinally channeled externally as generally indicated at 6. Each channel or groove 6, as best seen in Fig. 2, has an inner portion 7 providing a continuous seat for a corresponding electric conductor 10, a neck or somewhat reduced portion defined by side walls 8, 8, and a

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laterally open outer portion or mouth 9 at the periphery of the core or carrier 5. In the embodiment of Figs. 1 and 2, the channels 6 are spirally disposed about the core 5, advancing along it in open turns having a substantial lead and relatively flat angle of "wind," that is, crossing the core axis at an angle of not more than about 45° at the leading side. The number of channels 6, and of conductors 10 carried in them, may be varied and the angle of spiralling is in part determined by the number of channels and by the relative diameter of the conductors 10, whether one, two or more, three being shown in the illustrated example. With a less number the angle of spiral may be increased and the lead reduced, proportionately to reduce the spacing between adjacent points of traverse of a channel across any given longitudinal line at the periphery of the core.

Directly surrounding the plastic core 5 and the laterally open spiral channeling 6 thereof is a composite flexible electrically conductive tubing 12 comprising an inner layer of a fusible metal or alloy 13 and an outer layer or protective cover of a metal or metallic conductive material 14, such as a plating of copper, of relatively high temperature of fusion as compared with the inner layer. The latter is selected from the class of fusible metals and alloys to present the characteristic fusion point at the critical temperature as appropriate to the particular use circumstances.

It is noted, particularly with reference to Fig. 2, that the conductors 10 are spaced radially in from the periphery of the core 5, sufficiently for the purposes of electrical insulation, the channels presenting their laterally open portions or mouths 9 adjacent the fusible metal 13. Fusing of the latter at any point along the cable will accordingly cause the fused metal to enter the adjacent channel or channels 6 and short circuit the conductor therein across to the tubing 12. As shown, noting particularly Fig. 2, the channel mouths 9 are of a width to afford ready access for the fused metal to the bare conductors 10 held in the inner seat portions 7 of the channels in distinctly spaced relation radially inward from the periphery of the non-conductive flexible synthetic resinous core 5. The normal spacing of the conductors 10 from the tubing, the width of the channel mouths 9 and the described construction and arrangement of the core 5 are furthermore such that bending of the flexible cable as a whole, even upon an arc of small radius as in installing the cable around a corner, does not

cause electrical contact between a conductor 10 and the tubing 12.

In Fig. 3 I have shown a further embodiment of the cable of the invention, wherein the same numerals as in Figs. 1 and 2, with the addition of a prime mark, indicate corresponding parts. In this instance the radially open channels or grooves 6' are disposed in general parallelism to the axis of the plastic core 5', with little or no spiralling. In other respects the construction may be substantially as in Figs. 1 and 2. With the approximately straight channeling of Fig. 3, it is generally desirable to provide a plurality of channels, and the like number of conductors 10', preferably at least three, in the equally spaced circumferential arrangement shown, to insure fusion contact at all points along the cable, particularly in horizontal runs thereof.

Manufacture of the cable, of either of the illustrative examples, may in accordance with the invention be carried out as a single continuous operation, as schematically represented for instance in Fig. 4. In said figure an extruder for the plastic material is indicated at 20. The core element 5 issues continuously at the extruding nozzle with the spiral (or straight) channeling 6 simultaneously formed. The extruded core 5 is advanced continuously past conductor-laying stations, three in the example shown, at each of which a metal conductor or core 10 from a supply 22 is laid into a corresponding channel 6. Beyond the conductor-laying stations 22 a strip of the fusible alloy 13 is continuously laid along the conductor-carrying core 5, the alloy being led out from a suitable supply thereof as indicated at 24. The work comprising the alloy strip 13 and the plastic core 5 with the conductors 10 therein is then passed through a forming die 26 or other means adapted to fold the alloy strip into tubular form surrounding the core, with the longitudinal side edges of the strip abutted or lapped along a longitudinal juncture as at 13a. After passing the forming means 26, the work including the alloy sheathing 13 is advanced in operative relation to a joint-forming or sealing means 30 represented as a heating roll. The latter is maintained at a temperature adequate to soften or partly fuse the alloy along the juncture zone 13a adequately to unite the adjoined portions of the alloy into tubing form. In connection with the forming and jointing or sealing steps, or additionally if preferred, the work desirably is somewhat compressed, adequately to bring the channel walls 8, Fig. 2, into the conductor-retaining but open relation substantially as shown. After uniting or sealing the alloy member 13 into tubular form a thin plating of copper or other electrical conductive material 14, as previously described, is applied as a covering for the alloy. For this purpose the work is represented in Fig. 4 as passing through a plating bath, as at 35. The completed flexible cable 1 issues continuously from the plating bath, as indicated at the right in Fig. 4, and may be packaged in any convenient manner, as in coils or in cut lengths.

Where the plastic core 5 or 5' is formed or channeled for a plurality of the inner conductors such as 10 of Fig. 1 and 10' of Fig. 3, the individual conductors preferably are connected in parallel, generally in resistance-balanced relation to the tubular outer conductor and together constituting one side of a detector or signal circuit, as represented diagrammatically in Fig. 1. There the three conductors 10 are interconnected at one or more points along the cable, their common lead being connected in a circuit including a suitable source of electrical energy, an alarm, signal or the like A, and a lead connected to the outer conductive element 13, 14 of the cable. Similar parallel connection for the conductors 10' of Fig. 3 and associated alarm circuit will be understood, making it unnecessary in Fig. 3 to repeat the circuit diagram of Fig. 1.

My invention, either as to the articles or the method of making the same, is not limited to the particular constructions, means or steps as herein shown or described, its scope being pointed out in the following claims.

I claim:

1. A flexible fire-detector cable comprising a conductive tubing having at least an inner layer of fusible metal, an inner bare metallic conductor, and a nonconducting thermally stable carrier core for such inner conductor, the core being encompassed by the tubing and composed of an elongated flexible body of resinous material having a laterally open channel extending the length of the cable and including an inner conductor-receiving seat, an intermediate conductor-retaining neck and a relatively wide mouth for the inflow of fused metal from the tubing, the inner conductor being positioned in and by the channel seat and neck below the core periphery and in spaced relation to the tubing and instantly accessible via the channel mouth for electrical contact by heat-responsive fused metal from the tubing.

2. A flexible fire-detector cable according to claim 1 comprising a plurality of the channels each having a bare metallic conductor therein.

3. A flexible fire-detector cable according to claim 1 wherein the channel is disposed spirally along the core.

4. A flexible fire-detector cable according to claim 1 wherein the channel is substantially parallel to the core axis.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
435,629	Holcombe	Sept. 2, 1890
1,940,917	Okazaki	Dec. 26, 1933
2,275,873	Turenne	Mar. 10, 1945