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(54) Title: INSULATED WIRE AND CABLE

(57) **Abrégé/Abstract:**

Insulated wire and cable insulated by compositions containing a block copolymer in which one of the blocks is a crystalline polyvinylidene fluoride block and the other block is an amorphous block containing randomly copolymerized units derived from vinylidene fluoride and a comonomer, e.g. hexafluoropropylene. Particularly useful novel insulating compositions contain 53 to 90% of the block copolymer, 10 to 42% of polyvinylidene fluoride and 0 to 10% of other polymers.



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**ABSTRACT**

Insulated wire and cable insulated by compositions containing a block copolymer in which one of the blocks is a crystalline polyvinylidene fluoride block and the other block is an amorphous block containing randomly copolymerized units derived from vinylidene fluoride and a comonomer, e.g. hexafluoropropylene. Particularly useful novel  
5 insulating compositions contain 53 to 90% of the block copolymer, 10 to 42% of polyvinylidene fluoride and 0 to 10% of other polymers.

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**INSULATED WIRE AND CABLE****BACKGROUND OF THE INVENTION****Field of the Invention**

This invention relates to insulated wires and cables.

5 **Introduction to the Invention**

It is well known to provide electrical insulation around wires and other conductors by means of a thermoplastic polymeric composition. There can be one or more insulating layers around a single conductor, and/or one or more insulating layers around a plurality of individually insulated conductors. The insulating compositions  
10 normally include a polymeric component and other ingredients such as fillers, antioxidants, stabilizers and fire retardants. A wide variety of polymers have been used for this purpose, but there remains a need for insulating compositions which will provide improved properties and/or reduced cost. For example, improvement is desirable in insulated wires for use in automatic transmissions, e.g. in road vehicles powered by  
15 internal combustion engines. Such wires must provide extended service over a period of many years while immersed in automatic transmission fluid (often abbreviated to ATF) which, during operation of the vehicle, is heated to elevated temperatures, sometimes as high as 150°C. Furthermore, space is limited in automatic transmissions, so that the thinner the insulating layer, the better.

20 **SUMMARY OF THE INVENTION**

I have discovered, in accordance with the present invention, that compositions comprising certain block copolymers derived from vinylidene fluoride and other comonomers are very suitable for use as wire insulation, for example on wires for use in automatic transmission systems and in other situations in which the insulated wire  
25 is exposed to high temperatures and/or to liquids similar to ATF's. The block copolymers in question (which include, but are not limited to, the block copolymers disclosed in U.S. Patent No. 5,092,247 and European Patent Publication No. 0,456.019 A1) comprise (i) first polymeric blocks which comprise units derived from vinylidene fluoride and which are crystalline, and (ii) second polymeric blocks which comprise units derived from

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vinylidene fluoride and at least one comonomer, and which are substantially less crystalline than the first blocks and are preferably substantially amorphous. The first polymeric blocks preferably consist essentially of units derived from vinylidene fluoride, but may contain small amounts, preferably less than 5%, particularly less than 1%, of units derived from a comonomer (percentages are by weight through this specification). The second polymeric blocks comprise randomly copolymerized units derived from vinylidene fluoride and from at least one comonomer, preferably at least one other fluorinated comonomer.

The invention provides the use in an electrical harness for an automatic transmission of an insulated wire or cable which, when the harness is in use, is immersed in automatic transmission fluid, and which comprises (1) a wire, and (2) an electrically insulating jacket which (a) surrounds the wire, (b) has been melt-extruded around the wire, and (c) is composed of an insulating polymeric material comprising a polymeric component, said insulating material comprising at least 50% by weight, based on the weight of the polymeric component, and at least 40% by weight based on the material, of a block copolymer which comprises (i) first polymeric blocks comprising repeating units in which at least 95% by weight of the repeating units are derived from vinylidene fluoride and are crystalline, and (ii) second polymeric blocks comprising repeating units in which at least 95% by weight of the repeating units are derived from vinylidene fluoride and at least one other fluorine-containing comonomer, and in which the repeating units are randomly copolymerized and are substantially less crystalline than the first blocks; the ratio by weight of the repeating units derived from vinylidene fluoride in the first blocks to the repeating units derived from vinylidene fluoride in the second blocks being from 40:60 to 95:5, and the block copolymer containing 0.5 to 30% by weight of repeating units derived from the said at least one other fluorine-containing comonomer.

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### BRIEF DESCRIPTION OF THE DRAWING

The invention is illustrated in the accompanying drawings, in which

Figures 1 and 2 are diagrammatic cross sections of insulated wires according to the invention, and

5 Figure 3 is a diagrammatic sketch of an electrical harness for an automatic transmission and a casing for an automatic transmission in which the harness is placed.

### DETAILED DESCRIPTION OF THE INVENTION

In the block copolymers used in this invention, the ratio by weight of the units derived from vinylidene fluoride in the first blocks to the units derived from  
10 vinylidene fluoride in the second blocks is from 40:60 to 95:5, preferably 50:50 to 90:10, particularly 65:35 to 85:15, especially 70:30 to 80:20. The block copolymer contains 0.5 to 30%, preferably 1 to 20%, particularly 1 to 15%, especially 5 to 15%, of units derived from the comonomer, the percentages being by weight, based on the weight of the copolymer.

15 Those skilled in the art will have no difficulty, having regard to their own knowledge and the disclosure of this specification, in preparing block copolymers suitable for use in this invention. A preferred method of preparing suitable block copolymers comprises

(A) preparing a reactive oligomer corresponding to the first block by  
20 polymerizing a first monomer component which comprises at least 95% by weight vinylidene fluoride, and

(B) adding to the reaction mixture from step (1) a second monomer component which comprises vinylidene fluoride and at least one comonomer, and copolymerizing the second monomer component on the reactive oligomer, thus preparing  
25 the second block.

The polymerization steps (A) and (B) can be carried out by emulsion polymerization, or by suspension polymerization. For a detailed description of the preparation of suitable block copolymers by emulsion polymerization, reference may be

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made to U.S. Patent No. 5,093,247 (Barber, assigned to Atochem North America Inc.). The copolymers prepared by that process are thermoplastics, with at least a majority, and usually substantially all, of the polymeric molecules consisting essentially of a single first block and a single second block. Such copolymers can of course be prepared by other processes. The copolymers used in this invention can also be thermoplastic elastomers, in which at least a majority, and preferably substantially all, of the polymeric molecules comprise at least one second block which is linked to at least two first blocks, thus providing a polymer which is an elastomer at temperatures below the melting point of the first blocks, and a thermoplastic above the melting point of the first blocks.

The melting point of the block copolymers used in this invention is preferably at least 160°C, particularly at least 163°C, and can be, for example 160-170°C or even higher.

In the second blocks of the copolymer, the comonomer is preferably a fluorinated comonomer, particularly hexafluoropropylene (HFP). Other fluorinated comonomers which can be used, optionally in combination with HFP, include other fluoroalkenes, e.g. pentafluoropropylene, tetrafluoroethylene, and chlorotrifluoroethylene, fluoroalkoxyalkenes, e.g. perfluoroethoxyethylene, and fluoroalkylvinyl ethers, e.g. perfluoropropylvinyl ether, perfluoromethylvinyl ether, perfluoroethylvinyl ether and perfluorobutylvinyl ether.

One of the properties of the block copolymer which can have an important influence on the properties of the insulating jacket is its melt viscosity. In general, higher melt viscosities are preferred (though with a preferred maximum set by the desire for easy processability of the composition), with the preferred minimum being dependent in part on the amount and nature of other ingredients of the composition. The melt viscosity of the block copolymer is generally at least 5, preferably at least 10, particularly at least 15, especially at least 20, Kpoise, as measured by ASTM D 3835 at 232°C and at a shear rate of 100 sec<sup>-1</sup>.

The polymeric insulating compositions used in the present invention can contain other ingredients, in addition to the block copolymer, including other polymers and conventional ingredients such as fillers, antioxidants, stabilizers and fire retardants. The polymeric component of the composition contains at least 50% by weight of the block

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copolymer, based on the weight of the polymer component, and in general, the greater the percentage of the block copolymer, the better the properties of the insulation. For some uses, therefore, it may be preferred to use, at least 60%, more preferably at least 70%, particularly at least 80%, more particularly at least 90%, especially substantially 100%, of the block copolymer. On the other hand, when an adequate performance can be obtained using a blend of the block copolymer with an additional, less expensive, polymer, economic pressures may make it desirable to use such a blend. Additional polymers which may be present as part of the polymeric component, for example, in amount 10 to 45% by weight of the polymeric component, include other fluorinated polymers, e.g. homopolymers of vinylidene fluoride, which are preferred, homopolymers of one of the other fluorinated monomers referred to above, and random copolymers of two or more of vinylidene fluoride and such other fluorinated monomers. The block copolymer preferably constitutes at least 40%, preferably at least 60%, particularly at least 75%, by weight of the total composition.

I have found that if the block copolymers are mixed with relatively large proportions of vinylidene fluoride polymers, the resulting mixtures, particularly when crosslinked, can retain excellent elongation even after aging at high temperatures. These vinylidene fluoride polymers are easier and cheaper to prepare than the block copolymers, and in consequence these mixtures provide, at a more acceptable cost, a level of performance which is an improvement over earlier proposals and which is entirely satisfactory for many purposes, even though it may not be quite as good as the performance obtained when the block copolymer is the sole polymer. In a preferred embodiment, therefore, the polymeric component consists essentially of

(A) 53 to 100%, preferably 53 to 90%, particularly 58 to 90%, especially 58 to 75%, by weight of the block copolymer,

(B) 0 to 47%, preferably 10 to 45%, especially 25 to 42%, by weight of a polymer in which at least 95%, preferably substantially 100%, by weight of the repeating units are derived from vinylidene fluoride, and

(C) 0 to 10%, preferably 0%, by weight of one or more other polymers.

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The insulating composition is preferably applied to the wire by melt extrusion. There may be a single layer of insulation which contains the block copolymer, or two or more layers of insulation in which only one of the layers contains the block copolymer, that layer being the innermost layer, an intermediate layer, or an outermost layer. There may also be two or more layers of the same composition containing the block copolymer or two or more layers of different compositions containing the same block copolymer or different block copolymers. The thickness of the layer containing the block copolymer can vary widely, e.g. from 0.005 to 0.050 inch (0.127 to 1.27 mm) when the layer is the sole insulating layer, or from 0.001 to 0.050 inch (0.025 to 1.27 mm), preferably 0.002 to 0.01 inch (0.05 to 0.25 mm), when the layer is one of two or more layers. We have found that one of the surprising advantages of the invention is that a single layer which is only 0.006 to 0.015 inch, e.g. 0.007 to 0.010 inch (0.15 to 0.38 mm, e.g. 0.18 to 0.25 mm) thick can provide excellent results around a wire which is used in an automatic transmission system.

When the insulation around the wire includes a second layer of a different polymeric composition, the second layer can be of any kind which, in combination with the layer comprising the block copolymer provides the desired combination of physical properties. Even a very thin layer comprising the block copolymer, e.g. a layer about 0.003 inch (0.075 mm) thick, will substantially improve the performance of the wire when exposed to an ATF. We have obtained good results using a second layer which is 0.005 to 0.02 inch (0.127 to 0.5 mm), preferably 0.01 to 0.015 inch (0.25 to 0.4 mm), thick. The second layer may for example be composed of a composition which comprises polyethylene or another polyolefin, or one of the polymers described above as suitable additional polymers which may be blended with the block copolymer. Other suitable compositions are those described in U.S. Patent Nos. 2,167,278, 3,671,487, 3,835,089, 4,048,128 and 4,332,855, European Patent Publication No. 0,057,415.

After the insulating composition comprising the block copolymer has been placed around the wire, the composition can if desired be crosslinked, thus improving its high temperature properties, especially at temperatures approaching its melting point. The copolymer is preferably crosslinked by irradiation, e.g. with high energy electrons to a dosage of, for example, 10 to 30 Mrads. If the composition is to be crosslinked by

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radiation, it preferably contains an ethylenically unsaturated radiation crosslinking agent, e.g. triallyl isocyanurate (TAIC) or triallyl cyanurate (TAC).

The wires which are used in this invention can be stranded or solid, e.g. 16 to 24 AWG tin-coated copper wires. One particular use for the insulated wires of the invention is in automatic transmission systems, particularly in automobiles, trucks and other road and sea vehicles, in which the wires form part of circuits powered by batteries and/or by alternators, and in other situations in which the insulation is continuously or intermittently contacted by an organic liquid, e.g. a mineral oil or other hydrocarbon, and/or operates at an elevated temperature, e.g. 100-150°C. Preferably, the insulating jacket is such that the insulated wires, after immersion in ATF at 150°C for 2,000 hours, can be wrapped around a mandrel having a diameter twice the diameter of the insulated wire without cracking the insulation. For an automatic transmission, the wires are usually prefabricated into a harness comprising a plurality of wires arranged in a configuration which is designed to fit a specific transmission system. The harness may lie completely within the casing of the transmission, the wires then being electrically connected to parts of the transmission which lie within the casing, e.g. to solenoids, or to connectors which are physically secured to the casing of the automatic transmission so that electrical connection can be made between the harness and the wiring system of the vehicle which lies outside the casing. Generally, one or more of the wires of the harness pass through the casing via a sealed port. Particularly in the latter case, there is a danger that any transmission fluid which penetrates the insulation will pass down the stranded wire and out of the casing. To reduce this danger, the stranded wire is preferably blocked by impregnating it with a suitable polymeric composition, e.g. a siloxane or a silicon rubber.

When the insulated wires are used in the automatic transmission system of a road vehicle (e.g. an automobile or a truck) they often form part of a circuit which is powered by direct current from a battery (or an alternator), typically a 12 volt (nominal) or 24 volt (nominal) battery. It is expected that higher voltages, e.g. up to 600 volts, may be used in the future in electrically powered vehicles. Surprisingly, I have found that the electrical performance of the insulated wires is much better when using DC than when using AC.

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Compositions suitable for use as automatic transmission fluids (ATF's) are well known to those skilled in the art. Typically they are based on liquids which have low viscosity, e.g. less than 40 mm<sup>2</sup>/s at 40°C, and low viscosity-temperature dependence, and also contain numerous additives, e.g. friction modifiers, oxidation inhibitors and antiwear additives. Further information about ATF's is to be found in the SAE Information Report entitled Fluid for Passenger Car Type Automatic Transmissions -- SAE J311 APR86 and the SAE Recommended Practice entitled Powershift Transmission Fluid Classification -- SAE J1285 JAN85.

Referring now to the drawings, Figures 1 and 2 show an insulated wire comprising a stranded conductor 1 containing a blocking compound 2 and surrounded by a layer of insulation 3 containing a block copolymer as defined above and, in Figure 2, a second layer of insulation 4 of a different polymeric composition. Figure 3 shows an automatic transmission harness 6 which comprises a number of branches 61, 62 etc., each of which contains two or three insulated wires which terminate in terminals 71, 72 etc. which are plugged into receptacles 81, 82 etc. which are inside and secured to a transmission housing 8. The wires pass through the housing 8 via a sealed port 88.

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EXAMPLESExamples 1-5

Five insulating compositions were prepared. Each contained 88.8% of a polymer as specified in Table 1 below, 5% of antimony trioxide, 3.6% of triallyl isocyanurate, 0.1% of an antioxidant (available from Ciba Geigy under the trade name Irganox 1010) and 2.5% of dibasic lead phthalate (available from Anzon under the trade name Dythal™ XL). Each composition was melt extruded over a 13 AWG 37/29 tin-coated copper stranded wire to form an insulating jacket having a thickness of about 0.014 inch (0.35 mm). The jacket was then crosslinked by irradiating it to a dosage of about 15 Mrad. The insulation was removed from samples of the coated wires and subjected to the following tests.

Modulus The M<sub>100</sub> value of the insulation, as first produced, was measured at 200°C, using the method set out in U.S. Patent No. 4,155,823.

Initial Elongation The elongation of the insulation, as first produced, was measured at room temperature, using the method set out in ASTM D 3032, Section 17, at a crosshead speed of 20 inch/min. and a jaw separation of 1.1 inch..

Annealed Elongation The elongation of the insulation, after it had been heated to 200°C by placing it in a preheated oven and then cooled by allowing the oven to cool to room temperature over a period of about 3 hours, was measured at room temperature, using the same method as for the Initial Elongation.

Initial Necks The samples were observed as they were elongated in the initial elongation test. The notation “x/y” means that y samples were tested, and that x of those samples did not strain harden at all before breaking (i.e. a portion of the sample did not neck down) is associated with low average elongation values and is disadvantageous since it means that the elongation is likely to vary widely from sample to sample.

Annealed Necks The samples were observed as they were elongated after the heat treatment, and the necking (if any) recorded in the same way.

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Shrinkage The insulation was heated to 155°C and then cooled to room temperature. The shrinkage was measured.

The results of the testing are shown in Table 1 below.

The polymers used in Examples 1-5 are different grades of vinylidene fluoride polymer supplied by Atochem North America Inc. under the trade name Kynar™. The polymers used in Examples 3 to 5 are block copolymers as used in this invention; the polymers used in Examples 1 and 2 are not. Table 1 below sets out the characteristics of these polymers and the results of testing the insulated wires made in Examples 1-5. Table 1 also shows the characteristics of another Kynar polymer which is used in Example 9 below and is also a block copolymer as used in this invention. The abbreviations VDF and HFP in Table 1 refer to vinylidene fluoride and hexafluoropropylene respectively. The melt viscosities in Table 1 are given in kilopoise and were measured by ASTM 3835 at 232°C and a shear rate of 100 sec<sup>-1</sup>.

#### Examples 6-9

In Examples 6-9, an insulated wire as used in this invention was compared with insulated wires which have been used or proposed for use as insulation for automatic transmission wires. The insulated wires and the results of testing them are shown in Table 2 below. The following abbreviations are used in Table 2.

EF is a composition containing an elastomeric fluorocarbon polymer.

PES is a composition comprising a polyester alloy of the type disclosed in PCT (International) Application No. WO 93/08234 (E. I. du Pont de Nemours).

EAE is a composition comprising an ethylene/methacrylate elastomer sold by du Pont under the trade name Vamac™.

Samples of the coated wires were tested for pinch resistance by the method of SAE J1128 and for scrape abrasion by the method of ISO 6722/1, using a 0.75 Kg load.

Further samples of the wire of Example 9 were tested for thermal stability. After aging in air at 250°C for 168 hours, the insulation had an elongation of about 310% and a tensile strength of about 3,700 psi (260 kg/cm<sup>2</sup>), measured at room temperature by

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the method of ASTM D 3032 at a crosshead speed of 20 inch/min. and a jaw separation of 1.1 inch.

Further samples of the wire of Example 9 were tested for voltage withstand at 150°C. Application of an AC voltage of 250 volts RMS resulted in failure of the insulation. Application of a DC voltage of 40 volts did not cause failure, at 150°C or even at 200°C. Voltage withstand was measured by the procedure of UL Subject 758.

Further samples of the wire of Example 9 were tested for resistance to hot HTF. After immersion for 7,000 hours in a commercial ATF (the product sold by Exxon under the trade name H-FN1975) at 150°C, the insulation had not swollen, and did not crack when the insulated wire was wrapped several times around a mandrel having twice the diameter as the insulated wire. After immersion for 24 hours in the same ATF at 170°C, the insulation had not swollen, and did not crack when the insulated wire was wrapped several times around a mandrel having a diameter twice the diameter of the insulated wire. After immersion for 4,000 hours in another commercial ATF (the product sold by Ethyl Petroleum Additives Inc. under the trade name Dexron<sup>TM</sup> III) at 150 °C, the insulation had not swollen, and did not crack when the insulated wire was wrapped several times around a mandrel having a diameter twice the diameter of the insulated wire.

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TABLE 1

| <u>Example No.</u>                    | 1*  | 2*   | 3       | 4       | 5       | 9       |
|---------------------------------------|-----|------|---------|---------|---------|---------|
| <u>Polymer</u><br>Grade               | 460 | 2800 | RC10051 | RC10053 | RC10054 | RC10089 |
| <u>Monomers</u><br>VDF %              | 100 | 88   | 90      | 95      | 90      | 90      |
| HFP %                                 | 0   | 12   | 10      | 5       | 10      | 10      |
| <u>Properties</u><br>Melting Point °C | 160 | 144  | 165     | 165     | 165     | 168     |
| Melt Viscosity (Kp)                   | 26  | 23   | 3.4     | 9.1     | 19.5    | 20.4    |
| <u>Test Results</u><br>M100 (psi)     | 80  | 135  | 80      | 50      | 110     |         |
| Shrinkage %                           | 0   | 4.5  | 0       | 1       | 0       | 0       |
| Initial Elong'n %                     | 300 | 365  | 40      | 20      | 330     | 450     |
| Annealed Elong'n %                    | 50  | 330  | --      | --      | 310     |         |
| Initial Necks                         | 0/5 | 0/5  | 5/5     | 4/4     | 0/5     | 0/5     |
| Annealed Necks                        | 5/5 | 0/5  | --      | --      | 0/5     |         |

\* Comparative Example

TABLE 2

| Example No.                                 | 6         | 7         | 8          | 9          |
|---------------------------------------------|-----------|-----------|------------|------------|
| <u>Wire Size</u> (AWG) ( <i>Stranding</i> ) | 20 (7/28) | 20 (7/28) | 18 (16/30) | 20 (19/30) |
| <u>Jacket</u>                               |           |           |            |            |
| Material                                    | EF        | PES       | EAE        | RC10089    |
| Wall thickness (mil)                        | 16        | 16        | 37         | 8          |
| <u>Properties</u>                           |           |           |            |            |
| Pinch Resistance (lb)                       | 4.8       | 15.7      | 28.8       | 22.3       |
| Scrape Abrasion (cycles)                    | 106       | 625       | 316        | 95         |

\* Comparative Example

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Examples 10-14

Examples 10-14 are summarized in Table 3 below. In each Example, an insulating composition consisting of the indicated percentages of Kynar RC 10089 (a block copolymer as defined above containing 90% of vinylidene fluoride units and 10% of hexafluoropropylene units) and Kynar 460 (a homopolymer of vinylidene fluoride) was employed. In Examples 10-12, the composition was melt extruded as a layer 5 mils (0.13 mm) thick directly over a 20 AWG 19-stranded wire to give an insulated wire having an outer diameter of 49 mils (1.2 mm). In Examples 13 and 14, the composition was melt extruded as a layer 3 mils (0.08 mm) thick over a 20 AWG 19-stranded wire which had previously been coated with a 5 mil (0.13 mm) thick layer of polyethylene. In each Example, the coated wire was irradiated to a dosage of about 15 Mrads. The insulation was removed from samples of the coated wires (separating the Kynar insulation from the polyethylene insulation in Examples 13 and 14) and tested after annealing as in Examples 1-5. The results are shown in Table 3.

TABLE 3

| Example No.           | 10  | 11  | 12  | 13  | 14  |
|-----------------------|-----|-----|-----|-----|-----|
| <u>Polymers</u>       |     |     |     |     |     |
| Kynar RC10089         | 10  | 25  | 50  | 60  | 70  |
| Kynar 460             | 90  | 75  | 50  | 40  | 30  |
| <u>Properties</u>     |     |     |     |     |     |
| Annealed Elongation % | 70  | <20 | 150 | 410 | 440 |
| Annealed Necks        | 3/3 | 3/3 | 3/3 | 0/4 | 0/5 |

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CLAIMS:

1. The use in an electrical harness for an automatic transmission of an insulated wire or cable which, when the harness is in use, is immersed in automatic transmission fluid, and which comprises

5 (1) a wire, and

(2) an electrically insulating jacket which (a) surrounds the wire, (b) has been melt-extruded around the wire, and (c) is composed of an insulating polymeric material comprising a polymeric component, said insulating material comprising at least 50% by weight, based on the weight of the polymeric component, and at least 40% by  
10 weight based on the material, of a block copolymer which comprises

(i) first polymeric blocks comprising repeating units in which at least 95% by weight of the repeating units are derived from vinylidene fluoride and are crystalline, and

(ii) second polymeric blocks comprising repeating units in which at least  
15 95% by weight of the repeating units are derived from vinylidene fluoride and at least one other fluorine-containing comonomer, and in which the repeating units are randomly copolymerized and are substantially less crystalline than the first blocks;

the ratio by weight of the repeating units derived from vinylidene fluoride in the first blocks to the repeating units derived from vinylidene fluoride in the second  
20 blocks being from 40:60 to 95:5, and the block copolymer containing 0.5 to 30% by weight of repeating units derived from the said at least one other fluorine-containing comonomer.

2. The use according to Claim 1 wherein the polymeric component consists essentially of (A) 53 to 90 % by weight of the block copolymer, (B) 10 to 47% by weight  
25 of a polymer in which at least 95% by weight of the repeating units are derived from vinylidene fluoride and (C) 0 to 10% by weight of one or more other polymers.

3. The use according to Claim 2 wherein the polymeric component consists essentially of 58 to 75% by weight of the block copolymer and 25 to 42% by weight of a homopolymer of vinylidene fluoride.

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4. The use according to claim 1 wherein

(A) the block copolymer has a melting point of at least 160°C;

(B) the first blocks consist essentially of units derived from vinylidene fluoride,

5 (C) the other fluorine-containing monomer in the second polymeric blocks is at least one monomer selected from the group consisting of hexafluoropropylene, tetrafluoroethylene, chlorotrifluoroethylene, perfluoroethoxyethylene, perfluoropropylvinyl ether, perfluoromethylvinyl ether, perfluoroethylvinyl ether and perfluorobutylvinyl ether.

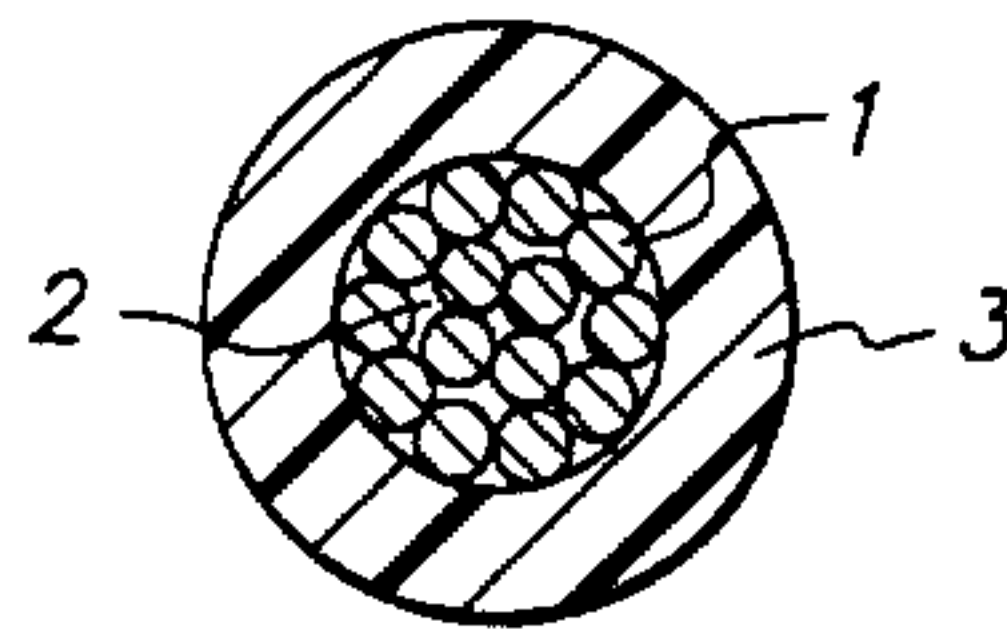
10 5. The use according to claim 1 wherein said insulating jacket (a) is 0.002 to 0.01 inch (0.05 to 0.25 mm) thick, and (b) surrounds and contacts an inner insulating jacket which surrounds and contacts the wire.

6. The use according to claim 1 wherein the insulating polymeric material has been crosslinked by irradiation.

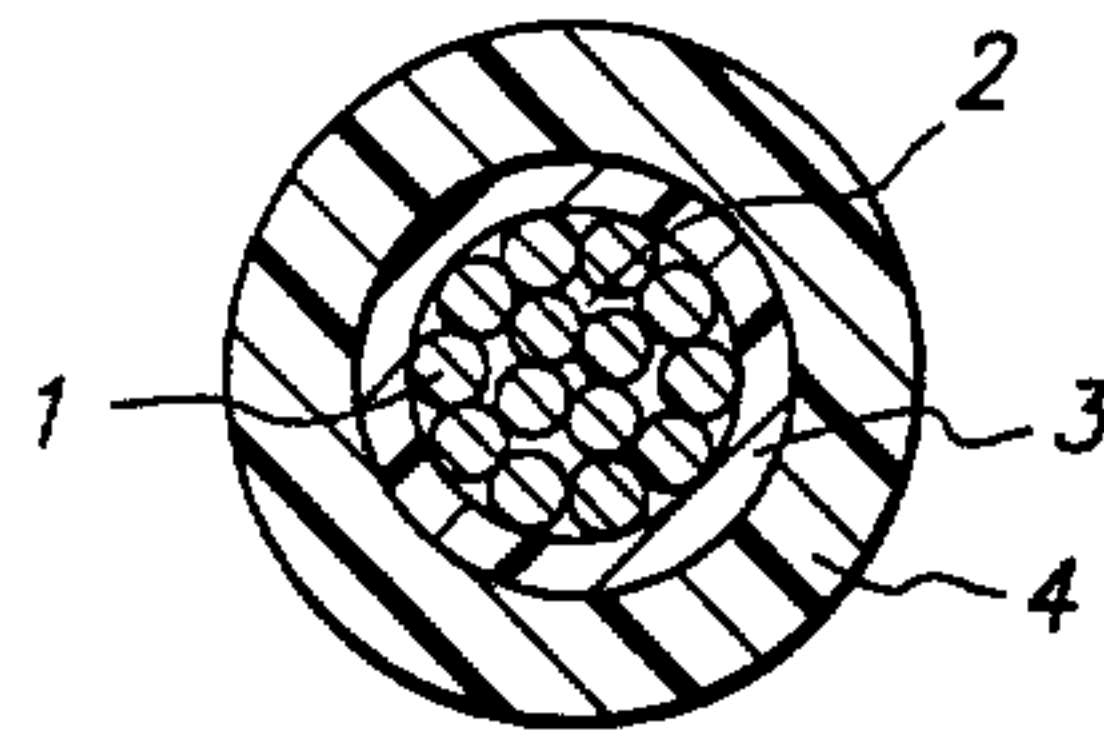
FETHERSTONHAUGH & CO.

OTTAWA, CANADA

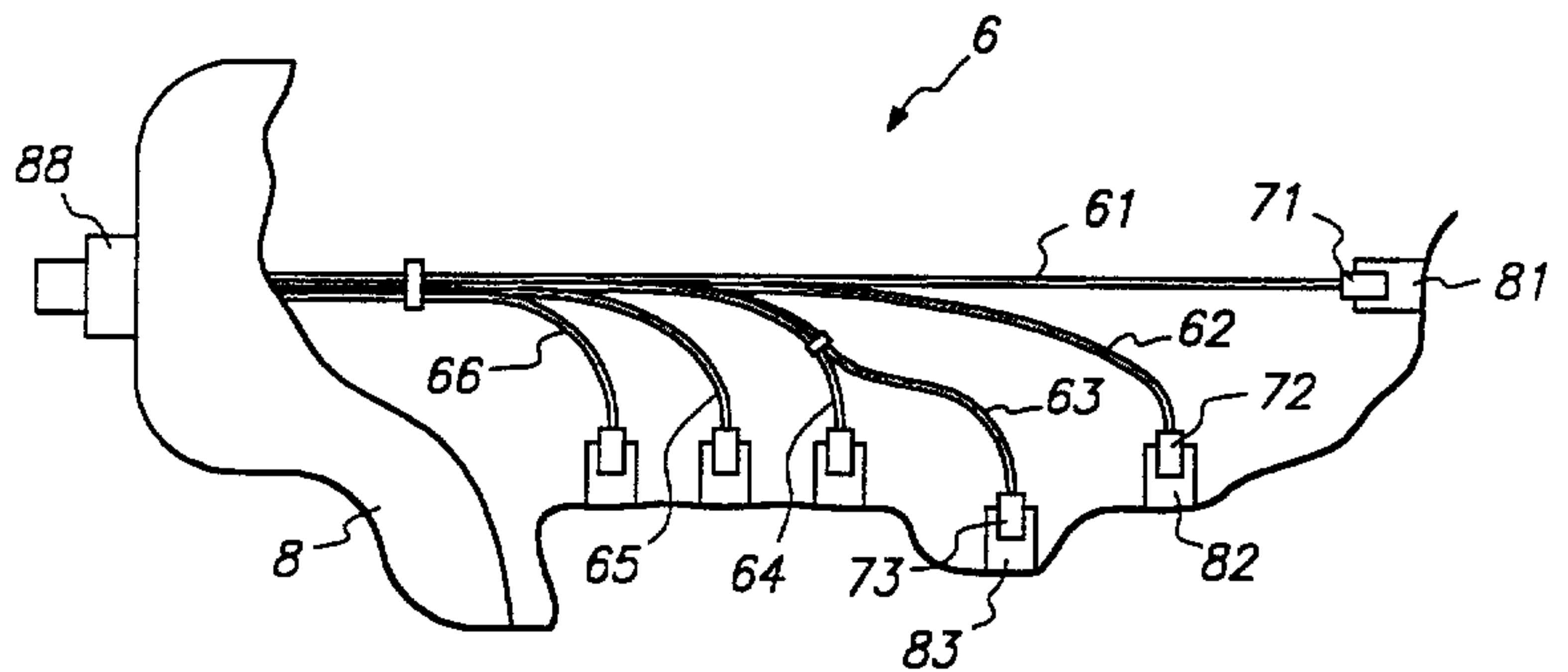
PATENT AGENTS



**FIG. 1**



**FIG. 2**



**FIG. 3**