United States Patent

[11] **3,576,940**

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[54] **FLAME-RETARDANT WIRE AND CABLE**
19 Claims, 4 Drawing Figs.

[52] **U.S. Cl.** **174/113,** 117/218, 174/121
[51] **Int. Cl.** **H01b 7/28**
[50] **Field of Search** ..... 174/110.7, 113—116, 121, 121.1, 121.4; 117/218

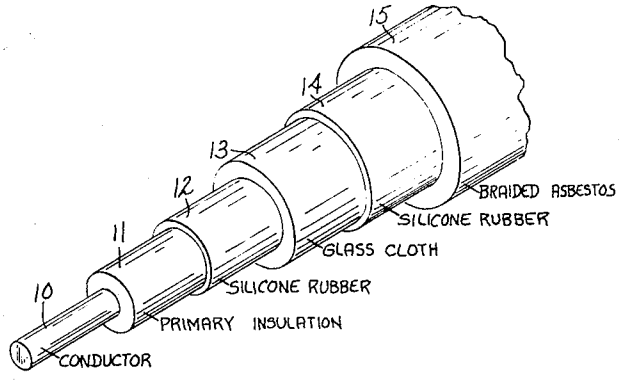
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ABSTRACT: An electrical conductor or cable, capable of maintaining electrical integrity when exposed to open flame temperatures of 1000° F. without propagating a fire or resulting in falling burning particles or generating large volumes of smoke. The conductor or cable of this invention is comprised of a metallic conductor or plurality of conductors covered by a layer of primary insulation. Such conductors are then covered by a layer of silicone rubber which is, in turn, covered by a layer of glass fiber. The layer of glass fiber may then be covered by another layer of silicone rubber which is, in turn, covered by a layer of braided asbestos impregnated with an intumescent material. In the alternative, the second layer of silicone rubber may be covered by an asbestos tape which is then covered by a layer of elastomeric material having fire-retardant properties.



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Fig. 1.

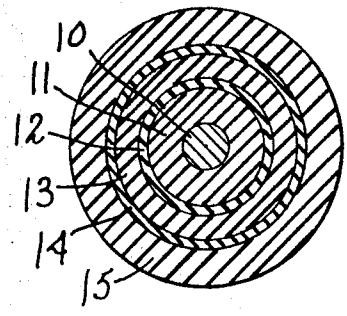


Fig. 2.

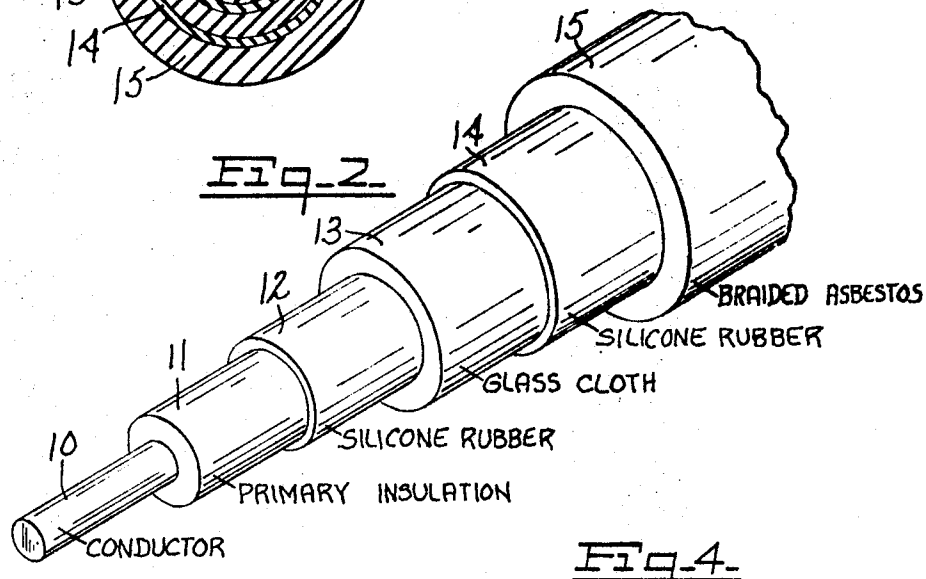


Fig. 3.

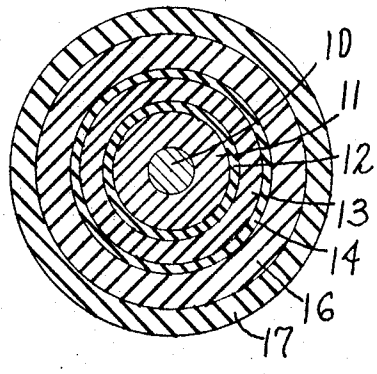
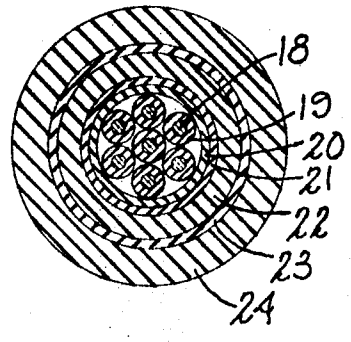


Fig. 4.



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FLAME-RETARDANT WIRE AND CABLE

This invention relates to electrical wire and cable and more particularly to electrical conducting wire and cable possessing relatively flameproof properties.

During the past several decades, the tray or ladder method of wiring industrial plants has come more and more into widespread use. The tray system involves the use of suspended metal work, in which wire and cable is laid in running the cable from a source of motive power to service panels or devices, as the case may be. This ladder or tray system is to be contrasted with the system of pulling wires through specified diameter conduits which, of course, limits the size and number of cables which can eventually be connected from one place to another within a fixed or prescribed conduit.

Tray systems are used in utility generating stations, steel mills and other industrial plants where the ease of running new cables in trays in a stacked fashion is common practice. The trays eventually end up in stacked rows with layers of cable side-by-side to various heights. In such plants, debris and foreign matter have a tendency to collect in the trays and, if there is any fire hazard presented by other operations such as welding and the like, the trays with their multitudinous number of cables set side-by-side and one upon another, pose a serious problem as to propagation of fire, smoke generation and the falling of burning particles. Since the tray system is used in many utility and industrial installations, fires of electrical nature can result in severe damage to expensive and critical equipment and devices and may propagate throughout the entire plant via the tray route.

At present, the only electrical conductors or cables which, when subjected to high temperatures of open flames, do not form burning falling particles, propagate flame or generate smoke, are electrical conductors or cables which have coverings commonly made of metal, metal alloys or the like. These conductors or cables are relatively expensive because of the difficulty involved in producing the metal covering and, further, they are unwieldy, bulky and cumbersome and difficult and expensive to repair and replace.

In view of the foregoing, applicants have devised an electrical conductor or cable capable of maintaining electrical integrity for sustained periods of time beyond 5 minutes and up to as much as 20 minutes when subjected to open flame temperatures in excess of 1000° F. The electrical integrity will be maintained without producing any falling burning particles which can deposit themselves on other devices or materials, causing separate and distinct fires from the original fire. In addition, the conductor or cable of this invention will not propagate a fire along its length when subjected to open flame conditions at a particular source or region, nor will it generate large quantities of smoke.

Accordingly, it is a principal object of this invention to provide a new and improved flameproof electrical wire and cable.

Another object of this invention is to provide a new and improved flameproof electrical wire and cable which will not produce falling, burning particles when subjected to open flame and which will not generate smoke.

Still another object of this invention is to provide a new and improved flameproof electrical wire and cable which will not propagate a fire along its length when subjected to open flame at a particular point or region.

A further object of this invention is to provide a new and improved flameproof electrical wire and cable which will maintain electrical integrity while subjected to an open flame, which electrical integrity will be maintained after the open flame hazard is removed.

A still further object of this invention is to provide a new and improved flameproof electrical wire and cable which is substantially flexible and relatively inexpensive.

Still other objects and advantages of the invention will in part be obvious and will in part appear hereinafter.

The invention accordingly comprises the several steps and the relation of one or more of such steps with respect to each of the others and the article possessing the features, properties

and the relation of elements which are exemplified in the following detailed disclosure and the scope of the invention will be indicated in the claims.

For a fuller understanding of the nature and objects of the invention, reference should be had to the following description, taken in connection with the accompanying drawings, in which:

FIG. **1** is a cross-sectional view of the insulated wire of this invention;

FIG. **2** is an isometric exploded view of the insulated wire of FIG. **1**;

FIG. **3** is a cross-sectional view of an alternate embodiment of the invention; and

FIG. **4** is a cross-sectional view of a cable insulated according to this invention.

In FIG. **1** there is illustrated a metal conductor **10** which may be of stranded or solid metals, such as copper or copper coated tin, as the case may be. Other metals, such as aluminum, silver plated copper, or other conductive alloys such as stainless steel, may also be utilized. The metal conductor may be a single solid metal conductor or a plurality of metallic conductors. A layer of a primary insulation **11** is applied over the conductor, generally in thicknesses of from about 5 mils to 2 inches and, preferably, in thicknesses of from 10 mils to about one-half inch.

In the preferred embodiment of the invention, the primary insulation **11** may be Rockbestos X Link 90 (a blend of polyethylene and ethylene propylene rubber which has been cross-linked) or other chemically cross-linked polyethylene compounds, silicone rubber, heat-sealed polyester tapes such as polyethylene terephthalates and ethylene propylene rubber. Other insulating materials which may be used are polyvinylchloride, polyethylene, nylon polysulfone, extruded polyester, butyl rubber, polytetrafluoroethylene and fluorinated ethylene propylene. Moreover, it is to be understood that other, equivalent thermosetting materials may be used as primary insulation **11**. Where superior electrical properties are desired, silicone rubber is preferable although the cost of silicone rubber is extremely high. Therefore, Rockbestos X Link 90 is preferred as the primary insulation since it has good dielectric properties, does not readily melt upon exposure to very high temperatures and is relatively inexpensive. In applying the insulation over the metallic conductor, the insulation layer may be extruded or applied as a tape or film. In the preferred embodiment, an extruded layer of Rockbestos X Link 90 is applied, preferably in thicknesses of 10 mils to about 500 mils.

Immediately adjacent to the primary insulation layer **11**, there is a layer of silicone rubber **12**, generally in thicknesses of 1 mil to 10 mils and, preferably, in thicknesses of 2 mils to 5 mils. The layer **12** may be methyl silicone rubber, vinyl methyl silicone rubber, phenyl silicone rubber, fluoro silicone rubber, or other types of silicone rubber. Although methyl silicone rubber is preferred, it should be understood that any of the other silicone rubbers may be utilized. The silicone rubber may be applied to the primary insulation layer as a tape or film or as part of a silicone rubber glass tape or film.

The layer of silicone rubber is a very effective insulation since, on exposure to high open flame temperatures, the layer reverts to a nonconductive inert silica layer. This silica layer performs two functions: (1) it acts as a fireproof media and prevents oxygen from passing through to the primary insulator and, thus, it prevents the primary insulation from decomposing and losing its effectiveness, and (2) the silicone rubber layer does not lose its own effectiveness as an insulation even though it is present as a silica layer.

Adjacent to and covering the silicone rubber layer **12**, there is applied a glass fiber layer **13**, generally in thicknesses of 3 mils to 10 mils and, preferably, in thicknesses of 4 mils to 7 mils. Glass cloth, glass braid or any other glass fiber such as glass mat, may be used to provide the required support and reinforcement for the silicone rubber layers. The glass cloth acts as an insulation and, as before, the glass cloth may be applied as a tape or film.

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Directly over the glass fiber layer **13**, there is applied another layer of silicone rubber **14**, generally in thicknesses of 1 mil to 10 mils and, preferably, in thicknesses of 2 mils to 5 mils. It should be understood that the second layer of silicone rubber is preferred, but is not necessary to this invention. This second silicone rubber layer prevents oxygen from passing into the underlying layers. Thus, the combination of layers **12**, **13** and **14** provides a very effective insulation barrier against high open flame temperatures and prevents oxygen from passing into and reacting with the primary insulation. The combination of the silicone rubber layers **12**, **14** and glass fiber layer **13** may take the form of a unitary layer, wherein the glass fiber has been coated or impregnated on one or both sides with the silicone rubber.

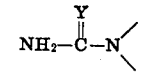
Adjacent to and immediately over the silicone rubber layer **14** there is applied a layer of asbestos **15**, generally in thicknesses of 20 mils to 90 mils and, preferably, in thicknesses of 25 mils to 50 mils, impregnated with an intumescent material. The asbestos layer **15** may be an asbestos braid or any loose asbestos fiber such as an asbestos felt. The asbestos provides mechanical protection for the wire or cable at all service temperatures in wet or dry locations and is readily available and inexpensive. In addition, asbestos has good bulk characteristics, in that it readily absorbs intumescent material while glass and other inorganic fibers are not very absorbent. Further, the asbestos has a very high melting point, is noncombustible and has the desirable property of expanding slightly at high temperatures. In actual operation, the asbestos acts as a noncombustible, inorganic high-strength support for the intumescent material at the elevated open flame temperatures to which it may be exposed. Moreover, the asbestos layer serves the additional purpose of supporting the silicone rubber layer **14** upon its reversion to silica when the system is exposed to an open flame. The intumescent material in the asbestos, when subjected to open flame temperatures, swells and forms a thermal insulating fire-retardant barrier between the flame and the layers of insulating material underneath. As a result, the cable or wire does not propagate a fire and there are no falling burning particles nor generation of dense smoke. Additionally, the flameproof electrical wire and cable of the present invention can be used in wet or dry locations. As a result, the electrical conductor or cable of this invention need not have an additional or ancillary protective coating such as metal braid, armor, conduit or tubing. Furthermore, a protective coating other than metal armor would not have the fireproof characteristics of the intumescent impregnated asbestos.

Intumescent materials or compounds which may be used to impregnate or coat the asbestos layer are raw isano oil, polyamide resins and amine formaldehyde resins. Examples of amine formaldehyde resins that have been found to be satisfactory in the present invention are melamine formaldehyde resin, urea formaldehyde resin and triazine formaldehyde resins. The polyamide resins used in the present invention are the products obtained by reacting a polymerized unsaturated vegetable acid with an amine. For example, the polyamide resin may be obtained by reacting dimerized and trimerized linoleic acid or linoleic acid of soy bean oil with ethylene diamide. It has been found that a superior intumescent composition is obtained when a mixture of raw isano oil with a polyamide resin or an amine formaldehyde resin is prepared where the amount of raw isano oil is 33—70 percent of the total composition. The use of the above composition in intumescent paints is set forth in U.S. Pat. No. 2,754,217.

Other intumescent compounds which may be used as intumescent material to impregnate the asbestos layer of the present invention are water insoluble metal metaphosphates, water insoluble polyols and water insoluble aminoplasts. Examples of water insoluble metal metaphosphates are insoluble potassium metaphosphate, insoluble sodium metaphosphate, zinc metaphosphate and calcium metaphosphate. Any of the water insoluble metaphosphate salts are applicable to this invention.

Various water insoluble polyhydric compounds may be used in various polymeric forms such as dimers or trimers, to impart intumescent properties to the asbestos layer. In particular, polypentaerythritols such as dipentaerythritol and tripentaerythritol are preferred.

The aminoplasts or amino aldehyde condensation products are prepared from aldehydes and organic compounds containing at least one amino group which has at least two replaceable hydrogens. The preferred compounds are water insoluble urea formaldehyde condensation products. In general, the aminoplasts are prepared by reacting an aldehyde such as formaldehyde, urea aldehyde, propionaldehyde and the like with amino compounds containing one to nine carbon atoms and having the grouping of the formula



where N< is a member selected from the group consisting of a nitrogen atom having two single valences attached to separate atoms selected from the group consisting of hydrogen and carbon atoms, and a nitrogen atom having two free valences representing a double bond attached to a carbon atom, and where Y is a member selected from the group consisting of O, S, and a nitrogen atom with one free valence which is attached to an atom selected from the group consisting of hydrogen and carbon atoms.

In order to obtain superior intumescent properties, it is preferred to use the above intumescent materials in combination in a composition containing 27—66 percent by weight of polypentaerythritol with a water insoluble metal metaphosphate. Further, an aminoplast may be added to the composition to increase the intumescent properties of the composition, such that the composition contains 15—70 percent by weight of urea formaldehyde resins. The uses of the above intumescent compositions in paint is illustrated in U.S. Pat. No. 3,037,951.

Another compound suitable for use as an intumescent material, is water-glass or sodium silicate. However, because of the solubility of sodium silicate in water, this compound has limited utility as an intumescent compound to impregnate the asbestos according to this invention.

Other publications which describe the uses of intumescent materials in paints, which intumescent materials or compositions are suitable for use in the present invention, are: J. Amer. Oil Chemists' Soc., "Water-resistant, Oil-based, Intumescing Fire-retardant Coatings," 41(10), 670–4 (1964), and Off. Dig., J. Paint Tech., "Water-resistant, Oil-based, Intumescing Fire-retardant Coatings," , 38 (793), 105–12 (1966) (Eng.).

The above intumescent compounds and compositions may be mixed or dissolved with a common carrier such as linseed oil, xylol, toluol and the like, so that the resulting mixture may be applied to the asbestos layer. Intumescent compositions premixed and suitable for their application to the asbestos layer are sold under the tradenames of No. 144639, Fire-retardant Coating, and Series 180, Coatings for Cross-linked Polyethylenes, sold by the Standard T Chemical Company, Inc. The intumescent material may be added to the asbestos before or after the asbestos has been placed on the silicone rubber layer **14**, although it is preferred that the intumescent material be applied to the asbestos after the asbestos has been applied over the silicone rubber layer. While it may be understood that the wire or cable dimensions of the present invention may vary according to the design for any particular application, the following is a typical range for the electrical conducting system of the instant invention, applied in the given order:

(1) Metallic conductors in wire—Typically tin-coated copper, inches	0. 10–2
(2) Primary insultation on wire, mils	10–500
(3) First layer of silicone rubber—Methyl silicone rubber, mils	2–5
(4) Glass cloth layer, mils	4–7
(5) Second layer of silicone rubber—Methyl silicone rubber, mils	2–5

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(6) Asbestos braid layer—Containing intumescent material, mils..... 25–50

It is to be understood that the above dimensions are typical and not intended to limit the invention in any way.

A wire of the present invention was subjected to the flame of a bunsen burner (in excess of 1500° F.) for 10 minutes. The exposed wire was found to have substantial insulation left and was capable of passing the dielectric test. Thus, electric integrity was maintained, there were no falling, burning particles and fire was not propagated along the wire nor was excessive smoke generated.

An alternate embodiment of the invention is illustrated in FIG. 3. Insulation layers **11—14** are the same as those disclosed with reference to FIGS. 1 and 2. As in the embodiment of FIG. 1, the second silicone rubber layer **14** may or may not be present. In the preferred form of the alternate embodiment, there is utilized a second silicone rubber layer. Silicone rubber layer **14** is covered by a layer of asbestos tape **16** or other form of asbestos wherein the fibers are closely woven. Since asbestos tape is rather closely woven, it is difficult to properly impregnate with intumescent material. Therefore, in place of the intumescent material, asbestos tape layer **16** is covered by a layer of an elastomeric material **17** having suitable fireproofing properties. The elastomeric material may be any elastomeric material to which the necessary fire-retardant compounds may be added and which can be extruded about asbestos tape layer **16**. Some examples of such elastomers are butyl rubber, silicone rubber, polyurethene rubber, neoprene, butadiene acrylonitrile, chlorosulfonated polyethylene and butadiene styrene. Before the elastomeric material is extruded over the asbestos, chlorinated parafins and halogenated phenols are compounded into it to impart additional fire-retardant properties to the material. Some examples of chlorinated parafins which were found suitable for the present invention are Chlorofin (trademark) manufactured by Hercules Chemical Company, Halowax (trademark) manufactured by The Union Carbide Corporation, and Chlorowax (trademark) manufactured by The Diamond Alkali Company. Halogenated phenols which were found suitable for imparting fire-retardant properties to the elastomeric material are tetrabromobisphenol, hexachlorophene and dichlorophene. Although, in the preferred embodiment, both chlorinated parafins and halogenated phenols are compounded into the elastomeric material, it should be understood that only one of the above two classes of compounds need be added. Further, to impart additional fire-retardant properties to the elastomeric material, fire-retardant inorganic compounds such as phosphates and borates, can be compounded into it. Specifically, compounds which were found to produce excellent results are antimony trioxide, zinc borate, tricresylphosphate, trioctylphosphate and triphenylphosphate. In particular, the interaction between antimony trioxide and chlorinated material to produce the intermediate, antimony oxychloride, at elevated temperatures, has proven an efficacious flame retardant. In the preferred embodiment, all three classes of compounds were compounded into the elastomeric material so as to impart to it maximum fire-retardant properties.

Layer **17** is generally 0.045 to 0.140-inches thick and, preferably, 0.060 to 0.140-inches thick. Since the combination of the glass fiber, asbestos tape and elastomeric material forms a layer which is highly impermeable to gases, this type of insulation presents a problem when the insulated wire or cable is exposed to fires. Thus, gases that are formed in the lower layers of insulation are trapped by the outer layers of glass fiber, asbestos tape and elastomeric material so that, as a result of increasing pressure of the trapped gases, the insulation comes apart. This problem is resolved in the present invention by having the lay of the layer of glass fiber and the asbestos tape layer in the same direction, to form a loose combination of layers. With respect to cables, the lay of the wires, the glass fiber layer and the asbestos tape layer are all in the same direction. The loose layers, that is, the layers of insulation having their lay in the same direction, expand under the influence of the pressure of the trapped gases allowing the trapped gases to pass, or travel, beneath the insulation and parallel to the axis of the wire or cable. This prevents the insulation from being torn apart.

Although such a loose covering of insulation is not usually desirable, it is used in a case where it is preferred to use an insulation system having the two external layers of asbestos tape and elastomeric material instead of asbestos it should be noted that the insulation system of this embodiment has fireproofing properties which are even better than those of the insulation system wherein intumescent material is used.

The basic insulation system of the present invention comprises a layer of primary insulation which is then covered by a layer of glass fiber. The glass fiber layer has at least one layer of silicone rubber on one of its sides. Preferably, both sides of the glass fiber layer are covered with silicone rubber. The layer of silicone rubber is, at this point, covered by a layer of asbestos. This is the basic insulation system of the present invention, which has the exceptional fireproofing properties described above. In addition, if an external layer of asbestos braid or asbestos felt, or any other loosely-packed asbestos fiber material is used, then the asbestos material can be impregnated with intumescent material to impart to the insulation additional fireproofing properties. On the other hand, if an external layer of asbestos tape is used, then an outer layer of elastomeric material, having suitable fire-retardant properties, is used to cover the asbestos tape. In this embodiment, the lay of the glass fiber layer and the asbestos tape layer is in the same direction so as to form a loose covering over the conductor.

In FIG. 4, there is illustrated a cable insulated according to the present invention. A plurality of individual metal conductors **18**, wherein each conductor may be composed of stranded or solid metals such as copper or copper coated with tin, as the case may be, are shown covered by a layer of primary insulation **19**, generally 5—500 mils in thickness and, preferably, in a thickness of from 10—250 mils. The primary insulation **19** is selected from the same class of material as primary insulation **11**. Covering the primary insulation **19** on the insulated wires **18**, there may or may not be a layer of intermediate covering material **20**. The intermediate covering material **20** may be neoprene, polyvinylchloride or any other thermosetting or thermoplastic insulation, which may be applied by extrusion or any other suitable manner. Generally, the layer of intermediate covering material is of 30—100 mils thickness and, preferably, is of 40—80 mils thickness. To the intermediate covering material **20** there is applied a covering of a layer of silicone rubber **21**, generally in a thickness of 1—10 mils and, preferably, in a thickness of 2—5 mils.

Immediately adjacent and above the silicone rubber layer, there is applied a glass fiber layer **22**, generally of 3—10 mils thickness and, preferably, 4—7-mils thick. The glass fiber layer **22** is subsequently covered by a layer of silicone rubber **23**, again in a thickness of generally 1 to 10 mils and, preferably of 2—5 mils. As explained with reference to FIGS. **1—3**, the second silicone rubber layer **23** may or may not be present. However, a second silicone rubber layer imparts additional fireproofing properties. Then, as in the embodiment illustrated in FIGS. 1 and 2, the second layer of silicone rubber **23** is covered by a layer of asbestos braid **24**, impregnated with intumescent material of a thickness of generally 20—90 mils and, preferably, 25 to 50 mils. The primary insulation layer **19**, the silicone rubber layers **21**, **23**, the glass fiber layer **22**, and, the impregnated asbestos layer **24**, are as described with reference to FIGS. 1 and 2.

With respect to cables, as in the case of a single electrical conductor, when the asbestos used to cover the second layer of silicone rubber comprises asbestos braid or any other asbestos material composed of loose fibers, the asbestos is impregnated with intumescent material. However, when the external asbestos layer is composed of asbestos tape or any other closely woven asbestos material, the asbestos is covered with a layer of elastomeric material having good fireproofing proper-

ties, as has been explained previously in connection with FIG. 3. As in the case of single electrical conductors, the elastomeric layer covering the asbestos tape is generally 0.025 to 0.200-inches thick and, preferably, 0.050 to 0.100-inches thick. Further, in the case where asbestos tape or other closely woven asbestos is used, the lay of the cable, the glass fiber layer and the asbestos layer is preferably in the same direction.

It will thus be seen that the objects set forth above, among those made apparent from the preceding description, are efficiently attained and since certain changes may be made in the above article without departing from the spirit and scope of the invention, it is intended that all matter contained in the above description and shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all the generic and specific features of the invention herein described and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

We claim:

1. An electrical insulated conductor, capable of maintaining electrical integrity when exposed to open flame temperatures of at least 1000° F. without propagating a fire or resulting in falling burning particles or generating dense smoke, comprising:
   a. a metallic conductor,
   b. a layer of primary insulation which covers said metallic conductor along its length,
   c. a layer of glass fiber over the layer of primary insulation,
   d. a layer of silicone rubber on one side of said layer of glass fiber; and
   e. a layer of asbestos which covers said layers of glass fiber and silicone rubber, said asbestos fibers impregnated with an intumescent material said layer of asbestos being the outer layer of said insulated conductor.

2. The electrical conductor of claim 1, wherein the lay of the layers of glass fiber and asbestos is in the same direction.

3. The electrical conductor of claim 1, wherein the electrical conductor is selected from the group consisting of a single solid conductor and a plurality of solid conductors.

4. The electrical conductor of claim 1, wherein the glass fiber layer is covered on both sides with a layer of silicone rubber.

5. The electrical conductor of claim 1, wherein the primary insulation is selected from the class of compounds consisting of chemically cross-linked polyethylene compounds, silicone rubbers, heat-sealed polyester tapes such as polyethylene terephthalate, ethylene propylene rubber, nylon, butyl rubber, polysulfone, polyvinylchloride, polytetrafluoroethylene and fluorinated ethylene propylene.

6. The electrical conductor of claim 1, wherein the intumescent material is selected from the class consisting of raw isano oil, polyamide resins, amine formaldehyde resins, water insoluble metal metaphosphates, polypentaerythritols, sodium silicate and combinations thereof.

7. The electrical conductor of claim 1, wherein the glass fiber is selected from the group consisting of glass cloth, glass braid, glass mat and other glass fibers and combinations thereof.

8. An electrical insulated cable, capable of maintaining electrical integrity when exposed to open flame temperatures of at least 1000° F. without propagating a fire or resulting in falling burning particles or generating dense smoke, comprising:
   a. a plurality of metallic conductors,
   b. a layer of primary insulation which covers and separates the plurality of metallic conductors along their lengths such that each metallic conductor is insulated from the other conductors,
   c. a layer of glass fiber over said primary insulation,
   d. a layer of silicone rubber on one side of said layer of glass fiber; and
   e. a layer of asbestos which covers said layers of glass fiber and silicone rubber.

9. The electrical cable of claim 8, wherein the layer of asbestos comprises asbestos selected from the group consisting of asbestos braid, asbestos mat and asbestos felt, which asbestos material is impregnated with an intumescent material.

10. The electrical cable of claim 8, wherein the layer of asbestos comprises asbestos tape which is then covered by a layer of an elastomeric material selected from the group consisting of neoprene, butadiene acrylonitrile, chlorosulfonated polyethylene and butadiene styrene.

11. The electrical insulated cable of claim 8, wherein a layer of silicone rubber covers both sides of said layer of glass fiber.

12. The electrical insulated cable of claim 8, further including an intermediate layer of insulating material which covers the plurality of metallic conductors insulated with the primary insulation and is immediately beneath the layer of glass fiber, wherein said material is selected from the group consisting of neoprene and polyvinylchloride.

13. The electrical cable of claim 10, wherein the lay of the wires, the glass fiber layer and the asbestos tape layer is in the same direction.

14. The electrical cable of claim 8, wherein the primary insulation is selected from the class of compounds consisting of chemically cross-linked polyethylene compounds, silicone rubber, heat-sealed polyester tapes such as polyethylene terephthalate, ethylene propylene rubber, nylon, butyl rubber, polysulfane, polyvinylchloride, polytetrafluoroethylene and fluorinated ethylene propylene.

15. The electrical cable of claim 9, wherein the intumescent material is selected from the class consisting of raw isano oil, polyamide resins, amine formaldehyde resins, water insoluble metal metaphosphates, polypentaerythritols, sodium silicate and combinations thereof.

16. The electrical cable of claim 8, wherein the glass fiber is selected from the class consisting of glass cloth, glass braid, glass mat and other glass fibers and combinations thereof.

17. The electrical conductor of claim 10, wherein the elastomeric material has compounded therein a chlorinated parafin.

18. The electrical conductor of claim 10, wherein the elastomeric material has additionally compounded therein halogenated phenols selected from the group consisting of tetrabromobisphenol, hexachlorophene and dichlorophene.

19. The electrical conductor of claim 10, wherein the elastomeric material has additionally compounded therein fire-retardant inorganic compounds selected from the group consisting of antimony trioxide, zinc borate, tricresylphosphate, trioctylphosphate and triphenylphosphate.

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