June 5, 1962 C. A. LARSON 3,038,021

RETRACTILE CORD AND COMPOSITION FOR JACKET THEREOF

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FIG. 1

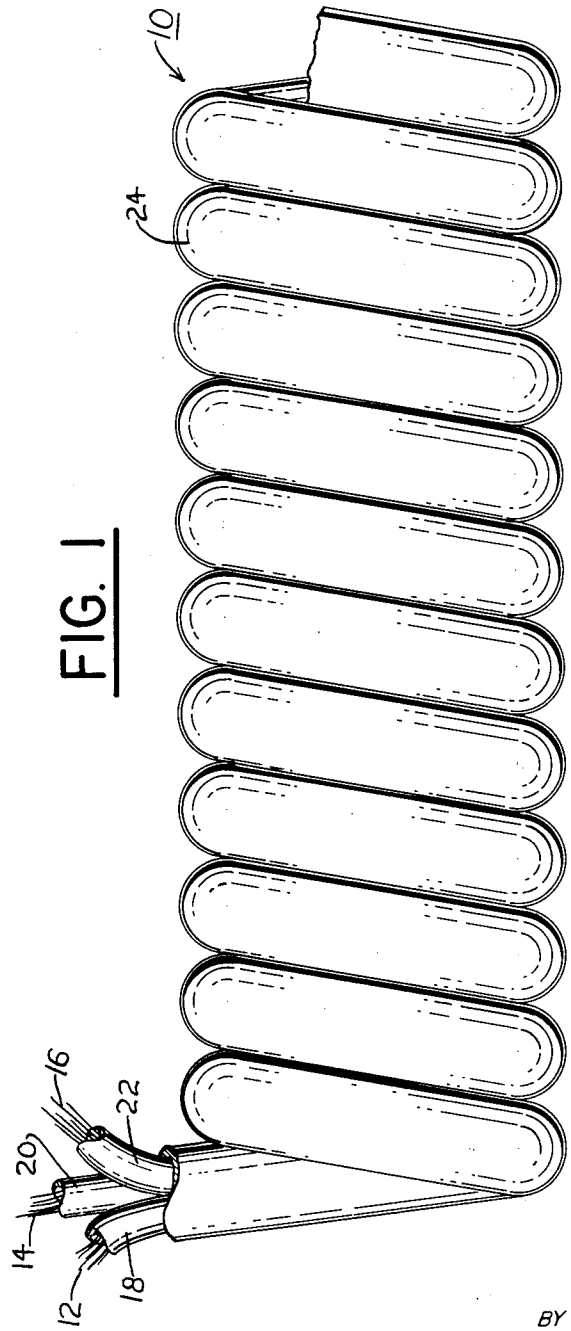
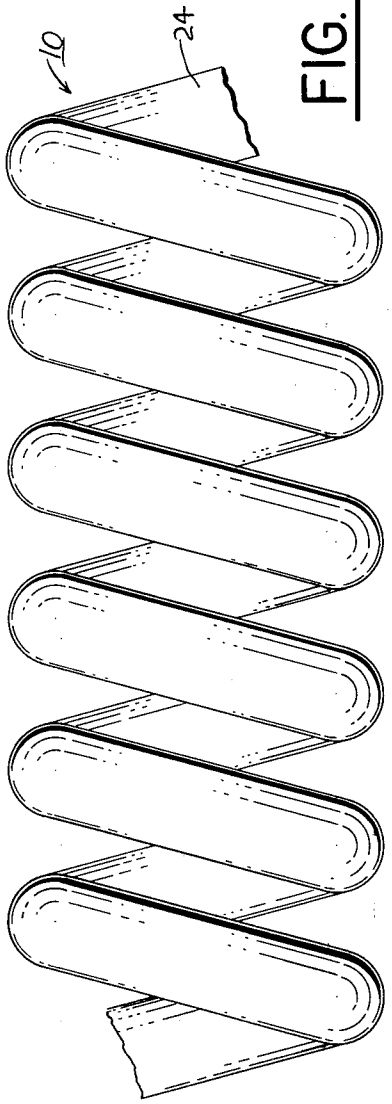


FIG. 2



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RETRACTILE CORD AND COMPOSITION FOR JACKET THEREOF

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This invention relates to an improved rubber compound used in jackets on electrical conductors such as telephone retractile cords and the like. In particular, it relates to such a jacket material which may be made in a wide range of colors, such as pastels, and whose properties are essentially unaffected by chemicals from the atmosphere and other common sources of undesirable active reagents. Specifically, it relates to a retractile telephone cord having a jacket possessing reliable resilience together with ability to take a range of desired colors together with other-mentioned important characteristics. Resilience of varying degrees may be imparted to the material used in such jackets for effective use on retractile helically-formed cords such as those used with telephone handsets.

The cords connecting telephone handsets to the bases on which they are supported are now largely of the retractile type. When the instrument is not in use, a cord of this type takes the form of a tightly-wound helix, and when the handset is removed from the base, the helix expands in the manner of a coil spring to permit the user to range a distance therefrom. The helical shape and the springiness of the cord are derived from characteristics of the jacket surrounding the cord, and thus the jackets are usually made of rubber or similar resilient material. In fact, synthetic rubber such as neoprene has, prior to my invention, been the most popular jacket material for retractile cords.

Among the more important desirable characteristics of retractile cords are the ability to extend under low load and attain a high ratio of extended to unextended length, while retracting completely to the original tight helical form when the load is removed. In view of the present vogue for telephones of widely varying colors, it is equally important that it be possible to impart all of such colors to the jacket material which desirably matches the rest of the apparatus. Moreover, the color should be stable in the presence of atmospheric constituents, as well as body fluids and other discoloring matter which may be picked from the hands of the user. The physical and chemical properties of the jacket should also be unaffected by light, dust attraction should be minimum, and the cord should be pleasant to touch with a total lack of stickiness.

Neoprene compositions generally have many of the desirable characteristics outlined above. However, their use in limited to very few colors. When adapted for the pigments necessary to impart other colors, they have been found to discolor under conditions of normal use. Also, the retraction characteristics of colored retractile jackets of neoprene are substandard.

Accordingly, it is a principal object of my invention to provide an improved resilient rubber composition for use as a covering material for cords and the like. It is another object of my invention to provide a composition of the above character capable of being made in a wide range of colors, preferably through the use of standard coloring pigments. It is a further object of my invention to provide a composition of the above character having stable physical and chemical characteristics and thus substantially unaffected by prolonged exposure to normal atmosphere constituents, oil, perspiration, etc. Yet another object of my invention is to provide a composition of the above character which attracts minimum dust and is pleasant to touch. A further object of the present invention is to provide a composition of the above character

which has the desirable physical characteristics of a covering material for retractile cords. Another object of the invention is to provide a composition of the above character which is economical to compound and form into jackets. It is yet another object of the invention to provide a jacket for retractile cords and the like formed from a composition of the above character. Other objects of the invention will in part be obvious and will in part appear hereinafter.

The invention accordingly comprises a composition of matter possessing the characteristics, properties, and the relation of constituents and the article possessing the features, properties, and the relation of elements which will be exemplified in the composition hereinafter described, 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 detailed description taken in connection with the accompanying drawing in which:

FIGURE 1 is a fragmentary pictorial representation of a portion of a retractile cord incorporating a jacket made according to my invention; and

FIGURE 2 is a view, similar to FIGURE 1, showing the cord in a partially extended position.

In general, a jacketing material compounded according to my invention has, as a base material, a synthetic rubber such as Buna N–(NBR), a butadiene acrylonitrile copolymer, modified by incorporation of polyvinyl chloride resin. Also included are suitable ester-type plasticizers such as octyldecyl phthalate, together with non-ester types such as paraffin, chlorinated paraffin, etc., compatible with both rubber and resin, and small quantities of vulcanizing materials and antioxidants. The compound contains approximately 45 percent of the rubber base material, and the remainder is predominantly a filler material of a reinforcing type.

The material is processed according to fairly standard procedures for rubber-resin base compounds and in the finished form has a specific gravity of approximately 1.4 as compared with 1.09 for the base material. It has colorability even for pastel tints and color stability on exposure to light. It is also non-staining as regards chemicals normally contacting it when it is used as a telephone cord covering material. The compound is highly resistant to the cracking ordinarily caused by atmospheric ozone, it is pleasant to touch and had no odor, and there is a complete lack of surface tack tending to pick up dust and dirt. It is also tough and has good tear resistance, and when used as a jacketing material for cords, it has good retractile characteristics. Furthermore, it is easily compounded, cured, and extruded, and after proper extrusion and vulcanizing it has a glossy finish facilitating complete matching of its appearance to that of the plastic materials used in the exterior parts of telephone sets.

More particularly, each 100 parts of base material consists of approximately 50 parts by weight of butadiene, 20 parts acrylonitrile, and 30 parts polyvinyl chloride. The composition sold by United States Rubber Company under the trade name "Paracril OZO," in which the proportions are respectively 49, 21, and 30, is a suitable base material as is the compound marketed by B. F. Goodrich Company under the trade name "Hycar 1203." In practice I have found that the base mixture may vary from 60 to 80 parts per hundred of the butadiene-acrylonitrile copolymer, corresponding to 40 to 20 parts polyvinyl chloride. At the 60–40 end of this range the elasticity of the material is relatively less, and its properties are therefore better for straight than for retractile cord.

As a plasticizer I prefer the predominant ingredient to be octyl-decyl phthalate, including also in some cases paraffin and chlorinated paraffin. The paraffin also

functions as a lubricant and the chlorinated paraffin is a flame retarder. These plasticizers may be used alone or in combination with others, so long as they are compatible, a total of 5 to 50 parts plasticizer being used per 100 parts of the rubber-resin base material.

The fillers, totaling to 50 to 150 parts per 100 parts base material, include hydrated silicon dioxide which imparts tensile strength and abrasion resistance to the composition, calcined clay, reasonably free from mica, which imparts body and desirable extrusion properties, and Atomite whiting. The proportions of these materials to the total amount of filler preferably lie in the range of 0–30 percent of silicon dioxide, 0–50 percent Atomite whiting, and 25–100 percent clay.

In compounding the material I prefer to use 2 to 10 parts zinc oxide as an activator along with .5 to 5 parts stearic acid, which serves as a dispersing agent and also combines with the zinc oxide in the activating function. One to three parts of accelerator are used. As accelerators I prefer tetramethylthiuram disulfide together with either mercaptobenzothiazole or benzothiazyl disulfide or both of the latter. These accelerators are synergistic with each other, and also they improve the aging characteristics of the jacket material. One to five parts sulfur are used for curing and .5 to 2 parts of 2.2′-methylene-bis (4 methyl-6-tertiary-butyl phenol) or other suitable non-staining antioxidant are also included in the jacket material.

The color of the cured material made from the above ingredients is in the neutral range, and it can be varied in the full range from black to white by the addition of suitable pigmentation. For example, a yellow color may be imparted to the composition by the addition of 1.5 parts cadmium sulfide, or a brown color may be obtained through the addition of one part carbon black plus 25 parts brown oxide per 100 parts rubber-resin base material. Other representative colors may be obtained from the pigments disclosed in the examples of my invention described below.

In compounding the above ingredients I first add the sulfur and zinc oxide to the rubber-resin base material as the initial charge in a Banbury mixer. After a few minutes' mixing, the fillers, pigments, and ester-type plasticizer are added. In a short time the temperature of the mixture reaches 275° F., at which time the stearic acid and paraffin are added. When the temperature reaches 300 to 325° F., the batch is discharged to a mill or directly to a strainer-extruder for extrusion and straining through 60 mesh screens. The entire mixing operation requires approximately 10 to 12 minutes for a 400 pound batch, and the straining time is 8 to 10 minutes.

Next, a 100 to 200 pound batch of the above product is placed on an 84 inch rubber mill, and when broken down sufficiently therein, the accelerators are added and mixed to insure good dispersion. During this milling operation, the temperature of the compound becomes too hot for extrusion and it must therefore be cooled. Accordingly, I remove the material from the mill in slab form and the slabs may be allowed to cool in air to room temperature. After cooling the material is again put in a mill and removed therefrom in continuous ribbon form and fed to an extruder. Extrusion and curing may be accomplishhed in the manner described in U.S. Patent No. 1,689,205, and where the cord is to be formed into a helix for retractile purposes, the procedures of U.S. Patent No. 2,173,096 may be utilized.

Referring now to FIGURES 1 and 2, a retractile cord generally indicated at **10** includes conductors **12**, **14**, and **16** with individual insulating coverings **18**, **20**, and **22**, respectively. The cord **10** is covered with a jacket **24** whose characteristics are the objectives of the present invention. As seen in FIGURE 2, the cord **10** may be extended from the closed helical configuration of FIGURE 1; when released, it will retract to its original configuration. The helical form and retractile characteristics

are imparted to the cord by the jacket **24** and such characteristics are enhanced by use of the novel compositions described herein in forming the jacket. Additionally, the use of these compositions results in the other highly desirable properties set out above.

My invention is illustrated by the following examples to which, however, it is not limited.

Example I

A batch of jacketing material is prepared in accordance with the process above with the following ingredients in the proportions stated below:

Rubber-resin base material ("Paracril OZO")	100.0
Fillers:	
Hydrated silicon dioxide	20.0
Clay	65.0
Plasticizers:	
Paraffin	3.0
Chlorinated paraffin	6.7
Octyl-decyl-phthalate	15.0
Activators:	
Zinc oxide	3.0
Stearic acid	1.5
Accelerators:	
Tetramethylthiuram-disulfide	0.5
Mercaptobenzothiazole	1.0
Benzothiazyl disulfide	1.0
Curative—sulfur	1.5
Non-staining antioxidant	1.0

10.0 parts of titanium dioxide were also included with this mixture in order to obtain a white color. Colorability over the full range of colors is excellent. A gray color may be imparted to the resulting compound by including .2 part carbon black, .42 part brown oxide pigment, and .84 part cadmium yellow pigment in each 100 parts of the mixture. A turquoise color may be obtained by including .08 part phthalocyanine green pigment and .04 part phthalocyanine blue pigment in each 100 parts. A beige color results from the inclusion of .0625 part cadmium yellow pigment and .039 part brown oxide pigment per 100 parts. An extruded jacket of this compound is fairly flexible and smooth and feels quite slippery to touch. It has excellent retractile characteristics when cured as outlined above and extruded into a helical form.

Example II

A compound having the following proportions of ingredients will feel slightly less smooth and will be boardy or dry rather than slippery to the touch.

Rubber-resin base material ("Paracril OZO")	100.0
Fillers:	
Clay	30.0
Atomite whiting	65.0
Plasticizers:	
Paraffin	3.0
Octyl-decyl-phthalate	4.8
Activators:	
Zinc oxide	3.0
Stearic acid	1.0
Accelerators:	
Tetramethylthiuram-disulfide	.5
Mercaptobenzothiazole	2.0
Curative—sulfur	1.5
Non-staining antioxidant	1.0

This compound has a neutral color without the inclusion of titanium dioxide pigmentation. Colorability is excellent. By way of example, a red color may be obtained by adding 2.25 parts pyrazolone red pigment, 1.98 parts brown oxide pigment, and .22 part toluidine orange pigment to each 100 parts of the above mixture.

Example III

Rubber-resin base material ("Paracril OZO")	100.0

Example III—Continued

Fillers: Hydrated silicon dioxide	20.0
Clay	60.0
Plasticizers: Paraffin	3.0
Octyl-decyl-phthalate	30.0
Activators: Zinc oxide	3.0
Stearic acid	1.0
Accelerators: Tetramethylthiuram-disulfide	.5
Mercaptobenzothiazole	1.0
Benzothiazyl disulfide	1.0
Curative—sulfur	1.0
Non-staining antioxidant	1.0

Ten parts titanium dioxide may be added to achieve a neutral color in this compound. Other desirable colors may be obtained by inclusion of suitable pigments as described above. Colorability of this compound is excellent.

Jackets made from the ingredients and proportions thereof listed in Examples I, II, and III have uniformly exhibited freedom from discoloration, both from body fluids such as perspiration and also oils and other substances which telephone cords normally contact. The characteristics of the cords are stable when exposed to the atmosphere and, in particular, there is absence of checking or cracking due to ozone. The material also has the other properties, described above, desirable in a telephone, particularly those required for a retractile cord. Furthermore, it is processed in the same manner as other rubber-resin compounds and formed into cord jacketing by well-known techniques. Thus, new skills and techniques need not be acquired in order to practice the present invention. The cost of materials also compares favorably with those used in prior cords.

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 composition of matter and in the above article without departing from the scope of the invention, it is intended that all matter contained in the above description 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 of 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.

Particularly, it is to be understood that in said claims, ingredients or compounds recited in the singular are intended to cover compatible mixtures of such ingredients whenever the sense permits.

I claim:

1. A new composition of matter having good hand feel and adapted for use as a jacket over electrical conductors such as those used on telephone receivers, particularly jackets for retractile cords which are colored and which come in contact with chemicals normally found on the human hand, said composition consisting essentially of 100 parts, by weight, of base material of a mixture of 60–80% butadiene-acrylonitrile copolymer and 40–20% polyvinylchloride, 50–150 parts reinforcing filler consisting essentially of 0–30% hydrated silicon dioxide, 25–100% clay, and 0–50% Atomite whiting, 5–50 parts octyl-decyl-phthalate and paraffin plasticizer, 2–10 parts zinc oxide, 0.5–5 parts stearic acid, 1–5 parts sulfur, 1–3 parts accelerator taken from the group consisting of tetramethylthiuram-disulfide, mercaptobenzothiazole and benzothiazyl disulfide, antioxidant, and suitable pigmentation adapted to provide a desired color to said composition.

2. The composition of claim 1 in which said accelerator consists essentially of 0.5 part tetramethylthiuram disulfide together with at least 1 part benzothiazyl disulfide.

3. The composition of claim 1 in which said accelerator consists essentially of 0.5 part tetramethylthiuram disulfide, 1 part benzothiazyl disulfide, and 1 part mercaptobenzothiazole.

4. A new composition of matter having good hand feel and adapted for use as a jacket over electrical conductors such as those used on telephone receivers particularly jackets for retractile cords which are colored and which come in contact with chemicals normally found on the human hand, said composition consisting essentially of 100 parts, by weight, of base material, 85 parts filler, 24.7 parts plasticizer, 4.5 parts activator, and 2.5 parts synergistic accelerator, said base material essentially consisting of 50 parts butadiene and 20 parts acrylonitrile as a copolymer admixed with 30 parts polyvinylchloride resin, said filler essentially consisting of 65 parts clay and 20 parts hydrated silicon dioxide, said plasticizer essentially consisting of 15 parts octyl-decyl-phthalate, 6.7 parts chlorinated paraffin, and 3 parts paraffin, said activator essentially consisting of 3 parts zinc oxide and 1.5 parts stearic acid, and said accelerator essentially consisting of 1 part benzothiazyl disulfide, 1 part mercaptobenzothiazole, and 0.5 part tetramethylthiuram disulfide.

5. An improved retractile electrical cord having good hand feel, good resiliency, good color range, and good color retention and being resistant to chemicals normally found on the human hand to rub-off comprising, in combination, at least one electrical conductor and a jacket formed around said conductor, said jacket being formed in a helical configuration and having a composition consisting essentially of 100 parts, by weight, of base material of 60–80% butadiene-acrylonitrile copolymer admixed with 40–20% polyvinylchloride, 50–150 parts reinforcing filler material consisting essentially of 0–30% hydrated silicon dioxide, 25–100% clay, and 0–50% Atomite whiting, 5–50 parts octyl-decyl-phthalate and paraffin plasticizer, 1–10 parts zinc oxide, 0.5–5 parts stearic acid, 1–5 parts sulfur, 1–3 parts accelerator taken from the group consisting of tetramethylthiuram-disulfide, mercaptobenzothiazole and benzothiazyl disulfide, antioxidant, and suitable pigmentation adapted to provide a desired color to said composition.

6. The cord defined in claim 5 in which said accelerator consists essentially of 0.5 part tetramethylthiram disulfide together with at least 1 part benzothiazyl disulfide.

7. An improved retractile electrical cord having good hand feel, good resiliency, good color range, and good color retention and being resistant to chemicals normally found on the human hand and to rub-off comprising, in combination, at least one electrical conductor and a jacket formed around said conductor, said jacket being formed in a helical configuration and having a composition consisting essentially of 100 parts, by weight, of base material of 50% butadiene and 20% acrylonitrile as a copolymer admixed with 30% polyvinylchloride, 80 parts filler essentially consisting of 60 parts clay and 20 parts hydrated silicon dioxide, 30 parts octyl-decyl-phthalate, 3 parts paraffin, 3 parts zinc oxide, 1 part stearic acid, 1 part benzothiazyl disulfide, 1 part mercaptobenzothiazole, 0.5 part tetramethylthiuram disulfide, 1 part sulfur, 1 part antioxidant, and suitable pigmentation adapted to provide a desired color to said composition.

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