Aug. 27, 1963 C. K. HEASLEY 3,101,845

STRETCHABLE MICA-CONTAINING INSULATING SHEET MATERIALS AND PRODUCTS INSULATED THEREWITH

Filed Sept. 26, 1960

FIG. 1

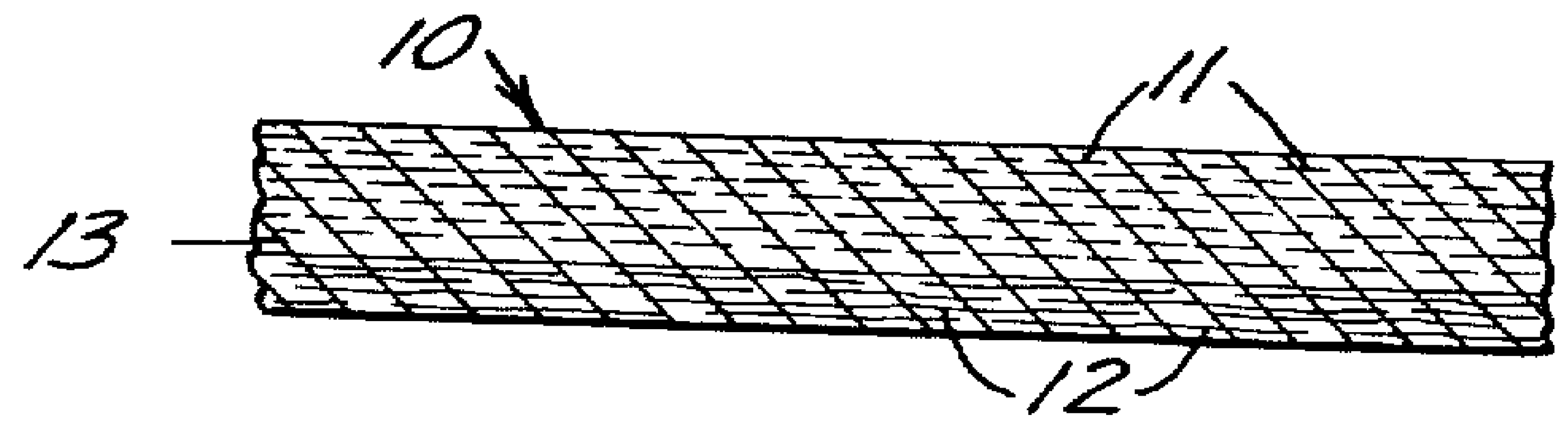


FIG. 2

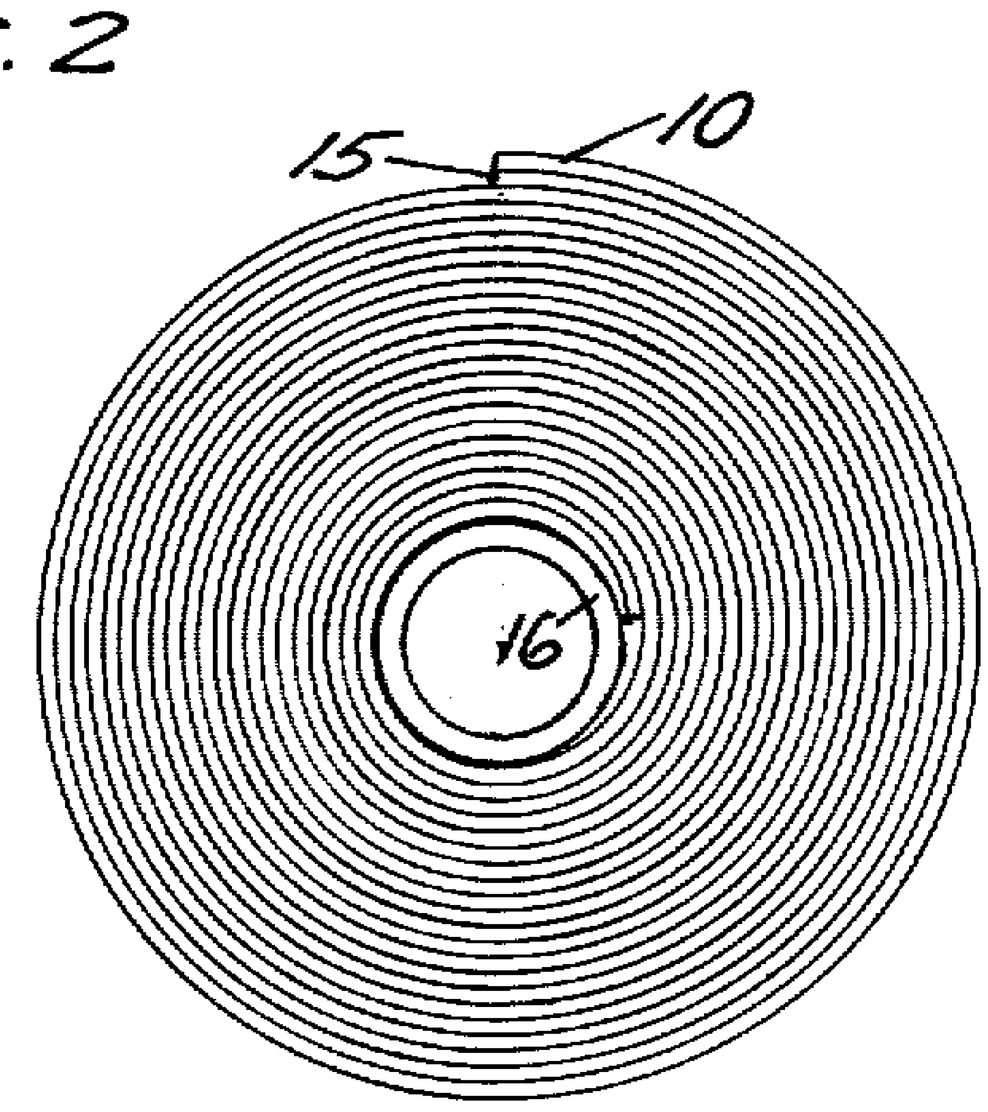
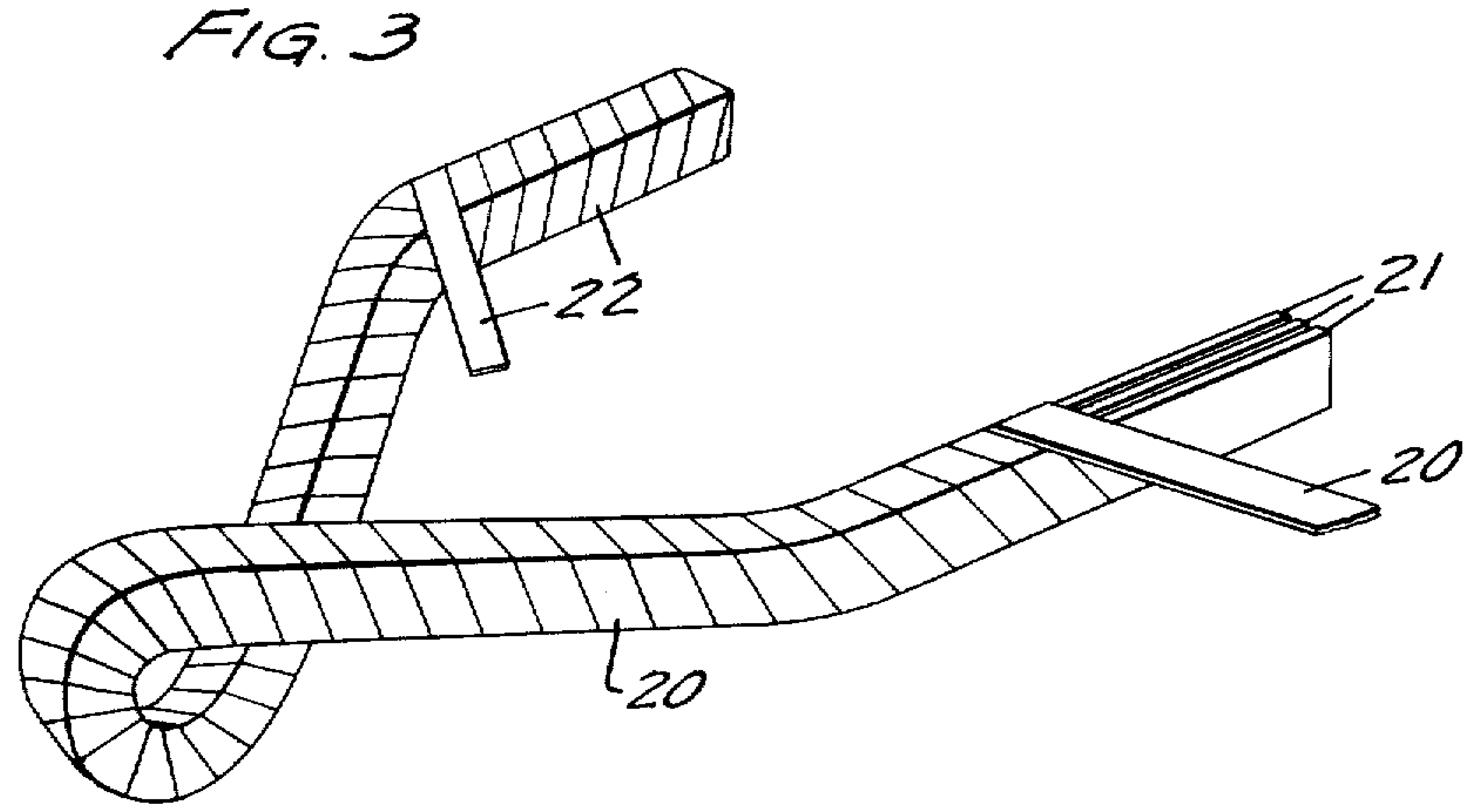


FIG. 3



INVENTOR
CHARLES K. HEASLEY
BY
Carpenter, Abbott, Coulter & Kinney
ATTORNEYS

United States Patent Office

3,101,845

Patented Aug. 27, 1963

3,101,845

STRETCHABLE MICA-CONTAINING INSULATING SHEET MATERIALS AND PRODUCTS INSULATED THEREWITH

Charles K. Heasley, St. Paul, Minn., assignor to Minnesota Mining and Manufacturing Company, St. Paul, Minn., a corporation of Delaware

Filed Sept. 26, 1960, Ser. No. 58,276
5 Claims. (Cl. 206—59)

The present invention relates to initially flexible curable resinous electrical insulating sheet materials. More particularly, it concerns initially flexible stretchable conformable mica-containing curable resinous insulating tape structures and highly insulated products utilizing said structures. This application is a continuation-in-part of my previous application Serial No. 630,896, filed December 27, 1956, now abandoned.

In the insulation of electrical conductors and groups thereof considerations of necessary thickness of insulation and types of insulative materials used are often of extreme importance. The minimum of insulative covering thickness consistent with adequate insulative strengths is generally desired in the interest of savings in often-precious space and weight. Insulation preferably is physically tough and strong. Uniformity in insulation minimizes waste and is highly desirable, since an insulative covering is no better in overall electrical properties than it is at its point or points of minimum properties. A smooth exterior is particularly important in the instance of insulated conductor components, such as the complexly configured coils of electric motors and generators, which must fit uniformly and compactly both together and in the slots or supports therefor. Insulating materials are therefore selected which, within the realm of economic feasibility, form insulative coverings having the best possible overall combinations of electrical and other desired properties.

One of the best and most efficient of insulating materials is mica. The dielectric strength of the material is high; its voltage endurance almost unparalleled. The form in which the mica is employed for insulative purposes depends in part upon the specific uses to which it is to be put. Where the shape of the insulative layer is to be flat and it is not to be subjected to significant flexure, layers of the well known sheet mica are generally used. On the other hand, where the mica-containing insulation must be of flexible nature during some stage of its use, as, for example, where it is employed in tape form for the wrapping or winding about conductors, the relatively nonconformable sheet mica is unsuitable. More flexible forms of mica must be utilized.

One type of flexible mica material which has seen wide use in the insulating of conductors by "taping," i.e. wrapping the material in narrow-widths about the conductors usually in partially overlapping relationship, is known as mica splittings tape. The micaceous component of this material consists primarily of sheet mica which has been reduced or "split" into relatively thin flakes measuring generally in the order of ¾–1½ inches across. The flakes individually are adhered to a flexible self-supporting backing such as paper, fabric or the like in overlapping relationship. In this fashion, a flexible mica sheet structure is obtained.

Another flexible micaceous sheet material is composed of very finely divided individual extremely thin mica flakes which have been formed into a paper-like sheet through use of procedures similar to those followed in making paper from pulp fibers. The sheet is self-sustaining in the sense that it can be lifted and manipulated without falling apart upon reasonably careful handling. However, it is quite fragile. Resistance to tear is very low.

The flexible mica sheet material types above discussed, by themselves, exhibit good electrical properties. However, it has long been known that upon as little as 1% elongation, the flexible mica sheet material breaks or tears abruptly, with correspondent failure in electrical properties. Consequently, prior art insulating sheet or tape structures utilizing flexible mica sheet materials disadvantageously have been incapable of being elongated or stretched without failure thereof. A complete appreciation of the merits of the present invention will be aided by a brief discussion of ways in which flexible mica-containing tape structures heretofore have been employed.

Resinous compositions generally are used in conjunction with flexible mica-containing structures in the insulative taping of conductors. The resinous compositions, when hardened, serve to strengthen and unify the insulation and to adhere it to the insulated member. Almost entirely until recent years, the resin compositions have been added separately, while in liquid form, by impregnation thereof between layer wraps of flexible mica tape previously wound about the conductor or conductors being insulated, followed by a hardening of the resin. These procedures are still used extensively. The impregnation is facilitated through vacuum impregnation procedures often employed in conjunction with external pressure molds. More recently, mica-containing tape structures have been disclosed in which resinous composition to be employed in the taping of the conductors is contained in the tape structure itself in the form of a stable heat-curable resin.

An example of the latter type of prior art mica-containing tape structures, which may employ either of the above-mentioned types of flexible mica sheet materials, is found in United States Patent No. 2,707,204, issued on April 26, 1955 assigned to the General Electric Company of New York on application dated October 31, 1951 and filed by Richardson et al., reference to which is hereby made. Where any firm tension is to be applied to his tape structure, Richardson employs an inextensible reinforcing web of longitudinal glass fibers to prevent elongation. Where his tape contains no reinforcing, it must be carefully employed in wrapping so as to prevent any significant elongation which would break the tape.

Numerous important disadvantages inhere in flexible mica-containing prior art insulative tape constructions, particularly when they are considered in view of the above-mentioned requisites for optimum insulative coverings. They do serve satisfactorily as insulating tapes in the taping of straight conductors. Impregnation of additional resin through vacuum impregnation is oftentimes even unnecessary where the resin containing tapes are used. However, the use of heretofore known mica-containing tapes for wrapping conductors of complex configurations, e.g. armature windings for electric motors, has disadvantages both in procedure and result. Since the prior art mica-containing tapes cannot be stretched or elongated to any significant extent without failure thereof, necessarily they do not and can not intimately conform to and take the shape of conductor surfaces about which they are wrapped having complex compound curves. Instead of intimate conformance, portions of the tape wrinkle and fold over upon themselves. Undesirable void spaces in the insulative layer exist between the folds. Usually only by such remedial measures as the use of high pressure confining molds which force configuration of the tape structure, and/or by the addition of resin through vacuum impregnation, can a suitable void-free insulation result. The use of high pressure is apt to rupture or cause weak spots in the folded mica material if such are not already present. Cumbersome apparatus which curtails "on the job" taping operations, is required. In any event, the folding over and wrinkling of the tape upon itself creates undesirable non-uniform bumps in portions of the insulation. The magnitude of the bumps increases with the successive layers of tape, resulting in insulative coverings having unnecessarily thick portions. Not only is such insulation costly and wasteful, great difficulty is experienced where exacting size tolerances must be met.

It is therefore an object of the present invention to provide flexible sheet structures containing as a principal insulant a mica sheet, which structures are flexible, stretchable and conformable when applied to or wound about surfaces of complex configuration. A further object of the present invention is the provision of a conformable mica-sheet-containing insulating tape which, upon being wound about a conductor under firm hand or machine tension and thereafter subjected to heat without confinement in a mold or pressure device, is converted to a continuous tough void-free insulative covering having superior electrical properties. Still another object hereof is the provision of tape structures as defined in the preceding objects wound in roll form, which structures may be stably stored for extended periods and later unwound and used. Another object of the present invention is the provision of novel insulated electrical components having excellent electrical properties, which components have been insulated with my insulative tape structures.

In attaining these and other objects and advantages heretofore unattained in the prior art, my invention provides a novel flexible stretchable and conformable mica-containing sheet material including as a principal insulant a thin paper-like sheet having high dielectric and voltage endurance properties and consisting essentially of finely divided individual extremely thin mica flakes. The paper-like sheet is contained in a resinous matrix and through the latter is intimately unified with a stretchable conformable reinforcing member component, the resulting combination having the characteristics of unity, continuity, stretchability and conformability without deleterious loss of electrical characteristics. The composite structure, when wound or wrapped about a geometrically complex surface conforms intimately thereto and, when thereafter heated without necessity of a confining mold, is converted to a tough, strong, uniform void-free insulative covering exhibiting superior electrical properties.

A clear understanding of the present invention will be facilitated upon reference to the accompanying illustrative drawing, the description thereof and to the specific illustrative examples which follow in the specification. In the drawing, wherein like reference characters denote corresponding parts in the several views, and in which dimensions have been exaggerated for the sake of clarity:

FIGURE 1 is a view in section of a resinous mica-containing insulating sheet structure hereof;

FIGURE 2 is a view of my novel sheet structure wound in roll form in conjunction with a carrier liner; and

FIGURE 3 is a view in perspective of a portion of an armature coil of a typical high-temperature high-voltage alternating current electric motor, the coil having been partially wrapped with my novel sheet structure.

Referring now to FIGURE 1, the mica-containing resinous sheet material **10** of the present invention contains a thin paper-like sheet **11** consisting essentially of finely divided individual extremely thin mica flakes. Superposed upon the paper-like mica sheet is a stretchable conformable reinforcing web **12** which is capable initially of being differentially uniformly stretched or elongated over its length, under tensions present during the firm hand pulling, e.g., in the order of 10–15 pounds per inch width, to an extent of at least about 10 percent. Essentially completely impregnating and filling the paper-like sheet **11** and uniting thereto the reinforcing web **12** is a stable temporarily heat-flowable and heat-curable stretchable and pliable resin composition **13**.

A preferred paper-like sheet of the desired character is obtained by following the procedures described in Bardet U.S. Patent No. 2,549,880, granted April 24, 1951, on application filed in this country on July 16, 1945. Briefly the procedures there described call for grinding or breaking up sheet mica followed by heating the ground particles to a temperature sufficient to produce cleavage thereof but lower than the critical temperature corresponding to total dehydration of the material. For example, the sheet may be heated to 800° C. The heated particles are then immersed quickly in a sodium carbonate solution where they are cooled. The mica is then removed from the solution and drained and thereafter dropped into a 5 percent hydrochloric acid solution for about an hour. The resulting finely divided extremely thin flakes are washed and suspended in water. A paper-like sheet is then formed of the flakes by separating the flakes from their suspension on a paper-forming wire screen and then removing and drying the resulting fragile but self-sustaining and flexible continuous porous paper-like sheet. A highly suitable such paper-like mica sheet having a nominal weight of 30 grains per 4 inch by 6 inch sheet and a nominal thickness of .004 inch is presently commercially available under the trade designation "Samica."

The mica-containing resinous sheet structure **10**, is generally formed on and releasably engaged with a flexible carrier liner, from which the sheet structure is readily stripped prior to use in the insulation of electric conductors and the like. With reference to FIGURE 2, my mica-containing sheet structure **10** is, when in contact with the carrier **15**, conveniently rolled therewith into roll form in which the exterior surface of the sheet structure is in contact with the surface of the next succeeding layer, i.e. of the carrier **15**. The rolls are generally wound about a central core **16** and in this form are sold in commerce.

Although the mica paper-like sheet is virtually incapable by itself of being stretched or elongated without failing completely both physically and in electrical properties, and although likewise such a paper-like sheet fully impregnated with a stretchable pliable resin is incapable of elongation to any substantial degree without substantially complete failure in physical and electrical properties, I have discovered surprisingly that my novel sheet structures composed as herein defined are capable of very substantial stretching and elongation without substantial or sudden decrease in electrical properties. In many instances my structures may be elongated to an extent of 20 percent or more. They are therefore highly suited to being employed in the intimately conformable wrapping and insulating of electrical conductors and other electrical components even when the articles being insulated have surfaces of complex geometrical configuration.

A manner in which the sheet materials hereof are employed will be seen upon reference to the segment of an electric motor armature coil shown in FIGURE 3. The narrow, e.g. ½–1 inch, tape **20**, previously unwound from a supply roll (not shown) is wound under firm hand tension in partially overlapping spiral wrappings about the conductors **21** of the coil. Simultaneously with the withdrawal of the tape **20** from the supply roll the carrier liner with which it was wound is removed. In being wound about the conductors **21** under firm hand tension the tape elongates, stretches and, through a tendency to retract, conforms intimately to the surface being wound. Thus uniform wraps are made even about those portions of the coil conductors **21** having very complex curvatures, as at the end loop portion of the coil. Substantially no folding over or wrinkling of the tape occurs. A second layer **22** is similarly wrapped about the coil over the previously applied wrappings of the tape 20. Additional layers of tape can be applied if desired. When the wrapping of any layer is complete the free end of the tape is fastened in position. This may be accomplished by tying the end in position with a piece of string or with a short length of pressure sensitive tape or the free end may be "tacked down" by temporarily applying heat, e.g. with a hot soldering iron, to the free end of the tape causing the resin to become tacky and to adhere to the surface with which it is in contact.

The thus taped coil is then heated, confinement in mold being unnecessary, at a sufficient temperature and at a sufficient time to cure the resin to a strong tough infusible state. Runoff of resin during cure is very largely avoided. A tough heat-resistant insulative covering having high dielectric strength and excellent voltage endurance results.

Having now generally described my invention, the same will now be illustrated specifically with the aid of the following non-limiting example.

EXAMPLE

A solution of resin composition is first prepared. In this instance, 65 parts by weight of a powdered solid of partially homopolymerized diallyl phthalate resin, having a specific gravity of 1.259 and a softening range of about 80–105° C., 35 parts by weight of diallyl phthalate prepolymer, and 2 parts by weight of tertiary butyl perbenzoate liquid were intimately mixed in 70 parts by weight of acetone solvent. Stirring of the constituents continued until solution had been effected. The diallyl phthalate polymer employed is presently commercially available under the trade designation "Dapon–60." The prepolymer of this example was a 100% solids essentially homopolymeric material having a specific gravity of 1.154 and a viscosity of about 165 centipoises at 23° C.

"Samica" brand mica paper, having a nominal thickness of 0.004 inch, a nominal weight of about 30 grains per 4 inch by 6 inch sheet and prepared generally in accordance with the procedures set forth in the aforementioned Bardet Patent No. 2,549,880, was unwound from a supply roll and superposed on the upper surface of a disposable carrier liner simultaneously being unwound from a supply roll. The carrier liner consisted of paper having a treatment of polyethylene on both surfaces.

A non-woven, stretchable, conformable fibrous fabric having a nominal weight of about 8 grains per 4 inch by 6 inch sheet was simultaneously withdrawn from a supply roll and led into superposition with the carrier and the mica paper in contact with the exposed surface of the latter. This fabric consisted essentially of a unified, compacted carded mixture of drawn and undrawn staple polyester fibers formed of a high molecular weight reaction product of ethylene-glycol and terephthalic acid ("Dacron"), both the drawn and undrawn fibers having a length of about 1 inch with the undrawn fibers being in the proportion of about 40 percent by weight and being autogenously interbonded at their possible crossing points to form a network within which the drawn fibers are interlaced. This fibrous stretchable conformable reinforcing web and a procedure for manufacturing it are disclosed in the application of A. W. Boese for United States Letters Patent, Serial No. 532,369, filed September 2, 1955. It is available commercially from the Minnesota Mining and Manufacturing Co., of St. Paul, Minn.

The three component structure consisting of a liner, mica paper and polyester web, enumerated respectively, from bottom to top, was then led horizontally through a knife coater where the previously prepared thinly fluid resin solution was coated on the structure at a dry coating weight of about 100 grains per 4 inch by 6 inch sheet. The thus coated web was then led into a drying oven where it was subjected to a temperature of about 150–175° F. for about one hour. Upon being applied to the web structure the liquid resin solution immediately commenced impregnating the polyester web and the mica paper, this impregnation being substantially completed during the earlier stages in the oven. The dried resin impregnated sheet structure, upon leaving the oven, was then wound into rolls with the carrier liner for storage and subsequent slitting into the desired widths and lengths. The exact time and temperature required in the drying step will vary for different resin systems, depending, inter alia, on the solvents employed, the molecular weight of the starting materials, and the relative amounts of the various components present. At any rate, care should be taken to heat the resin to the point where, when the cooled composite sheet material is elongated by firm hand pulling, the resin does not merely "flow" but instead has sufficient "consistency" or 'body" to carry the mica particles with it, thus maintaining the mica particles in the same relative position to the backing as they had initially. Heating should not be continued, however, to the point where the resin is no longer stretchable enough to permit moderate elongation of the composite sheet material without cracking, nor should the temperature be so high that the accelerator, or catalyst, is activated.

The thus produced insulative sheet was easily strippable from the liner without transfer or offset of resin. Apart from the liner, the sheet had a nominal thickness of about 18–20 mils. Upon microscopic examination it appeared that the resin impregnated mica sheet constituted about one-half or more of the total thickness. This is considerably greater than the initial mica paper thickness of about 4 mils. The resin composition thoroughly impregnated and penetrated the paper, and intimately contacted the mica flakes, and adhered the latter to the reinforcing web.

Sheet material prepared in accordance with the preceding example has been subjected to vigorous tests in order to evaluate its electrical and physical properties. The results of one such test, representative of the electrical properties of the sheet material, are reproduced in the table below. The test determined the dielectric values of several samples previously elongated different amounts. It was carried out in accordance with American Society of Testing Materials test No. D149–55T, with a single exception. In view of the extreme voltage necessary, a liquid dielectric, perfluorotributylamine, in place of air, constituted the medium in which the tests were performed. The test samples were cut into sizes of 1 inch wide by eight inches in length. They were then stripped from the liner and mounted between opposed gripping jaws of a tensile test machine, which gripped the end one inch at each end of the samples. The samples were then each elongated between the jaws a designated amount. The odd numbered samples were then released from the jaws, allowed to contract or recover until in equilibrium, and laid in an oven and cured at 250° F. for 2 hours. Further contraction occurred during cure. The even numbered samples were cured under the same conditions while still elongated, and thus under tension, between the jaws. Test results were as follows:

Table

Sample	Percent Elongation	Dielectric Strength,[1] Volts/Mil
Control[2]	0	1,800
1	2	1,600
2	2	1,500
3	5	1,650
4	5	1,650
5	10	1,500
6	10	1,400
7	15	1,300
8	15	1,200
9	20	1,200
10	20	1,300

[1] Arithmetic average of five readings.
[2] Nominal thickness 0.018''; cured same as other samples.

The results reproduced in the table are especially significant in view of (1) the inability of prior art mica-containing tape structures to be elongated to any significant extent without substantially complete failure in electrical properties, and (2) the fact that stretchability and elongatability of insulating tape structures to an extent of about ten percent, without substantial loss in dielectric properties, is necessary to the conformability desired in the wrapping of conductors having complex configurations.

Other electrical properties of the sheet structures similarly proved superior. Importantly, voltage endurance of elongated samples under corona conditions was extremely long, e.g. in the order of that exhibited by the heretofore known initially flexible relatively non-elongatable mica-containing tapes. When insulative tape of the present example was utilized in the wrapping of conductors under firm hand tension and cured without a mold, firm tough insulative coverings resulted which were uniform exteriorly. The electrical properties of the coverings were generally equivalent to that obtained by cumulating the properties of the individual layers present. This indicated continuous void-free insulation throughout.

The storage life of the sheet structures prepared in accordance with the above example, prior to use, has proven to be very satisfactory. For example, where the uncured sheet structures wound with the carrier liner in roll form have been stored under slightly refrigerated conditions (e.g. 40–50° F.), they performed in every respect as satisfactorily more than a year after manufacture as they did when employed as insulation immediately. Where stored, at room temperatures, they performed well when stored as long as six months or longer.

Other types of stretchable elongatable conformable reinforcing webs can, of course, be employed as the reinforcing webs in my structures. Although I prefer those of a nonwoven fibrous nature, such as the polyester web utilized in the above example, stretchable or elongatable webs formed of a continuous film or of woven fibers may be employed. Fibrous webs have the advantage of permitting flow of resin composition between wrappings when the taped article is heated during the curing operation. Thereby intimate void-free layer-to-layer bonding is promoted. The materials of which the web can be made are also varied. Generally I prefer the organic high molecular weight polymers, such as the polyester above used, polyamides (nylon), polyacrylonitriles ("Orlon"), etc., whether the web is fibrous or a film. So-called bias-cut glass cloth, i.e., woven cloth having the filaments lying on the bias, is elongatable and conformable to a useful extent. In any event, the reinforcing web should be uniformly strong enough to distribute tensile strains uniformly thereover along any stressed length. Thus elongation thereof occurs differentially uniformly. The reinforcing webs when employed in narrow widths, e.g. one inch, further, are extensible in response to firm hand pulling to an extent of at least about ten percent. The web should be selected with an eye toward the resin composition to be employed. Needless to say, if the particular resin composition used chemically attacks or dissolves, or causes attack of the web, the requisite properties of the reinforcing web may be adversely affected.

The polyester-type diallyl phthalate, peroxide-type accelerator-containing resin composition employed in the specific example represents a preferred pliable stretchable stable heat-curable and flowable resin composition hereof. A particularly suitable feature of this material is the manner in which it appears to "wet" and thoroughly penetrate, swell and fill the mica paper-like sheet when incorporated therein. If desired, the consistency of the solvent-free resin may be adjusted by the addition of either monomeric diallyl phthalate or a suitable thickening agent such as finely divided mica. The diallyl phthalate resin composition can, of course, be replaced by other equivalent compositions. Indeed, other resin compositions have been employed in the preparation of my stretchable conformable mica-containing insulative sheet structures. For example, various stable heat-curable silicone resins have advantages in their inherent electrical properties and have value in that regard. Various stable heat-curable epoxide compositions, notably various alkyl-resin modified epoxide compositions, have desirable features. Stable resin compositions which upon heat-curing convert to polyurethane resin compositions have proven interesting. The resins I employ are stable, that is, they can be stored at room temperatures or below in incompletely cured state and later, for example at least several months later, be heat-cured to a tough infusible state. They are flexible, pliable, stretchable solids or near solids at room temperatures and hence do not unduly migrate; yet upon heating, prior to cure, liquefaction to a flowable state results. It is generally necessary to apply the resin composition in solution or thinly fluid form to facilitate impregnation. An impregnating composition which is quite fluid, yet not sufficiently thin such that it runs through and out the sides of the sheet is preferable. In this fashion essentially complete filling of the mica-paper is promoted.

The amount of resin composition incorporated into the mica paper-reinforcing web composite may be varied within limits. I have found that if sufficient resin is incorporated into my sheet structures such that the reinforcing web cannot be separated from the sheet with the fingers after the impregnated structures have been dried and cooled, sufficient resin is present to provide a tape capable of forming void-free insulation upon being wrapped about conductors under firm hand tension and cured. The mica component is caused to be impregnated by the resin in preference to the reinforcing web, due presumably to its extremely large surface area. Preferably, however, sufficient resin composition is incorporated into the structure so that upon drying the reinforcing web does not appear resin starved. Sometimes I employ an excess of resin composition in my sheet structures where cavities exist in the components to be wrapped, e.g. a bundle of conductors having circular cross-section. In this manner filling of the cavities by the resin excess is promoted.

What I claim is:

1. A flexible stretchable mica-containing insulating sheet material suitable for hand wrapping around electrical conductors under firm hand pulling, thereby being elongated and conformed intimately to the configuration of the surface being wrapped, to provide a compact void-free insulating covering of very high dielectric strength upon heating while unconfined, said sheet material comprising a thin porous paper-like sheet of finely divided extremely thin mica flakes, a differentially uniformly stretchable reinforcing web superposed upon said paper-like sheet, and a stable heat-curable stretchable and pliable resin composition essentially completely filling said paper-like sheet and uniting it to said web by firmly adhering to the latter the mica flakes of said paper-like sheet, said sheet material being stretchable under hand pulling to an extent of at least ten percent without rupture of said paper-like sheet.

2. The sheet material of claim 1 in superposition with a carrier liner and convolutely wound therewith in roll form, the sheet material being temporarily adhered to said carrier liner but readily strippable therefrom.

3. A flexible stretchable mica-containing insulating sheet material suitable for hand wrapping around electrical conductors under firm hand pulling, thereby being elongated and conformed intimately to the configuration of the surface being wrapped, to provide a compact void-free insulating covering of very high dielectric strength upon heating while unconfined, said sheet material comprising a thin porous paper-like sheet of finely divided ex-

tremely thin mica flakes, a differentially uniformly stretchable reinforcing web superposed upon said paper-like sheet, said paper-like sheet being essentially completely filled and firmly united to said web by a stable heat-curable stretchable and pliable resin composition, the resin-filled paper-like sheet in said insulating sheet material having a thickness at least twice as great as that of an otherwise identical unfilled paper-like sheet and being stretchable under hand pulling to an extent of at least ten percent without rupture of said paper-like sheet.

4. A flexible stretchable mica-containing insulating sheet material suitable for hand wrapping around electrical conductors under firm hand pulling, thereby being elongated and conformed intimately to the configuration of the surface being wrapped, to provide a compact void-free insulating covering of very high dielectric strength upon heating while unconfined, said sheet material comprising: a thin porous paper-like sheet of finely divided extremely thin mica flakes; a non-woven stretchable reinforcing web consisting essentially of a compacted carded mixture of drawn and undrawn staple polyester fibers which both have a length of at least approximately one inch, said undrawn fibers being in the proportion of about 40–60 percent by weight of said web and being autogenously interbonded at their crossing points to form a network within which the drawn fibers are interlaced;

and a stable heat-curable resin composition esssentially completely filling said paper-like sheet and uniting it to said web by firmly adhering to the latter the flakes of said paper-like sheet, said composition including about 65 parts by weight of initially solid partially homopolymerized diallyl phthalate resin, about 35 parts by weight of 100% solids initially liquid essentially homopolymeric diallyl phthalate and a sufficient amount of peroxide-type accelerator to cause conversion of said resin composition to an essentially infusible state upon heating to a temperature in the order of 250° F. for a time in the order of about two hours, without causing substantial autogenous conversion of said composition upon storage of said sheet material for lengthy periods at temperatures in the order of 40–70° F.

5. The sheet material of claim 4 in superposition with a carrier liner and convolutely wound therewith in roll form, the sheet material being temporarily adhered to said carrier liner but readily strippable therefrom.

References Cited in the file of this patent

UNITED STATES PATENTS

2,707,204	Richardson et al.	Apr. 26, 1955
2,763,315	Berberich et al.	Sept. 18, 1956
2,868,269	Letteron	Jan. 13, 1959

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,101,845 August 27, 1963

Charles K. Heasley

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 6, line 15, for "or 'body" to carry" read -- or "body" to carry --; column 8, line 8, for "alkyl-resin" read -- alkyd-resin --.

Signed and sealed this 25th day of February 1964.

(SEAL)
Attest:
ERNEST W. SWIDER

Attesting Officer

EDWIN L. REYNOLDS
Acting Commissioner of Patents