A bi-color insulating sleeve formed from a compression molding process. The compression process producing a product from a process wherein an inner layer of the sleeve made of a first color is only partially vulcanized. A second material of a different color is the placed over the sleeve and the use of heat and pressure are applied so that both the first and second materials vulcanize at the same time. The second material forming an outer layer and taking the form of the outer shape of the insulating sleeve wherein a compromise in the safety of the sleeve is visually identified whenever the inner layer can be seen through the outer layer.
Fig. 4
BI-COLORED INSULATING SLEEVE

FIELD OF THE INVENTION

[0001] This invention is directed to the field of safety gear and, more particularly, to a bi-colored insulating sleeve for use by linemen.

BACKGROUND OF THE INVENTION

[0002] Maintenance on electric power distribution systems such as power lines, transformers, fuses and switches is performed by specialists commonly referred to as linemen. Working on such electrical systems equipment poses a threat of injury to the linemen as it is not practical to simply turn off power grids when equipment and systems maintenance is required. For instance, when testing or repairing electrical power line distribution systems, it is desirable, but in many instances not feasible, to disconnect and reconnect a de-energized (cold) line from an energized (hot) line. Because maintenance is routinely performed while power lines and equipment are energized, special protective gear must be worn by the linemen to prevent contact with energized lines and equipment that could cause electric shock and burns.

[0003] To assure the safety of the lineman, protective equipment is employed. For the immediate protection of the lineman from the electrical voltage hazard, insulated gloves and insulated sleeves are generally used. However, while properly maintained protective equipment will help protect the lineman from serious injury, the safety equipment is not effective if any of the safety equipment has been compromised. For instance, a lineman’s sleeve that has been subjected to abrasion, snags, scrapes, chemicals, or extended exposure to sunlight, ultra-violet light, and other sources of ozone may have compromised or reduced dielectric properties rendering them potentially unsafe.

[0004] Of particular concern are the insulating sleeves worn by the linemen which protect the arms against high voltage electricity. Sleeves, made and sold in pairs, are used to cover the lineman’s arm from the wrist to the shoulder. These insulating sleeves are manufactured from any elastomer or combination of elastomeric compounds such as natural or synthetic rubber and wrap around the arm and are supported at the shoulder by straps or harnesses across or around the neck. Insulating sleeves are normally worn in conjunction with rubber insulating gloves and the wrist end of the sleeves fit inside the open cuff of the gloves. In the United States, ASTM standard specification 91051 covers the manufacture and testing of rubber insulating sleeves. ASTM specifications are consensus standards developed and maintained by the industry and are referenced in the OSHA regulations governing worker safety.

[0005] The insulating sleeve must be made out of a flexible, seamless, dielectric material allowing the lineman to use his arms or otherwise function while wearing the sleeve. Rubber insulating sleeves are susceptible to physical damage which affects their insulating characteristics against high voltage electricity. Sleeves are normally inspected and tested at a central location before being taken into the field for use. According to the ASTM specification for the in-service care of insulating gloves and sleeves, the sleeves shall be visually inspected by the wearer for defects or damage. While gloves may be visually inspected by inflating with air, such field testing of sleeves is much more difficult as both ends of the sleeve are open making the use of pneumatic testing impractical.

[0006] There are currently two conventional methods of producing rubber insulating sleeves. One method is by molding, either compression molding or injection molding. The molding method employs a molding tool that basically consists of a top, bottom, and center core. When raw material is placed in a molding tool, the raw material takes the shape created by the tool with the excess material bled out of the tool through venting. After the appropriate amount of time, pressure, and heat, the press is opened and the product is removed from the tool. The advantages of this method of production are lower production cost and greater yield or higher percentage of acceptable products. However, a disadvantage of this method of production is that products are made from a single material and a single color. As will be further explained, the use of a single color makes it difficult to visually find defects or breaches in the product.

[0007] Another method of production is known as dipping. In a dipping method the rubber material is either liquefied into a solution by the use of a solvent or used in its natural latex state. A porcelain or aluminum form is dipped into the liquid and when removed, there is a film of rubber on the form. This dipping procedure may be repeated multiple times to produce the required thickness of rubber needed for the product. The exact number of dips, and thus the thickness of the end product, is dependent upon the classification sought and the type of product being produced. A dipping process can take up to two weeks to produce a product. Evaporation of the solvent cannot be too fast or a large number of voids, or inconsistencies within the surface, will be generated. If the dipping process uses rubber in its natural latex state, chemical coagulants and other potential impurities must be leached out of the rubber film or the dielectric or physical properties of the product will also be affected. Once the required thickness has been reached, the rubber is vulcanized, or cured, in an oven. Different color materials could be employed during the dipping process and a bi-color sleeve can be made. Thus, the advantage of this method of production is the ability to manufacture a bi-color sleeve, contrasting inner and outer colors as a visual indicator of deterioration, damage, wear or other hazards that may affect safety. The disadvantages of this method of production are higher cost, longer production time, the environmental impact of using solvents, risks of allergic reactions from the use of natural latex rubber, and generally lower production yields.

[0008] There is a need for a bi-color insulating sleeve that can be produced through a molding process to provide a uniformly safe product, faster production time, and higher yields all with an underlying layer color that will visually reveal damage to the outer layer.

SUMMARY OF THE INVENTION

[0009] The present invention protects the user from the hazard of high voltage electricity by covering the arms of the lineman and allows the lineman the ability to visually check his own equipment to determine if it is safe. Disclosed is a bi-color insulating sleeve product formed by a compression molding process. In one embodiment, the compression mold has a top and a bottom with one set having a smaller interior cavity than the other. The steps comprise inserting of a first material having a first color to cover the bottom of the tool and placing a core in the tool. Covering the core of the tool with
the first material, closing the tool and applying heat and pressure to form an inner layer of the sleeve, the inner layer only partially vulcanized. The tool is then opened and the core, with partially vulcanized sleeve attached thereto, is removed. A second material having a second color is placed in the bottom of the open tool and the core, with the partially vulcanized sleeve attached thereto, is reinstalled. The second material is placed over the top of the core and the tool closed forcing the second material to fill the void between the partially vulcanized sleeve and the top and the bottom of the tool. Heat and pressure are applied so that both the first and second materials vulcanize at the same time. The second material forming an outer layer and taking the form of the outer shape of the insulating sleeve wherein a compromise in the safety of the sleeve is identified whenever the inner layer can be seen through the outer layer.

[0010] An objective of the invention is to provide a bi-color insulating sleeve from a molding process that protects the arms of the lineman from high-voltage electricity and provides a visual indicator of sleeve integrity.

[0011] Another objective of the invention is to provide an improved product by a process that will lower production costs and improve product quality of bi-colored sleeves.

[0012] Another objective of the invention is to provide a lineman’s sleeve which can be readily manufactured and visually inspected in the field.

[0013] Still another objective of the invention is to provide a bi-color sleeve having contrasting inner and outer colors as a visual indicator or deterioration, damage, wear or other hazards that may affect safety.

[0014] Yet another objective of the invention is to teach the use of process of making a bi-colored sleeve having a first material having a longer cure/vulcanizing time and a second material has a shorter cure/vulcanizing time so that when the first material is only partially cured/vulcanized and removed from a tool, the remainder of its cure/vulcanizing time of the first material matches the shorter cure/vulcanizing time of the second material so that the finished product is cured/vulcanized to achieve optimal properties at the same time.

[0015] Other objectives and advantages of this invention will become apparent from the following description taken in conjunction with any accompanying drawings wherein are set forth, by way of illustration and example, certain embodiments of this invention. Any drawings contained herein constitute a part of this specification and include exemplary embodiments of the present invention and illustrate various objects and features thereof.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] These and other details of the present invention will be described in connection with the accompanying drawings, which are furnished only by way of illustration and not in limitation of the invention, and in which drawings:

[0017] FIG. 1 is a perspective view of the rubber insulating sleeve;

[0018] FIG. 2 is a side view of a tool process forming an inner sleeve shown in an uncompressed state;

[0019] FIG. 3 is a side view of the tool process of FIG. 2 shown in a compressed state;

[0020] FIG. 4 is a side view of a tool process forming an outer sleeve shown in an uncompressed state;

[0021] FIG. 5 is a side view of the tool process of FIG. 4 shown in a compressed state;

[0022] FIG. 6 is a plane view of the bottom tool with the inner sleeve;

[0023] FIG. 7 is a plane view of the bottom tool with the inner sleeve and core;

[0024] FIG. 8 is a plane view of the top tool with the inner sleeve;

[0025] FIG. 9 is a plane view of the top tool with the outer sleeve;

[0026] FIG. 10 is a plane view of the bottom tool with the outer sleeve and core;

[0027] FIG. 11 is a plane view of the top tool with the outer sleeve;

[0028] FIG. 12 is a plane view of alternative embodiment compression tool with an inner sleeve; and

[0029] FIG. 13 is a plane view of FIG. 12 with an outer sleeve placed over the inner sleeve.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0030] Referring now to FIG. 1, depicted is an overview of the bi-colored insulating sleeve 5 having a lower arm section 6 and an upper arm section 7. As will be further described in the specification, the insulating sleeve of the instant invention is formed by compression molding, the materials employed may consist of natural and synthetic rubber compounds that meet the American Standards of Testing Materials (ASTM) standard specifications for linenman sleeves, which include characteristics directed to the toughness, hardness, elongation to break, puncture resistance and strength of the material as outlined in ASTM-D1051. Thickness of the material can further be based upon a classification requirement namely: Class 0 products are for working voltages up to 1,000 volts; Class 1 products are for working voltages up to 7,500 volts; Class 2 products are for working voltages up to 17,000 volts; Class 3 products are for working voltages up to 26,500 volts; and Class 4 products are for working voltages up to 36,000 volts. In a preferred embodiment, the materials used may include cis-1,4-polysoprene rubber of natural or synthetic origin or any ozone-resistant elastomer or combination of elastomeric compounds.

[0031] Referring now to FIGS. 2 and 3, the rubber insulating sleeve is produced in a two step process by compression molding wherein a first material is used to form the sleeve inner layer 12 and a second material is used to form the sleeve outer layer 14. The two part process allows for a contrasting color between the inner layer 12 and outer layer 14. The first material is compounded from a rubber with a longer cure/vulcanizing time than the second material. In the preferred embodiment the first material has a longer cure/vulcanizing time and the second material has a shorter cure/vulcanizing time so that when the first material is only partially cured/vulcanized and removed from the tool, the remainder of its cure/vulcanizing time of the first material matches the shorter cure/vulcanizing time of the second material so that the finished product is cured/vulcanized to achieve optimal properties at the same time. Thus, the first material and second material can be of the same type, with different vulcanizing time. Alternatively, the first material can be of one type of rubber and the material of another type of material, again with a different vulcanizing time. In this embodiment, the formation of the sleeve is performed by using a multi-piece tool as follows:

[0032] 1. The compression molding tool has a center core 19 around which the sleeve is formed which can be performed
in either one or two parts in order to accommodate the natural elbow curve which is preferred by users. The top and bottom of the tool form the outer surface of the sleeve. There are two inserts which fit over the top and bottom parts to make the interior cavity smaller for the first step in the process.

2. For the first step in the process, the inserts are affixed to the top and bottom to form the inner layer of the sleeve to make the identifying color layer. A first raw material is placed in the tool positioned to cover the insert on the bottom of the tool, then the core is placed in position, then more of the first raw material is placed to cover the core. The tool is closed and heated under pressure so that the full inner layer of the sleeve is formed but only partially vulcanized.

3. For the second step in the process, the partially vulcanized sleeve, still affixed to the core, is temporarily removed from the tool. Then the inserts are removed (FIGS. 4 and 5). The second raw material is placed in the bottom of the tool and then the partially vulcanized sleeve, still on the core, is placed in position over the bottom layer of a second raw material. More of the second raw material is placed over the top of the partially vulcanized sleeve when the tool is closed, the second raw material will fill the void between the partially vulcanized sleeve and top and bottom. The tool is heated under pressure so that both raw materials complete their vulcanizing at the same time and the second raw material takes the form of the outer shape and design of the finished product.

After the prescribed time for vulcanizing the rubber material (both the first and second raw materials achieve ideal vulcanization at the same time), the tool is opened and the part removed. Then the interior core parts are removed leaving the finished sleeve, ready for trimming.

After the sleeve cools, excess rubber is trimmed from the edges and the sleeve is visually inspected and electrically tested to assure compliance with relevant specifications.

It is to be understood that while a certain form of the invention is illustrated, it is not to be limited to the specific form or arrangement herein described and shown. It will be apparent to those skilled in the art that various changes may be made without departing from the scope of the invention and the invention is not to be considered limited to what is shown and described in the specification and any drawings/figures included herein.

One skilled in the art will readily appreciate that the present invention is well adapted to carry out the objectives and obtain the ends and advantages mentioned, as well as those inherent therein. The embodiments, methods, procedures and techniques described herein are presently representative of the preferred embodiments and are intended to be exemplary and not intended as limitations on the scope. Changes therein and other uses will occur to those skilled in the art which are encompassed within the spirit of the invention and are defined by the scope of the appended claims. Although the invention has been described in connection with specific preferred embodiments, it should be understood that the invention as claimed should not be unduly limited to such specific embodiments. Indeed, various modifications of the described modes for carrying out the invention which are obvious to those skilled in the art are intended to be within the scope of the following claims.

What is claimed is:

1. A bi-color insulating sleeve formed from a compression molding tool having a center core, a top and a bottom, and two inserts from the step of:
   affixing said inserts to said top and said bottom for the purpose of forming the inner layer of the sleeve, covering the insert on the bottom of the tool with a first material having a first color, covering the center core of the tool with said first material, closing the tool and applying heat and pressure to form an inner layer of the sleeve, said inner layer only partially vulcanized, opening the tool and removing said center core with said partially vulcanized sleeve attached thereto, removing said inserts from the opened tool, placing a second material having a second color in said bottom of the open tool, reinstalling said center core with said partially vulcanized sleeve attached thereto, placing said second material over the top of said center core with said partially vulcanized sleeve attached thereto, closing the tool forcing said second material to fill the void between said partially vulcanized sleeve and said top and bottom of said tool, and
applying heat and pressure to said tool so that said partially vulcanized sleeve and said second material fully vulcanize at the same time, said second material forming an outer layer and taking the form of the outer shape of the insulating sleeve wherein a compromise in the safety of said sleeve is identified when the inner layer can be seen through the outer layer.

2. The insulating sleeve according to claim 1 wherein said center core is two pieces allowing a sharper elbow curve.

3. The insulating sleeve according to claim 1 wherein said top and said bottom form an outer surface of the sleeve.

4. The insulating sleeve according to claim 1 wherein said inserts fit over the top and bottom to form a smaller interior cavity.

5. The insulating sleeve according to claim 1 wherein said inner layer of said sleeve is an identifying color layer.

6. The insulating sleeve according to claim 1 wherein said first material has a first vulcanization time and said second material has a second vulcanization time.

7. The insulating sleeve according to claim 1 wherein said first and second material are selected from the group of cis-1,4-polyisoprene rubber or any ozone-resistant elastomer or combination of elastomeric compounds.

8. A bi-color insulating sleeve formed from two compression molding tools having a top and a bottom with one set having a smaller interior cavity than the other, from the step of:

inserting a first material having a first color to cover the bottom of the tool,
placing the core in the tool,
covering the core of the tool with said first material,
closing the tool and applying heat and pressure to form an inner layer of the sleeve, said inner layer only partially vulcanized,

opening the tool and removing said core with said partially vulcanized sleeve attached thereto,
placing a second material having a second color in said bottom of the second tool,
reinstalling said core with said partially vulcanized sleeve attached thereto,
placing said second material over the top of said core with said partially vulcanized sleeve attached thereto,
closing the second tool forcing said second material to fill the void between said partially vulcanized sleeve and said top and bottom of said tool, and
applying heat and pressure to said second tool so that said partially vulcanized sleeve and said second material vulcanize at the same time, said second material forming an outer layer and taking the form of the outer shape of the insulating sleeve wherein a compromise in the safety of said sleeve is identified when the inner layer can be seen through the outer layer.

9. The insulating sleeve according to claim 8 wherein said core is two pieces allowing a sharper elbow curve.

10. The insulating sleeve according to claim 8 wherein said top and said bottom form an outer surface of the sleeve.

11. The insulating sleeve according to claim 8 wherein said inner layer of said sleeve is an identifying color layer.

12. The insulating sleeve according to claim 8 wherein said first material has a first vulcanization cure time and said second material has a second vulcanization cure time.

13. The insulating sleeve according to claim 12 wherein said first vulcanization cure time is longer than said second vulcanization cure time.

14. The insulating sleeve according to claim 8 wherein said first and second material are selected from the group of cis-1,4-polyisoprene rubber or any ozone-resistant elastomer or combination of elastomeric compounds.