Sept. 8, 1936. W. E. BOYLE 2,053,811

PROCESS FOR PRODUCING ABRASION RESISTING GUARDS

Original Filed July 30, 1932 2 Sheets-Sheet 1

Fig. 1.

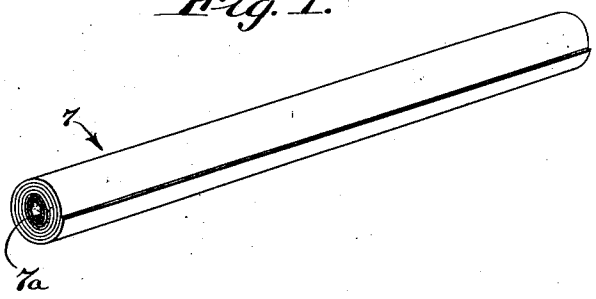
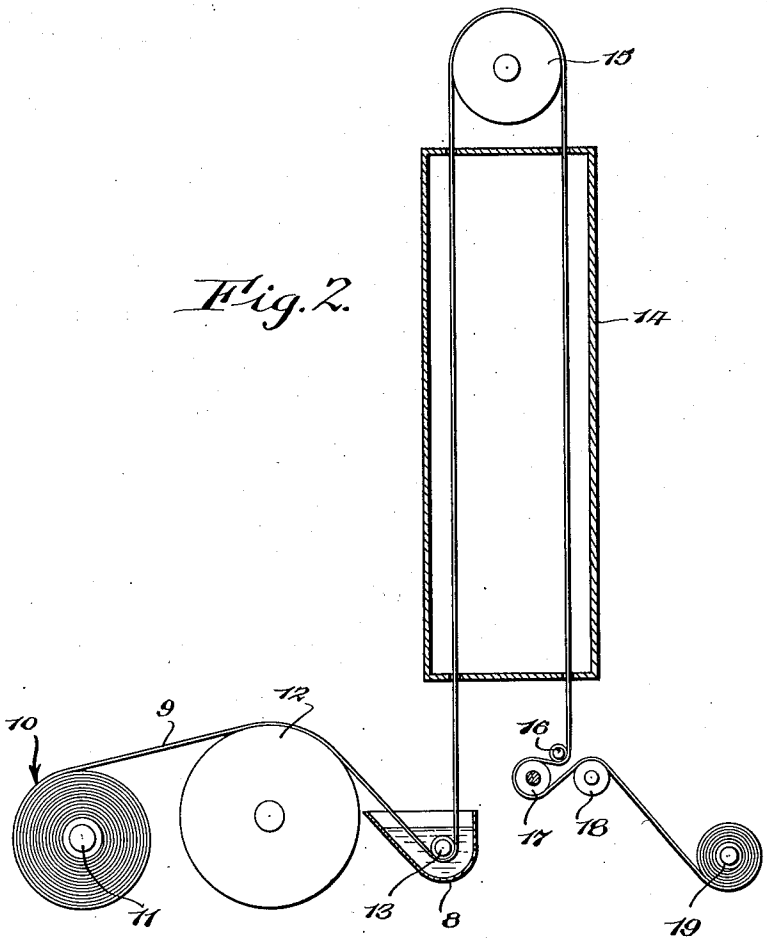


Fig. 2.



INVENTOR
William E. Boyle
BY
Popp and Powers
ATTORNEYS

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Original Filed July 30, 193½ 2 Sheets-Sheet 2

Fig. 3.

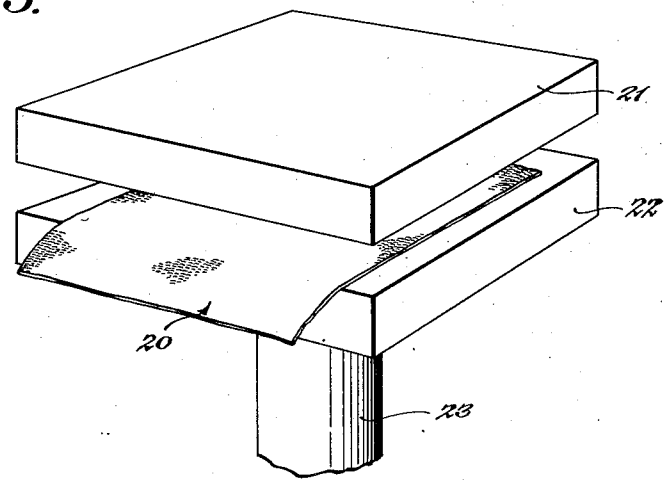
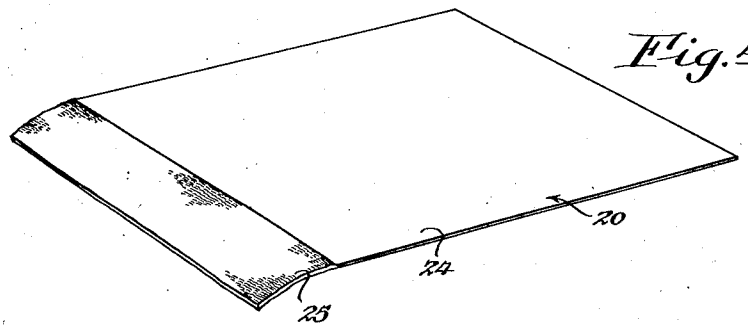


Fig. 4.



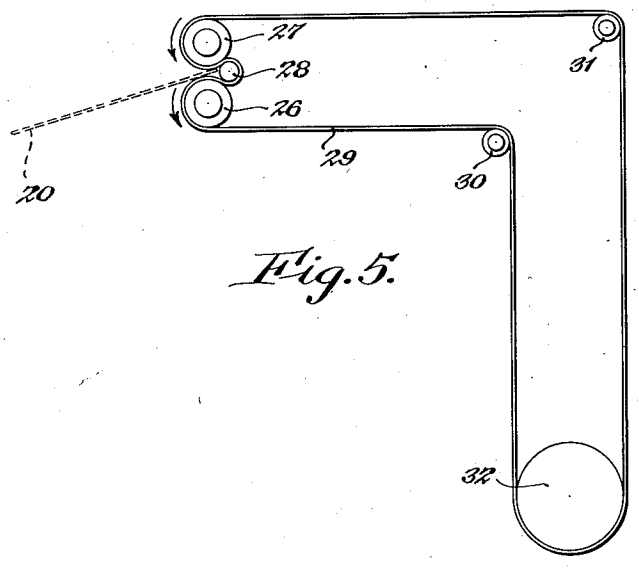


Fig. 5.

INVENTOR
William E. Boyle
BY
Popp and Powers
ATTORNEYS

Patented Sept. 8, 1936

2,053,811

UNITED STATES PATENT OFFICE

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PROCESS FOR PRODUCING ABRASION RESISTING GUARDS

William E. Boyle, Madison, N. J., assignor to Spaulding Fibre Co. Inc., Tonawanda, N. Y., a corporation of New Hampshire

Original application July 30, 1932, Serial No. 626,977. Divided and this application July 26, 1933, Serial No. 682,307

5 Claims. (Cl. 18—56)

This invention relates to the manufacture of abrasion resisting guards which are suitable as protective shields for electrical conductors and the like, the present application being a division of my co-pending application, Serial No. 626,977, filed July 30, 1932, and covering the method disclosed therein.

As noted in my said co-pending application injury to the electrical conductors and service interruptions are often caused by tree branches in the vicinity of the conductors, the branches rubbing against the conductors as they move in the wind and wearing away the insulating covering of the conductors, if they are insulated, or intermittently grounding the conductors if they are bare. Guards produced in accordance with the invention are of particular utility when employed in connection with such conductors, the guards being adapted to protect the conductors against abrasion and at the same time providing additional insulation at the points of application.

One object of the invention is a novel method of producing abrasion resisting guards of the kind generally described.

A further object is to provide a guard which has high dielectric and abrasion resisting characteristics.

A still further object is to provide a guard which is applicable to conductors of various diameters whether they be bare or insulated, this object contemplating a guard which, when it is applied automatically contracts around the conductor and firmly engages it.

A still further object is to provide a guard which may be applied with facility.

A still further object is to provide a guard which is light in weight and which is so designed that the diameter of the conductor will not be increased to an objectionable degree at the point where it is applied.

Apparatus for practicing the invention is illustrated in the accompanying drawings, in which:

Figure 1 is a perspective view of an abrasion resisting guard produced in accordance with the invention.

Figure 2 is a diagrammatic view of equipment for impregnating and drying the material from which the guards are formed.

Figure 3 is a fragmentary perspective view of equipment for curing the sheets from which the guards are formed.

Figure 4 is a perspective view of a prepared sheet showing the location of the cured and uncured zones.

Figure 5 is a diagrammatic view of equipment for rolling the sheets to form the guards.

A guard of the kind covered by my said co-pending application is indicated generally at 7 in Figure 1. The said guard is of tubular shape and is formed from a spirally wound sheet of material. The internal diameter of the guard is predetermined with reference to the diameter of the conductor for which it is designed. Preferably the internal diameter of the guard is slightly less than the diameter of the conductor. The various convolutions of the sheet from which the guard is formed tend to retain their shape. Thus, while the guard can be unrolled to enable its application to a conductor it will, when released, automatically contract around, and firmly engage, the conductor as it returns, or attempts to return, to its original shape. In order that the guard will be held in the position in which it is arranged upon the conductor the inner convolution 7a thereof is preferably treated so that it will cling to the conductor. In the embodiment illustrated, the frictional engagement between the guard and the conductor is increased by providing the inner convolution with a rough surface.

The base material from which the guard is formed is preferably a fabric such as, for example, duck, jute, paper or the like. It is impregnated with a binder, preferably a phenol-formaldehyde condensation product, which may, for example, consist of a resin such as "Bakelite", or any other suitable synthetic resin. If desired, the binder may include a filler of suitable bituminous matter or a lubricating ingredient such as graphite. The binder is applied to the base material while in a liquid state, this being conveniently effected by passing the material through a liquid bath of the binder. After the application of the binder the impregnated material is dried. The binder is then cured by the application of heat and pressure to the material. After the resin is cured, and while it is still hot, the material is rolled into a tube of the desired dimensions and is held in such shape while it cools. As the binder cools it hardens. Hence when cool the guard will not only retain its tubular shape but when unrolled and released will also return to such shape.

The binder, when cured, provides the material from which the guard is formed with a hard smooth surface which is highly resistive to an abrading action. The binder, when dry and uncured, however, imparts a rough surface to the base material. Hence by permitting that part

of the material which is to provide the inner convolution of the guard to escape the curing operation the said convolution will retain its rough surface and will, therefore, adhere to the object upon which the guard is arranged.

The apparatus for carrying out the process may be of any well known construction. As illustrated, it includes a trough-like receptacle **8** (Figure 2) in which a bath of a suitable binder is maintained, for example, a 40 to 50 per cent phenol-formaldehyde resin. The base material is preferably in the form of a continuous strip **9** and it may, for example, consist of eight ounce duck. A roll **10** of the material is carried upon a shaft **11**. As it unwinds the material passes over a drum **12** and down into the receptacle **8** beneath a roller-like weight **13** which is immersed in the liquid binder. As the material emerges from the receptacle **8** it is directed through a drier **14** which is heated in any suitable manner. It emerges from the drier, passes over an idler roller **15** and returns through the drier beneath a guide roll **16** to a drive roll **17**. The material passes beneath the latter and over a guide roll **18** to a roll **19**, upon which it is wound upon completion of the drying operation.

It will be apparent that the material is impregnated with the binder as it passes through the receptacle **8**. Thereafter it is dried and wound upon the roll **19**, it being understood that the speed of the drive roll **17** may be suitably regulated so that the material is dried to the extent desired.

The material is preferably cured in the individual sheets from which the guards are to be formed. The material taken from the winding roll **19** is, therefore, divided into individual sheets of a length determined by the size of the guards to be produced.

Equipment suitable for curing the sheets is illustrated in Figure 3 in which an individual sheet is indicated generally at **20**. The said equipment includes upper and lower platens **21** and **22** respectively. The upper platen is fixed while the lower platen is movably mounted upon a plunger **23**, it being understood that both of the platens are heated in any suitable manner. The sheet **20** is arranged upon the lower platen **22** as indicated, that portion of the sheet which is to constitute the inner convolution of the guard being arranged so that it overhangs the lower platen. Power is then applied to the lower platen through the agency of the plunger **23** and that portion of the sheet which is arranged between the platens is subjected to a high pressure. At the same time the platens heat the engaged portion of the sheet and the binder with which that portion of the sheet is impregnated is cured. The sheet which is then removed from between the platens includes a main zone **24** (Figure 4) in which the binder is cured and a supplemental zone **25** in which the binder is uncured, that is to say, is in the same condition that it was upon emerging from the drier **14**. In the curing operation the surface of the main zone **20** is rendered smooth while the surface of the supplemental zone **25** remains in the roughened condition in which it was upon leaving the drier.

While still hot from the curing operation, the sheet is formed into a tube of the required dimensions. Equipment for this purpose is illustrated in Figure 5 and includes a pair of co-operating rolls **26** and **27**, the former being driven in the direction indicated by the arrow in any suitable manner. A mandrel **28** is located behind the opening between the two rolls. The rolls and mandrel are connected by a belt **29** which is driven from the roll **26**, the said belt passing in front of the roll **26**, in back of the mandrel and in front of the roll **27**. The two runs of the belt pass over suitable idler rolls **30** and **31**, the proper tension being maintained upon the belt by a take-up roll **32**. In the use of the equipment the sheet of material **20** is introduced into the opening between the rolls **26** and **27** and is caused to be engaged between the belt **29** and the mandrel **28**, the sheet preferably being handled so that the uncured zone is the last part to enter the rolls. As the sheet is engaged by the belt and mandrel it is pulled through the opening between the rolls **26** and **27** and is wound tightly upon the mandrel, the outer convolution of the tube thus provided being formed from the uncured zone **25**.

The tube is preferably maintained in a tightly rolled condition until it has cooled. This may be effected in any suitable manner. For example, a sheet of paper may be run in between the rolls **26** and **27** behind the sheet **20***a*, whereby to form a paper wrapper around the tube. The ends of the wrapper may be twisted to hold the wrapper upon the tube and prevent the tube from unwinding. The tube and mandrel may then be removed as a unit from between the rolls **26** and **27** by loosening the belt **29**. This may be effected by raising the take-up roller **32**, it being understood that while the belt **29** is loose the mandrel upon which the succeeding sheet is to be wound may be arranged between the rolls **26** and **27**. After the tube and mandrel are removed from between the said rolls the paper wrapper and mandrel are removed. This may be done either before or after the tube cools, it being understood that in the former instance another wrapper may be wound upon the tube to hold it in shape until cool. When the tube has cooled it will retain its shape. It is to be understood that, if preferred, the tube may be initially wound so that the rough zone **25** provides the inner convolution of the tube (see Figure 1), the said zone in this case constituting the leading end of the sheet as it is introduced between the rolls **26** and **27**.

The formation of the tube in the manner first described, that is to say so that the outer convolution is formed from the rough zone, has the advantage that in the application of the tube it may be rerolled, starting from the rough zone end, directly upon the conductor. When formed so that the rough zone provides the inner convolution, as shown in Fig. 1, the tube is preferably rerolled upon cooling so that the inner convolution will become the outer convolution, whereby to enable application of the tube to a conductor by rerolling it upon the conductor in the manner described.

A guard produced in the manner described will retain its shape and while it can be deformed during its application it will, when released, automatically contract itself around the conductor. The surface of that portion of the guard which is formed from the cured section of the sheet is hard and smooth and is capable of withstanding the rubbing action of a limb or other abrading object over long periods of time. As the dielectric properties of the binder are very high the guard provides additional insulation for that portion of the conductor upon which it is arranged.

It will be apparent that the thickness of the guard can be varied either by varying the number of convolutions or by varying the weight of

the base material. The guard has the advantages that it is light in weight and will not greatly increase the diameter of the conductor at the part where it is applied. The guard is resistant to the action of water, chemicals, heat, oil, light and fire and it will remain in position without the aid of auxiliary clamping means.

I claim as my invention:

1. The method of producing an abrasion resisting guard for an electrical conductor which consists in impregnating a fabric base material with a binder, drying the impregnated material, curing all of the binder with the exception of that within a predetermined zone by the application of heat and pressure to the impregnated material and forming the material into its final shape while hot, the uncured zone providing the guard with a rough surface for direct engagement with the conductor.

2. The method of producing an abrasion resisting guard for an electrical conductor which consists in impregnating a fabric base material with a binder, drying the impregnated material, curing all of the binder with the exception of that within a predetermined zone by the application of heat and pressure to the impregnated material, forming the material into final shape while hot and holding it in such shape while it cools, the uncured zone providing the guard with a rough surface for direct engagement with the conductor.

3. The method of producing an abrasion resisting guard for an electrical conductor which consists in impregnating a fabric base material with a phenol-formaldehyde resin, curing all of the resin with the exception of that within a predetermined zone by the application of heat and pressure to the impregnated material and forming the material into its final shape while hot, the uncured zone providing the guard with a rough surface for direct engagement with the conductor.

4. The method of producing an abrasion resisting guard for an electrical conductor which consists in impregnating a fabric base material with a phenol-formaldehyde resin, drying the impregnated material, curing all of the resin with the exception of that within a predetermined zone by the application of heat and pressure to the impregnated material and forming the material into its final shape while hot, the uncured zone providing the guard with a rough surface for direct engagement with the conductor.

5. The method of producing an abrasion resisting guard for an electrical conductor which consists in impregnating a fabric base material with a phenol-formaldehyde resin, drying the impregnated material, curing all of the resin with the exception of that within a predetermined zone by the application of heat and pressure to the impregnated material, forming the material into its final shape while hot and holding it in such shape while it cools, the uncured zone providing the guard with a rough surface for direct engagement with the conductor.

WILLIAM E. BOYLE.