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METHOD FOR FORMING A PELLICLE INTO ROLL FORM SUBSTANTIALLY FREE OF ELECTROSTATIC CHARGES ON THE SURFACE THEREOF

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FIG. 1

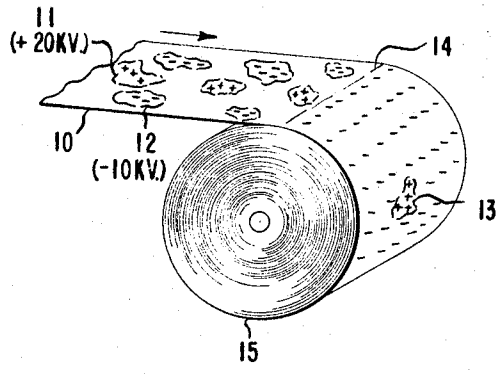
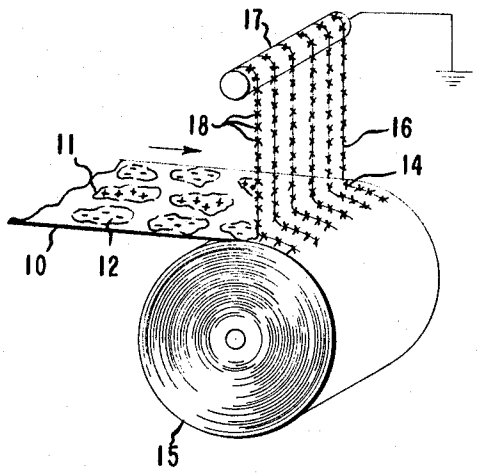



FIG. 2





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# METHOD FOR FORMING A PELLICLE INTO ROLL FORM SUBSTANTIALLY FREE OF ELECTROSTATIC CHARGES ON THE SURFACE THEREOF

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The present invention relates to a method for reducing the electrostatic charges on pellicles of synthetic organic polymeric material, and more particularly is directed to improvements in and relating to a method for removing or reducing the level of electrostatic charges on pellicles of synthetic organic polymeric material during winding said pelliciles into roll form.

A serious problem attaching to the production and handling of pellicles of synthetic organic polymeric material is that regarding electrostatic charges that accumulate on the surfaces of the pellicle. It is well known, for instance that many pellicle manufacturing and handling operations such as, for example, guiding, slitting and the like, cause electrostatic charges to accumulate on the surfaces thereof. The electrostatic charges that accumulate on the pellicle surfaces are undesirable because, inter alia, they attract dust and other particles leading to contamination of the pellicle surfaces, are the source of sparks and painful shocks to personnel handling the pellicles and produce electrostatic patterns on the pellicle surface which adversely affect the coating thereof with coating compositions. Attempts have been made to remove or reduce the level of electrostatic charges on a pellicle during the production and handling thereof, such as contacting the pellicle with strands of conductive material at random points along its path of travel in the course of its manufacture and handling. Although such attempts have perhaps effected some improvement, they are largely inadequate and fail to provide a satisfactory solution to the problem of electrostatic charges on pellicle surfaces because they cope with essentially only limited sources thereof. The type of random discharge procedure mentioned above cannot effectively remove all of the accumulated electrostatic charges, and passage of the pellicle over or near grounded bodies will cause uncontrolled discharging resulting in randomly charged areas on the surface of the pellicle.

It has now been found that a major source or cause, among the various sources or causes, of electrostatic charges on pellicle surfaces is that due to winding of the pellicle into roll form. That is, winding a pellicle into roll form produces an electrostatic charge on the roll surface of uniform polarity and over a relatively narrow but high voltage range at about the point in the winding operation where the pellicle falls into close contact with the preceding layer on the roll. For intsance, pellicles of, for example, polyethylene, polypropylene, polyethylene terphethlate, although neutral or substantially neutral before winding, acquire electrostatic charges of from 20 to 30 kilovolts (kv.) upon being wound into roll form. It is, therefore, the principal object of the present invention to provide a method of removing or reducing the level of electrostatic charges on pellicles of synthetic organic polymeric material especially during the winding thereof into roll form.

According to the present invention, there is provided a method for forming a pellicle into roll form substantially free of electrostatic charges on the surface thereof which comprises winding said pellicle and contacting the surface of said pellicle across the width thereof at about the point at which said pellicle first contacts said roll thereof with electrically grounded conductive strands.



The nature and advantages of the invention will be more clearly understood by the following description, the appended claims, and the several views illustrated in the accompanying drawings wherein like reference characters refer to the same parts throughout the several views and in which:

FIGURE 1 shows in a general manner the nature of electrostatic charges on the surface of a pellicle before, during, and after winding into roll form;

FIGURE 2 shows the manner of practicing the present invention.

Electrostatically charged areas randomly located on the surface of a pellicle are illustrated in FIGURE 1. The charged areas are effectively shown on the surface of the pellicle by depositing electroscopic powders thereon. A particular powder of this type may be readily charged to assume a single polarity, either positive or negative, and if brought into contact with a charged body, such as a pellicle, will cling to the body tenaciously. The powder may be dyed according to polarity, e.g. red being positive and green being negative, the powder patterns will show up the charged areas on the pellicle according to polarity. FIGURE 1 shows a pellicle **10** having positively charged areas **11** and negatively charged areas **12** randomly distributed on the surface thereof. After winding the pellicle into roll form, the random distribution of polarity of the charged areas is largely overshadowed by the uniform charge effected by winding the pellicle, but the potential of some areas **13** may be so high that occasionally some such isolated areas of polarity may remain on the surface of the pellicle. The potential of these areas may be measured and this is most effectively done before dusting the pellicle with electroscopic powder which causes partial dispole formation and apparent reduction of charge. Typical voltages measured by a Kiethly model 250 electrometer are shown enclosed in parenthesis on FIGURE 1. During winding of the pellicle into roll form substantially uniform charging of the surface thereof occurs at about line **14** in FIGURE 1. It is to be understood that the polarities shown in the figures are arbitrarily selected for illustrative purposes only.

FIGURE 2 illustrates an embodiment of the essential features of mechanical means effective for removing the electrostatic charge resulting from winding pellicle **10**, as well as removing the random residual charges, to provide a roll of uniformly low electrostatic charge or substantially no electrostatic charge in accordance with the present invention. Pellicle **10** is wound into roll form **15** by suitable mechanical means including a motor driven mandrel, not shown. Electrically conductive strands **16** such as tinsel are secured at one end to electrically grounded bar **17**; the other or free end of electrically conductive strands **16** contact the surface of pellicle **10**. The electrically conductive strands **16** must be no more than about two inches apart, preferably separated by a distance approximately equal to their diameter, since spacing the strands more than about two inches apart is not conducive to efficient operation. Also, the electrically conductive strands **16** must contact the pellicle at least about the tangent line **14** at which point the pellicle is wound onto the roll. Preferably, the strands **16** should drag on the surface of the roll for a short distance. The electrically conductive strand is preferably metal tinsel preferably having a plurality of electrically conducting bristles **18** axially spaced thereon and extending radially outwardly therefrom.

The above described association of means are effective for removing the electrostatic charges on the pellicle surface during winding of the pellicle into roll form, especially since providing two discharge paths or mechanisms: (1) induction, i.e., ionization of the air by the very high

electric fields at the points of the conductive strands, and (2) conduction through the strands which are in contact with the web. The continuous contact between the conductive strand and the pellicle, the close proximity of the adjacent strands and the preferred trailing portion of the conductive strands contacting the roll provide a cooperative association of features assuring that the entire surface of the pellicle will come within the distance necessary for the inductive process to be operative. The preferred trailing portion of the conductive strands contacting the roll permits the conductive strands to be attached to or otherwise come in contact with electrostatically charged areas on the surface of the pellicle and the roll having electrical potentials too low to be discharged by the inductive mechanism, so that these areas are discharged by conduction. It is, therefore, preferred that the conductive strands contact and trail or drag on the pellicle after the initial line of contact thereof with the roll.

The effectiveness of and the benefits to be derived from the present invention are illustrated in the following comparison:

A. A polyethylene terephthalate film being wound (at approximately 450 feet/minute) on a mill roll at the end of a production line exhibited electrostatic charges having voltages averaging —10 to —30 kv. on the roll surface.

B. A grouping of tinsel strands having thin copper foil points and individual strands suspended 1¾ inches apart was suspended from an electrically grounded bar so that the strands contacted the film at the line of contact of the film with the winding roll and trailed on the surface of the roll for a short distance, to contact approximately one-half of the width of the winding roll. Measurement of the electrostatic charge on the part of the wound roll surface following the tinsel blanket (with a Kiethly model 250 electrometer equipped with a model 2501 search unit) showed substantially zero charge (occasionally from —2 to +2 kv.), while on the unblanketed portion of the roll the charge remained in the —10 to —30 kv. range.

C. Finished rolls with charges having electrical potentials exceeding 30 kv. have been produced without tinsel, while rolls blanketed with tinsel are consistently lower than about 2 kv.

The feature of removing the electrostatic charge on the pellicle surface with electrically conductive elements along the line where the web contacts the roll, in accordance with the present invention, is effective to remove the electrostatic charge as it is formed and while it is of uniform voltage and polarity, for greater ease of removal, and before adverse uncontrolled discharging can occur. The disposition of the conductive strands at a distance of not more than about two inches apart and at the location of the newly formed electrostatic charge assures that the entire film comes within operative distance for inductive discharge when the film surface charge potential is at a level such that the inductive mechanism is most effective. Furthermore, having the conductive strands spaced sufficiently closely, especially in combination with a trailing portion thereof contacting the surface of the roll, permits conductive discharge of the electrostatic charges that are below the functional range of inductive discharge.

The use of tinsel involves not only functional advantages, but also cost advantages. Functionally, tinsel is a high resistance material, which prevents massive discharge, i.e. large sparks as highly charged areas come near the tinsel, and the multiplicity of points on the tinsel provides the high electric field gradient necessary for inductive discharge.

A further advantage is the low cost and simplicity of installation, and low maintenance cost. No costly control apparatus is required and no hazards from radiation or sparking exist.

What is claimed is:

1. A method for forming a pellicle into roll form substantially free of electrostatic charges on the surface thereof which comprises winding said pellicle and contacting the surface of said pellicle across the width thereof at about the point at which said pellicle first contacts said roll thereof with electrically grounded conductive strands.

2. The method of claim 1 comprising contacting both the surface of said pellicle across the width thereof at about the point at which said pellicle first contacts the rotating roll thereof and the surface of said roll with a plurality of electrically grounded conductive strands spaced no greater than about two inches apart.

3. The method of claim 2 wherein the conductive strands are metal tinsel.

4. A method for forming a pellicle of synthetic organic polymeric material into roll form substantially free of electrostatic charges on the surface thereof which comprises winding said pellicle and contacting the surface of said pellicle across the width thereof at about the point at which said pellicle first contacts said roll thereof with a plurality of electrically grounded conductive strands spaced no greater than about two inches apart.

5. The method of claim 4 wherein the conductive strands are metal tinsel.

6. In the method of forming a pellicle of synthetic organic polymeric material into roll form wherein said pellicle is rotatably wound, the improvement comprising contacting the surface of said pellicle across the width thereof at about the point at which said pellicle first contacts the rotating roll thereof with a plurality of electrically grounded conductive strands spaced no greater than about two inches apart and having a plurality of conductive bristles axially spaced thereon and extending radially outwardly therefrom.

7. The method of claim 6 wherein the conductive strands are metal tinsel.


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