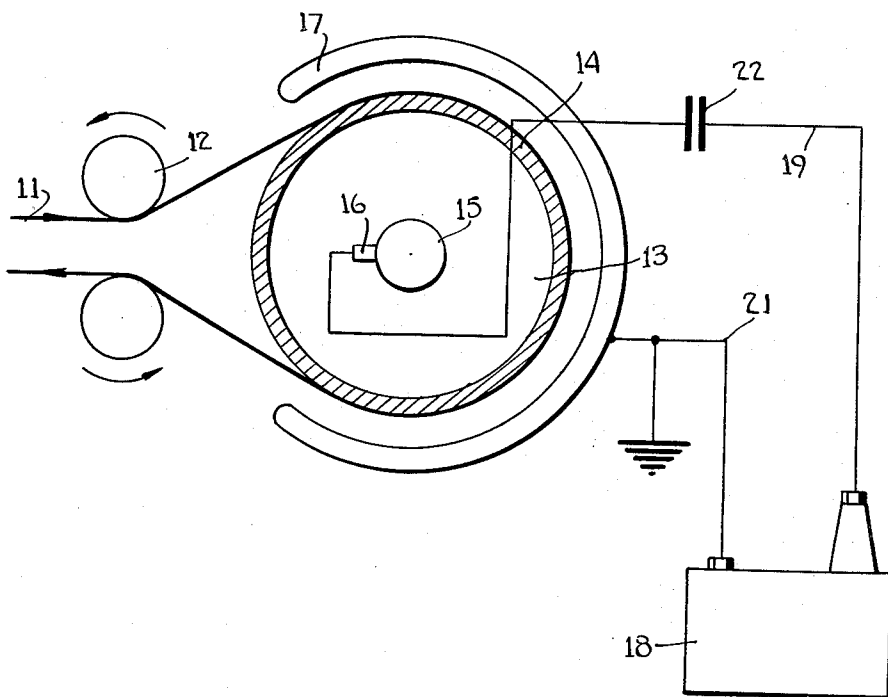


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FILM TREATING APPARATUS

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2,991,360

FILM TREATING APPARATUS

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This invention relates to film treating apparatus and relates more particularly to film treating apparatus for subjecting a film to a high voltage electrical discharge.

It has been previously proposed to improve the printability of polyethylene films by subjecting said films to a high voltage electrical discharge. In a preferred prior process, the film is passed between a pair of electrodes having an extended surface area to which is applied a high alternating potential sufficient to produce a diffuse, corona discharge between the electrodes. When this process is carried out on a normal commercial scale, treating films having a width of many feet and employing large size treating apparatus, it is found that the treatment is not fully uniform, with some areas being insufficiently treated for good printability. To overcome certain of the drawbacks of this prior process, it is possible to increase the treating current employed so that those areas receiving the minimum of treatment will possess adequate printability. However, when this is done many areas of the film will receive excessive treatment with the result that the surface characteristics of the film, including the coefficient of friction, will be altered in an undesirable manner.

It is an important object of this invention to provide a film treating apparatus which will be free from the foregoing and other disadvantages.

A further object of this invention is to provide a film treating apparatus for subjecting a film to a high voltage electrical discharge that will produce a relatively uniform treatment throughout the entire treated area.

Other objects of this invention will be apparent from the following detailed description and claims.

It has now been found that the non-uniformity of treatment of the film results from variations in the treating current flowing through different areas of the treating electrodes because of differing electrical capacities between said areas. These differing capacities are produced primarily by irregularities in the spacing between the electrodes, which irregularities are difficult to eliminate completely since the treating electrodes have areas of many square feet.

According to the present invention, the effect of the differing capacities is materially reduced by effectively inserting a capacitor in series with the treating electrodes. When this is done, the percentage variations of treating current between different areas of the treating electrodes will be appreciably reduced so that the uniformity of treatment of treatment of the film will be improved. Under these conditions, the treating current may be readily adjusted so that all areas of the film will receive adequate treatment to insure printability, yet no areas of the film will be overtreated to such an extent as seriously to impair its properties.

The film treating apparatus of this invention comprises generally a pair of electrodes of extended surface area that are positioned so as to form between them an air gap of substantially uniform thickness. For example, the electrodes may comprise a pair of flat plates positioned parallel to one another and to which a high alternating potential is applied. The electrodes may also comprise a drum having a stator spaced from and concentric therewith. The film being treated is passed between the electrodes, spaced from the electrodes when

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both surfaces of the film are to be treated to improve its printability or in contact with one of the electrodes when only one surface of the film is to be treated. There may also be positioned between the electrodes a sheet of dielectric material to prevent an arc-over and damage to the film being treated in the event that said film has pinholes or other weak spots therein.

A suitable source of high alternating potential is applied to the electrodes to produce a corona discharge therebetween. A capacitor is positioned effectively in series with the treating electrodes and acts to make more uniform the distribution of the treating current between the electrodes. The capacitor may be placed directly in series with the treating electrodes. Alternatively, the capacitor may be placed in series with the primary or low voltage winding of the high-voltage transformer employed to supply the high alternating potential to the treating electrodes. When a capacitor having a capacitance C is placed in series with the primary winding, it is equivalent to placing in directly in series with the treating electrodes a capacitor having a capacitance

$$\frac{C}{A^2}$$

where A is the transformer turns ratio. Placing the capacitor in series with the primary or low voltage winding offers the advantage that low voltage capacitors are less expensive and more easily installed than high voltage capacitors.

In general, it is desirable to use as small a series capacitor as possible since this minimizes the influence of differing electrical capacities between differing areas of the treating electrodes and tends to make the film treatment more uniform. However, there is a practical lower limit to the size of the series capacitor since, as the size of this capacitor is reduced, the applied voltage must be raised to obtain the desired treating current.

The drawing shows diagrammatically one embodiment of this invention.

Referring now to the drawing, the reference numeral 11 designates a polyethylene film which is guided by means of a roller 12 onto the surface of a rotating drum 13 covered with a layer of dielectric material 14 and provided with a slip ring 15 and a brush 16 for electrical contact. Concentric with and spaced from the drum 13 is a stator 17. A high alternating potential is applied between the drum 13 and the stator 17 from a suitable source 18 through leads 19 and 21. Connected in the lead 19 in series with the treating electrode is a capacitor 22.

Through the use of this apparatus, it is readily possible to achieve an adequate treatment of all areas of the film for printability without, at the same time, overtreating any of said areas to such an extent as seriously to impair its other characteristics.

The following example is given to illustrate this invention further.

Example

A film treating machine as shown in the drawing having a drum diameter of 36 inches, a drum length of 71 inches, an air gap 0.125 inch thick and a layer of cellulose acetate dielectric 0.02 inch thick has inserted directly in series with the treating electrodes a capacitor having a capacitance of 0.2 microfarad. The uniformity of the treatment of a polyethylene film passing through the apparatus is materially improved.

It is to be understood that the foregoing detailed description is given merely by way of illustration and that many variations may be made therein without departing from the spirit of our invention.

Having described our invention what we desire to secure by Letters Patent is:

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1. Film treating apparatus comprising a pair of spaced electrodes of extended surface area positioned so that the spacing between the electrodes is substantially uniform, means for applying a high alternating potential difference to said electrodes to produce a discharge therebetween, means for passing a film between said electrodes with said electrodes on opposite sides of said film, and a capacitor effectively in series with said electrodes.

2. Film treating apparatus comprising a drum, a stator spaced from and concentric with said drum and forming with said drum a pair of spaced electrodes, means for applying a high alternating potential difference to said electrodes to produce a discharge therebetween, means for passing a film between said electrodes with said electrodes on opposite sides of said film, and a capacitor effectively in series with said electrodes.

3. Film treating apparatus comprising a drum, a stator spaced from and concentric with said drum and forming with said drum a pair of spaced electrodes, a sheet of dielectric material between said electrodes, means for

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producing a diffuse corona discharge between said electrodes and including means for applying a high alternating potential difference to said electrodes, means for passing a film between said electrodes with said electrodes on opposite sides of said film, and a capacitor effectively in series with said electrodes.

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