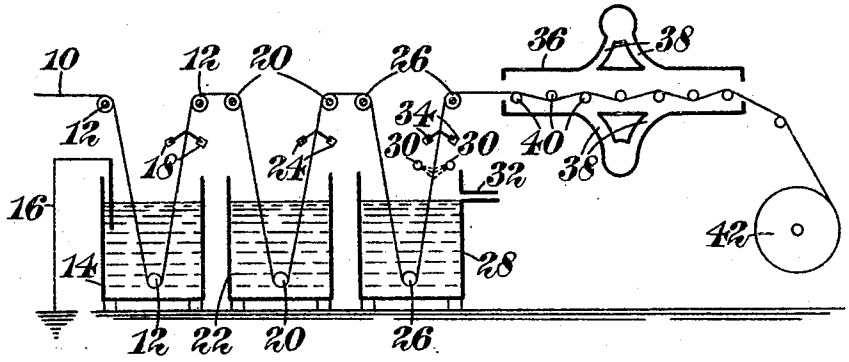
June 23, 1931. H. J. HANDS 1,811,689

MANUFACTURE OF SHEETS OF FILMS

Filed Aug. 20, 1928



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Patented June 23, 1931

1,811,689

UNITED STATES PATENT OFFICE

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MANUFACTURE OF SHEETS OR FILMS

Application filed August 20, 1928, Serial No. 300,932, and in Great Britain August 30, 1927.

This invention relates to the manufacture of sheets of films of compositions containing esters or ethers of cellulose, such as cellulose acetate, by spreading a solution of such composition in a volatile solvent on a surface, drying off the solvent and removing the sheet or film from the surface.

In such manufacture, it is found that the sheet or film after leaving the surface on which it is formed carries an electric charge which is liable to cause sparking and consequent ignition of the vapour of the solvent or other combustible matter in the vicinity.

It is one of the principal objects of the invention to provide methods of and means for removing this electric charge.

According to one feature of the invention, the product, after it leaves the aforesaid surface, is passed through an aqueous bath (preferably an electrolyte) capable of wetting the product, which bath is electrically connected to earth.

Preferably, the bath is one which slightly alters the chemical composition of the surface layers of the product, for example, it reduces an extremely thin layer thereof to cellulose, thereby more effectually removing the electric charge therefrom.

Such a bath may consist of an aqueous solution of a caustic alkali, or of an acid or an acid salt. Preferably, the product is afterwards immersed in a neutralizing bath and is then washed with water and dried by means of hot air.

A further object of the invention is to provide methods of and means for removing the last traces of solvent from the product; this residual solvent being apt to cause cockling or distortion of the product and to impart odour thereto.

According to this further feature of the invention, the product, after it leaves the surface on which it is formed, is passed through an aqueous oxidizing bath, for example, a bath containing hydrogen peroxide.

The treatments for conducting away the electric charge and for removing residual solvent may be effected, if desired, in a single bath having the necessary characteristics.

The invention is particularly advantageous when applied to the treatment of very thin films.

The accompanying drawing illustrates diagrammatically apparatus with which the invention may be carried into effect in the case of film manufacture by applying continuously a solution of the ingredients thereof to an endless travelling band from which the film, substantially dry, is continuously removed.

The film 10 when stripped from the endless band (not shown in the drawing) is passed around rollers 12 in a downwardly-directed loop through a tank 14 containing a solution of caustic soda in water which is electrically connected to earth as indicated at 16. The strength of this solution may vary within wide limits, depending partly upon the time of immersion. For example, the strength may be ½ to 1 per cent. by weight for a time of immersion of about 10 seconds. The caustic soda may, if desired, be dissolved in an oxidizing bath consisting of an aqueous solution of about ½ per cent. by weight of sodium peroxide and ¼ to ½ per cent. by weight of sulphuric acid. In this case the bath is alkaline but contains hydrogen peroxide which it has been found assists in removing the last traces of solvent from the film. Alternatively, the oxidizing bath may be separate from the alkaline bath.

After leaving the tank 14, the film passes between squeegees 18 which remove the bulk of the liquid adhering thereto. It then passes around rollers 20 through a tank 22 containing an acid solution (for example very dilute sulphuric acid, one part of acid to four hundred parts of water) for the purpose of neutralizing the alkali adhering to its surface.

After passing between a second pair of squeegees 24 the film is passed around rollers 26 through a tank 28 containing water. On emerging from the water, the film passes between two pipes 30 supplied with water, and provided with holes through which jets of water are directed upon both sides of the film. The excess of water escapes from the tank through a waste-pipe 32.

The film then passes between a third pair of squeegees 34 and enters a drying chamber 36 supplied with hot air through ducts 38 which enter the drying chamber from above and below. Within the chamber 36 the film passes in a zig-zag manner over and under a series of guide-rollers 40, and is finally wound on a reel 42, or cut into length as desired.

The solution of caustic soda has the property of wetting the surface of the product. It also reacts chemically with it, reducing a very thin surface layer thereof to cellulose. It is believed that this chemical action assists materially in the removal of the electric charge and that it renders the product less liable to acquire and hold a charge after treatment as it is liable to do owing (it is thought) to molecular changes undergone in the process of "ageing". It is advantageous also to add a softening agent such as methylated spirit to the alkaline bath, for the purpose of assisting the aforesaid chemical action. The amount of spirit may be about one-tenth of the total volume of water.

Although it is preferred to employ a caustic alkali, an acid bath may alternatively be used. This may consist of a weak solution of an acid salt, for example, sodium-hydrogen sulphate.

It is within the scope of the invention to employ a wetting and conducting bath which exerts no chemical action on the product, although in general a longer time of immersion is necessary with such a bath. Solutions of sodium chloride or ammonium sulphate or sodium sulphate may, for example, be used.

The invention may advantageously be carried out in conjunction with that described in the specification of our co-pending U. S. Patent application Ser. No. 238,150. In this case, the product is first subjected to the action of moist air or steam and is then passed through the aqueous bath or baths described herein.

When the surface layers of the sheet or film are reduced to cellulose, as hereinbefore described, it is found that gelatine coatings adhere more readily thereto than to the surface of the same material which has not been thus treated.

I claim:—

1. A process of the type described for the manufacture of cellulose acetate films, which consists in spreading in the form of a film on a supporting surface a solution of the cellulosic acetate in a volatile solvent, concentrating the solution by the evaporation of solvent therefrom, and removing the film from the supporting surface aforesaid and passing it through an electrically conducting aqueous bath which is capable of wetting the film and is electrically connected to earth.

2. A process of the type described for the manufacture of cellulose acetate films, which consists in spreading in the form of a film on a supporting surface a solution of the cellulosic acetate in a volatile solvent, concentrating the solution by the evaporation of solvent therefrom, and removing the film from the supporting surface aforesaid and passing it through an electrically conducting aqueous bath which is electrically connected to earth, and is adapted to wet the surface of the film and to alter slightly the chemical composition of its surface layer.

3. A process of the type described for the manufacture of cellulose acetate films, which consists in spreading in the form of a film on a supporting surface a solution of the cellulosic acetate in a volatile solvent, concentrating the solution by the evaporation of solvent therefrom, and removing the film from the supporting surface aforesaid and passing it through an electrically conducting aqueous bath which is electrically connected to earth and is adapted to wet the film and to alter slightly the chemical composition of an extremely thin surface layer by reducing the ester to cellulose.

4. A process of the type described for the manufacture of cellulose acetate films, which consists in spreading in the form of a film on a supporting surface a solution of the cellulosic acetate in a volatile solvent, concentrating the solution by the evaporation of solvent therefrom, and removing the film from the supporting surface aforesaid and passing it through an electrically conducting aqueous bath which is alkaline and is electrically connected to earth.

5. A process of the type described for the manufacture of cellulose acetate films, which consists in spreading in the form of a film on a supporting surface a solution of the cellulosic acetate in a volatile solvent, concentrating the solution by the evaporation of solvent therefrom, and removing the film from the supporting surface aforesaid and passing it through an electrically conducting aqueous bath which is electrically connected to earth and comprises a solution in water of caustic soda.

6. A process of the type described for the manufacture of cellulose acetate films, which consists in spreading in the form of a film on a supporting surface a solution of the cellulosic acetate in a volatile solvent, concentrating the solution by the evaporation of solvent therefrom, and removing the film from the supporting surface aforesaid and passing it through an electrically conducting aqueous bath which is electrically connected to earth and comprises from one-half to one per cent solution by weight of caustic soda in water.

7. A process of the type described for the manufacture of cellulose acetate films, which consists in spreading in the form of a film on a supporting surface a solution of the cellu-

losic acetate in a volatile solvent, concentrating the solution by the evaporation of solvent therefrom, stripping the film from its supporting surface, passing the film through an electrically conducting aqueous bath which is adapted to wet the film and is electrically connected to earth, and treating the film with an aqueous oxidizing solution to remove the last traces of solvent from the film.

8. A process of the type described for the manufacture of cellulose acetate films, which consists in spreading in the form of a film on a supporting surface a solution of the cellulosic acetate in a volatile solvent, concentrating the solution by the evaporation of solvent therefrom, stripping the film from its supporting surface, passing the film through an electrically conducting aqueous bath which is adapted to wet the film and is electrically connected to earth, and thereafter passing the film through an aqueous oxidizing bath containing hydrogen peroxide.

9. A process of the type described for the manufacture of cellulose acetate films, which consists in spreading in the form of a film on a supporting surface a solution of the cellulosic acetate in a volatile solvent, concentrating the solution by the evaporation of solvent therefrom, and removing the film from the supporting surface aforesaid and passing it through an electrically conducting aqueous bath which is electrically connected to earth, is adapted to wet the film and contains a softening agent.

10. A process of the type described for the manufacture of cellulose acetate films, which consists in spreading in the form of a film on a supporting surface a solution of the cellulosic acetate in a volatile solvent, concentrating the solution by the evaporation of solvent therefrom, and removing the film from the supporting surface aforesaid and passing it through an electrically conducting aqueous bath which is electrically connected to earth, is adapted to wet the film, and contains ethyl alcohol.

11. A process of the type described for the manufacture of cellulose acetate films, which consists in spreading in the form of a film on a supporting surface a solution of the cellulosic acetate in a volatile solvent, concentrating the solution by the evaporation of solvent therefrom, removing the film from the supporting surface aforesaid and passing it through an electrically conducting aqueous bath which is electrically connected to earth and comprises a solution in water of caustic alkali, then treating the film in an acid solution in such manner as to neutralize any alkali adhering to its surface, thereafter washing the film with water, and finally drying the film.

12. A process of the type described for the manufacture of cellulose acetate films, which consists in spreading in the form of a film on a supporting surface a solution of the cellulosic acetate in a volatile solvent, concentrating the solution by the evaporation of solvent therefrom, removing the film from the supporting surface aforesaid, and passing it through an electrically conducting aqueous bath which is electrically connected to earth, and comprises a solution of sodium hydrogen sulphate.

In testimony whereof I affix my signature.

HENRY JAMES HANDS.