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MANUFACTURE OF FLEXIBLE SHEET METAL

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This invention relates to the manufacture of flexible sheet material and particularly material adapted or intended for use as film stock or otherwise as a support for photographic material.

It is known that films of cellulose esters are produced from solutions of these esters, in volatile organic solvents with or without softening agents.

The method of producing film stock involves the deposition on to an endless band or carrier of a layer of this solution of the ester and the evaporation of the solvent under the action of heated air.

In the known methods this heated air is conducted in such a way that it flows over the whole upper surface of the solution deposited on to the carrier. This heated air must be constantly kept at a temperature below the boiling point of the solvent otherwise bubbles will be produced during the evaporation of the solvent. This limitation of temperature has the result that the production cannot be carried out with the desired speed, which is an economic drawback.

It is further known that a film must have a certain degree of flexibility, otherwise it does not satisfy all the requirements of for instance a support for photographic material. For the purpose of obtaining this required flexibility, to the solution of cellulose-esters, bodies are added which may function as softening agents; however the addition of these bodies has the disadvantage of diminishing the tensile strength of the film.

The invention helps to diminish appreciably the mentioned disadvantages of the known methods of producing films.

We have found that in producing films from solutions of cellulose-esters in volatile organic solvents, with or without softening agents, unexpectedly favourable results are obtained, if in addition to the heating of the space above the solution layer, to a temperature lower than the boiling point of the solvent, the space immediately beneath the carrier is heated to a temperature appreciably higher than the boiling point.

It is surprising that, although the temperature beneath the carrier is higher than the boiling point, the evaporation of the solvents takes place without forming bubbles in the layer; due to this high temperature the evaporation of the solvents takes place at a quicker rate and it is possible to increase the speed of the production of the film.

It is also surprising that the film produced by the new method possesses a greater flexibility than by the known methods. It follows that the desired flexibility of the film can be obtained with less softening agents and that consequently the tensile strength can be augmented.

The invention therefore comprises the method of forming films from cellulose-ester compositions, which includes the deposition on to a flexible band, of a solution of such ester in volatile organic solvents, with or without softening agents, subjecting the deposited layer to heat, at the upper side at a temperature below the boiling point of the solvent and at the rear side at a temperature appreciably higher than the boiling point.

For supplying heat to the space above the carrier, a continuous stream of heated air can be applied. For supplying heat to the space at the rear side, several types of heating bodies can be used as for instance an arrangement of tubes through which steam or a heated fluid is passed, or rollers which are in contact with the carrier and are therefore kept in movement, or electric heating means.

The following particulars are given by way of example for the purpose of comparing the results obtained in treating particular solutions of cellulose esters by applying heat to the upper side of the film only, and by proceeding in accordance with the invention, that is to say by subjecting the deposited layer to heat at the upper side of the film at a temperature below the boiling point of the solvent and also at the rear side at a temperature appreciably higher than the boiling point of the solvent.

Example 1

Cellulose diacetate was dissolved in acctone (boiling point 56°) and deposited on an endless carrier. The air above the carrier was heated to a maximum temperature of 45° C. for the purpose of avoiding bubbles due to the solvent boiling. The film which was obtained in this manner had a tensile strength of 7.5 kg. per m^2 and an elongation of only 27.7%.

When, however, in accordance with the invention, the air above the carrier was heated to the temperature above indicated and the space beneath the carrier was heated to 80° C. the film obtained gave an elongation of 33.2%.

Example 2

Cellulose triacetate was dissolved in methylene chloride (boiling point 40°) and alcohol. During casting the air above was heated to a maximum temperature of 38° C. The film had a ten-

sile strength of 9.5 kg. and an elongation of 16.6%.

When, however, in accordance with the invention, the space beneath the carrier was in addition heated to 90° C. the film obtained gave an elongation of 25%.

Example 3

Cellulose aceto-butyrate was dissolved in methylene chloride and alcohol. The air above the carrier was heated to a maximum temperature of 38° C. To obtain the required dryness of the film when stripping it from the carrier, the speed of the carrier could not be increased above about 1 metre per minute.

When, in accordance with the invention, the space beneath the carrier is in addition heated to 85° C. the speed of the carrier could be raised to 1.5 metres per minute to secure the same dryness when removing or stripping the film from the carrier.

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