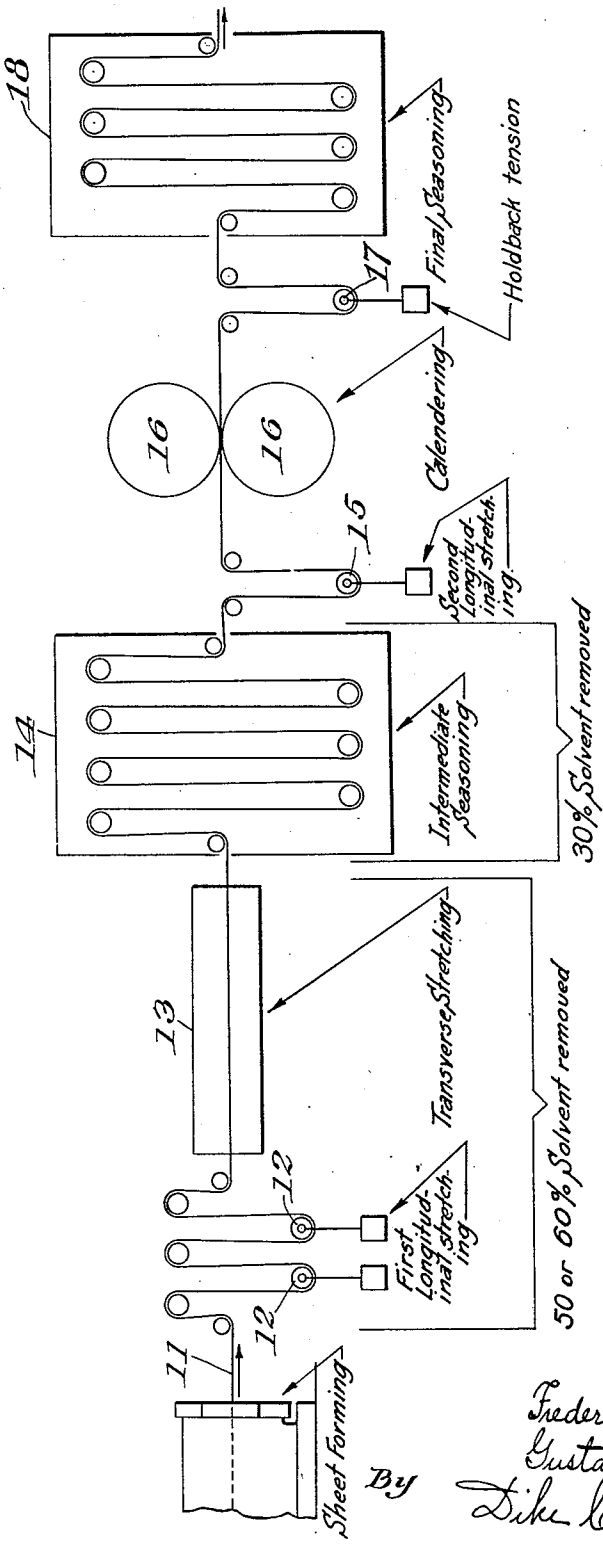
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MANUFACTURE OF THIN SHEETS OF CELLULOSE

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MANUFACTURE OF THIN SHEETS OF CELLULOSE

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6 Claims. (Cl. 18—57)

Our invention relates to the manufacture of thin sheets of cellulose ester plastics, particularly acetate and nitrate such as are used for a great variety of purposes, but especially in manufacture of laminated glass. Our process is primarily an improvement on existing processes for the manufacture of such sheets in the form of a web or continuous strip. It is well known to those skilled in the art that a very slight variation in thickness greatly diminishes the value of the product for use in laminated glass, the greatest permissible variation being only one or two thousandths of an inch. The particular object of the invention is therefore to produce a sheet of more uniform thickness than has heretofore been possible where the sheets are manufactured in web form.

Our invention is based primarily on the discovery that the sheet or web can be rolled or calendered and thus reduced to a sufficiently uniform thickness provided this is done while the sheet is in a partially seasoned condition and especially if it is under heavy longitudinal tension sufficient to give it substantial permanent elongation. In practice we perform the calendering operation as part of the continuous process by which the stock is seasoned.

It will be understood that the stock as it leaves the apparatus which forms it into sheets contains the entire amount of solvent which was included as part of the original mix from which the sheet was made and that all of the solvent must be removed except the small amount which remains in the sheet. This is known as the residual solvent. While it is perhaps possible to calender the web while it contains all or substantially all of the solvent included in the original mix, we have found that the best results are obtained by removing enough of the solvent to increase the tensile strength of the web sufficiently to permit it to be subjected to the heavy longitudinal tension to which it must be subjected during calendering and calender it while in this condition. In practice the amount removed before calendering is in the neighborhood of 75% of the solvent originally included.

Our invention produces stock the variation and thickness of which is well within the limits required as for example in the manufacture of laminated glass and the method is easily practiced.

The invention will be fully understood by reference to the accompanying drawing and the novel features thereof will be pointed out and clearly defined in the claims at the close of this specification.

In the drawing the figure is a diagrammatic view of an apparatus employed for practicing our invention.

Referring to the drawing it will be understood that a mix containing the proper amount of solvent is made and that the material is then formed by any suitable apparatus into a web 11. This webb 11 travels through the machine being subjected to the several treatments to be described and being enclosed in the machine in such a way that it is subjected to the action of a carefully controlled atmosphere. It will also be understood that the solvent is given up as the web passes through the machine. As soon as the web leaves the sheet forming apparatus it is subjected to longitudinal stretching by means of weighted rollers 12 or in any other suitable way. Next the web passes into the apparatus by means of which it is given transverse stretching. This apparatus is indicated at 13 and in practice we employ a tenter for this purpose. In the apparatus in which we practice the invention we remove about 50% or 60% of the original solvent during the progress of the web through the longitudinal stretching apparatus 12 and through the tenter 13, but we find in practice that for the best results still more solvent should be removed before calendering. Accordingly we then pass the web through an intermediate drier 14 by which another 30% of the original solvent is removed reducing the residual solvent to about 15% of the original amount. The removal of the solvent as thus described greatly increases the tensile strength of the web. While we prefer to remove about five sixths of the original solvent before the final stretching and calendering treatment we do not limit ourselves to this amount, since it may vary widely with different mixes and with different kinds of stock, the essential being that enough solvent be removed to increase the tensile strength of the web sufficiently so that it will withstand the heavy stretching to which it is then to be subjected.

The web is then subjected to the second longitudinal stretching by the weighted roll or rollers 15 which are placed immediately in front of the calender rolls 16, 16 so that the sheet is under tension at the time when it is being calendered.

In practice and with stock made of cellulose nitrate containing, for example, about 37% of solvent initially which solvent is reduced to about

5% before calendering and with a web of 0.023" thickness we find that a tension of about twenty pounds per inch of width produces satisfactory results.

The calender rolls for a sheet 27 inches wide of the character described are constructed to apply a pressure of about twenty tons, but the full pressure need not be exerted.

With the web of the character already described and with the longitudinal pull and calendering pressures mentioned we find that an elongation of about 12% takes place during the second longitudinal stretching and the calendering. We have made no particular attempt to ascertain how much of the stretching is produced by the stretching apparatus itself and how much by the calendering.

After the web leaves the rolls 16, 16 it is subjected to a hold back tension by the weighted roll or rollers 17 as it goes to the final seasoning apparatus 18 in which the solvent is reduced to the required extent. Preferably, the rollers 17 are adapted to subject the web to a tension of about 10 to 12 pounds per inch of width of the web or about one half the tension to which the web is subjected on the lead in side of the calender rolls 16 by the rollers 15. The seasoning may, of course, be performed in any suitable manner either by drying or by immersion in a suitable extracting bath.

A sheet or web manufactured as described meets the present commercial requirements for uniformity of gauge and surface finish excellently, and the process adds little or no expense to the cost of manufacture.

We claim:

1. The method of producing a continuous web of cellulose ester plastic of uniform thickness which consists in simultaneously subjecting to longitudinal stretching and calendering a web from which sufficient solvent has been removed to give necessary tensile strength and then seasoning the web.

2. The process of producing a continuous web of cellulose ester plastic of uniform thickness which consists in subjecting a web to initial stretching, removing sufficient solvent to give the necessary tensile strength and then calendering the web while being subjected to a second longitudinal stretching and finally removing the desired amount of remaining solvent.

3. The process of producing a continuous web of cellulose ester plastic of uniform thickness which consists in subjecting the web to initial longitudinal and transverse stretching, removing sufficient solvent to give the necessary tensile strength and then calendering the web while subjected to a second longitudinal stretching and finally removing the desired amount of remaining solvent.

4. The process of producing a continuous web of cellulose ester plastic of uniform thickness which consists in subjecting the web simultaneously to longitudinal stretching and calendering after the major portion of the solvent initially present in the web has been removed.

5. The process of producing a continuous web of cellulose ester plastic of uniform thickness which consists in subjecting the web simultaneously to longitudinal stretching and calendering after the major portion of the solvent initially present in the web has been removed, and subjecting the web to initial stretching before said major portion of solvent has been removed.

6. The process of producing a continuous web of cellulose ester plastic of uniform thickness which consists in subjecting the web simultaneously to longitudinal stretching and calendering after the major portion of the solvent initially present in the web has been removed, and subjecting the web to initial longitudinal and transverse stretching before said major portion of solvent has been removed.

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