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FILM CASTING MACHINE

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8 Claims. (Cl. 18—15)

The present invention relates to an improvement in the curing process of film supports, and more particularly to those supports which are set by coagulation.

One object of the invention is the provision of means for pre-curing the edges of the support to stiffen the latter and thus prevent curling thereof.

Another object of the invention is the provision of an arrangement by which this edge curing is accelerated so that the edges of the support or web becomes set prior to the setting of the body of the support, thus preventing the thinning down of the edges when the web shrinks due to the evaporation of the solvent therefrom.

Still another object of the invention is the provision of an arrangement for precuring the edges of the support so that any tendency of the edges to tear, due to thinning down, is prevented.

A further object of the invention is the provision of an edge curing means which is simple in construction, inexpensive to manufacture and highly effective in use.

To these and other ends, the invention resides in certain improvements and combinations of parts, all as will be hereinafter more fully described, the novel features being pointed out in the claims at the end of the specification.

In the drawing:

Fig. 1 is a diagrammatic sectional elevation of a casting wheel or drum used in the manufacture of film supports, showing the relation thereto of an edge curing means constructed in accordance with the present invention;

Fig. 2 is a sectional view, with parts broken away, taken substantially on the line 2—2 of Fig. 1, showing the arrangement for throttling or restricting the discharge end of one of the edge curing members;

Fig. 3 is a partial plan view of the periphery of the drum taken just below the wheel casing with the latter in section, showing the relation of the edge curing chambers to the casting wheel or drum.

Similar reference numerals throughout the various views indicate the same parts.

In the manufacture of photographic film, a suitable "dope," comprising a cellulose derivative in a volatile solvent or solvent mixture, is applied to the surface of a slowly moving casting wheel or drum. When sufficient solvents have been removed, the dope is stripped off the wheel in the form of a continuous web or strip and constitutes what is known in the art as "film support." The manufacture of certain types of supports, partic-

ularly those used in a motion picture film customarily employs a solution of dope of cellulose nitrate in various forms. Some of these dopes are of a coagulable nature and coagulate in a humid atmosphere.

When such a coagulable dope is flowed onto the surface of a coating wheel and is coagulated by the introduction of steam or high humidity air into the wheel casing, evaporation of solvents takes place along with the setting of the gel. This evaporation of the solvents causes some shrinkage of the film support. The shrinkage which takes place in the crosswise direction gives rise to a pulling effect on that portion of the support which is near the edges of the wheel. The film support, at this stage of the process, is still rather soft and easily stretched. The stretching action tends to lessen the thickness of the support along the edges thereof. This effect is further aggravated by traces of oil left by the leather packing which brushes the edges of the wheel. As the support travels through the various curing sections, the thinned edge tends to curl up on itself, and gives rise to many processing difficulties because of its presence and irregularity. In some cases, this curling continues until the support has become so wrinkled that it will not pass through the air curing section of the machine.

In other cases, the thin edge of the support, being very fragile in the uncured state, is easily torn and the tear when once started may even extend across the entire width of the support, and thus interrupt the curing operation and cause a considerable amount of waste product.

It has been found that this difficulty may be eliminated by accelerating the curing of the edges of the support immediately following deposition of the dope on the casting wheel. If the edges of the support are cured and hardened to a greater degree than the body of the web between the edges, then when shrinkage begins, due to the evaporation of the solvents, the support by means of its greater firmness near the edges is unable to thin down, thus giving rise to the curing effect above described.

This pre-curing of the edges of the support may be accomplished by introducing steam or highly humidified air into a shallow chamber extending along the edges of the wheel adjacent the dope hopper, and projecting over the surface of the freshly coated film support for a short distance, approximately one-half inch. The bottom edges of this chamber extend almost to the surface of the freshly coated support, but do not actually

touch it. In the coating process, the edges of the freshly coated support, immediately after deposition on the wheel, come under the chambers, and are rapidly cured by steam or highly humidified air which is supplied to the chamber at one end thereof. This humid air flows along the edges of the support and in intimate contact therewith and is finally discharged from the opposite end of the chambers. The length which it is necessary to extend these chambers along the edges of the wheel depends on various factors, such as the speed of the coating wheel, as well as the temperature of the moist air or steam which is injected into the chamber. It has been found, however, that satisfactory results can be secured by placing the edge curing chambers adjacent the dope applying hopper, as shown in the drawing, and by making the chambers of a length substantially equal to $\frac{1}{10}$ to $\frac{1}{20}$ of the wheel circumference.

It should be pointed out that the use of excessive amounts of steam or too high a moisture content in the air supplied to these curing chambers will give rise to extremely tight edges, thus causing a creased condition in the center of the web. This, of course, is undesirable and may be avoided by a correction of humidity and the duration of that humidity on the edges of the film support. It has been found that with the edge curing chambers approximately 2 inches square and extending along the periphery of the wheel for the above-described distance, an absolute humidity of about 250 grams of moisture per pound of dry air with a dry bulb temperature of 175 degrees Fahrenheit gives satisfactory results when the wheel is operated at the customary speeds.

The drawing illustrates the preferred embodiment of the present invention, and shows a conventional type of film forming apparatus comprising the casting or coating wheel or drum 11. The wheel assembly is carried by a shaft 12 supported in a bearing 13. A suitable casing 14 surrounds the drum and is provided with moist air inlet 15 and air and solvent outlet 16. Any suitable well known means, not shown, may be provided for heating and humidifying the air supplied to the casing 14 to coagulate the body of the film support 17 on the wheel 11. The film dope is fed to the surface of the wheel 11 from a dope hopper 18, of well-known construction. After sufficient solvents have been removed, the support 17 passes over a stripping roll 19, and is then passed through the various curing sections of the machine, not shown, where the balance of the solvents are removed from the web or strip. The edge curing chambers, generally indicated by the numeral 21 and of the shape best shown in Fig. 1, are positioned adjacent the dope hopper 18, so that the edges 22 of the support 17 will pass under the chambers 21 immediately following the deposition of the dope on the wheel 11. Each chamber 21 is concentric with the periphery of the wheel 11, and is formed of a rigid material, preferably metal, to provide an inverted U-shaped member having a bottom 23, and side walls 24 and 25. The lower end 26 of the side wall 25 extends almost to, but does not touch the freshly coated support, as clearly shown in Fig. 2. The bottom of the chamber 21 is opened so that the humid air in the chambers may actually contact the edges 22 of the film support to quickly coagulate and set the edges, for the reasons pointed out above.

The steam or highly humid air is supplied to

the upper end of each of the chambers 21 through a pipe or conduit 28 which is connected to a suitable source, not shown, of steam or humid air. A portion of the conduit 28 is preferably flexible for reasons to be later described. It is apparent from an inspection of the drawing, that the humid air will contact the edges 22 to set or congeal the latter prior to the setting of the body portion 29 of the web 17 intermediate the edges 22. However, in order to regulate the velocity of the curing medium through each chamber 21, the discharge end thereof is provided with a baffle 30 which restricts or throttles the discharge or outlet 31 of the chamber. If a pressure should build up in the chamber 21, the curing medium may tend to discharge under the side walls 24 and 25, thus prematurely curing the body portion 29 and the web 17 adjacent the chambers 21. To overcome this difficulty, the baffle 30 is preferably made slidable, in any suitable well-known manner, so that the opening 31 may be adjusted to prevent the building up of a pressure in the chambers 21.

As the bottom edge 26 of the side 25 extends almost to the surface of the web 17, see Fig. 2, this edge may become coated with slugs of coagulated dope, which obviously must be removed. To facilitate this removal, the side 25 is preferably made of two parts 32 and 33, which are slidable relative to each other and are operatively connected by a bolt 34. If desired, a gasket 35 may be interposed between the parts 32 and 33 to effect a tight joint therebetween. When the edge 26 is to be cleaned, the bolt 34 is loosened and the part 33 is slid upwardly along the part 32, the bolt 34 moving along a slot 36 formed in the part 32. After cleaning the part 33, it is moved to its operative position, the bolt 34 engaging the bottom of the slot 36 to limit the downward movement of the slidable part 33.

As various widths of web may be formed on the wheel 11, it is desirable to make the chambers 21 adjustable across the face of the wheel, so that the chambers may always overlie the edges 22 of the web, regardless of the width thereof. To this end, the chambers 21 are slidably mounted and supported by a pair of rods 40, which extend across the machine, through the chambers 21, and have the opposite ends thereof secured to the sides 41 of the casing 14, as shown in Figs. 2 and 3. Obviously, one of the rods 40 may be suitably threaded, so that, upon rotation thereof, both chambers 21 may be moved as a unit toward or away from each other to position the chambers over the edges 22 of the web, regardless of the width thereof. However, in order to insure accurate positioning of the chambers, they are preferably separately movable and adjustable. Therefore, each chamber is provided with a threaded rod 42, which extends laterally therefrom and through a threaded opening 43 in the side wall 41 of the casing 14. Thus, when the rods 42 are rotated, each chamber may be separately and independently adjusted. If desired, suitable stops 44 may be provided on the rod 42 to limit the inward movement of the chambers 21. In order to permit this movement of the chambers 21, a portion of the conduit 28 should, obviously, be made flexible.

It is apparent, from the above description, that the present invention provides an arrangement for steaming or pre-curing the edges of a coagulable film support immediately after deposition, so as to stiffen the edges thereof to prevent the thin-

ning down and curling of the edges as the main portion of the web is cured. It is also apparent that this pre-curing of the edges of the support prior to the setting of the main body of the web effectively prevents the pulling in and thinning down of the edges.

While one embodiment of the invention has been disclosed, it is to be understood that the inventive idea may be carried out in a number of ways. This application is, therefore, not to be limited to the precise details described, but is intended to cover all variations and modifications thereof falling within the spirit of the invention or the scope of the appended claims.

I claim:

1. In an apparatus for the manufacture of a continuous web from a coagulable dope, the combination with a rotary wheel on which the dope is cast to form the web, of means for casting the dope on said wheel, and a shallow bottomless chamber positioned to extend along an edge of said web adjacent the surface thereof and adapted to receive high humidity air and to conduct the latter along said surface and in intimate contact therewith to cure said edge only.

2. In an apparatus for the manufacture of a continuous web from a coagulable dope, the combination with a rotary wheel on which the dope is cast to form the web, of means for casting the dope on said wheel, and a chamber adjacent said casting means and extending along a portion of the periphery of said wheel and overlying an edge only of said web for applying a high humidity coagulating medium directly to said edge to pre-cure the latter.

3. In an apparatus for the manufacture of a continuous web from a coagulable dope, the combination with a rotary wheel on which the dope is cast to form the web, of means for casting the dope on said wheel, and an inverted U-shaped chamber arranged along and adjacent an edge only of said web and adapted to receive and apply directly to said edge a coagulating medium for setting said edge only.

4. In an apparatus for the manufacture of a continuous web from a coagulable dope, the combination with a rotary wheel on which the dope is cast to form the web, of means for casting the dope on said wheel, an open end chamber positioned along an edge of said web to apply a co-

agulating medium thereto to cure said edge, and means for throttling the discharge of said chamber.

5. In an apparatus for the manufacture of a continuous web from a coagulable dope, the combination with a rotary wheel on which the dope is cast to form a web, of means for casting the dope on said wheel, an inverted U-shaped chamber positioned adjacent said casting means and extending along a portion of the periphery of said drum and overlying an edge only of said web for applying high humidity and high temperature air to said edge to cure the latter, and means for restricting the discharge of said air from said chamber.

6. In an apparatus for the manufacture of a continuous web from a coagulable dope, the combination with a rotary wheel on which the dope is cast to form the web, of means for casting the dope on said wheel, an open chamber positioned along an edge only of said web to apply a high humidity coagulating medium directly to said edge to cure the latter, and means for adjusting said chamber across the face of said drum.

7. In an apparatus for the manufacture of a continuous web from a coagulable dope, the combination with a rotary wheel on which the dope is cast to form the web, of means for casting the dope on said wheel, a casing for conducting moist air along said web to congeal the latter, and an inverted U-shaped chamber positioned along an edge only of said web and adapted to apply high humidity and high temperature air directly to said edge to pre-cure and stiffen said edge.

8. In an apparatus for the manufacture of a continuous web from a coagulable dope, the combination with a rotary wheel on which the dope is cast to form the web, of means for casting the dope on said wheel, a casing for conducting moist air along said web to congeal the latter, an inverted U-shaped chamber positioned adjacent said casting means and along an edge only of said web and adapted to apply high humidity and high temperature air directly to said edge to pre-cure and stiffen said edge, means on said chamber for controlling the pressure of said air therein, and means for adjusting said chamber relative to said drum.

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