Aug. 19, 1941. E. R. CLEARMAN 2,253,060

COATING APPARATUS

Filed Dec. 16, 1939

FIG. 1.

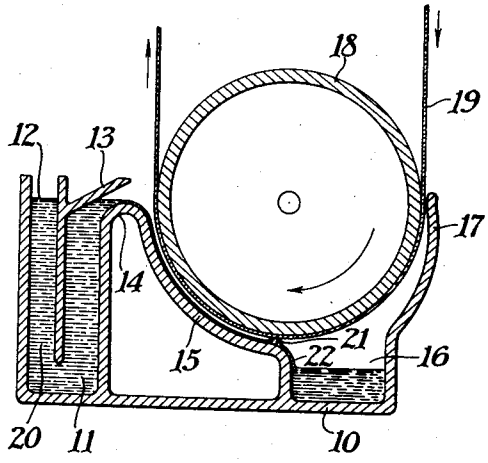


FIG. 2.

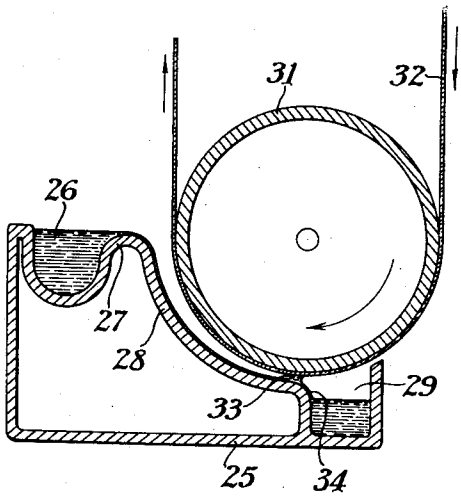
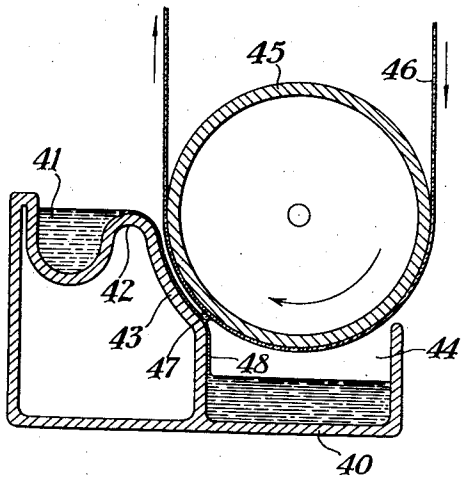


FIG. 3.



EUGENE R. CLEARMAN
INVENTOR

N. M. Perrins

BY Daniel S. Mayo

ATTORNEYS

Patented Aug. 19, 1941 2,253,060

UNITED STATES PATENT OFFICE

2,253,060

COATING APPARATUS

Eugene R. Clearman, Rochester, N. Y., assignor to Eastman Kodak Company, Rochester, N. Y., a corporation of New Jersey

Application December 16, 1939, Serial No. 309,641

4 Claims. (Cl. 91—10)

This invention relates to apparatus for coating sheets and films, and more particularly to apparatus for continuously and uniformly coating a thin coating on photographic film base; or other types of strip material such as flexible cellulose ester sheeting which may be employed for decorative purposes.

In continuously coating strip material and especially when coating subbing or other layers on photographic film base various difficulties are experienced depending considerably on the type of coating apparatus employed. A common type of coating device is that in which the sheet is passed across a rotating roll which transfers the subbing solution from a supply in a pan to the sheet. An outstanding difficulty with the usual type of pan for subbing applications is that it is likely to produce longitudinal lines running along the length of the sheet to which the sub is being applied. These lines are caused by "flow lines" in the pan which, in turn are due to fresh sub of one viscosity flowing in and not mixing uniformly or immediately with the sub of another viscosity in the pan. The design of such device often does not permit uniform entry of fresh sub all along the length of the pan, and does not permit uniform draw-off along the length thereof. In addition, considerable "dead" space is present where the sub supply is more or less idle, the sub becoming more stagnant as time goes on due to temperature changes or the evaporation of solvents from the sub. Furthermore since the sheet or film support passes over the pan containing the coating solution particles of the sheet may fall into the pan and result in additional contamination of the solution and hamper uniform distribution on the coating roll.

An object, therefore, of the invention is an improved coating device which continuously furnished uniform and fresh coating solution to the sheet being coated.

Another object of the invention is a coating device in which "dead" areas are substantially eliminated.

A further object of the invention is a coating device which eliminates foreign material which may fall into the coating solution.

In accordance with the invention these and other objects are attained by an apparatus, the preferred form of which comprises a reservoir for the coating solution into which the fresh solution is continuously and uniformly introduced through a slot which extends along the length of the reservoir and permits the solution to enter the reservoir below the level of the liquid. The coating solution flows from the reservoir over a curved dam and down a curved inclined chute to an outflow pan. The sheet or film to be coated is passed under a guide roll which has a radius of curvature similar to that of the curved chute. The sheet is maintained out of contact with the chute but at the lower end of the chute it contacts the solution and forms a bead along the width of the coating chute. A surplus amount of solution is caused to flow down the chute so that any foreign particles which may fall off the sheet into the solution in the chute will pass to the overflow pan and be removed from the vicinity of the moving sheet. The reservoir may be suitably covered to prevent foreign material from falling into it and a shield may be placed around part of the roll to prevent escape of volatile solvents. This type of hopper permits the removal of a film of liquid across the full width of the hopper instead of in small streams which are normally formed due to capillary attraction in other types of apparatus.

The invention will be more clearly understood by reference to the following detailed description and accompanying drawing, in which—

Fig. 1 is an end sectional view in elevation showing the preferred form of the apparatus.

Fig. 2 is a similar view of a modification of the apparatus in which the coating chute is formed with a different radius of curvature than that of the coating roll.

Fig. 3 shows another modification of the apparatus in which the length of the coating chute is reduced.

Referring to Fig. 1 there is shown a coating apparatus 10 comprising a reservoir 11, an inlet slot 12, a cover member 13, a curved dam 14, a coating chute 15, an outflow pan 16, a guard member 17, a guide roll 18 mounted to rotate and conduct a continuous sheet 19 over and out of contact with the coating chute 15. The coating solution bead is formed at 21 near the lower end of the coating chute 15. The position of the hopper or the roll can be adjusted, by means not shown, either vertically or horizontally so that the bead will be formed as desired. The excess solution is shown spilling into the outlet pan 16 at 22. The coating solution 20 is introduced into the inlet slot 12 by any suitable manner as by a constant volume pump, not shown, which is adjusted to furnish an excess of solution over that required to coat the sheet.

To operate the device the roll 18 is caused to rotate in a counter-clockwise direction thereby passing the sheet 19 over the curved coating chute

15. The reservoir 11 is filled with a suitable coating solution 20 and the solution is continuously replenished through slot 12. Since the entering solution is relatively far below the level of the solution in the reservoir it has substantially no undesirable disturbing effect on the surface of the liquid of the reservoir. Furthermore this slot will trap the majority of the air bubbles which may be in the solution and they will tend to rise to the top of the coating slot rather than passing along to the reservoir. Sufficient coating solution is added to the reservoir to raise the level of the solution so that it will flow uniformly over the curved dam 14 and down the curved chute 15. This solution will contact the sheet 19 at the lower end of the chute and form a bead 21 therebetween which extends across the width of sheet 19. Sufficient excess solution is permitted to flow down the chute so that there will be a continuous flow of solution into the outflow pan 16. This assures the removal from the bead of any foreign material, whereas in former types of coating apparatus foreign material in the solution tended to accumulate in the bead.

Referring to Fig. 2 there is shown a modification of the invention. The coating apparatus is shown at 25 and comprises a reservoir 26, a dam 27, a curved chute 28, an overflow pan 29, a guide roll 31. The sheet to be coated is shown at 32. As will be apparent from this drawing the curved coating chute 28 is of a different radius of curvature than roll 31. This permits a more viscous solution to be employed and/or assures that no contact will be made between the sheet and the solution until near the end of the chute. A different type of reservoir is shown at 26 but otherwise the operation of the device is similar to that of Fig. 1, an excess amount of solution being permitted to flow over the dam 27 and down chute 28 to form a bead 33 with the excess 34 shown flowing into the outlet pan 29.

In Fig. 3 the coating apparatus is shown at 40 and comprises reservoir 41, dam 42, coating chute 43, outlet pan 44, guide roll 45, and sheet 46, bead 47 with the excess flow shown at 48. This device operates similar to that of Fig. 2 but a difference in the position of the bead relative to the guide roll is attained by reducing the length of the chute.

It will be understood, of course, that suitable end plates not shown in the schematic drawings retain the coating solution in the various portions of the apparatus.

While in Figures 1, 2, and 3 the coating solution is shown contacting the sheet across its width in a bead, the hopper may be adjusted in any of the three cases to be nearer the support so that the curvature of the chute is concentric with the curvature of the guide roll. This will cause the space between the sheet and the surface of the chute to fill up with coating solution. The sheet is, therefore, coated by being immersed in the solution as it travels through the chute. However, since an excess of solution is flowing down the chute no contamination of the coating will result since dirt and other foreign particles will pass on to the outflow chamber. This operation thus permits immersion coating without the difficulty heretofore experienced.

By sheets or sheeting in the following claims is meant to include film base or any other type of material which can be coated in my apparatus.

I claim:

1. In a coating apparatus for continuously coating long strips of sheeting, a guide roll adapted to move the sheeting through the apparatus, a reservoir approximately the same length as the roll and positioned parallel thereto adapted to contain the coating solution and having an outlet positioned in a plane along approximately the horizontal axis of said roll, a solution drain positioned below the guide roll, an inclined chute positioned adjacent the reservoir adapted to conduct coating solution to contact the sheeting only at a line in the vicinity of said drain, and a round topped dam positioned between the chute and the reservoir along the length thereof adapted to regulate the uniformity of the flow of the solution into the chute.

2. In a coating apparatus for continuously coating long strips of sheeting, a guide roll adapted to move the sheeting through the apparatus, a reservoir approximately the same length as the roll and positioned parallel thereto adapted to contain the coating solution and having an outlet positioned in a plane along approximately the horizontal axis of said roll, an inclined chute positioned adjacent the reservoir adapted to conduct coating solution to contact the sheeting supported by the roll only at a line in a plane approximately on the vertical axis of said roll, and a round topped dam positioned between the chute and the reservoir along the length thereof adapted to regulate the uniformity of the flow of the solution into the chute.

3. In a coating apparatus for continuously coating long strips of sheeting, a guide roll adapted to move the sheeting through the apparatus, a reservoir approximately the same length as the roll and positioned parallel thereto adapted to contain the coating solution and having an outlet positioned in a plane along approximately the horizontal axis of said roll, an inclined chute positioned adjacent the reservoir adapted to conduct coating solution to contact the sheeting supported by the roll only in a line near the end of the chute, and a round topped dam positioned between the chute and the reservoir along the length thereof adapted to regulate the uniformity of the flow of the solution into the chute.

4. In a coating apparatus for continuously coating long strips of sheeting, a guide roll adapted to move the sheeting through the apparatus, a reservoir approximately the same length as the roll and positioned parallel thereto adapted to contain the coating solution and having an outlet positioned in a plane along approximately the horizontal axis of said roll, an inclined chute of a width approximately the same length as the reservoir and having a radius of curvature approximately that of the roll for conducting coating solution to contact the sheeting moved by the roll only in a line like bead near the end of the chute, and means for removing excess solution from the apparatus after the solution contacts the sheeting.

EUGENE R. CLEARMAN.