

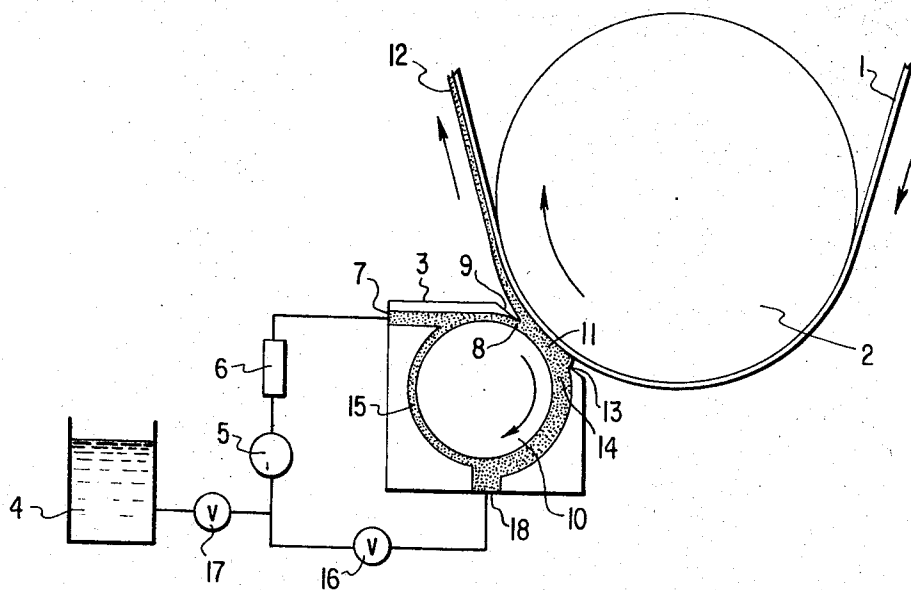
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COATING PROCESS

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COATING PROCESS

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1 Claim

ABSTRACT OF THE DISCLOSURE

A method of applying a coating liquid to a continuously travelling web wherein the coating liquid is supplied in a direction opposite to the travelling direction of the web so that the liquid collides against the surface of the web with great force.

This invention relates to a method of applying a liquid to a moving web-like support, and more particularly, it is concerned with a coating method for the production of photographic light-sensitive materials (coating of silver halide emulsion, antihalation back solution, filter coating solution, etc.), magnetic recording tapes, baryta papers, coated papers and the like, which method can be adapted to cases of coating at high speeds, coating precisely to give a thin layer and coating a dispersion carrying solid particles which tend to settle readily.

Previous attempts to coat at high speeds or to coat precisely to give thin layers by roller coating have been unsatisfactory, primarily because the coating liquid becomes unstable at a nip portion where a coating roller is contacted with a support to be coated and the coating surface becomes rough or the thickness becomes uneven. Therefore, it is difficult to select a suitable coating liquid, coating apparatus and operation conditions. In particular, sufficient attention must be paid to materials as well as the adjustment and maintenance of a metering roll and a doctor blade. In the case of coating a liquid wherein solid particles having a tendency to settle are dispersed, the solid particles settle to the bottom of a coating pan, resulting in non-uniformity of the coating liquid, and the resulting precipitate, if applied to a support, brings about longitudinal streaks or unevenness thereon, thereby decreasing the quality of the coating. Accordingly, the coating pan must be exchanged or washed during the coating in order to overcome such disadvantages.

The principal object of the present invention is to provide a coating method which can be adapted to coating at high speeds, coating precisely to give a thin layer and coating a dispersion carrying solid particles having a tendency to settle, wherein the foregoing disadvantages are overcome. That is to say, the feature of the coating method of our invention consists in supplying an excess of coating liquid to the web in a direction opposite to the travelling web so that the coating liquid collides against the surface of the web, and thereafter, removing the excess coating liquid by suction at a location where the liquid pressure is reduced.

The accompanying drawing represents a diagrammatic view illustrating an apparatus which may be used to practice the coating method of the invention. Web-like support 1 travels in the direction of the arrow over a rotary roller 2 for coating and is coated by means of coating device 3. A coating liquid corresponding to an amount to be applied is fed from coating liquid tank 4 via a control valve 17 by suction of a compressed metering pump 5 together with some recirculating liquid through circulating liquid valve 16. The liquid amount discharged from the metering pump 5 is the sum of the coating liquid from the tank to be coated on the web and the coating liquid to be

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withdrawn and recirculated, which should be determined properly according to the coating conditions. The coating liquid, passing through liquid filter 6 where impure matters are removed, enters coating device 3 at liquid inlet 7. The coating liquid in coating device 3 streams out of slot 8 which is formed between upper lip 9 of a front wall of the device 3 and inner core 10 of the coating device in a direction opposite to the travelling direction of support 1 so as to be directed thereto for collision against the support with great force at collision contact point 11. A part of the colliding coating liquid is passed through a gap between the support and end of upper lip part 9 and coated onto the support as coating film 12, while the other part thereof, even after colliding with great force at the collision contact point, advances in a direction opposite to the moving direction of the support in contact therewith. Then the excess coating liquid is led to suction port 14 which is formed between lower lip part 13 and inner core 10 of the coating device and is sucked therein. Since this gap or port 14 is made broader than the gap of slot 8 and the quantity of the coating liquid is reduced by the quantity coated on the support, the pressure of the coating liquid at the suction port is lower than that of the coating liquid at the nozzle. This serves to reduce the pool of coating liquid formed between the upper lip part and the support to thin the coating thickness.

The coating liquid sucked into suction port 14 is discharged from the liquid coating device through liquid exhaust port 18, and is pumped by metering pump 5 through recirculating liquid valve 16.

In detail, the liquid coating device 3 is preferably so constructed that the gap of liquid slot 8 may be freely controlled by making the end of upper lip part 9 adjustable. The position of the end of upper lip part 9 serves as much to impart a stability to a pool of liquid at the nip portion between the support and coating roller as well as to control the coating thickness to be applied.

Moreover, a structure or mechanism may be desired so that the distance between a support to be coated and the liquid coating device can be regulated as occasion demands. When inner core 10 of the coating device consists of a rotary roll as shown in the drawing, the velocity distribution of a coating liquid to be delivered can be readily controlled and cleaning of the interior of the coating device becomes convenient, although this is not necessarily essential in the invention. It may be fixed or of a shape other than a roll. In the case of a roll, it is preferred to provide a clearance 15 to enable the roll to rotate properly. Selection of a suitable speed of rotation of the inner core roll, depending on the velocity distribution of a liquid stream to be delivered, may serve to control the collision angle of a coating liquid and a support. In some cases, the core roll may be used in the reverse direction (opposite to arrow). Furthermore, the core roll, being immersed in a coating liquid, must be provided with such a system that both ends of the roll are liquid sealed without affecting the coating liquid. Although the foregoing description is directed to only an inner core consisting of a rotary roll, it may be a fixed wall because the principal function thereof consists in the formation of one side wall of a liquid nozzle and suction port respectively.

In the operation of such an apparatus, the following advantages can be obtained. Coating at high speeds is made possible under a stable condition. Coating precisely to give a thin layer is readily made possible, which has been considered to be very difficult up to this time. Coating of a dispersion carrying solid particles having a tendency to easily settle can be stably achieved for a long period of time to provide an even coating of good quality without the formation of longitudinal streaks and unevenness, which advantages markedly improve the production efficiency. In addition, various troubles in coating, for ex-

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ample, due to dusts adhering to a support can be reduced to minimum.

The coating apparatus of this type may cover wider ranges depending on the characteristics of the coating liquid, coating speed and coating thickness without needing any mechanical precision, as compared with other coating systems such as roller coating and extrusion coating.

The following examples serve to illustrate the coating method of the invention without limiting the same.

EXAMPLE 1

A gelatino-silver halide emulsion having a viscosity of 50 cp. was applied to a film base of cellulose triacetate, subbed previously, at a coating speed of 50 m./min. by the use of the apparatus as shown in the drawing thereby to give a smooth and uniform thickness coating of 40 ml./m.². The resulting photographic film gave qualities similar to those of ordinary film, when subjected to photographic processings.

EXAMPLE 2

A solution of high molecular material for forming a magnetic film containing magnetic iron oxide of 3500 cps. was applied to a film base of cellulose triacetate at a coating speed of 30 m./min. by the use of the coating

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apparatus of the drawing to give a smooth and uniform thickness coating of 50 ml./m.².

What is claimed is:

1. A method of applying a coating liquid to the surface of a continuously travelling web comprising supplying a coating liquid under pressure in an amount larger than the amount needed to coat said web, directing said coating liquid under pressure against said web at an angle such that the coating liquid has a velocity component in a direction opposite to the direction of travel of said web, removing the excess liquid by suction means at a point up-stream from the point of impingement of the liquid on the web relative to the direction of travel of said web.

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