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(54) **Continuous coating of webs having spliced joints.**

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DE - A - 1 805 734
DE - A - 1 904 928
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Continuous coating of webs having spliced joints

The present invention relates to a method for the continuous coating of moving webs with a layer of a coating composition, wherein the webs have spliced joints that do not disturb the coating process.

In many manufacturing operations a substantially continuous web is coated with a liquid material, such as aqueous solutions or dispersions of hydrophilic colloids, which may then be dried to form the desired product. Such manufacturing processes are used in the manufacture of adhesive tapes, magnetic recording tapes and photographic films and papers, among others. In order to increase the efficiency, and consequently lower the cost, of manufacturing these products, the coating process generally is carried out in a continuous manner. Inasmuch as the web for the coating can only be obtained in finite lengths, a new supply roll of the web must be periodically spliced to the end of the preceding supply roll so that the coating process may go on continuously.

It has been found that the most desirable way of splicing such webs is to utilize a splicing tape width of adjacent ends of two and joining the two adjacent ends of the web together. It has also been found that the application of the splicing tape to the front side of the web, that is the side that is intended for receiving a coating, provides fewer coating flaws than does the application of the splicing tape to the back side of the web. However, even though the application of the splicing tape to the front side of the web results in fewer coating problems than do other methods of splicing, streaks and other defects have still been found in the coating downstream from the splicing tape. Normally, the spliced section of the continuous web is cut from the finished product and is scraped so that the defects in the coating occurring at the splice joint are not found in the final product. However, it has been found that under certain conditions, the splice joint may affect substantial lengths of the coated web following the splice. In many products, it is possible to cut out the affected portion of the web without substantially affecting the usability of adjacent portions. However, in many products this is not possible, and the entire web containing such defects must be scrapped.

As the speed of coating webs is increased and as the width of the web is also increased, the value of the product being scrapped due to splice-imparted defects downstream from the splice have become excessive. This is even more true in high-cost products utilizing an expensive coating material which cannot be easily recovered from scrapped portions of the web. As a result, it has become increasingly important to minimize, if not eliminate, defects resulting from the splice from the coated web products. Moreover, the elimination of these defects must be accomplished without materially increasing the cost of the product.

Furthermore, the elimination of the splice-imposed defects must not in any way result in other, potentially less desirable defects in the coated product. Additionally, the method of eliminating the splice-imposed defects must be readily accomplished without affecting the production rates possible in modern high-speed coating machines.

Many of the defects in coated webs appear to result from the entrainment of air in the coating deposited on the web or from the adherence of a small bubble of air to the coating nozzle or to the coating lip of a so-called slide hopper which then affects further portions of the coating deposited on the web. It has been found that such entrained air is picked up and such bubbles are generated as the coating drops down over the splice tape onto the surface of the web. The air being entrained appears to come from that trapped in the angle formed between the edge of the tape and the surface of the web.

It has been proposed to eliminate disturbances in the layer of the coating composition downstream from a spliced joint in the web, by coating the web surface immediately downstream from the spliced joint, or by coating said web surface and the adjacent tape surface with a hydrophobic composition prior to applying the layer of coating composition. It has also been proposed to form a tapered transition from the downstream edge of the splicing tape surface to the web surface. This may occur by feathering the downstream edge of the splicing tape, or by filling the transition from the tape surface to the web surface by an oily-hydrophobic material or with a rubber cement. Both methods are disclosed in DE 1,805,734.

It has still further been proposed to wet the splice member and the adjacent web surface immediately downstream from the splicing tape with water and, before the water dries, to coat the aqueous coating composition onto the web. This method is disclosed in DE 1,904,928.

It has still further been proposed to roughen the surface of the second web at an area just downstream of the spliced joint. This method is disclosed in DE 2,440,280.

Finally, it has been proposed to vary the thickness of the leading end of the new web immediately downstream from the surface discontinuity at the splicing zone to provide to said web end facing the coating station a height which is not less than the height of the surface discontinuity. This method is disclosed in US 3,972,762.

Japanese preliminary publication 51—48067 (Yamanchi Rubber Kog KK) Published 24 April 1976, discloses the concept of splicing webs

using tape that runs from one side of a first web to the opposite side of the next web.

While all the mentioned measures are effective in overcoming coating failures as described hereinbefore, they all require additional measures in the splicing station which, as for instance in the case of the filling of the transition from the tape to the web, are difficult to realize.

It is the object of the present invention to provide a method for the continuous coating of a moving web, wherein a spliced joint between two successive webs does not require any of the additional measures referred to.

The invention aims in particular to provide a method for the continuous coating of moving webs that are to be coated by means of a slide hopper or any other coating device that is very closely spaced from the web, and wherein the speed at which a web splice may be passed through the coater before coating defects of the kind referred to start to occur, may be higher than the usual speeds at which suchlike defects occur. As "usual speeds" we consider in the present case speeds ranging from 80 to 100 meters per minute ($m.min^{-1}$).

In accordance with the present invention, a method for the continuous coating of a moving web with at least one layer of a coating composition, wherein a spliced joint between two successive webs is formed by a splicing tape that forms a flexible transition between the trailing web end, i.e. the rearmost end according to the direction of movement of the web, and the adjacent leading web end, i.e. the foremost end according to the direction of movement of the web, is characterized thereby that both web ends are separated from each other over a distance of at least ten times the web thickness, and that the splicing tape is fixed to the trailing end of the old web at the front side of said web, i.e. the side that is intended to receive a coating, and to the leading end of the new web at the back side of the web, i.e. the web side that is opposite to the front side, thereby to provide only step-up discontinuities at the front side of the web splice that passes past the coating head in the coating station.

The term "front side" of the webs stands for the side of the web that is intended to receive a coating, whereas the term "back side" of the webs stands for the opposite web side, as mentioned already hereinbefore. It should be understood that said terms have a relative meaning only, and a web which has been coated on one side in accordance with the method according to the invention, may as well be unwound again from the roll onto which it has firstly been wound, in order to be passed in reversed condition through another splicing and associated coating station or stations to receive a coating or coatings at its opposite side. This step is notably practised in the manufacture of, for instance, common radiographic film which is provided with a radiation-sensitive and an anti-stress layer on both its sides.

The terms "leading" and "trailing" have been used to designate physical position or location and are used in reference to the direction of travel of the webs.

Since the splicing tape has to pass through the opening between the two web ends from one side of the webs to the opposite side, it will be understood that some minimum distance between the web ends is desirable in order to give the leading end of the new web the opportunity to be situated in the same position, or to follow the same path, as the trailing end of the receding web. A web end separation over a distance of at least ten times the web thickness is therefore a practical minimum. However, it will be understood that, depending on the relative stiffness of the webs, the stiffness of the splicing tape, the radius of the roller about which the webs are wrapped for guiding them through the coater, and the web tension, said distance may be considerably greater, and thus a web end separation of for instance 10 mm for webs of polyethyleneterephthalate of a thickness of 180 μm should not be considered as excessive.

The splicing tape may be formed from two standard self-adhesive tapes that are adhered to each other with the adhesive layers in contact with each other and while in partly overlapping relationship, thereby to present two adhesive bands that are situated at opposite edges and at opposite sides of the composite splicing tape. Such adherence of both tapes to each other to have rolls of tape with the described configuration may be carried out beforehand, for instance by the manufacturer of the tape. It will be understood, however, that the mutual taping together of the splicing tapes may also occur upon their unwinding in a tape dispenser that is mounted on the carriage that cuts and tapes the webs together as it moves transversely across the webs in an automatic web-splicer.

According to an alternative embodiment, two splicing tapes may be separately unwound over a length corresponding with or slightly exceeding the width of the webs, a portion of one tape pressed onto one side of one web and the other tape pressed onto the opposite side of the other web, at a similar portion of the other side, and then the tape portions are pressed onto each other.

The splicing tape may also consist of one support that is provided with two adhesive bands that are situated at opposite margins and opposite sides of such support.

The invention will be described hereinafter with reference to the accompanying drawings wherein:

Fig. 1 is a schematic representation of a bead coater and of a web that has a splicing zone that has passed already through the coater.

Fig. 2 is an enlarged schematic section through one embodiment of a spliced joint in accordance with the present invention, and

Fig. 3 is an enlarged schematic section

through another embodiment of a spliced joint in accordance with the invention.

Referring to fig. 1, a web 10 is drawn over a web-supporting roller 11 through a coating station that in the present example has been illustrated as a slide hopper or bead coater. Such a coater may comprise a coating head 12 with a manifold 13 through which the coating composition is pumped outwardly onto a slide surface 14 from which it flows downwardly as a layer of uniform thickness. Contact of the layer with the web occurs through a so-called bead of coating composition which may be stabilised by maintaining at the lower side of the lip 15 of the coater an air pressure that is lower than the air pressure at the upper side of the lip, said upper pressure being usually the ambient air pressure. The spacing between the front side of the web and the front side of the lip 15 usually ranges between 0.2 and 0.3 mm.

The web 10 may be considered in the present embodiment as the new web, since it is spliced by a tape splice 16 to the web 17 which is the old web that has already passed through the coating station. The tape splice may have different forms that are illustrated in figs. 2 and 3.

The splice joint 16 shown in fig. 2 is formed by two tapes 18 and 19 and each have a self-adhesive layer on one side, and that have been adhered to each other in slightly staggered relation considered according to the width of the tapes, with the self-adhesive layers in contact with each other. The remaining free band of the self-adhesive layer of the tape 18 is adhered to the front side of the trailing end of the web 17, whereas the remaining free band of the self-adhesive layer of the tape 19 is adhered to the back side of the leading end of the web 10. It is clear that the described tape splice configuration has step-up discontinuities only — considered in the direction of movement of the splice past the coating station — namely the edge 20 of the tape 18 and the edge 21 of the web 10.

In the present fig. 2 there has been shown a slight spacing between the edges of the tapes and the corresponding edges of the webs that do not adhere to each other, such as illustrated by the numerals 22 and 23. This has been done to illustrate that it is not critical that such tape edges should precisely meet the corresponding web edges. It has been shown that separations of some tenths of a millimeter can be admitted whereas in some cases said separation may even become negative, that is, the second tape may slightly underlie the first tape so that at the extremities of the webs the thickness of the web end is increased by two times the tape thickness. It should in any case be understood that the adhesive zone of a tape that is in contact with a web should be sufficiently great to establish a bond with the web that withstands the usual longitudinal tensions in the web during its winding and unwinding, the corrections of the lateral position of its path of travel, acclerations in web accumulation.

The following example illustrates the described embodiment.

Two polyethyleneterephthalate webs with a thickness of 180μm that were provided at their front side with a subbing layer, were spliced by means of two polyester tapes that had a width of 32 mm and a thickness of 50μm, inclusive of the self-adhesive layer. The tapes overlapped each other over a distance of 22 mm, and the gaps at the positions 22 and 23 were not greater than 0,1 mm, so that the widths over which the tapes were in contact with the corresponding web ends were slightly smaller than 10 mm. The tapes were provided at their rearside opposite the adhesive with a subbing layer of the type applied to the webs thereby to not disturb the coating of an aqueous gelatinous silver halide layer. It was shown that bead coating of a layer of an aqueous silver halide radiographic composition by means of the illustrated coater could occur at speeds up to 130 m min^{-1}, for a web-coater spacing of 0.3 mm, without the occurrence of any of the coating defects described hereinbefore. In comparison therewith, the coating of the same composition was limited to a speed of 100 m min^{-1} if the webs were butt-joined by a tape of 50 μm thick applied to the front side of the webs, and the downstream tape end and the web after the tape were coated with a hydrophobic composition.

The splice joint 16 shown in fig. 3 is made by means of a single tape 24 that is provided at opposite ends and opposite sides with bands 25 and 26 of a self-adhesive material. Supply of such a tape in the form of a roll of tape does not offer problems since the thickness of the tape at both its adhesive zones is equal. It may be seen that, similarly as in the embodiment of fig. 2, only step-up edges are formed by the tape splice at the front side of the webs (the upper web side in the drawings of figs. 2 and 3).

Finally, the broken line 27 in fig. 3 shows that the leading edge of the new web 10 may occasionally be bevelled or feathered. This configuration may be desirable at elevated coating speeds since in such case the passage of the unbevelled extremity of the new web 10 may disturb the coating bead in such a way that the thickness of the coated layer is briefly reduced and immediately thereafter correspondingly increased. Although such defect may be limited to a web length of some centimeters only, the consequence may be that the locally thicker layer cannot be dried by an existing drying installation so that in that way an undesirable limitation might be imposed upon the coating speed.

Claims

1. A method for the continuous coating of a moving web with at least one layer of a coating composition, wherein a spliced joint between two successive webs is formed by a splicing

tape that forms a flexible transition between the trailing web end, i.e. the rearmost end according to the direction of movement of the old web, and the adjacent leading web end, i.e. the foremost end according to the direction of movement of the new web, characterized in that both web ends are separated from each other over a distance of at least ten times the web thickness, and that the splicing tape is fixed to the trailing end of the old web at the front side of said web, i.e. the side that is intended to receive a coating, and to the leading end of the new web at the back side of the web, i.e. the web side that is opposite to the front side, thereby to provide only step-up discontinuities at the front side of the web splice that passes past the coating head in the coating station.

2. Method according to claim 1, wherein said splicing tape is formed from two standard self-adhesive tapes that are adhered to each other with the adhesive layers in contact with each other in partly overlapping relationship in an amount to form a bond which withstands the longitudinal winding tension, and wherein the edges of the tape nearly meet the ends of the web.

3. Method according to claim 1, wherein said splicing tape comprises one support that is provided with two self-adhesive bands that are situated at opposite ends and opposite sides of said support.

Revendications

1. Procèdè pour enduire de façon continue une bande en mouvement comprenant au moins une couche d'une composition de revêtement, ce procédé étant effectué comme suit: on exécute un joint de raccordement entre deux bandes se succédant au moyen d'un ruban de raccordement qui forme une transition flexible entre le bout traînant de l'ancienne bande, c.-à-d. l'extrémité arrière de celle-ci vue selon la direction de son mouvement, et le bout adjacent arrivant de la nouvelle bande, c.-à-d. l'extrémité avant de celle-ci, vue selon la direction de son mouvement, ce procédé présentant la caractéristique suivante : les deux bandes sont séparées l'une de l'autre sur une distance au moins égale à dix fois l'épaisseur de bande et le ruban de raccordement est fixé d'une part sur l'extrémité traînante de l'ancienne bande, sur la face avant de celle-ci, c.-à-d. la face de la bande devant être revêtue, et d'autre part sur l'extrémité avant de la nouvelle bande, sur la face arrière de celle-ci, c.-à-d. sur la face opposée de la face avant, produisant ainsi seulement des discontinuités allant en s'élevant sur la face avant du raccordement des bandes qui passe devant la tête d'enduction due poste d'enduction.

2. Procédé suivant la revendication 1, dans lequel le ruban de raccordement est constitué par deux rubans auto-adhésifs courants qui sont adhérés l'un contre l'autre au moyen de leurs couches adhésives en contact l'une avec l'autre et se chevauchant partiellement, de telle façon qu'il se forme une connexion résistant la tension d'enroulement longitudinal, et dans lequel les bords du ruban de raccordement se conforment aux extrémités des bandes.

3. Procédé suivant la revendication 1, dans lequel le ruban de raccordement comprend un support pourvu de deux rubans adhésifs qui sont situés sur les extrémités opposées et les faces opposées de ce support.

Patentansprüche

1. Verfahren zum kontinuierlichen Beschichten von einer weiterbewegenden Materialbahn mit wenigstens einer Schicht einer Giesszusammensetzung, gemäss dem eine Endenverbindungsstelle zwischen zwei einander auffolgenden Materialbahnen durch einen Verbindungsstufen geschaffen wird, wobei dieser Verbindungsstreifen eine biegsame Übergangsstelle zwischen dem Ende der ablaufenden Bahn, d.h. dem hinteren Ende wie betrachtet in Richtung der Bewegung der ablaufenden Bahn, und dem naheliegenden führenden Ende einer neuen Bahn, d.h. dem vorderen Ende wie betrachtet in Richtung der Bewegung der neuen Bahn, bildet, dadurch gekennzeichet, dass die beiden Materialbahnen über eine Entfernung von wenigstens zehnmal der Bahndicke gleich voneinander entfernt sind und dass der Verbindungsstreifen auf das ablaufende Ende der alten Materialbahn, an der Vorderseite derselben, d.h. an der beschichteten Materialbahnseite, und auf das führende Ende der neuen Materialbahn, an der Hinterseite derselben, d.h. an der der Vorderseite dieser Bahn gegenüberliegenden Seite, aufgeklebt wird, wobei nur stufenweise erhöhte Unterbrechungen an der Vorderseite des sich dem Düsenkörper der Beschichtungsstation vorüber bewegenden Klebestreifens gebildet werden.

2. Verfahren nach Anspurch 1, dadurch gekennzeichnet dass der Verbindungsklebestreifen aus zwei normierten Klebestreifen besteht, welche mit ihren Klebeschichten, die einander teilweise überlappend berühren, in solcher Weise aufeinander geklebt werden, dass eine der longitudinalen Aufwickelspannung der Materialbahn widerstehende Verbindungsstelle gebildet wird und dass die Kanten des Klebestreifens sich mit den Bahnenden zusammentreffen.

3. Verfahren nach Anspruch 1, dadurch gekennzeichnet dass der Verbindungsklebestreifen einen Träger enthält, der mit zwei Selbstklebebändern, die an gegenüberliegenden Enden und gegenüberliegenden Seiten dieses Trägers angebracht wurden, versehen ist.

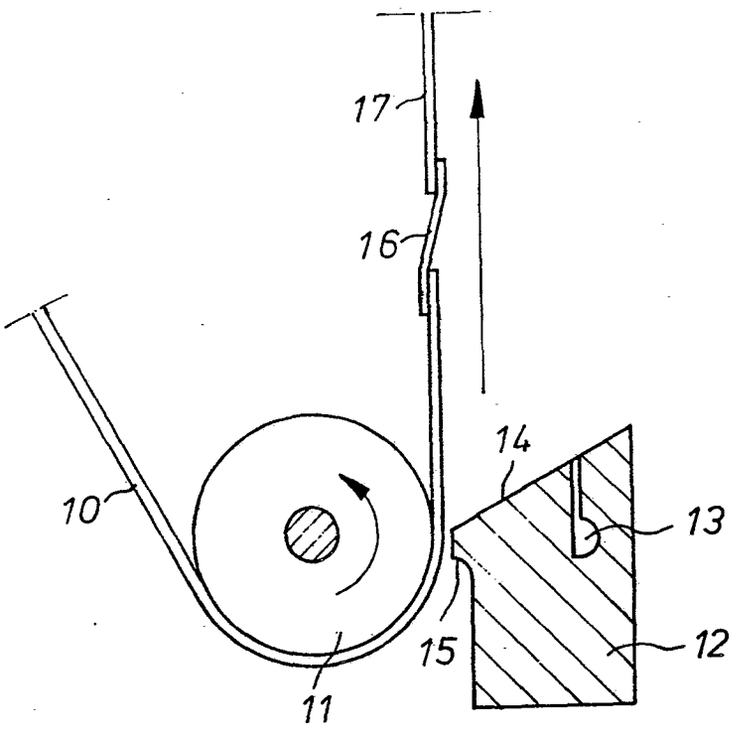

Fig. 1

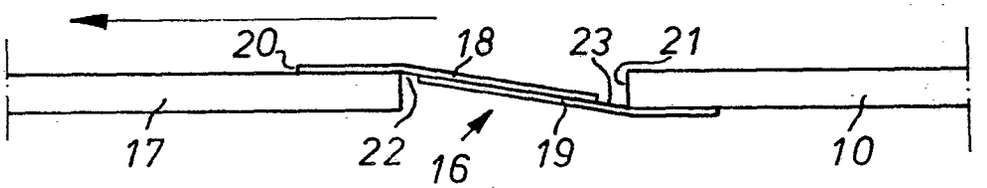

Fig. 2

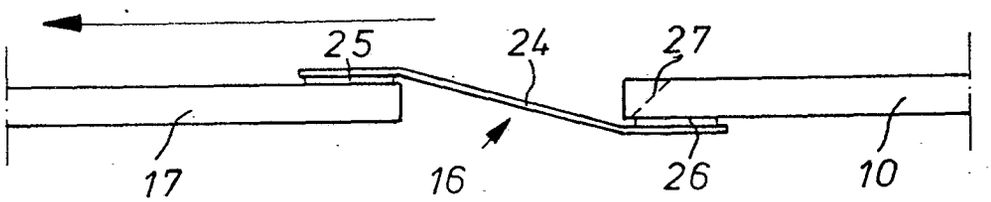

Fig. 3