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(54) Free span coater with backside support.

(57) An apparatus (10) for free span coating on a web (12) includes a seamless sleeve (20) mounted around two rollers (22,24) which supports the backside (18) of the web (12) during coating. The sleeve (20) moves with the web (12) to minimize resistance to web movement, and supports the backside (18) of the web (12) while permitting free span coating on the front (19) of the web (12). The sleeve (20) is steered to maintain the position of the sleeve (20) on the rollers (22,24). A tensioning device tensions the sleeve (20) to provide a uniform tensioned support for the web (12).

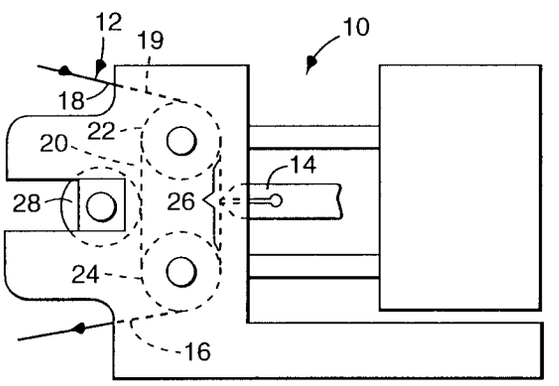

Fig. 1

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TECHNICAL FIELD

The present invention relates to free span web coaters. More particularly, the present invention relates to free span die coaters having support for the free span of the web.

BACKGROUND OF THE INVENTION

Free span die coaters are a preferred coating method for die coating on a web. Free span type coaters are superior to other die coaters because free span coaters have less stringent operational characteristics and can be used to coat thinner coatings. Free span coaters do not require a precision backup roller as the coating die is positioned between two idler rollers. They do not require a precision caliper web backing because the absence of a rigid backup support eliminates any fixed gap between the die and the rollers and allows the web to float on a fluid bearing so the coater does not see any backing thickness variations.

One type of free span coater is a floating knife coater. A modification of this is a knife-on-blanket coater. In knife-on-blanket coating, the web is coated between two rollers around which an endless rubber blanket is wrapped. The blanket provides additional support for the web. The blanket is driven and the blanket tension can be controlled. Like conventional floating knife coaters, the coating weight is controlled in part by the web speed and the viscosity of the coating solution, as well as the downward pressure of the knife on the substrate. Moreover, the rubber blanket is not sufficiently accurate for the required coating precision of today's systems. Also, rubber blankets create static problems, must be driven, and are usually not seamless.

Roll runout with free span coaters is not a critical parameter. However, free span coating is not always feasible. Baggy or puckered webs cannot be coated uniformly using known free span coaters. A backup roller or other support is required to permit uniform coating on an uneven web. There is no known method of providing sufficient support for webs in a free span coater.

Air cushions which blow air against the backside of the web in a free span coater are known. The air cushion provides support for the web in the free span. However, the air cushion is usually very small, and any disruptions such as web splices or web tension upsets can cause problems. The air cushion manifold is located a fixed distance from the backing while the die is pushed against the web, creating a tight fixed gap. The gap size restricts what can pass through, and the air stream creates noise.

SUMMARY OF THE INVENTION

The apparatus for free span coating on a web includes a die which applies a coating on a moving web. The coating can be applied to the web by known dies which can be fixed or adjustable in any direction. The apparatus also includes a system which supports the free span of the web during coating. This system includes a sleeve, mounted around two idler rollers, over which the web passes. The sleeve is seamless and moves with the web to minimize resistance to web movement, and supports the backside of the web while permitting free span coating on the front of the web. A tensioning device, such as a tensioning roller, tensions the sleeve to provide a uniform tensioned support for the web. A steering system steers the sleeve to maintain the position of the sleeve on the rollers.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a schematic view of the free span coater with backside support of the present invention.

Figure 2 is a front view of the free span coater of Figure 1 showing a steering mechanism.

Figure 3 is a side view of the free span coater of Figure 2 showing a tensioning mechanism.

Figure 4 is a front view of a free span coater according to another embodiment of the present invention.

Figure 5 is a side view of the free span coater of Figure 4 showing the tensioning and steering mechanism.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

Referring to Figure 1, the apparatus 10 for free span coating on a web 12 includes a device such as a die 14 which applies a coating 16 on the moving web. Examples of free span coating methods include fluid bearing die coaters, roll coaters, kiss coaters, Meyer rod coaters, and notched or round smoothing bars. The coating 16 can be applied to the web 12 by known dies 14 which can be fixed in position or adjustable in any direction. The apparatus 10 also includes a system which supports the backside 18 of the web 12 during coating.

This backside support system includes a sleeve 20 over which the web 12 passes. The sleeve 20 is seamless and moves with the web 12 to minimize resistance to web movement. The sleeve 20 supports the backside 18 of the web 12 while permitting free span coating on the front 19 of the web 12. The sleeve 20 is mounted around

two spaced rollers 22, 24. The rollers 22, 24 are rigid to reduce sag and prevent sag-induced steering problems.

Preferably, the sleeve 20 is wider than the web 12 being coated and has 2-5 cm of clearance on each side of the web. The sleeve 20 can be a 61 cm (24 in) circumference, 0.013 cm thick, non-perforated or perforated nickel SLE Sleeve sold by Stork Screens America, Inc. of Charlotte, North Carolina. Alternatively, the sleeve can be steel. These metallic materials are superior to materials such as rubber because they are more accurate, do not create static problems, do not have to be driven, and can be seamless. The sleeve 20 supports the web 12 in the free span 26 between the two rollers 22, 24 and provides a uniform tensioned support across the web for the web 12 where the die 14 applies coating 16 to the web 12 between the two rollers 22, 24.

The rollers 22, 24 can be idler rollers, which are rotated by the sleeve 20 which, in turn, is rotated by the web 12 passing over the sleeve 20. Alternatively, the rollers 22, 24 can be driven externally to drive the sleeve 20 at the same speed as the web 12. Moving the rollers 22, 24 with the web 12, whether driven or not, prevents the sleeve 20 from scratching the web 12 while preventing slipping between the web 12 and the sleeve 20 when thin or fragile webs are used.

A tensioning device, shown in Figure 3, tensions the sleeve 20 to provide a uniform tensioned support for the web 12 and can include a tensioning roller 28. The tensioning roller 28 can be forced into the sleeve 20 using air pressure which loads the tensioning roller 28 against an adjustable mechanical stop 30. The amount of tensioning can be adjusted by adjusting the location of the stop 30 which is threaded to permit fine tension adjustment and can also steer the sleeve. Moving the stop 30, and therefore the tensioning roller 28, toward the idler rollers increases the tension of the sleeve.

The tensioning roller 28 can be crowned, having a smaller diameter at the ends than at the middle. This aids in maintaining constant cross-web tension and aids in control if the idler rollers sag due to sleeve or backing tension. Alternatively, as shown in Figures 4 and 5, the tensioning roller 28 can be eliminated and the sleeve 20 can be tensioned by adjusting the spacing and orientation of the rollers 22, 24 around which the sleeve 20 is mounted. Adjusting the tension by adjusting the idler roller spacing from one end also could be used to steer the sleeve. The tensioning roller 28 can be located inside the sleeve 20 if a larger circumference sleeve is used. The tensioning roller 28 can serve as a steering roller in this configuration.

Regardless of which tensioning system is used, web splices can pass easily through the coating portion of the system because the sleeve 20 is flexible and flexes to accommodate the splices. In Figures 1 and 2, the sleeve 20 is tensioned by an air actuated tensioning roller 28. The air-actuated tensioning roller acts as a shock absorber to absorb the temporary upset in web thickness due to the web splice. There is no mechanical impedance to the increased thickness of the splice. After flexing, for example, to accommodate a splice, the sleeve 20 returns to its original position. Also, this apparatus 10 permits minimal contact between the die 14 and the web, reducing web wrap on the die face.

A steering system steers the sleeve 20 to maintain the position of the sleeve 20 on the rollers 22, 24. Edge guides could damage the sleeve which is fragile. Known steering mechanisms use web edge sensors which must not contact the sleeve. These sensors sense the edge of the sleeve and send a signal to the mechanical steering mechanism which is typically inserted on the inside of the sleeve between the two rollers. The steering system, as shown in Figure 2, includes a rubber steering roller 32 which is forced against the sleeve 20, rotates with the sleeve, and is canted to cause the sleeve 20 to travel on the idler rollers 22, 24 and to compensate for and counteract misaligned tracking of the sleeve.

As contrasted with knife-on-blanket coating, the coating weight is not controlled by the downward pressure of the die on the substrate. Rather, the coating weight is determined by the volume of coating material fed to the die. Moreover, the apparatus 10 of the present invention enables successful coating of lower coating weights than in known free span coaters.

In an alternative embodiment, the sleeve is stationary relative the web and the web moves past the sleeve. This setup also permits the sleeve to support the backside of the web while permitting free span coating on the front of the web.

Alternatively, a single system can be used both to tension and to steer the sleeve 20. This system can operate without a separate tensioning roller 28. As shown in Figures 4 and 5, the idler roller 22 is connected to a tensioning and steering device 34 which tensions and steers the sleeve 20. This tensioning and steering device 34 is mounted on each end of the idler roller 22 and each side of the sleeve 20 is independently adjustable to steer the sleeve 20. When the tensioning and steering devices 34 are moved simultaneously and equally, they alter the tension on the sleeve 20.

This backside support system enables the coating of webs 12 that are baggy or contain puckers. Because the sleeve 20 provides a uniform

tensioned support for the web 12, it presents a uniform web to the face of the die 14 regardless of the tautness of the web. This increases the number of products that can be successfully coated on a free span coater as compared with known systems. Additionally, some webs, such as paper, vary in bagginess from one roll to the next. The backside support system eliminates the need to adjust the coating die each time a new roll is coated as the sleeve maintains the position of the web with respect to the die face. This reduces the amount of required operator supervision. Less web wrap is used which means that the die no longer must be pushed far into the web to obtain a uniform coating, thereby reducing stress-induced web defects.

Tests using this system to coat baggy webs and applying thin wet caliper coatings that otherwise could not be uniformly coated have shown that this system can successfully compensate for bagginess and enable the web to be coated uniformly. Another advantage is that thin or fragile webs can be coated in a "high tension zone." The web tension can be kept low, as required in the remainder of the coating process, but high backside tension can be supplied by the sleeve at the point of coating application to improve coating. This yields a more uniform coating than is attainable without the backside support. Also, using the backside support results in attaining lower wet coating thicknesses.

Claims

1. An apparatus for free span coating on a web comprising:
- means, including a die, for applying a coating (16) on the web (12),
- means for creating a free span (26) of web (12), wherein the applying means applies the coating (16) on the web (12) in the free span,
- means for supporting the backside (18) of the free span (26) of the web (12) during coating comprising a seamless sleeve (20) over which the web (12) passes, wherein the sleeve (20) moves with the web (12) to minimize resistance to web movement, and supports the backside (18) of the web (12) while permitting free span coating on the front (19) of the web (12), and
- means for controlling the coating weight applied to the web (12) independent of the downward pressure of the die on the web (12) and dependent on the volume of coating material fed to the die.

2. The apparatus according to claim 1 characterized by means for creating a zone of high tension in the location of the application of the coating (16) to the web (12) while maintaining a lower web (12) tension in the remainder of the coating process.

3. The apparatus according to claim 2 characterized in that the zone creating means comprises means for tensioning the sleeve (20) to provide a uniform tensioned support for the web (12) and present a uniform web (12) to the face of the die regardless of the tautness of the web (12).

4. The apparatus according to any one of claims 1 to 3 characterized in that the supporting means further comprises two idler rollers (22,24) around which the sleeve (20) is placed, wherein at least one of the idler rollers (22,24) is driven to drive the sleeve (20) at the same speed as the web (12).

5. The apparatus according to claim 3 or 4 characterized in that the tensioning means comprises means for altering the distance between the two rollers (22,24).

6. The apparatus according to any one of claims 1 to 5 characterized in that the applying means applies coating (16) to the web (12) between the two rollers (22,24).

7. The apparatus according to any one of claims 3 to 6 characterized in that the tensioning means comprises a crowned tensioning roller (28) mounted adjacent the sleeve (20) opposite the applying means and means for moving the tensioning roller (28) towards and away from the sleeve (20).

8. The apparatus according to any one of claims 1 to 7 characterized by means for steering the sleeve (20) to maintain the position of the sleeve (20) on the rollers (22,24), wherein the steering means comprises a steering roller (32) which is forced against the sleeve (20), rotates with the sleeve (20), and is cantable to cause the sleeve (20) to travel on the rollers (22,24).

9. An apparatus for free span coating on a web comprising:
- means, including a die, for applying a coating (16) on the web (12),
- means for creating a free span (26) of web (12), wherein the applying means applies the coating (16) on the web (12) in the free span (26),

- means for supporting the backside (18) of the free span (26) of the web (12) during coating, wherein the supporting means comprises a seamless sleeve (20) over which the web (12) passes, wherein the sleeve (20) is stationary relative to the web (12) and the web (12) moves past the sleeve (20), and wherein the sleeve (20) supports the backside (18) of the web (12) while permitting free span coating on the front (19) of the web (12), and
- means for controlling the coating weight of coating (16) applied to the web (12) independent of the downward pressure of the die on the web and dependent on the volume of coating (16) fed to the die.

10. The apparatus according to claim 9 characterized by means for creating a zone of high tension in the location of the application of the coating (16) to the web (12) while maintaining a lower web tension in the remainder of the coating process, wherein the zone creating means comprises means for tensioning the sleeve (20) to provide a uniform tensioned support for the web (12) and present a uniform web (12) to the face of the die regardless of the tautness of the web (12).

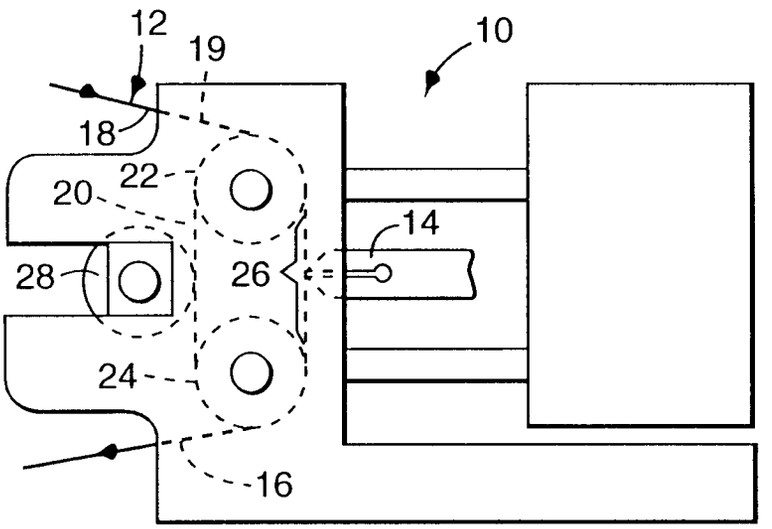

Fig. 1

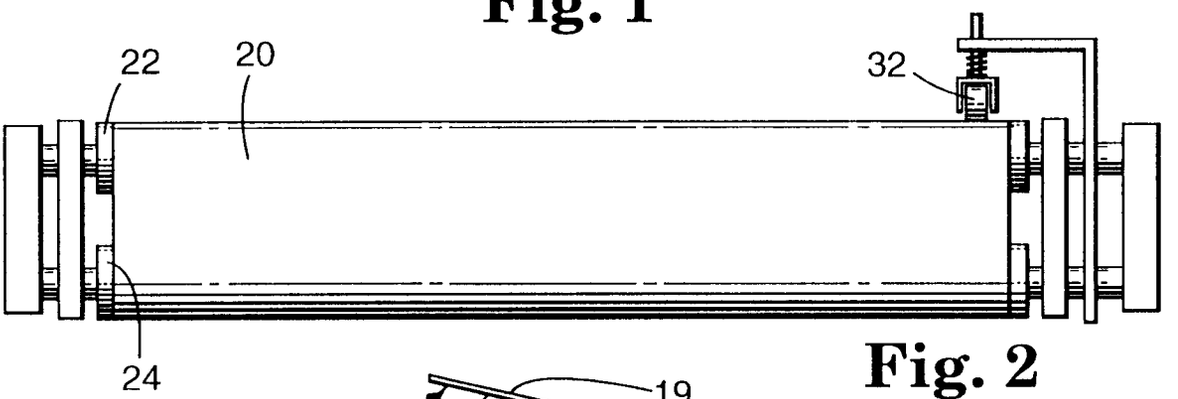

Fig. 2

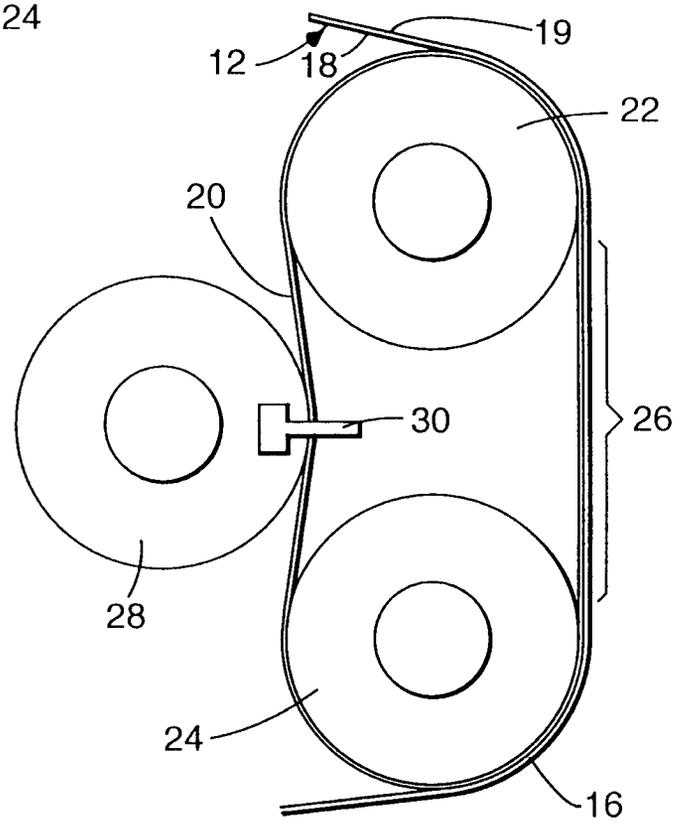

Fig. 3

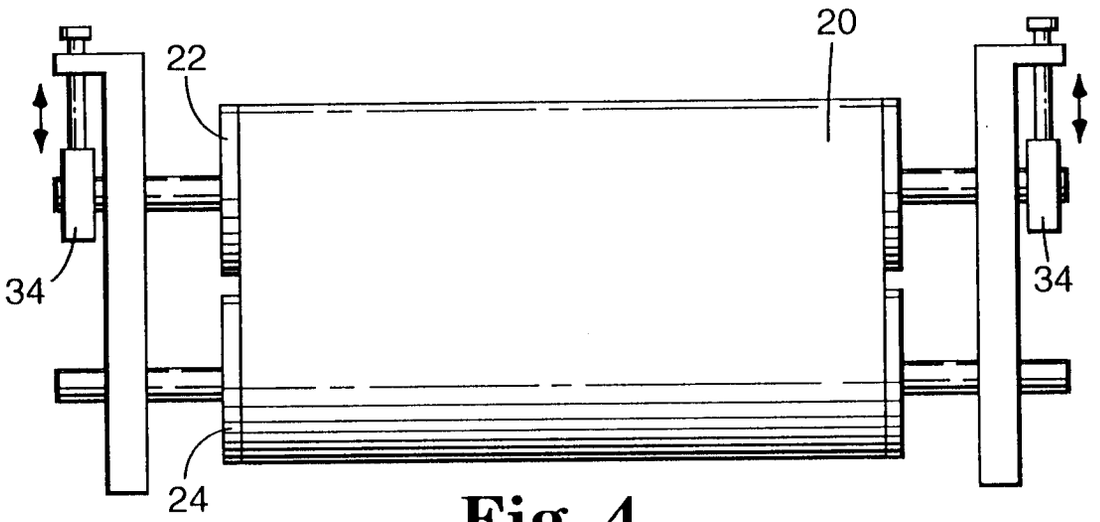

Fig. 4

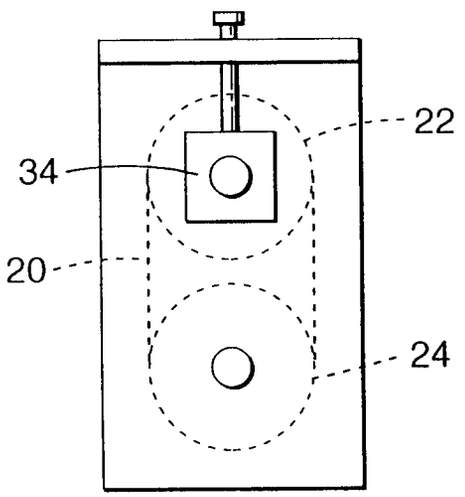

Fig. 5

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EUROPEAN SEARCH REPORT

Application Number
EP 93 12 0480

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.5)
X A	FR-A-2 312 590 (HOECHST) * page 2, line 19 - line 22 * * page 4, line 16 - line 34; figure 4 *	1,6,9 2,4,7,8, 10	B05C5/02 D06B1/08 B05C11/10
A	EP-A-0 423 774 (RÜMMER) * column 8, line 53 - column 10, line 19; figure 3 *	1	
A	NL-A-8 901 012 (STORK BRABANT B.V.) * page 10, paragraph 1; figure 4 *	1	

TECHNICAL FIELDS SEARCHED (Int.Cl.5)

B05C
D06B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	29 March 1994	Guastavino, L

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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