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[54] **SMOOTHING SCRAPER-COATING APPARATUS**

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[30] **Foreign Application Priority Data**

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[51] **Int. Cl.** **B05c 11/02,** B05c 3/02

[58] **Field of Search** ...15/256.51; 118/123, 126, 261, 118/407, 413, DIG. 23

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[57] **ABSTRACT**

The specification discloses a scraper, or skimming, blade arrangement for controlling the thickness of a layer of coating composition deposited on a running web. The blade extends pivotally attached to the rear of the frame. Part of the bed extends rearwardly the web and has one longitudinal edge fixed to a support beam on the side of the beam which faces the web. An inflatable tube between the beam and the blade is expansible by fluid pressure to flex the blade into operative engagement with the web downstream from the region of supply of the coating composition to the web. A leaf spring element interposed between the tube and the blade serves to distribute the pressure of the tube along the blade so that the pressure with which the blade engages the web is substantially uniform along the full length of the blade.

7 Claims, 3 Drawing Figures

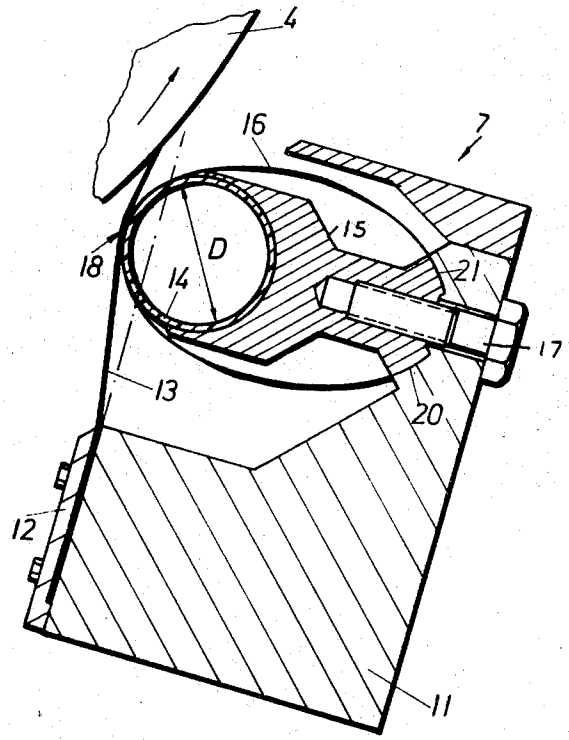


Fig. 1

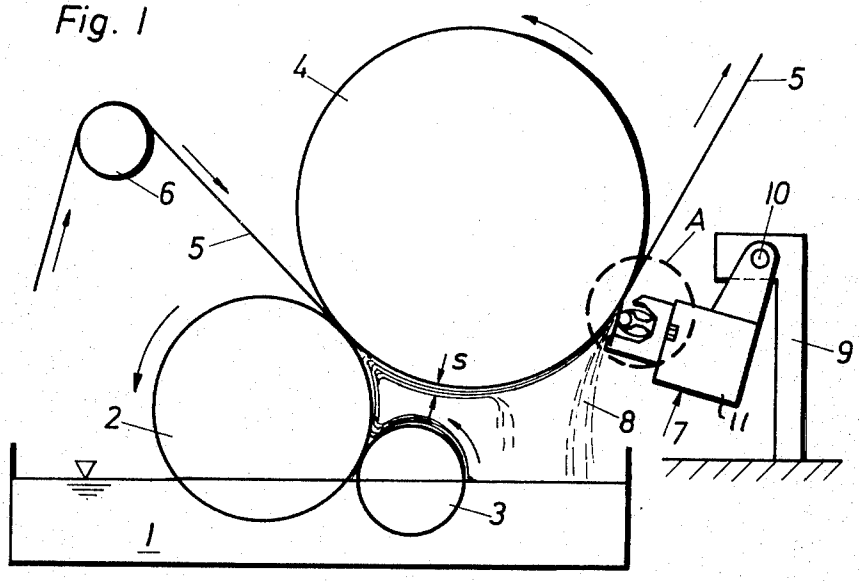


Fig. 2

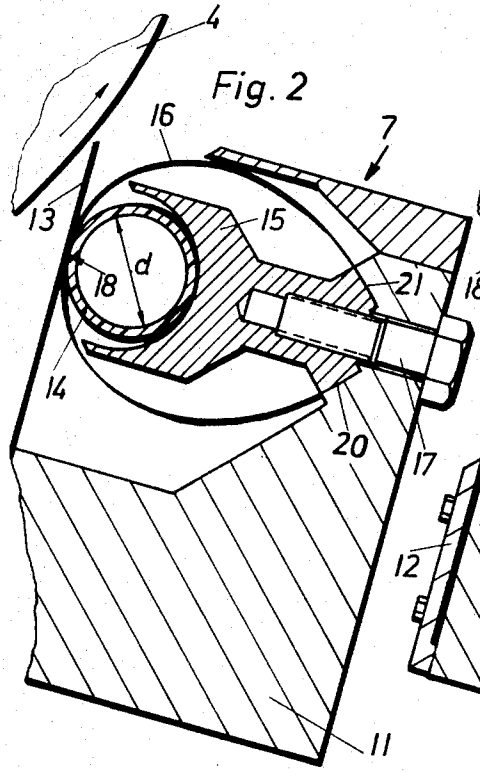
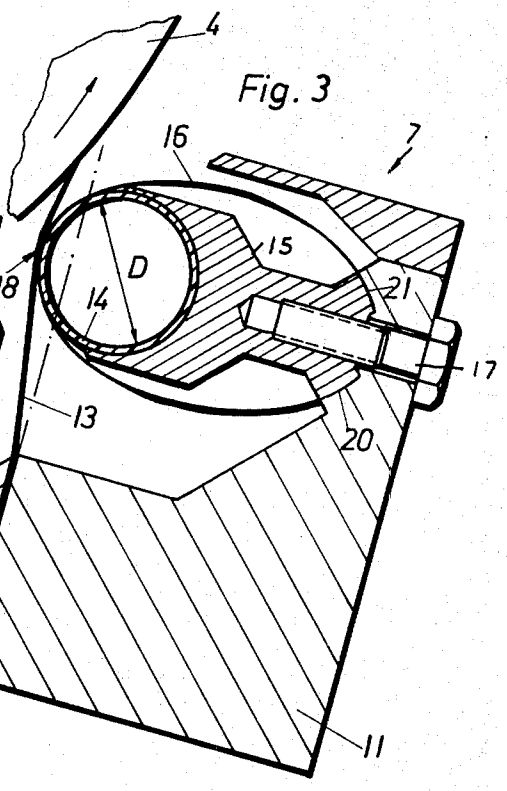


Fig. 3



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SMOOTHING SCRAPER-COATING APPARATUS

The present invention is concerned with controlling the thickness of a layer of coating composition on a running web, particularly a paper web, and is particularly concerned with a novel form of blade arrangement extending the width of the web and operable for controlling the thickness of a coating composition applied to the web.

Arrangements for controlling the thickness of films or layers of coating compositions applied to webs are known in the form of doctor blades and the like. It is also known to employ somewhat resilient or flexible blades which are pressed against a running web to control the thickness of a film deposited thereon. It is, furthermore, known to provide expansible backing elements, such as inflatable tubes, behind such blades in order to thrust the blades against the web being treated thereby to control the stripping off of excess coating compositions from the web.

It has always been a problem to maintain uniform contact pressure between such a flexible blade and the web engaged thereby. Obviously, any variation in contact pressure across the width of the web will interfere with the uniformity of the film of coating composition thereon and, therefore, with the surface weight of the coating composition which finally remains on the web. It is essential, for the production of a high quality, uniform, product, to maintain extreme accuracy in respect to the amount of coating composition remaining on the web per unit area thereof and across the entire width of the web.

It has been found that when the control blade in an arrangement of the nature described is backed up by an inflatable tube which presses the blade toward the web, even if the air pressure in the tube is uniform throughout the length of the tube, the blade will not always be thrust against the web with the required degree of uniformity of pressure. This lack of uniformity of the pressure of a blade against the web comes about because of irregularities in the material of the web or due to non-uniformity in the wall thickness of the tube and for other reasons and interferes with the production of a uniform product.

One attempt to compensate for such irregularities involves backing up the inflatable tube, on the side thereof opposite the blade which it engages, with a bearing or backing strip which is subdivided into a plurality of sections arranged in end to end relation. The individual sections referred to are connected to spindles which may be operated to move the sections toward and away from the web so that individual compensating pressures of appropriate magnitude can be superimposed on the pressure exerted in respective regions along the blade by the inflated tube when the pressure of the blade on the web is non-uniform. This arrangement, however, proved to be unsatisfactory and has failed to solve the problem because the adjustment of the individual spindles for the separate sections was difficult and the arrangement, furthermore, did not take into account changing conditions that could be encountered from one portion of a web to another.

With the foregoing in mind, a primary objective of the present invention is the provision of an arrangement of the nature referred to in which the pressure of the blade on the web can be maintained highly uniform from one side of the web to another.

A further object is the provision of an arrangement of the nature referred to in which the pressure of the blade on the web from side to side of the web remains substantially uniform at all times and without the necessity of difficult and complex adjustment of the supporting structure for the blade.

A particular object is the provision of an arrangement referred to in which irregularities in the wall thickness of an inflatable element for thrusting the blade toward the web are automatically compensated for so that the pressure of the blade on the web is uniform across the entire width of the blade.

The exact nature of the present invention will become more apparent upon reference to the following detailed specification taken in connection with the accompanying drawings in which:

FIG. 1 schematically illustrates a roller coating machine having a coating thickness controlling arrangement according to the present invention;

FIG. 2 is a sectional view showing the coating thickness controlling arrangement according to the present invention with the scraper blade of the arrangement lifted off from the web; and

FIG. 3 is a view like FIG. 2, but shows the scraper blade pressed against the web in an operative position.

BRIEF SUMMARY OF THE INVENTION

According to the present invention, a scraper, or skimming, blade arrangement is provided for use in a coating installation, such as a roller coating installation, in which the blade is in the form of a strip-like yieldable element extending transversely of the web. The blade is supported along one marginal edge in a support beam in such a manner that the free edge of the blade is normally spaced from the web.

Between the side of the blade opposite the web and the support beam there is provided an inflatable member which can be inflated, as by compressed air, or the like, and thereby press the blade against the web to be scraped thereby.

According to the present invention, a leaf spring is provided between the inflatable tube and the blade and extending the whole length of the tube and curved so as to be convex toward the back of the blade. The leaf spring is flexible and will yield when the inflatable tube expands so as to press the blade toward the web. The function of the leaf spring is to absorb and distribute pressure peaks occuring at any position along the length of the tube and thereby to make uniform the pressure with which the blade engages the web. It is convenient for the leaf spring to be constructed in the form of a sleeve which substantially encloses, or surrounds, the tube. The sleeve may, for example, be substantially elliptical in cross sectional shape with the major axis of the ellipse extending substantially in the direction in which the tube, when expanded, moves the scraping blade.

DETAILED DESCRIPTION OF THE INVENTION

Referring to the drawings somewhat more in detail, the coating apparatus illustrated in FIG. 1, comprises a trough 1 containing coating composition and in which rollers 2 and 3 immerse. A larger roller 4 is arranged in opposition to roller 2 and a paper web 5 enters the bight between rollers 2 and 4 after having passed over a guide roller 6. The coating composition taken up from

trough 1 by immersion rollers 2 and 3 is first applied to web 5 in excess, for example, to a thickness indicated at *s* in FIG. 1, and what coating composition does not drop from the web back into the trough 1, is conveyed by the web to a scraping apparatus, generally indicated at 7. As the coated web passes scraping apparatus 7, the film thickness is scraped, or skimmed, down to the desired uniform film thickness. The excess material removed by apparatus 7 drops back into trough 1 as indicated at 8 in FIG. 1.

The apparatus 7 may be supported on a bracket as 9 by a pivot 10 so that the apparatus can be pivoted bodily toward and away from the axis of roller 4.

Details of the apparatus 7 will be seen more clearly in FIGS. 2 and 3. In these Figures, it will be observed that the scraping apparatus comprises a scraper beam 10 extending parallel to the axis of roller 4 and having fixed thereto a strip-like yieldable scraper blade 13 which is clamped along its lower marginal edge to beam 11 as by clamping plate 12. Disposed on the side of blade 13 opposite the web 5 is an expansible tube 14 which may, for example, be formed of rubber or a like elastomeric material. Tube 14 extends behind blade 13 over the entire width of the web and blade 13 and is supported on the side opposite blade 13 by a support strip 15. Strip 15 also extends the entire length of blade 13 and is fixedly anchored in beam 11 as by screws 17 distributed along the length of strip 15.

According to the present invention, a leaf spring 16, steel, for example, is provided which is clamped at its marginal portions 20 and 21 beneath strip 15 and which extends outwardly from the clamped peripheral portions in a substantially elliptical shape and in surrounding relation to strip 15 and tube 14. The portion of tube 14 nearest blade 13, and indicated at 18, is the pressing zone and it will be noted that spring 16 advantageously engages both the tube and the back of blade 13 in the said pressing zone and curves backwardly away from the back of blade 13 on both sides of the pressing zone 18.

In FIG. 2, tube 14 is deflated and has an internal diameter designated *d* and it will be noted that blade 13 is at this time retracted from the surface of roller 4 and engages spring 16 but would be spaced a substantial distance from any web passing about roller 4.

In FIG. 3, inflatable tube 14 has been supplied with air under pressure and has expanded to a diameter D and has caused leaf spring 16 to expand in the longitudinal direction and to press blade 13 into engagement with the surface of a web passing about roller 4.

It will be noted that strip 15 is provided with an elongated arcuate recess in which tube 14 is mounted so that the portion of tube 14 facing away from blade 13 is confined when the tube is in expanded condition and thereby directing the expansive force of the tube in the direction toward pressing zone 18. Furthermore, leaf spring 16 passes around the side of the tube which faces the back of blade 13 so that the tube is substantially completely confined in a cavity defined by leaf spring 16 and the arcuate recess in strip 15 when the tube is in the expanded condition.

Because of this confinement of tube 14, it will be appreciated that the tube 14 could be made quite flexible, thereby further to diminish the influence of non-uniform wall thickness thereof.

Still further, it will be noted that leaf spring 16 can be arranged to exert a substantial retracting force on tube 14 in a direction away from roller 4, thereby to insure retraction of blade 13 away from the surface of the roller when the pressure and tube 14 is reduced.

It has been mentioned that tube 14 is radially expansible by air pressure and, to this end, a fluid supply fitting including a valve is provided at one or both ends of tube 14 for supplying air pressure thereto to expand the tube and for releasing air pressure therefrom to collapse the tube.

Modifications may be made within the purview of the appended claims.

What is claimed is:

1. In an apparatus for controlling the thickness of a coating composition applied to one face of a running web which has the other face engaged by a support; a beam extending in the direction of the width of said web adjacent said one face thereof, a yieldable blade extending longitudinally along said beam on the side thereof toward said web and having one marginal edge fixed to said beam, the other marginal edge of said blade being moveable into engagement with said one face of said web directly opposite said support, a radially expansible fluid tight element extending longitudinally of said beam and located between said beam and said blade, said expansible element being operable when expanded to exert pressure on said blade in a longitudinal region thereof spaced from said one marginal edge of the blade, and a leaf spring extending longitudinally of said beam and having a portion extending longitudinally of said blade and disposed between said expansible element and said blade, said leaf spring being connected to said beam in at least one region of the spring which is spaced from said portion thereof.

2. An apparatus according to claim 1 in which said leaf spring in cross section is curved so as substantially to surround said inflatable element.

3. An apparatus according to claim 2 in which the marginal edge of said leaf spring on each side of the said portion thereof is fixed to said beam.

4. An apparatus according to claim 1 in which said beam includes a support strip thereon engaging the side of said inflatable element opposite the said blade, said leaf spring having longitudinal marginal edges fixed to said strip along regions spaced from said inflatable element and curving therefrom about said inflatable element so as to be generally elliptical in cross section.

5. An apparatus according to claim 4 in which said inflatable element is in the form of a tube, said support strip having a longitudinal arcuate recess facing said blade and in which said tube is disposed.

6. An apparatus according to claim 4 in which said support strip at the side opposite said inflatable element is detachably connected to said beam, the marginal edges of said leaf spring being clamped between said strip and said beam.

7. In an apparatus for coating a running web: means for supporting a web to be coated during movement of the web in the direction of the length thereof, a coating station in the apparatus operable for applying an excess of coating composition to one face of the web, and blade means in the apparatus downstream from said station adapted to engage the coated face of the web to control the thickness of said coating, said blade means

comprising a yieldable blade adjacent said web extending transversely of said web and having one marginal longitudinal edge fixedly supported, an inflatable radially expansible tubular element operatively engaging the blade on the side thereof facing away from the web and expansible by fluid pressure to flex the blade toward the web and cause the other marginal edge thereof to engage the coated face of the web, and leaf spring means extending longitudinally of said blade and interposed between said tubular element and said blade, said leaf spring means being concave toward said tubular element, said leaf spring means being relatively freely moveable in the direction toward and away from said web to permit said flexing of said blade but being relatively stiff against bending in a direction perpendicular to said blade whereby to absorb pressure peaks along said tubular element and to distribute the pressure peaks longitudinally of said blade.

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