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L. HORNOSTEL
APPARATUS FOR COATING
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Fig-1

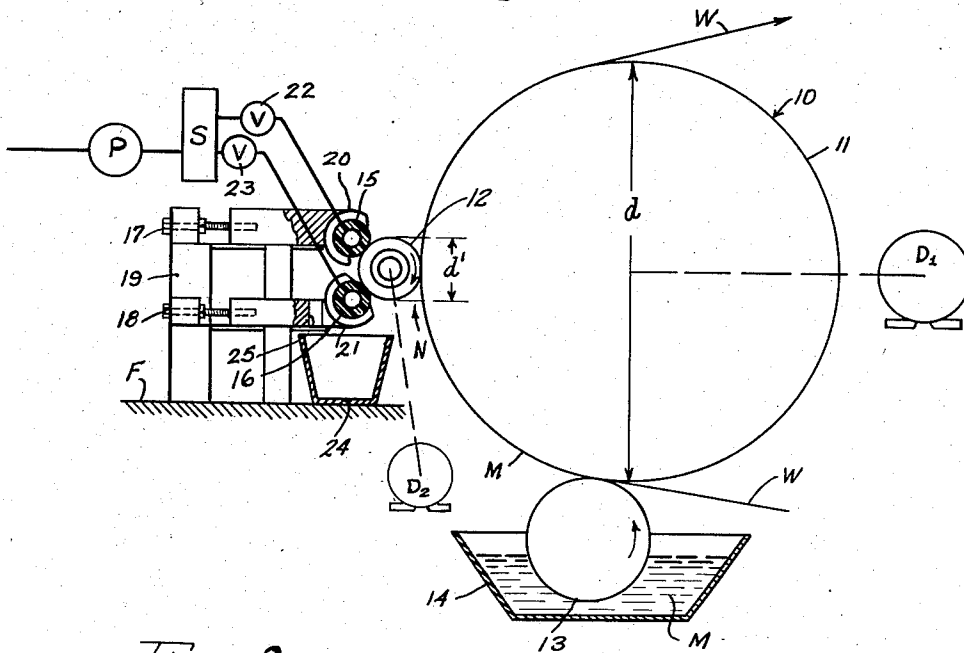


Fig-3

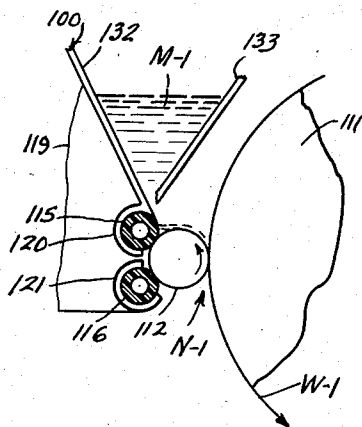
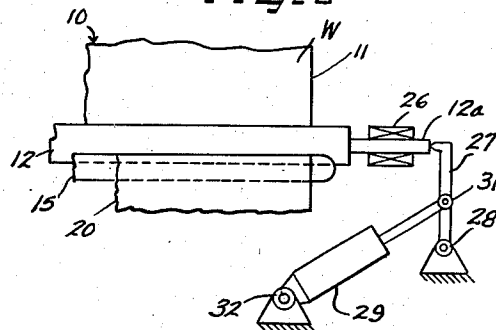


Fig. 2



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APPARATUS FOR COATING

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8 Claims. (Cl. 118—113)

The instant invention relates to apparatus for coating a sheet or the like, and more particularly, to apparatus for applying a uniform coating to a travelling sheet such as a paper web.

Ordinarily, in the coating of a travelling sheet or web fabric, plastic film, paper or the like, the sheet is backed by a supporting surface and the coating is applied to the exposed side thereof using a "doctor" to smooth the coating material on the sheet and insure uniform application thereof. Although the instant invention may have use in the coating of any of such sheets, it is particularly useful in the coating of paper webs and will be described primarily with respect to this use.

In coating devices of this general type the advantages of small (diameter) "doctor" rolls are well known in the art. The main backing roll or "platen" roll is ordinarily of substantial size and its structure and internal supports are such that this roll is relatively rigid as compared to a relatively flexible small doctor roll. This is a principal disadvantage of the doctor roll, because this relative flexibility or lack of stiffness must be compensated one way or another in order to insure the application of a coating of uniform thickness. In many instances the small doctor roll is crowned, but this results in a difference of surface speeds between the speed at the crowned center of the roll and the speed at the ends of the roll. Stationary blades have been used because these can be adequately supported, but such blades lack a number of advantages which the doctor roll provides, including particularly the advantage of being able to rotate the doctor roll. Loading of the doctor rolls has been attempted by the use of other rolls, but the difficulties also increase greatly with increases in the width of the machine.

The instant invention offers a solution to the problems involved in the use of a relatively small flexible doctor roll with the usual relatively rigid large platen roll. In the instant invention loading of the doctor roll is accomplished by the use of one or more members presenting a resilient surface slidably engaging the back side of the doctor roll and by the use of fluid pressure means operating against the back side of the resilient surface for the full length of the doctor roll so as to uniformly load the doctor roll against the platen roll throughout the length thereof. The resilient means may be in the form of an elastomer tubular member which receives the fluid pressure within the tube and which engages the back side of the doctor roll so as to function as a wiper therefor. Such tubular members apply pressure uniformly throughout the full length of the doctor roll so that no crowning is necessary and a coating of uniform thickness is maintained by the doctor roll across the entire width of the coated sheet backed by the platen roll. In addition, the resilient surface of the tubular member slidably engaging the doctor roll permits rotation thereof in either direction as well as oscillating movement thereof longitudinally of the axis of the doctor roll. The uniform application of fluid pressure (via the resilient member) throughout the full length of the doctor roll also permits compensation for

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inequalities of the platen roll due to heat as well as variations in the sheet itself.

It is, therefore, an important object of the instant invention to provide an improved apparatus for coating travelling sheet material or the like.

It is a further object of the instant invention to provide an improved apparatus for coating a travelling sheet, comprising a relatively rigid platen roll supporting the travelling sheet wrapped thereby, a relatively flexible doctor roll defining with said platen roll a nip through which the sheet passes, coating means at the on-coming side of the nip and on the doctor roll side of the sheet applying coating to the sheet, a member presenting a resilient surface slidably engaging said doctor roll, and fluid pressure means urging said resilient surface against the doctor roll to load the doctor roll against said platen roll.

Other and further objects, features and advantages of the present invention will become apparent to those skilled in the art from the following detailed disclosure thereof and the drawings attached hereto and made a part hereof.

On the drawings:

Figure 1 is an elevational view, with parts shown in section and parts shown diagrammatically, of a coating apparatus embodying the instant invention;

Figure 2 is a fragmentary top plan view showing essentially diagrammatically an oscillating drive for one end of the doctor roll shown in Figure 1; and

Figure 3 is a fragmentary elevational view, with parts shown in section and parts shown diagrammatically showing another embodiment of the instant invention.

As shown on the drawings:

In Figure 1 there is shown a coating apparatus indicated generally by the reference numeral 10 embodying the instant invention. The apparatus 10 comprises a relatively rigid large platen roll 11 supporting a traveling sheet or paper web W wrapped thereby. The web W travels in the direction indicated by the arrow from beneath the platen roll 11 along the uprunning side thereof. The platen roll 11 is rotated by drive means D_1 (shown diagrammatically) of the usual type which include a suitable motor and speed control gearing assembly, which need not be further described herein. The platen roll 11 is of substantial diameter "d" and is provided with suitable internal supports so that it is rigid (which respect to the members of lesser size which will be described hereinafter); and the platen roll 11 is provided with a smooth surface. Also, means (not shown) for supplying heat internally to the platen roll 11 may be provided to assist in drying the coating on the web W while the web W is wrapped about the platen roll 11.

The apparatus 10 is also provided with a relatively flexible doctor roll 12 defining a nip N with the platen roll 11 along the uprunning side thereof. The web W passes through the nip N whereat the doctor roll 12 levels the coating on the exposed side of the web W so that a uniform application of coating material is obtained.

At the on-coming side of the nip N, or beneath the nip N, coating means in the form of a coating roll 13 applies a coating material M to the exposed side of the web W. As here shown the coating roll 13 is mounted in a tank 14 which contains a bath of the coating material M partially submerging the coating roll 13. The coating roll 13 may be provided with drive means (not shown) if desired or it may be rotated by frictional engagement with the web W backed by the platen roll 11, as here shown. As the coating roll 13 rotates it picks up coating material M from the tank 14 and applies the same to the exposed side of the web W in a well known manner. The coating material M then remains on the exposed surface of the web W as it starts up the uprunning side of the platen roll 11 until the web reaches the nip N, whereat the doctor roll 12 smooths down and levels the coating

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material M so that a uniform application thereof is accomplished. The doctor roll 12 is rotated by means of drive means D₂ (shown diagrammatically), which again includes the usual motor and speed and direction control gearing well understood in the art. Preferably, the doctor roll 12 is rotated as shown by the arrow in a direction opposite to the rotation of the platen roll 11 so as to obtain the most effective smoothing of the coating material M and the most uniform distribution thereof. In the prior art, a coating roll such as the roll 12 which is relatively small, having a diameter d' that may range from as much as one-third of the platen roll diameter d to as little as perhaps one-twentieth thereof, is so flexible that it is difficult or impossible to apply a uniform layer of coating material M. As previously mentioned, crowning of such a doctor roll results in a lack of uniformity in the surface speeds along the length of the roll and various prior loading devices for such a doctor roll were ineffective.

In the instant invention, however, members 15 and 16 present resilient surfaces slidably engaging the doctor roll 12 so as to effectively load the doctor roll 12 against the platen roll 11 in a manner which will be described.

A structural frame member 19 secured to a stationary fixture such as the floor F (but adjustable via set screws 17 and 18) presents a pair of semi-cylindrical mounting means 20, 21 at the back side of the doctor roll 12 just slightly above and slightly below the doctor roll 12 for mounting the resilient members 15 and 16, thereby providing a fixed backing for the resilient members 15 and 16. By suitable adjustment of the position of the frame element 19 relative to the platen roll 11 the actual thickness of coating material M passing through the nip N on the web W may be controlled.

As here shown, the resilient members 15 and 16 are tubes of elastomeric material, such as rubber, synthetic rubbers, polyethylene, polytetrafluoroethylene ("Teflon"), and the like resilient plastic materials. The preferred material here used is polytetrafluoroethylene. The members 15 and 16 are tubes sealed at the ends which communicate with a source of fluid under pressure, here indicated diagrammatically at S. A pump P maintains air pressure in the source tank S and valves 22 and 23, respectively, control the flow of air into the interior of the tubes 15 and 16. As will be appreciated, the tubes 15 and 16 extend the full length of the doctor roll 12, so that the fluid pressure uniformly distributed within the tubes 15 and 16 is in turn uniformly imparted to the doctor roll 12 and the doctor roll 12 is in turn uniformly urged throughout its length against the platen roll 11.

As will be appreciated, the resilient members 15 and 16 are preferred because these members actually contact the doctor roll 12 along a minimum of surface area. The members 15 and 16 slidably engage the doctor roll 12 so as to permit rotation thereof. The loading force applied by the members 15 and 16 is applied generally along a line connecting the diameter of the doctor roll 12 and the center of the particular tube 15 or 16 because of the sliding engagement between the elements 12, 15 and 16. This sliding engagement also effectively permits wiping of the surface of the doctor roll by the tubes 15 and 16. As will be seen, a drip pan 24 is provided to receive coating material M wiped off the doctor roll 12 by the lower tube 16. Any material wiped off by the upper tube 15 can flow down past the lower tube 16 through passage-way 25 into the drip pan 24.

The tubes 15 and 16 afford the additional advantage that they are loaded against the doctor roll 12 so as to effectively wipe the same clean. The tubes 15 and 16 also afford the advantage that, while loaded against the doctor roll 12, they effectively permit limited oscillating or axial movement of the roll 12. Oscillating movement of the roll 12 is important to compensate for any minor inequalities in the operation of the platen roll 11 as well as for smoothing out possible wrinkles in the web W.

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Referring to Figure 2, it will be noted that a fragmentary top view of one side of the device 10 is shown, showing the top side of the web W passing on up over the platen roll 11. The doctor roll 12 is shown rotatably mounted at one end in bearings 26 (shown diagrammatically). The top resilient tube 15 retained in the backing element 20 is shown urged against the back upper portion of the rotating doctor roll 12. The doctor roll 12 is mounted in the bearings 26 for limited axial oscillation. Such axial oscillation can be effected by the use of any of a number of driving means, but here shown is an arm 27 mounted on a fixed pivot 28 for limited pivotal movement toward and away from the roll 12 and against the rotating roll journal 12a, so as to oscillate the roll 12 axially. The pivot arm 27 is moved by a pneumatic piston and cylinder (shown diagrammatically at 29) mounted on a fixed pivot 30 and connected to the middle of the pivot arm 27 by a pivot pin 31. The actuation of pneumatic piston and cylinder assemblies such as the assembly 29 is well understood by those skilled in the art and need not be further described herein in detail; but it should be mentioned that considerable force can be applied to the pivot arm 27 and a slow oscillating movement may be thus accomplished in the operation of the instant device.

Referring now to Figure 3, it will be seen that a somewhat different arrangement indicated generally by the reference numeral 100 is shown for the application of a coating material M-1 at a nip N-1 formed between a platen roll 111 and a rotating doctor roll 112. The platen roll 111 is covered by a web W-1 which passes through the nip N-1. A pair of resilient tubes 115, 116 having substantially the same structure as the tubes 15 and 16 of Figure 1 are loaded with compressed air and resiliently urge the doctor roll 112 against the platen roll 111 in the manner already described. The tubes 115, 116 are backed by semi-cylindrical rigid backing members 120, 121, respectively which are mounted in a fixed frame 119. The frame 119 also mounts walls 132 and 133 which form a V-shaped receptacle for the coating bath M-1. The wall 133 is spaced slightly from the wall 132 at the bottom thereof to form a gate for flowing controlled amounts of the material M-1 just over the top of the top resilient tube 115 and onto the top of the doctor roll 112. The doctor roll 112 turns upwardly at the nip N-1 and against the flow of coating material M-1 (although permitting the desired limited amount of flow of material onto the web W-1), while the web W-1 is drawn downwardly at the nip N-1 by the platen roll 111. The advantage here is that the wiping effect of the roll 112 on the resilient tube 115 is such that coating material is constantly retained at the base of the walls 132, 133 and the only coating material escaping therefrom is that applied in the desired amount to the surface of the web W-1. The coating wiped from the surface of the roll 112 is retained precisely in the position desired for additional coating to be applied to the web W-1. As will be appreciated, drive means for rotation and oscillation of the various elements in the embodiment 100 can be the same as those shown in connection with the embodiment 10 of the instant invention.

It will be understood that modifications and variations may be effected without departing from the spirit and scope of the novel concepts of the present invention.

I claim as my invention:

1. Apparatus for coating a travelling sheet, comprising a relatively rigid platen roll supporting the travelling sheet wrapped thereby, a relatively flexible doctor roll defining with said platen roll a nip through which the sheet passes, coating means at the on-coming side of the nip and on the doctor roll side of the sheet applying coating to the sheet, a plurality of members each presenting a separate resilient surface slidably engaging said doctor roll, and fluid pressure means urging each said resilient

surface against the doctor roll to load the doctor roll against said platen roll.

2. Apparatus for coating a travelling sheet, comprising a relatively rigid platen roll supporting the travelling sheet wrapped thereby, first drive means rotating said platen roll, a relatively flexible doctor roll defining with said platen roll a nip through which the sheet passes, coating means at the on-coming side of the nip and on the doctor roll side of the sheet applying coating to the sheet, a plurality of members each presenting a separate resilient surface slidably engaging said doctor roll, and fluid pressure means urging each said resilient surface against the doctor roll to load the doctor roll against said platen roll.

3. Apparatus for coating a travelling sheet, comprising a relatively rigid platen roll supporting the travelling sheet wrapped thereby, first drive means rotating said platen roll, a relatively flexible doctor roll defining with said platen roll a nip through which the sheet passes, second drive means rotating said doctor roll, coating means at the on-coming side of the nip and on the doctor roll side of the sheet applying coating to the sheet, a plurality of members each presenting a separate resilient surface slidably engaging said doctor roll, and fluid pressure means urging each said resilient surface against the doctor roll to load the doctor roll against said platen roll.

4. Apparatus for coating a travelling sheet, comprising a relatively rigid platen roll supporting the travelling sheet wrapped thereby, a relatively flexible doctor roll defining with said platen roll a nip through which the sheet passes, drive means rotating said doctor roll, coating means at the on-coming side of the nip and on the doctor roll side of the sheet applying coating to the sheet, a plurality of members each presenting a separate resilient surface slidably engaging said doctor roll, and fluid pressure means urging each said resilient surface against the doctor roll to load the doctor roll against said platen roll.

5. Apparatus for coating a travelling sheet, comprising a relatively rigid platen roll supporting the travelling sheet wrapped thereby, a relatively flexible doctor roll defining with said platen roll a nip through which the sheet passes, means oscillating said doctor roll longitudinally of its axis, coating means at the on-coming side of the nip and on the doctor roll side of the sheet applying coating to the sheet, a pair of members each presenting a separate resilient surface slidably engaging said

doctor roll, and fluid pressure means urging each said resilient surface against the doctor roll to load the doctor roll against said platen roll.

6. Apparatus for coating a travelling sheet, comprising a relatively rigid platen roll supporting the travelling sheet wrapped thereby, a relatively flexible doctor roll defining with said platen roll a nip through which the sheet passes, drive means rotating said doctor roll, means oscillating said doctor roll longitudinally of its axis, coating means at the on-coming side of the nip and on the doctor roll side of the sheet applying coating to the sheet, a pair of members each presenting a separate resilient surface slidably engaging said doctor roll, and fluid pressure means urging each said resilient surface against the doctor roll to load the doctor roll against said platen roll.

7. Apparatus for coating a travelling sheet, comprising a relatively rigid platen roll supporting the travelling sheet wrapped thereby, a relatively flexible doctor roll defining with said platen roll a nip through which the sheet passes, coating means at the on-coming side of the nip and on the doctor roll side of the sheet applying coating to the sheet, a pair of expandable resilient members each slidably engaging said doctor roll along the full length thereof, and a source of fluid under pressure expanding each said member to urge the doctor roll against the platen roll uniformly along the full length of the doctor roll.

8. Apparatus for coating a travelling sheet, comprising a relatively rigid platen roll supporting the travelling sheet wrapped thereby, a relatively flexible doctor roll defining with said platen roll a nip through which the sheet passes, coating means at the on-coming side of the nip and on the doctor roll side of the sheet applying coating to the sheet, a plurality of elastomer tubular members each slidably engaging said doctor roll along the full length thereof, and means expanding each member to urge the doctor roll against the platen roll uniformly along the full length of the doctor roll.

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