

Oct. 17, 1950

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2,525,863

COATING AND LAMINATING APPARATUS

Filed Jan. 29, 1947

2 Sheets-Sheet 1

Fig. 1

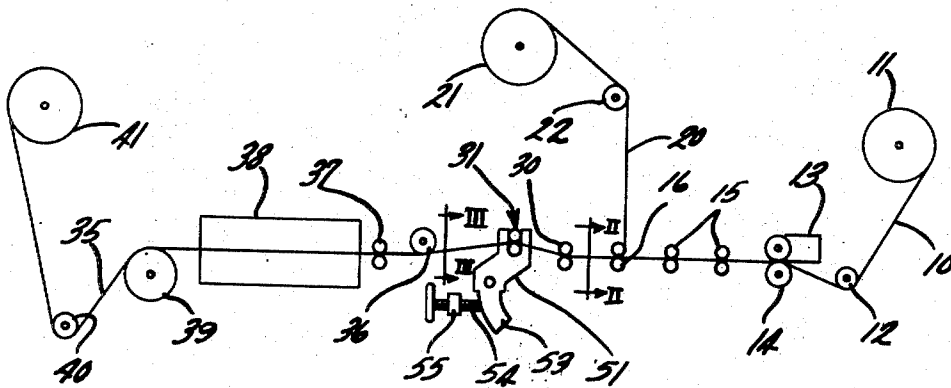


Fig. 2

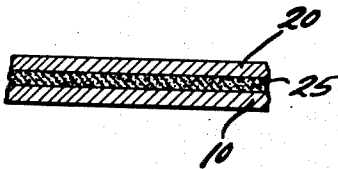


Fig. 3

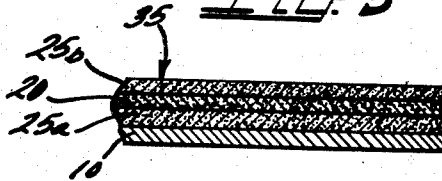
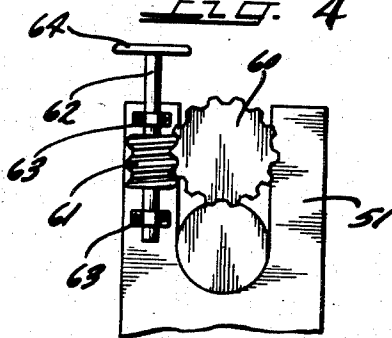


Fig. 4



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Fig. 5

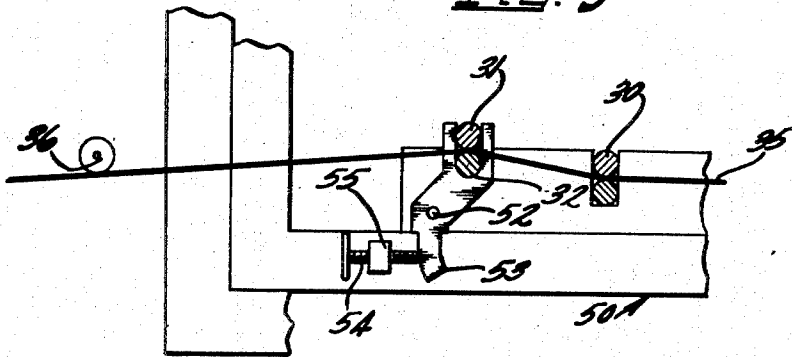


Fig. 6

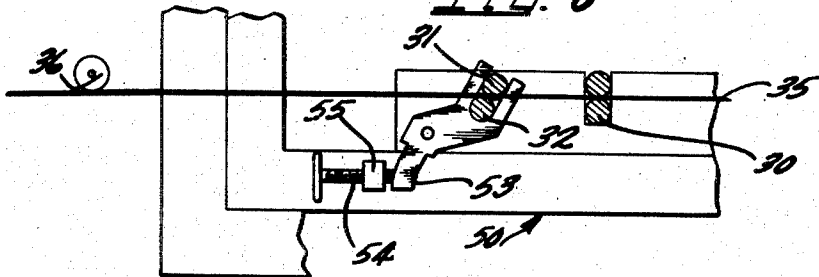


Fig. 7

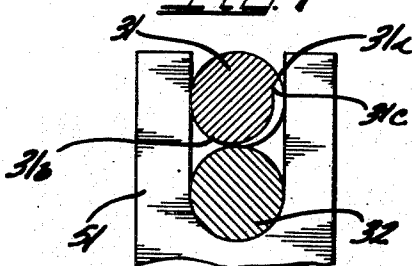


Fig. 8

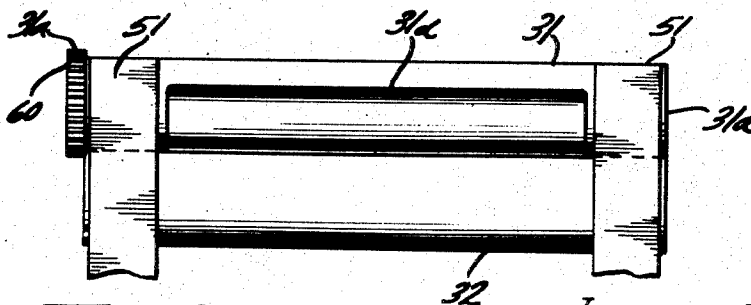
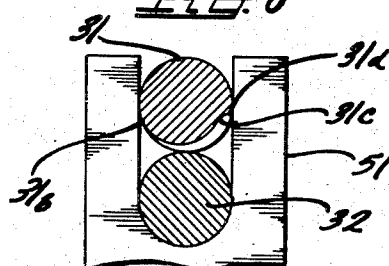


Fig. 9

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UNITED STATES PATENT OFFICE

2,525,863

COATING AND LAMINATING APPARATUS

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7 Claims. (Cl. 154—37)

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This invention relates to apparatus for coating and impregnating liquid-permeable sheet or tape material with a liquid composition. The apparatus of this invention is applicable to the preparation of the "Adhesive Tapes" described and claimed in my copending applications Serial Nos. 635,945 and 635,946, both filed December 19, 1945, the latter now abandoned.

As disclosed in said copending applications, liquid-permeable sheet or tape material such as paper or textile fabrics may be superimposed upon a layer of a liquid coating composition and pressed thereagainst by suitable tensioning means to force said coating composition upwardly through said paper or textile material to impregnate the same and to form a layer of coating composition on the upper face of said paper or textile fabric.

The present invention provides novel apparatus for carrying out such impregnating and coating operations. One particular feature of this novel apparatus comprises adjustable tensioning means for compressing a layer of liquid coating composition between two webs to force the liquid through the upper of said two webs. More particularly, said tensioning means may include a first generally cylindrical member over which said two webs (having a layer of liquid therebetween) may travel, at least one second cylindrical member below which said two webs may travel, and means for adjustably raising said first member above said second member to tension the two webs and compress the liquid therebetween.

Another feature of the apparatus of the present invention comprises an eccentric or cam-shaped generally cylindrical third member angularly adjustable above said first member and movable therewith as a unit transversely of said webs. Adjustment of the angular position of said eccentrically suspended third member with respect to said first member varies the spacing of said members, so that the lowest portion of the third member can serve to spread out and distribute evenly over the surface of the upper web liquid material that has penetrated the upper web due to the tensioning effect brought about by raising the first member above said second member.

It is therefore an important object of the present invention to provide coating and impregnating apparatus of the type indicated including a tensioning and spreading unit adjustable transversely of a multi-layer sheet passing there-through and made up of two generally cylin-

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drically members of which one is eccentric or cam-shaped and angularly adjustable with respect to the other.

Other and further objects and features will become apparent from the following description, appended claims and accompanying drawings which show, diagrammatically and by way of example, a specific type of apparatus according to the present invention. More particularly:

Figure 1 is a side elevation of an apparatus according to the present invention, supporting or frame means being omitted;

Figure 2 is a greatly enlarged, fragmentary, transverse cross-sectional view taken along the line II—II of Figure 1, and showing an impregnated sheet product in an intermediate stage of manufacture;

Figure 3 is a greatly enlarged, fragmentary, transverse cross-sectional view taken along the line III—III of Figure 1 and showing the sheet product of Figure 2 in a later stage of manufacture;

Figure 4 is a greatly enlarged, fragmentary, side elevation showing adjustment means for the spreading means illustrated in Figures 5, 6, 7, 8 and 9;

Figure 5 is a greatly enlarged, fragmentary side elevational view, with parts shown in section, of the apparatus of Figure 1 showing the tensioning unit in one operating position;

Figure 6 is a view similar to Figure 5 but showing the tensioning unit in another position;

Figure 7 is a greatly enlarged side elevational view, with parts shown in section, of the spreading means of the apparatus of Figure 1 in one operating position;

Figure 8 is a view similar to Figure 7, but showing the spreading means in another operating position; and

Figure 9 is an end elevation of the spreading means shown in Figures 7 and 8.

In Figure 1, the reference numeral 10 indicates an elongated web or tape that is unwound from a roller 11 at the right-hand end of the apparatus and is pulled through the apparatus toward the left by means described hereinbelow. More particularly, the web 10 first passes under a roller 12, to be coated with a liquid composition deposited from a suitable box, hopper or distributor 13. The web 10 with the superimposed liquid coating then passes between rollers 14 that serve to distribute the coating composition evenly over the top of the web 10.

The coating composition may consist of any conventional coating, impregnating, adhesive,

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water-proofing or other material. I can, for instance, employ an appropriate solution of any of the well known film-forming resins, such as cellulose acetate, cellulose acetate butyrate, ethyl cellulose or other cellulose ethers, nylon (super-polyamides), poly vinyl alcohol, poly vinyl alcohol acetate, poly vinyl chloride, poly vinyl chloride-acetate, poly vinyl butyral, poly styrene, polymerized methyl methacrylate or the like. These solutions may contain an amount of plasticizer adapted to confer upon the resulting film any desired degree of flexibility.

The web 10 is preferably made up of paper or other material more or less incompletely permeable to the coating composition deposited thereon when little or no impregnation of the web 10 is desired. When the web 10 is to be impregnated, more or less completely, then the web 10 is made up of material permeable to the coating composition, such as more or less porous or bibulous paper.

The web 10 coated with an evenly distributed layer of coating composition may next be passed between two pairs of cylinders or rollers 15 maintained at the level of the rollers 14. Next, the coated web is passed between a pair of rollers 16 (maintained in the plane of the rollers 15 and 14), where a web 20 of porous or bibulous paper or tissue or textile or other sheet material permeable to the coating composition and having the same width as the web 10 is superimposed on the layer of coating composition distributed over the web 10. As shown, the web 20 is unreel from a roller 21 and passes over another roller 22 before passing between the rollers 16 to be superimposed upon the coated web 10.

The intermediate product obtained at this stage is shown in greater detail in Figure 2 as including the web 10 coated, for instance, with adhesive 25 having the permeable web 20 superimposed thereon.

The three-ply laminate shown in section in Figure 2 and shown in Figure 1 as issuing from between the rollers 16 next passes between additional cylinders or rollers 30 (disposed at the level of the rollers 14, 15 and 16) and then passes between an upper cylinder 31 and a lower cylinder 32 adjustably maintained as a unit above the level of the rollers 30 by means described in greater detail hereinbelow. As a result, the webs 10 and 20 are tensioned. The web 10 cannot move downwardly under the influence of this tensioning, but the web 20, when thus tensioned, compresses the liquid layer 25, forcing the coating composition upwardly through the permeable web 20, displacing air contained therein. The coating composition thus permeates the web 20 and forms a distinct layer on the top surface thereof. When the coating composition is compressed between the webs 10 and 20, all the coating composition is not displaced from the underside of the web 20. The laminated structure thus formed is shown in greater detail in Figure 3 and there indicated generally by the reference numeral 35. As shown, this structure consists of four layers: the web 10, a layer of coating composition 25a, the web 20 (now impregnated with coating composition), and an uppermost layer of adhesive 25b. The upper cylinder 31 serves to smooth out the layer 25b of coating composition, in a manner described in detail hereinbelow.

The laminate 35 thus obtained next passes under a roller 36 whose lower surface lies in the plane of the cylinders 30, and thus serves to aid in the establishment of tension by the roller 32.

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The laminate 35 next travels between a pair of cylinders or rollers 37, through a dryer 38, over a roller 39, under a roller 40, and is finally wound up on a power driven roller 41, which latter serves to maintain the web material being processed under tension.

Reference is now made to Figures 1, 5 and 6 for a detailed showing of the arrangement of the adjusting means for the cylinders 31 and 32. As illustrated, the apparatus of Figure 1 may include a frame or support generally indicated at 50. The cylinders 31 and 32 have their end portions disposed in two spaced forks 51 pivoted from the frame 50 at 52. An arm 53 projects downwardly from each fork 51 for displacement to the right under the influence of a screw 54 that can be turned and thus displaced lengthwise through a threaded aperture in a lug 55 projecting from the frame 50. It will be noted that the fork 51 is offset away from the lug 55 so that the force of gravity will tend to hold the fork in the lowered position shown in Figure 6 where the cylinders 31 and 32 are on the same level as the cylinders 30. Further, the fork 51 is so formed that when the same is displaced to the left, the arm 53 being displaced to the right under the influence of the screw 54 (as shown in Figure 5), the cylinders 31 and 32 are lifted above the cylinders 30 to any desired level depending upon the amount of pivoting effected under the action of the screw 54. In other words, the fork 51 with its arm 53 forms a two-armed lever pivoted at the point 52 capable of being actuated by the screw 54 to lift the web passing between the cylinders 31 and 32 to any desired extent, and thus to tension the web which is restrained against upward movement by the cylinders 30 and the roller 36.

As explained hereinabove, the tensioning of the web 20 compresses the layer of coating composition 25 between the webs 10 and 20 and forces the coating composition up through the web 20. The coating composition penetrating completely through the web 20 tends to form separate droplets on top thereof or, at least, is not always uniformly distributed over the top of the web 20. To distribute the coating of impregnating material uniformly over the top surface of the web 20, I have formed the cylinder 31 with terminal shoulders 31a of circular cross-sectional configuration adapted always to contact the corresponding terminal portions of the cylinder 32 which has a circular cross-sectional configuration throughout its length. Between the shoulders 31a, one-half of the periphery of the cylinder 31, more or less, is hollowed out so that the bottom of the hollowed-out portion progressively recedes in the manner of a spiral, from a point 31b adapted to contact the roller 32 to a point 31c spaced further from the roller 32 than any point along the line joining the points 31b and 31c. From the point 31c, the bottom of the hollowed-out portion of roller 31 rises to intersect with the cylindrically formed surface at the point 31d. Thus, from the point 31b to the point 31c, the member 31, in effect, is formed with a cam surface eccentric with respect to the remainder of the periphery of the cylinder 31, and angular displacement of the member 31 with respect to the member 32 will space this surface to a smaller or greater extent from the member 32.

Means for adjustably rotating the member 31 with respect to the member 32 are provided in the form of a gear wheel 60 (see Figures 4 and 9) attached to one end of the member 31 outside one shoulder 31a; a worm gear 61 on a shaft 62 jour-

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naled in bearings 53 on one branch of the fork 51 and parallel therewith; and a hand wheel 54 for rotating the shaft 52.

In operation of the apparatus shown in Figure 1, the screw 54 is rotated to pivot the fork 51 upwardly so as to lift the members 31 and 32 for bringing about the desired tension on the three-ply laminate passing between the members 31 and 32. Further, the member 31 is rotated with respect to the member 32 so as to space the cam surface 31b—31c by that distance from the member 32 at which the coating composition penetrating the web 20 will be distributed evenly over the top surface of the web 20 by smoothing contact with said cam surface.

If desired, a similar adjustable smoothing action may be obtained by making the member 31 perfectly cylindrical throughout its length and eccentrically suspending the member 31 above the member 32 on a shaft permitting adjustment of the angular position of the member 31 with respect to the member 32. Other details of construction may also be varied within a wide limit without departing from the principles of this invention and without sacrificing the advantages mentioned hereinabove and it is therefore not my purpose to limit the patent granted on this invention otherwise than necessitated by the scope of the appended claims.

I claim as my invention:

1. In coating and impregnating apparatus having means for forming a three-layer structure including a liquid impermeable web, a liquid permeable web and a layer of liquid interposed therebetween and means for advancing said structure in substantially a single plane, a tensioning and spreading unit comprising a supporting frame, supporting arms pivotally mounted on said frame adjacent opposed edges of said structure, a pair of cylinders carried by said supporting arms to extend transversely to the direction of travel of said structure and adapted to receive said structure therebetween in contact with one of said cylinders, said one cylinder having a cylindrical outer surface and the other cylinder having a recessed surface portion extending uniformly across its effective width, and means for effecting pivotal movement of said supporting arms and said cylinders to deflect said structure from said single plane, whereby the structure is tensioned about said one cylinder to force said liquid through said permeable web establishing a layer of liquid on each side thereof with the other of said cylinders distributing liquid evenly over the surface of that portion of the structure supported by said one cylinder.

2. In a coating and impregnating apparatus having means for forming a three-layer structure including a liquid impermeable web, a liquid permeable web, and a layer of liquid interposed therebetween and means for advancing said structure in substantially a single plane, a tensioning and spreading unit comprising a supporting frame, a pair of arms pivoted to said frame to extend upwardly along opposed edges of said structure, said arms having slotted upper off-set portions and a depending portion, a pair of cylinders mounted in said slotted upper portion to extend transversely to the direction of travel of said structure and adapted to receive said structure therebetween, screw means carried by said frame and contacting said depending arm portion to pivot said arm deflecting said structure from said single plane, whereby the structure is tensioned to force said liquid through said permeable

web establishing a layer of liquid on each side thereof with one of said cylinders serving to distribute liquid evenly over the structure surface.

3. In coating and impregnating apparatus having means for forming a three-layer structure including a liquid impermeable web, a liquid permeable web, and a layer of liquid interposed therebetween and means for advancing said structure in substantially a single plane, a tensioning and spreading unit comprising a supporting frame, a pair of supporting arms pivotally secured to said frame, a pair of closely spaced cylinders supported by said arms to extend transversely to the direction of travel of said structure for contacting corresponding opposing portions of said structure, said cylinders being adapted to receive said structure therebetween to deflect said structure from said one plane upon movement of said arms so that the structure is tensioned to force said liquid through said permeable web establishing a layer of liquid on the exposed surface of said web, one of said cylinders having a recessed eccentric surface portion extending uniformly along its effective axial length for contacting liquid on the structure surface, said one cylinder serving as a doctor member to distribute liquid evenly over the structure surface, and means for rotating said one cylinder to space said eccentric surface portion from said structure surface to determine the thickness of said surface layer thereon.

4. In coating and impregnating apparatus having means for forming a three-layer structure including a liquid permeable web, a liquid impermeable web and a layer of liquid interposed therebetween and means for advancing said structure in substantially a single plane, a tensioning and spreading unit comprising a supporting frame, a pair of supporting arms pivotally secured to said frame and extending upwardly alongside each edge of said structure, said arms having a slotted upper off-set portion and a depending portion, a pair of cylinders mounted in said slotted portion to extend transversely to the direction of travel of said structure and adapted to receive said structure therebetween, means contacting said dependent arm portion for pivoting said arm to move said structure from said single plane to tension said structure forcing said liquid through said permeable web and thus establishing a layer of liquid on each side thereof, the upper of said cylinders being formed with a recessed eccentric surface portion adjacent the liquid layer on the structure surface, and means for rotating said one cylinder about its longitudinal axis to vary the distance between said cylinder surface and said exposed structure surface to determine the thickness of the liquid layer thereon.

5. In coating and impregnating apparatus, a tension and spreading unit for evenly spreading a liquid layer over the surface of a web carrying said layer, comprising a supporting frame, a pair of supporting arms pivotally secured to said frame, a pair of cylinders supported by said arms to extend transversely to the direction of travel of said web, said cylinders being adapted to receive said web therebetween to tension said web upon pivotal movement of said arms, one of said cylinders having a recessed eccentric surface portion extending uniformly along its effective axial dimension for opposing the cylindrical surface of the other of said rolls, and means for rotating said one cylinder to vary the distance between said eccentric surface portion and said web

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supported on the other of said rolls to determine the thickness of the liquid layer thereon.

6. In coating apparatus, a spreading unit for uniformly distributing a surface layer over a carrier web, comprising spaced supporting arms adjacent opposed lateral edges of said web, a first cylinder supported by said arms and having a cylindrical surface extending therebetween for supporting said web, a second cylinder supported by said arms for overlying said web and having a recessed eccentric surface extending uniformly along its effective axial dimension, the eccentric surface of such second cylinder being adapted to contact the surface layer on that portion of said web supported by said first cylinder to evenly spread said layer thereon, and means for rotating said second roll relative to said first roll and the web supported thereon to vary the distance from said eccentric surface to said web and thereby the thickness of said surface layer.

7. In coating apparatus, a spreading and tensioning unit for uniformly distributing a surface layer over a carrier web, comprising a supporting frame, a first cylinder supported by said frame and having a cylindrical surface for receiving said web thereabout, a second cylinder also supported by said frame for overlying said web and having an eccentric recessed surface extending

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uniformly along its effective axial dimension in closely spaced relation to the cylindrical surface of said first cylinder, the recessed surface portion of said second cylinder serving to smoothly distribute said surface layer over that portion of said web supported on said first cylinder, and means for pivoting said cylinders about an axis displaced from the axes of said cylinders to vary the tension applied to said web as the web is supported on said first cylinder.

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