May 1, 1934. F. COATES 1,956,562

COATING APPARATUS

Filed Aug. 6, 1931 3 Sheets-Sheet 1

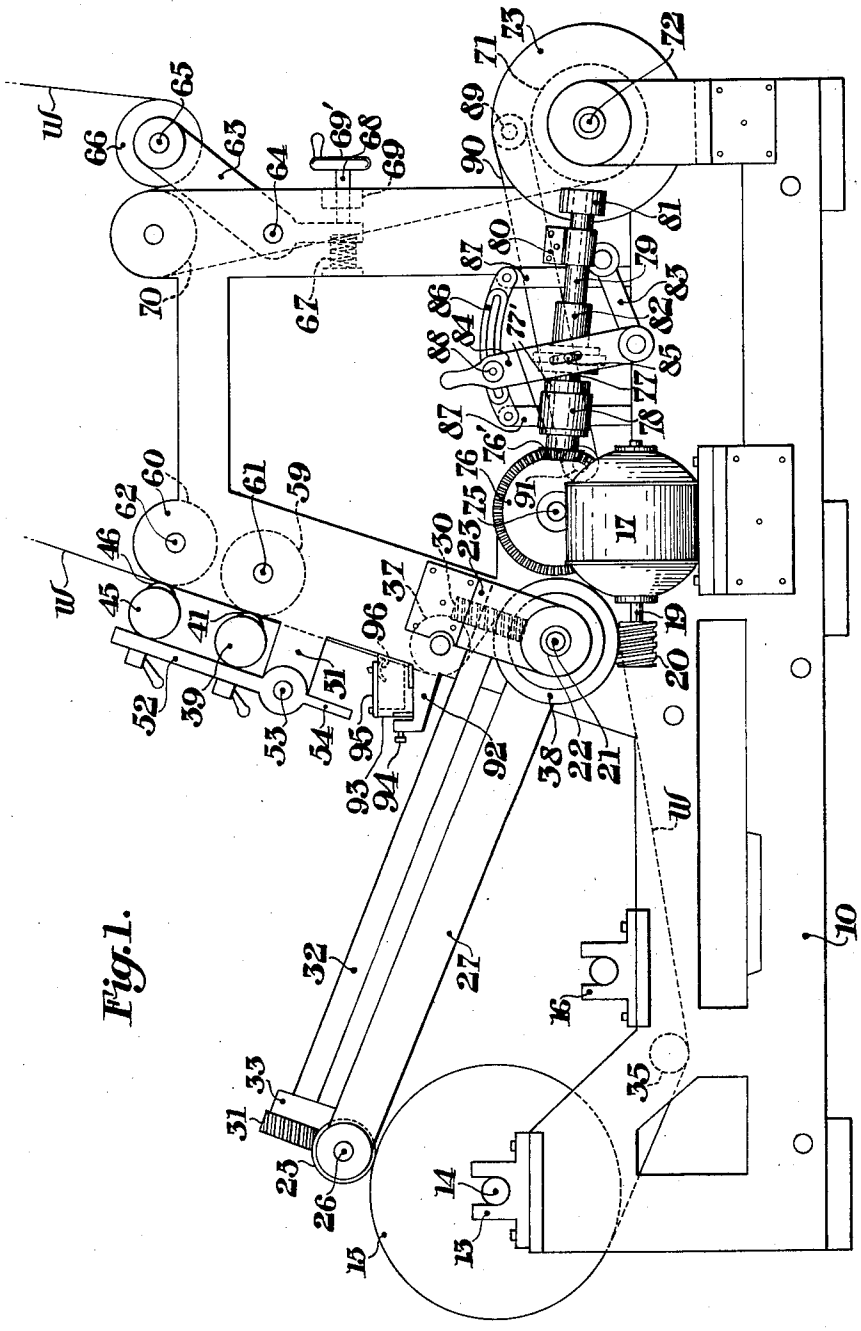


Fig. 1.

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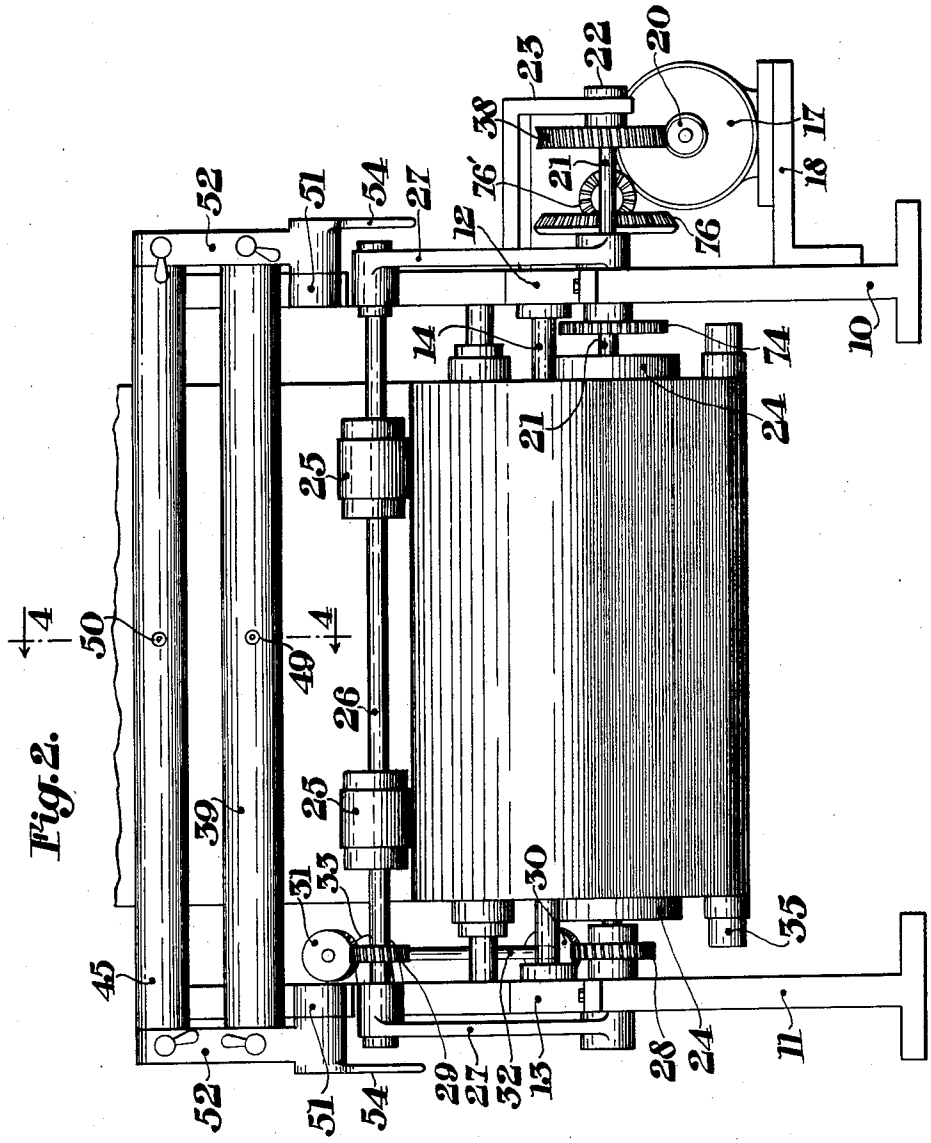


Fig. 2.

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Fig.3.

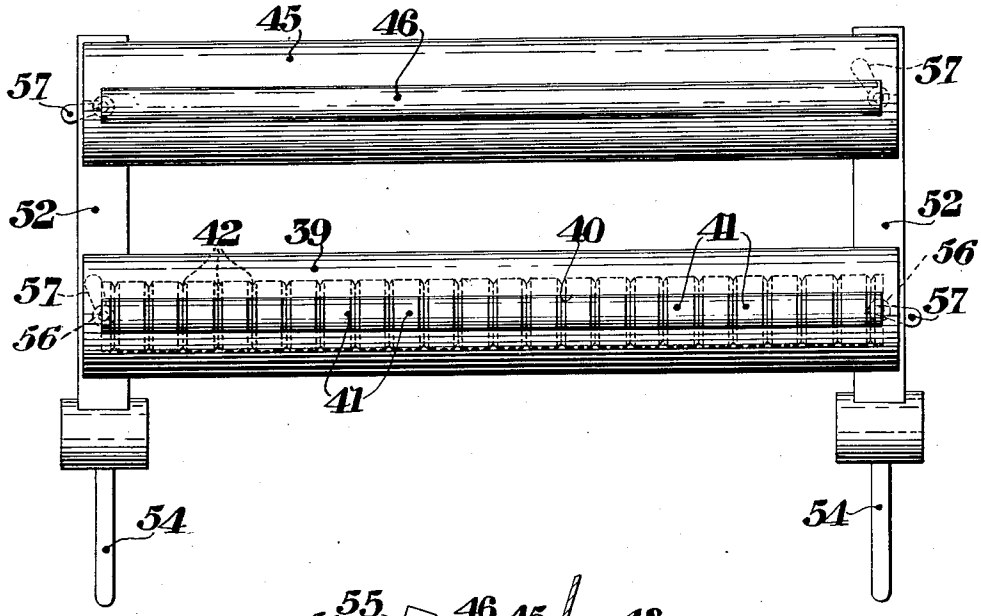


Fig.4.

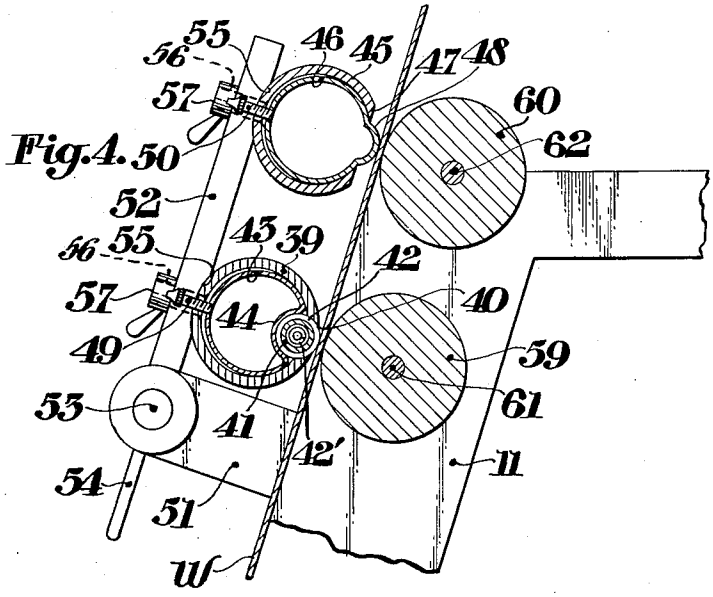
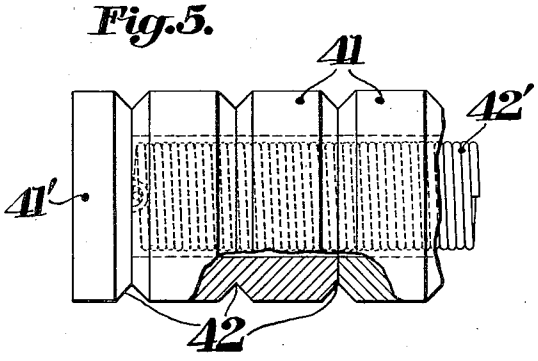


Fig.5.



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UNITED STATES PATENT OFFICE

1,956,562

COATING APPARATUS

Frederick Coates, Rochester, N. Y.

Application August 6, 1931, Serial No. 555,437

12 Claims. (Cl. 91—53)

The present invention relates to a method and apparatus for web coating and more particularly to a method and apparatus which provide for formation of the dope into longitudinal stripes on the web and spreading the dope to cover the web evenly.

One important object of the invention is the provision of the method for web coating which provides for applying the dope in excess to the web and removing the excess with the formation of a plurality of longitudinal stripes of dope which are later smoothed out to cover the web evenly.

Another important object of the invention is the provision of an apparatus for manipulating the dope on a web which includes a wiper means for removing the excess dope and forming the remaining dope into longitudinal stripes.

Another object of the invention is the provision of a spreader means for smoothing out the stripes of dope formed by the wiper means so that the web is evenly coated.

A further object of the invention is the provision of a pneumatic means within the wiper means and within the spreader means thus facilitating the creation and variation of pressures within each of said means.

Still another object of the invention is the provision of the wiper means and spreader means in the apparatus so that they act in succession upon the dope on the web, the wiper means acting first to form the stripes of dope and the spreader means acting second to spread said stripes out into an even coating.

A still further object of the invention is the provision of a wiper means which is specifically constructed of a cylinder provided with a longitudinal slot and containing a scraper provided with V-shaped circumferential grooves, a pneumatic tube with a concave portion also being contained within the cylinder and upon inflation being adapted to press the grooved scraper through the slot of the cylinder into contact with the web.

Another object of the invention is the provision of reaction rollers in combination with the wiper means and spreader means, said reaction rollers being located opposite each of said means and adapted to make rolling contact with the surface of the web opposite those surfaces in sliding contact with the wiper and spreader means.

With the above and other objects in view as will be hereinafter apparent, the invention consists in general of certain novel steps of operation, details of construction and combination of parts hereinafter fully described, illustrated in the accompanying drawings and defined in the appended claims.

In the accompanying drawings like numerals of reference designate like parts in the several views, and;

Fig. 1 illustrates a side elevation of the machine for reeling the web material as well as the attachment of the wiper and spreader means of the invention to said machine.

Fig. 2 is an end elevation of the combined reeling and coating means of the complete machine.

Fig. 3 is a detail of the wiper and spreader means mounted on the frame showing the protrusion of the grooved scraper and bulging of the pneumatic tube through the slots of the cylinders for each means.

Fig. 4 is a transverse cross section through the wiper and spreader means and the reaction rolls which are opposite each means taken on the line 4—4 of Fig. 2.

Fig. 5 is an enlarged detail view of the scraper for the wiper means.

In the illustrated embodiment of my invention Figs. 1 and 2 illustrate primarily the apparatus for handling the web material which constitutes no part of the invention but which is fully disclosed herein because of its particular adaptability to use with the method and apparatus of the invention. The reeling apparatus has two side frames 10 and 11 which are of irregular formation found to be most feasible in practical operation. A pair of cradles 12 and 13 are respectively mounted at the ends of side frames 10 and 11 to receive a shaft 14 which carries the supply roll 15 of web material. A second pair of cradles 16 are mounted on the side frames 10 and 11 and are displaced from cradles 12 and 13 so that an additional supply roll may be mounted upon the machine before exhaustion of the supply roll 15 in the cradles 12 and 13.

A prime mover such as an electric motor 17 is mounted upon a bracket 18 attached intermediately to the side frame 10. The shaft 19 of motor 17 has a worm 20. A drive shaft 21 rotates between the side frames 10 and 11 and extends beyond side frame 10 to a bearing 22 mounted on a bracket 23. A driving roll 24 is attached to drive shaft 21.

The supply roll 15 of web material is given a peripherial speed equal to the linear speed of web material through the apparatus by means of friction rollers 25 mounted on a shaft 26 which is journaled in the free ends of arms 27. The arms 27 have the other ends thereof pivotally con-

nected to the drive shaft 21 so that the friction rollers 25 rest upon the outer convolution of supply roll 15. The shaft 26 is driven from drive shaft 21 by means of a gear 28 mounted on drive shaft 21 and a similar gear 29 mounted on shaft 26, both gears being interconnected by a shaft 32 which has gears 30 and 31 on each end thereof meshing with the gears 28 and 29 respectively. Shaft 32 may be mounted rotatably in proper position in any suitable manner such as by means of a shoulder 33 projecting from the enlarged end of arm 27. A tensioning roller 35 is laid across the web material adjacent the supply roll 15.

A coating station of any well known or suitable design may be attached to the side frames 10 and 11. By way of example only I have illustrated the coating station which includes brackets 92, a trough 93, adjusting screws 94, cover 95 and a scraper 96. It should also be understood that the dope may be applied to the web at this point manually or by a gravity feed means external to the apparatus. In practice it is possible merely to pour the dope upon the web without affecting the final coating. Furthermore, inasmuch as the wiper means turns back all the excess dope it is merely necessary to manually maintain a bead beneath the wiper means to insure that sufficient dope is being applied to the web.

From the foregoing description it should be evident that the web W in its path to and through the coating stations passes, from supply roll 15 beneath tension roller 35, around driving roll 24, around idle roller 37 and past the coating station. The drive shaft 21 has keyed thereto a worm wheel 38 which engages the worm 20 on the shaft of motor 17. By proper selection of worm 20, worm wheel 38 and gears 28 to 31 inclusive, as well as the diameters of friction rollers 25 and driving roll 24, the peripheral speed of the supply roll 15 will be equal to the linear speed of the web W over driving roll 21 through the coating station.

The excess of dope on the web is first reduced in amount to the definite volume necessary for evenly coating the web over its entire surface. This removal of the excess dope is effected by a wiper means which also causes the formation of the remaining dope into raised stripes. The stripes formed by the wiper means are preferably in equal spaced relation and extend longitudinally of the web. The wiper means specifically includes a hollow cylinder 39 provided with a longitudinal slot 40 and containing a scraper. Said scraper is composed of a plurality of hollow rings 41 and two end discs 41'. A spring 42' extends between the end discs 41' within the hollow rings 41 to hold said rings 41 in end to end abutting relation. A plurality of V-shaped circumferential grooves 42 are provided in the scraper by beveling the ends of rings 41 and by intermediately grooving the same. This sectionalized construction of the grooved scraper permits manufacturing variations which would be extremely difficult, if not impossible, to eliminate, and which would be detrimental to precise formation of the stripes of dope. The grooves 42 are preferably in axial spaced relation and located at equal intervals. The wiper means also includes a pneumatic means within the hollow cylinder 39 such as a pneumatic tube 43 having concave portion 44 which is adapted to partially encircle the rings 41 of the scraper upon inflation of pneumatic tube 43.

Obviously variations in the viscosity of the dope to be applied and/or in the character of coating required will necessitate substitution of another scraper with differently spaced, shaped or sized circumferential grooves 42. The alterations in the provision and formation of circumferential grooves 42 will depend upon the desired changes in the dope viscosity or character of coating required. Such alterations are contemplated and deemed to be within the purview of the present invention.

The spreader means is located so as to smear the stripes of dope precisely and evenly over the surface of the web, such a spreader means is preferably composed of a second hollow cylinder 45 which contains a pneumatic means such as a pneumatic tube 46 and which has a flat side 47 provided with a longitudinal slot 48.

A valve stem 49 is attached to pneumatic tube 43 and a valve stem 50 is attached to pneumatic tube 46. Valve stems 49 and 50 are of well known construction and similar to the stems for admitting and regulating the air pressure within pneumatic tubes in general and such as are used on bicycles and automobiles.

Upon inflation of pneumatic tube 43 through the valve stem 49 the grooved rings 41 will be moved to protrude through the longitudinal slot 40 of hollow cylinder 39. Also upon inflation of pneumatic tube 46 through the valve stem 50 a portion of said tube 46 will bulge through the longitudinal slot 48 in cylinder 45. The pressure exerted upon the web either by rings 41 or the bulging portion of pneumatic tube 46 will obviously depend upon the air pressure within the pneumatic tubes 43 and 46 respectively. It should be noted that the pressure exerted by the aforesaid elements on the web can be readily created by the introduction of air under pressure into the tubes 43 and 46 and can be finely adjusted in a known manner by manipulation of the valve stems 49 or 50.

The mounting of the wiper and spreader means with respect to the moving web may be accomplished in any suitable manner. However, I have found the following mounting to be very satisfactory. A pair of lugs 51 are integral and project from the side frames 10 and 11 at a point which is above the aforementioned coating station. A pair of levers 52 are pivotally connected to the lugs 51 by means of pins 53. Handles 54 extend below the pivotal connection for levers 52 so that the levers may be readily moved. Levers 52 are provided with circular grooves 55 which receive the hollow cylinders 39 and 45. A series of bolts 56, see Figs. 3 and 4, pass through cylinders 39 and 45 as well as levers 52 and engage hand nuts 57.

A pair of reaction rollers 59 and 60 are respectively mounted on shafts 61 and 62 which extend between the side frames 10 and 11. The reaction rollers 59 and 60 are so located that they substantially form line contact with one surface of the web directly opposite the substantial line contacts formed by the wiper and spreader means with the web. These reaction rollers 59 and 60 may be composed of hard non-resilient material since the necessary resiliency for the wiper and spreader means will be provided in the air cushion within the pneumatic tubes 43 and 46 respectively. The assembly comprising lever arms 52, the wiper and spreader means is mounted so that, in operative position, the wiper and spreader means are held against the web by gravity. It should also be noted that the whole assembly may be pivoted out into a horizontal position in which the internal elements of the wiper and spreader means will be quite accessible.

After leaving the spreader means the dope is very evenly distributed over the surface of the web but may still be in moistened condition and not yet ready for winding in a roll. Consequently the web is passed over a series of rolls through a drying chamber or drying tower (not shown), the provision and construction of which is well known in the coating art.

After leaving the drying means the web W is passed over a tensioning means which may also promote even reeling of the web material. The tensioning means comprises a pair of bell cranks 63 pivotally mounted at 64 to the inner sides of frames 10 and 11, respectively, and a shaft 65 which is journaled in the upper ends of bell cranks 63 and which supports a roller 66. The other ends of bell cranks 63 may be moved into desired position against the action of springs 67 by means of screws 68 passing through blocks 69 on the inner sides of frames 10 and 11, said screws 68 being rotated by hand wheels 69. Thus either of bell cranks 63 may be independently moved to various positions in which the roller 66 will be parallel or at a slight angle to the web. In this manner the tension upon the web may be adjusted and any slack along either edge of the web may be compensated.

From the roller 66 the web W passed over an idle roller 70 to a take-up roll 71 having a shaft 72 rotatably mounted between side frames 10 and 11.

As is well known the take-up roll must be frictionally driven so that the web material will only be wound as fast as it is delivered from the drying means and over rollers 66 and 70. There are many known mechanisms for frictionally driving a take-up roll and the one disclosed in the present application is merely by way of example. A large disc 73 is attached or keyed to shaft 72. This disc 73 is driven from the motor 17 by a series of shafts and gears particularly described in the following. A gear 74 (see Fig. 2) is keyed to drive shaft 21 and engages a corresponding gear (not shown) on a counter shaft 75. A beveled gear 76 is attached to and rotates with counter shaft 75. A shaft 77 rotates within a bearing 78 attached to the outer side of frame 10 and has a beveled gear 76' engaging bevel gear 76. Collars 77' are fixed to shaft 77 on each side of bearing 78 and prevent axial movement of shaft 77 with respect to bearing 78. A shaft 79 is rotatably mounted in a bracket 80 also attached to the outer side of frame 10. Shaft 79 has a friction roller 81 on one end thereof frictionally engaging the surface of disc 73. The other end of shaft 79 has a sleeve member 82 which is axially slidable with respect to shaft 77 but which rotates therewith. A lever 83 is pivotally mounted on side frame 10 at one end and pivotally connected at the other end to a slotted lever 84. The slot in lever 84 engages a pin 85 on sleeve member 82 so that movement of lever 84 will cause movement of shaft 79 and friction roller 81. The upper end of lever 84 is adjustably attached to a slotted sector 86 mounted on side frame 10 by means of brackets 87, the adjustment of lever 84 being accomplished by loosening hand nut 88 which is tightened to maintain the friction roller 81 in the desired position. It should be noted that the position of friction roller 81 may be varied to increase or decrease, as desired, the speed at which disc 73 and take-up roll 71 are rotated.

A smoothing roller 89 rests upon the outer convolution of take-up roll 71 and is pivotally supported by a pair of lever arms 90 pivotally mounted at 91 to the side frames 10 and 11.

The present invention relating to method and apparatus for manipulating the dope on the surface of a web presents certain advantages and improvement over the United States patent to John G. Jones, 1,309,858, issued July 15, 1919, and also my copending application, Serial No. 468,042, filed July 15, 1930, for Improvements in coating apparatus. The particular novel features of the present invention are the formation of the dope into longitudinal stripes which have a very definite volume, said volume being that which is precisely necessary for coating the web. Furthermore, the combination of the wiper means for forming such stripes of dope with the spreader means including a pneumatic tube for evenly smearing the dope over the web constitute a substantial advance in the coating art. The rotatable reaction rollers which are located opposite the wiper and spreader means cooperate therewith to form a further patentable combination.

Since many modifications of my method and apparatus for web coating are possible, I do not intend to be limited by the illustrated embodiment of my invention but only by the scope of the appended claims.

Having now particularly described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. In a web coating machine adapted to apply dope to a web, the combination with a wiper means adapted to form on the web stripes of dope having definite volume for coating and to remove all excess dope from the web, of a pneumatic means adapted to smear the stripes of dope evenly over the surface of the web.

2. In a web coating machine adapted to apply dope to a web, the combination with a wiper means adapted to form on the web stripes of dope having definite volume for coating and to remove all excess dope from the web, of a pneumatic tube adapted to smear the stripes of dope evenly over the surface of the web.

3. In a web coating machine adapted to apply dope to a web, the combination with a wiper means including a pneumatic tube and a grooved scraper which is adapted to be held against one surface of the web upon inflation of said tube and to form stripes of dope on said surface of the web, of a pneumatic tube adapted upon inflation to smear the stripes of dope evenly over the surface of the web.

4. In a web coating machine adapted to apply dope to a web, the combination with a wiper means including a pneumatic tube and a scraper provided with circumferential grooves having a cross section adapted to correspond to the volume of dope to be applied to the web, said scraper being adapted to be held against the web by said tube to forms stripes of dope on the web, of a pneumatic tube adapted upon inflation to smear the stripes of dope evenly over the surface of the web.

5. In a web coating machine adapted to apply dope to a web, the combination with a wiper means including a pneumatic tube and a scraper provided with circumferential V-shaped grooves having a cross section adapted to correspond to the volume of dope to be applied to the web, said scraper being adapted to be held against the web by said tube to form stripes of dope on the web, of a pneumatic tube adapted upon inflation to smear the stripes of dope evenly over the surface of the web.

6. In a web coating machine adapted to apply dope to a web, the combination with a frame, a pair of cylinders mounted one above the other on said frame and provided with slots, and a grooved scraper protruding through the slot of the lower cylinder, of a pneumatic tube within the lower cylinder adapted to be inflated and to position said grooved scraper so as to form stripes of dope on the web, and a second pneumatic tube within the upper cylinder adapted to be inflated, to bulge through the slot and to smear the stripes of dope evenly over the surface of the web.

7. In a web coating machine adapted to apply dope to a web, the combination with a frame, a pair of cylinders mounted one above the other on said frame and provided with slots, and a grooved scraper protruding through the slot of the lower cylinder, of a pneumatic tube within the lower cylinder having a concave portion adapted upon inflation of the tube to abut said grooved scraper and to hold the same in sliding contact with the web to form stripes of dope thereon, and a second pneumatic tube within the upper cylinder adapted upon inflation to bulge through the slot and to smear the stripes of dope evenly over the surface of the web.

8. In a web coating machine adapted to apply dope to a web, the combination with a frame, a pair of cylinders mounted one above the other on said frame transversely to the web and provided with longitudinal slots, and a grooved scraper protruding through the slot of the lower cylinder, of a pneumatic tube within the lower cylinder adapted to be inflated and to position said grooved scraper so as to form stripes of dope on the web, and a second pneumatic tube within the upper cylinder adapted to be inflated, to bulge through the slot and to smear the stripes of dope evenly over the surface of the web.

9. In a coating machine adapted to supply dope to a web, the combination with a wiper means including a pneumatic tube, a plurality of grooved rings and a spring holding said rings, end to end, said rings being adapted to be held against one surface of the web upon inflation of said tube, of a reaction roller rotatably mounted opposite said wiper means and adapted to make rolling contact with the other surface of the web.

10. In a coating machine adapted to supply dope to a web, the combination with a wiper means including a pneumatic tube, a plurality of hollow grooved rings and a spring within said rings holding the same in movable end to end abutment, said rings being adapted to be held against one surface of the web upon inflation of said tube, of a reaction roller rotatably mounted opposite said wiper means and adapted to make rolling contact with the other surface of the web.

11. In a wiper means for a web coating machine, the combination with a pneumatic tube, of a plurality of grooved rings and a spring holding said rings end to end, said rings being adapted to be held against one surface of the web upon inflation of said tube.

12. In a wiper means for a web coating machine, the combination with a pneumatic tube, of a plurality of hollow grooved rings and a spring within said rings holding the same in movable end to end abutment, said rings being adapted to be held against one surface of the web upon inflation of said tube.

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