Dec. 23, 1952 A. E. MIKKELSEN 2,622,558

MACHINE FOR COATING WEB MATERIAL

Filed Jan. 19, 1948 3 Sheets-Sheet 1

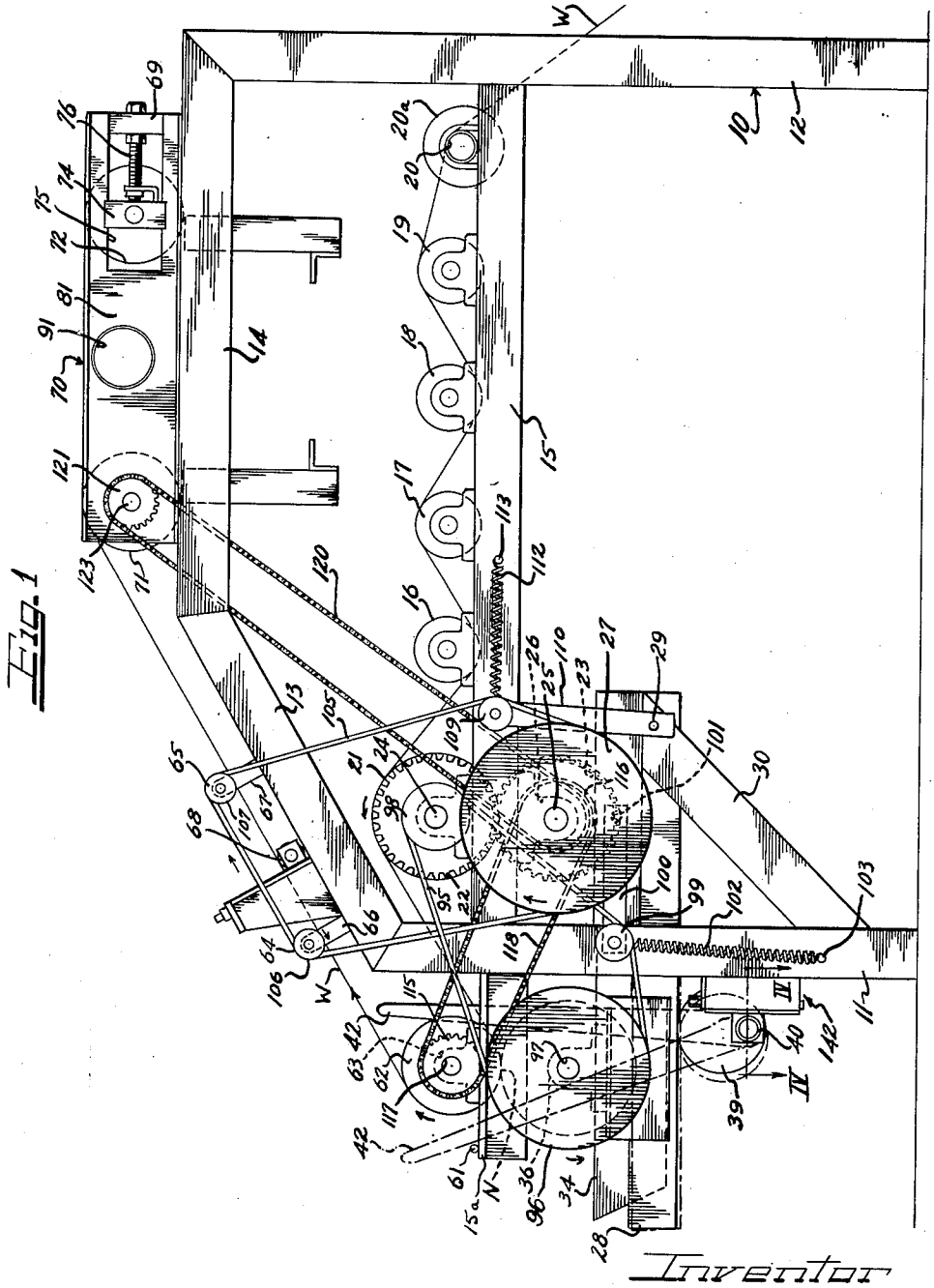


Fig. 1

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Fig. 2

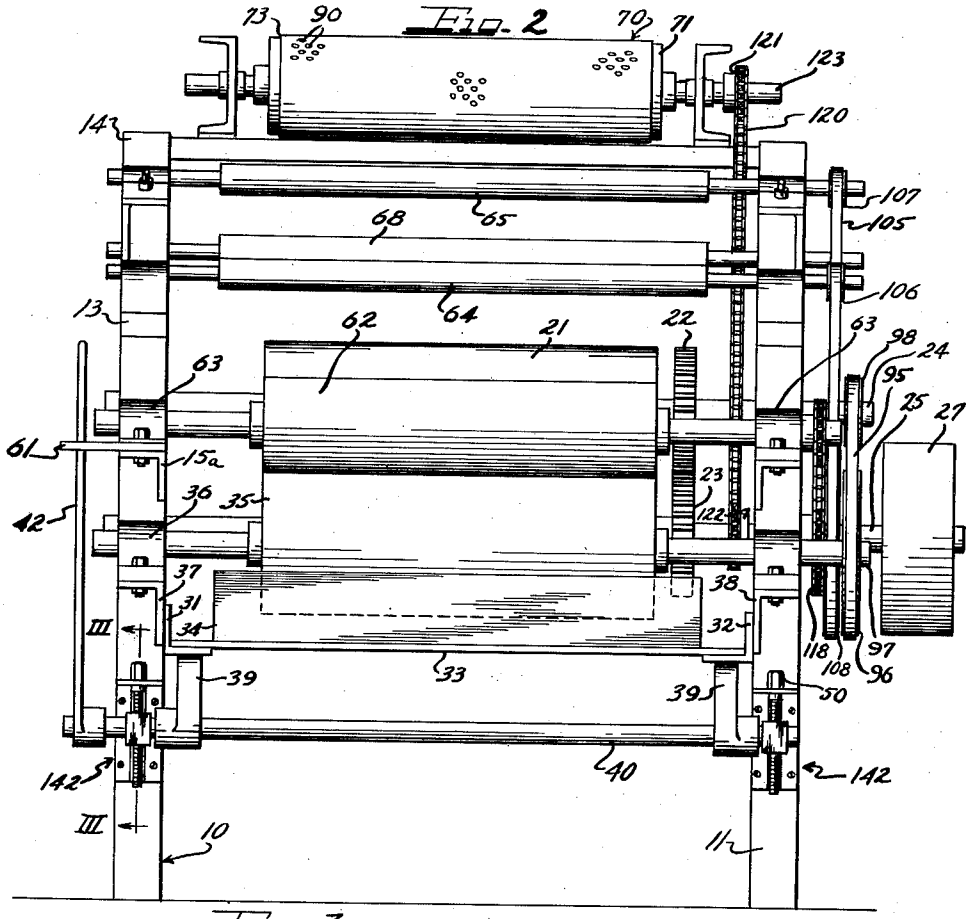


Fig. 3

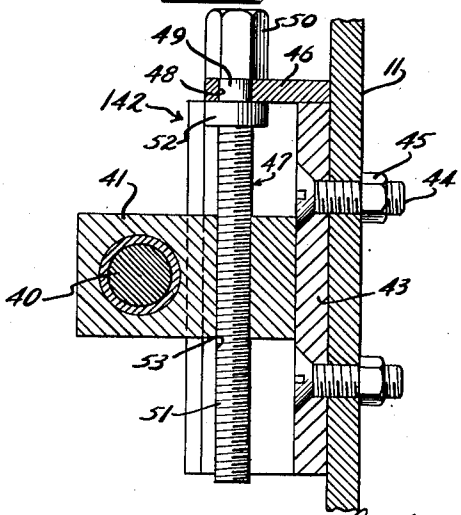
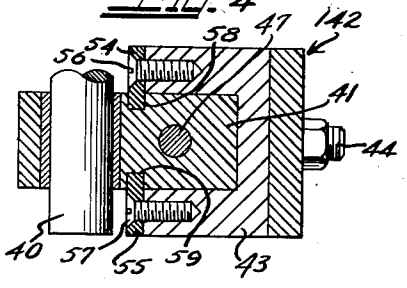


Fig. 4



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Fig. 5

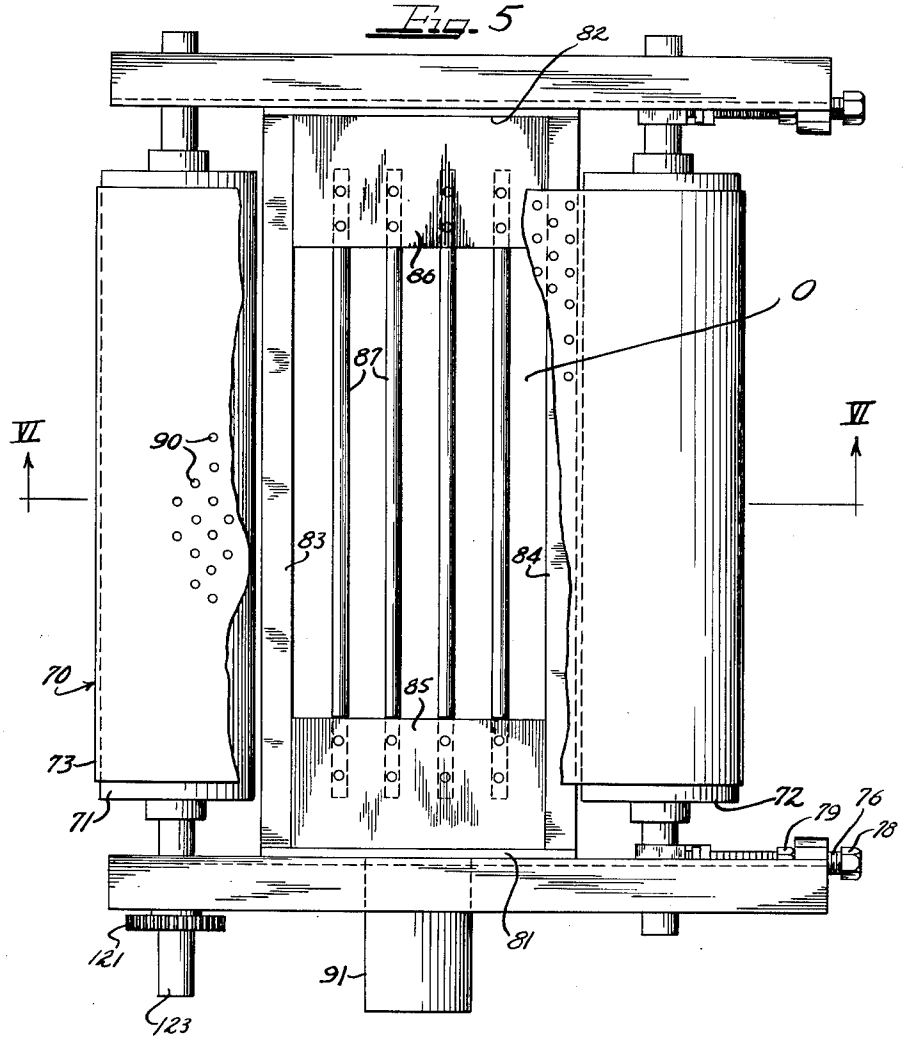
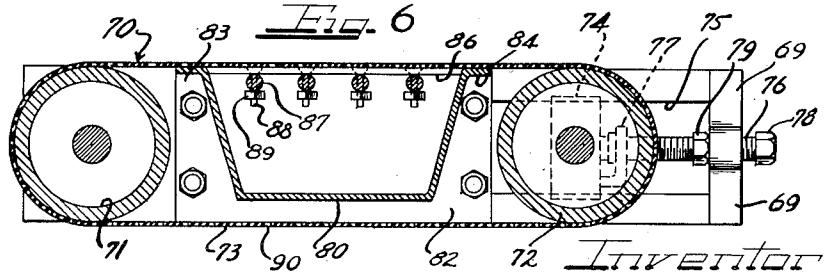


Fig. 6



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UNITED STATES PATENT OFFICE

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MACHINE FOR COATING WEB MATERIAL

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Application January 19, 1948, Serial No. 3,101

3 Claims. (Cl. 118—249)

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This invention relates to a coating machine, and more particularly to a machine for the coating of web material in a continuous method.

In accordance with the principles of my present invention, I provide a machine of the fountain roll type for the coating of web material, such as paper, preparatory to printing the paper or applying colored designs thereto. As a result of the coating applied, the paper is better suited to receive the subsequent printing material. The coating machine includes a color pan or receptacle, a fountain roll mounted on the color pan, and a sub-frame pivotally mounted from the main frame for movement by a cam mechanism of the color pan and fountain roll as a unit. The web to be coated is guided into the nip between a backing roll and the color roll for receiving the coating composition from the surface of the fountain roll. When the machine is not operating, or when it is desired to stop the machine for any reason, the cam mechanism is actuated through a hand lever to drop the fountain roll away from the backing roll. In addition, means are provided for effecting a fine adjustment of the fountain roll relative to the backing roll to get the desired degree of pressure contact therebetween.

After leaving the backing roll, the paper web is drawn under tension past relatively small diameter finishing and smoothing rolls that are driven in a direction opposite to the direction of travel of the web at the point of contact between the web and finishing rolls. These finishing rolls are preferably hard and highly polished, chromium plated rolls, and their speed of rotation is such as to give a peripheral speed preferably 50% greater than the linear speed of travel of the paper and in a direction opposite to the direction of travel of the paper. The mechanism for drawing the paper past the finishing rolls is a driven perforated, flexible belt through which suction is applied to the web of paper to cause the paper to travel with the belt and thus draw the paper web through the machine.

The driving connections are taken off of a common driven shaft, with connections to the backing roll, to the fountain roll, to the smoothing and finishing rolls, and to one of the rolls about which the endless perforated flexible belt is trained. In order to provide for adjustment of the fountain roll relative to the backing roll without necessitating the disconnection of the driving mechanism for the fountain roll, a spring-urged idler pulley is employed for maintaining the desired tension on the belt drive independently of the relative positioning of the fountain roll. This makes it possible to make both coarse and fine adjustments of the fountain roll relative to the backing roll without disconnecting the driving mechanism for the fountain roll.

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It is therefore an important object of this invention to provide a coating machine having novel and improved constructional features, including a pivotal arrangement for the color pan and fountain roll, as a unit, for movement relative to the backing roll with which the fountain roll normally cooperates for the application of the coating material.

It is a further important object of this invention to provide a coating machine wherein suction traction means are provided for drawing the paper, or other web material, past small diameter, highly polished finishing and smoothing rolls, which are positively driven at a peripheral speed greater than the speed of travel of the paper and in a direction opposite to the travel of the paper at the point of contact.

It is a further important object of this invention to provide a common driven member for connection with elements of the coating machine that are to be driven, and to so arrange and constuct the driving connections as to permit relative movement of some of the elements of the machine without disturbing such driving connections.

Other and further important objects of this invention will be apparent from the disclosures in the specification and the accompanying drawings.

On the drawings:

Figure 1 is a side elevational view of the coating machine embodying the principles of my present invention.

Figure 2 is a front end elevational view of the same.

Figure 3 is an enlarged fragmentary sectional view taken substantially along the line III—III of Figure 2.

Figure 4 is a fragmentary sectional view taken substantially along the line IV—IV of Figure 1, with parts in elevation.

Figure 5 is a top plan view, with parts broken away, of the suction traction mechanism for drawing the web through the machine.

Figure 6 is a sectional view taken substantially along the line VI—VI of Figure 5.

As shown on the drawings:

The reference numeral 10 indicates generally the main frame of the machine, comprising a

pair of upright standards 11 and 12 at the front and rear sides of the machine and upper connecting frame members 13 and 14 joined to said upright standards at both the front and back of the machine. The upper frame members 14 are truly horizontal, while the connecting upper frame members 13 are at an angle to the horizontal and slope downwardly and forwardly toward the front standards 11. In addition, a horizontal pair of frame members 15 extend below the upper frame members for the full length of the machine and are permanently affixed to the uprights 11 and 12.

A plurality of web tensioning rolls 16, 17, 18 and 19 and a guide bar 20 are mounted upon the horizontal frame members 15. The web of paper W is led over the stationary bar 20 between the guide flanges 20*a* to contact first the upper side of the tensioning roll 18, then the lower side of the tensioning roll 18, then the upper side of the tensioning roll 17 and finally the underside of the tensioning roll 16, from which the web passes over a helper roll 21, which is driven. The tensioning rolls 16—19 are not driven but are idler rollers, whereas the helper roll 21 is positively driven through intermeshing gears 22 and 23 mounted, respectively, on the helper roll shaft 24 and a second shaft 25. The shaft 25 is journaled in bearings 26 attached to the undersides of the horizontal intermediate frame members 15. Said shaft 25 is driven by means of a pulley 27 secured to the extended outer end of said shaft 25 and adapted to be driven by means of a belt from a suitable source of power (not shown). The pulley 27 is driven in the direction indicated on Figure 1, or in a clockwise direction as there shown, while the helper roll 21 is driven in the opposite direction, or in a counterclockwise direction.

A sub-frame, indicated generally by the reference numeral 28, is pivotally mounted at its inner end, as at 29, from sloping supports 30 secured to the uprights 11. Said sub-frame 28 comprises a pair of angle irons 31 and 32 (Fig. 2) joined by transversely extending supports 33 for supporting a color pan 34. The color pan 34 serves to hold the coating composition, or "color," as it is sometimes called. The fountain roll 35 is journaled in bearings 36 that are supported by and attached to supplemental angle irons 37 and 38 which may be welded or otherwise secured to the angle irons 31 and 32. The fountain roll 35 and color pan 34 thus constitute a unit that is pivotally mounted with respect to the pivot point 29.

The free or outer end of the sub-frame 28 is supported by a pair of cams 39 mounted upon a cross shaft 40 that is journaled at its ends in adjustable blocks 41. A manually operable handle or lever 42 is fixedly secured to said shaft 40 for rocking the same to turn said cams 39 and thus raise or lower the free end of the sub-frame 28. The lever 42 thus serves to effect a major or rough adjustment of the positions of the fountain roll 35. Finer adjustment is accomplished by means of the following mechanism, indicated generally by the reference numeral 142 and shown in greater detail in Figures 3 and 4. Said adjusting mechanism 142 comprises a member 43 of U-shape in cross section, the web of which is secured to an upright frame member 11 by means of bolts 44 and nuts 45. A flat plate 46 extends across the open upper end of the member 43 and is secured thereto to provide a support for the upper end of a

threaded member 47. For this purpose, the plate 46 is provided with an aperture 48 into which is received the unthreaded portion 49 between the hexagonal head 50 and the threaded portion 51 of said adjusting member 47. A threaded washer 52 threaded upon the threaded portion 51 is normally positioned against the lower surface of said plate 46 to hold the adjusting member 47 against turning. When it is desired, however, to turn the adjusting member 47, the washer 52 is backed away from the under surface of the plate 46. The block 41 is provided with an internally threaded bore 53 for mounting the block upon the threaded adjusting member 47. A pair of guiding strips 54 and 55 are secured by means of screws 56 and 57 to the outer faces of the U-shaped member 43 and extend laterally into grooves 58 and 59 formed for the purpose in the block 41.

By virtue of the construction just described, the color pan and fountain roll unit can be moved vertically up or down as desired for a purpose that will later be explained. Such movement is accomplished by turning the hexagonally shaped head 50 on the adjusting member 47, after which the washer 52 is again threaded into position against the under surface of the plate 46 to hold the unit in adjusted position. It will be understood, of course, that two such devices 142, one at the front and the other at the rear of the coating machine, are provided.

When the lever 42 is in its vertical position as shown in full lines in the drawings (Figs. 1 and 2), the cams 39 exert their maximum elevating effect upon the free end of the pivotally mounted sub-frame 28. When in its dotted position, the lever 42 rests against a stop 61 (Fig. 2). Upon moving the lever 42 from its full line to its dotted position (Fig. 1) the free end of the sub-frame 28 under the action of gravity follows the surfaces of the cams 39 to a lowered position. The purpose of this cam elevating and lowering mechanism will more fully appear as the description proceeds.

A backing roll 62 is journaled in bearings 63 stationarily mounted on the intermediate horizontal frame members 15*a*. Said backing roll 62, like the fountain roll 35, is preferably rubber surfaced and is so positioned as to coact with the fountain roll in its elevated position in the coating of the paper. By way of example, the rubber covering of the fountain roll may have a durometer hardness of 40 and the rubber covering of the backing roll may have a durometer hardness of 45. The paper web W moves in a generally downward direction from the upper surface of the helper roll 21 into contact first with the backing roll 62 to hug the surface of said backing roll as the web enters the nip N between said backing roll and the fountain roll. The web W continues to hug the surface of the backing roll through a substantially 180° arc and leaves the backing roll in an upwardly inclined path that is substantially parallel to the run of the paper between the helper roll 21 and the backing roll 62.

In its upwardly inclined path, the web W passes into contact with the lower surfaces of a pair of small diameter smoothing and finishing rolls 64 and 65 which are stationarily supported in bearing brackets 66 and 67 mounted on the inclined frame members 13. Said rolls 64 and 65 are preferably steel rolls having chrome plated surfaces and are of the order of one and one-half inches in diameter. A third small diameter

roll 68 is also mounted from the inclined frame members 13 but at a position midway between the rolls 64 and 65 and at such an elevation as to act against the underside of the paper web W to hold the web in its tensioned condition up against the undersides of the finishing rolls 64 and 65.

The tensioning of the web is effected by a suction traction mechanism indicated as a whole by the reference numeral 70 and supported upon the upper horizontal frame members 14. Said suction traction mechanism 70 comprises a pair of rolls 71 and 72 around which is trained an endless perforated flexible belt 73. As illustrated, the roll 71 is driven, while the roll 72 is not driven except through the endless belt 73. Said roll 72 is mounted in bearing blocks 74 which are slidably held within guideways 75 for horizontal adjustment by means of threaded adjusting members 76. Each of the adjusting members 76 is threaded through an end plate 69 extending across the end of a guideway 75. At its inner end, each adjusting member 76 is secured for rotation but not for relative translatory movement within a bracket 77 secured to a bearing block 74. The outer extended end of each adjusting member 76 is provided with a head 78 to facilitate the turning of the member, and a nut 79 is threaded on the intermediate portion of each adjusting member to hold such member in adjusted position. When an adjustment is to be made, the nut 79 is backed away from the end plate 69 and the adjusting member 78 is rotated in the direction required for making the desired adjustment, after which the nut 79 is again threaded against the surface of the end plate 69.

A suction box 80 is positioned between the rolls 71 and 72. Said suction box 80 is an open-topped metal trough supported between end plates 81 and 82 and provided with upper horizontal flanges 83 and 84 which are at the same level as the upper surfaces of the rolls 71 and 72. Plates 85 and 86 extend inwardly from each end of the suction box 80 between said flanges 83 and 84 to leave an opening O of slightly less width than the width of the endless belt 73. A plurality of bars 87 extend across said opening and are secured at their ends to the undersides of the plates 85 and 86 by means of screws 88 and nuts 89. Said bars 87 thus serve to support the run of the belt 73 as it passes over said opening O. The belt 73 is provided with perforations 90 through which the suction is applied to the undersurface of the traveling web. A conduit 91 connects the interior of the suction box 80 to a source of vacuum (not shown).

As previously stated, the drive for the machine is through the pulley 27. Said pulley 27 is mounted upon a shaft 25 which is journaled in the bearings 26. The helper roll 21 is driven through the gears 22 and 23 mounted, respectively, on the shaft 24 and 25.

The fountain roll 35 is driven by a belt 95 which is trained around a pulley 96 secured on the extended end of the fountain roll shaft 97. Said belt 95 is also trained around a pulley 98 mounted on the extended end of the helper roll shaft 24. Said belt 95 is tensioned by means of a tension roller 99 (Fig. 1) mounted on the free end of a pivotally movable strap 100. Said strap 100 is pivoted, as at 101 to the side of the subframe 28. A spring 102 is connected at its upper end to the free end of the strap 100 and is secured at its lower end, as at 103 to the vertical frame member 11. The spring 102 is thus held under tension and thereby serves to put the proper tension on the belt 95 regardless of the relative position of the fountain roll 35. Accordingly, the fountain roll 35 may be moved relative to the backing roll 62 without disturbing the belt and pulley driving arrangement.

The finishing rolls 64 and 65 are driven through a belt 105 which is trained around pulleys 106 and 107 on the ends, respectively, of the shafts of said finishing rolls 64 and 65. The belt 105 is also trained around a pulley 108 mounted on said shaft 25. A tensioning idler roller 109 serves to apply the desired tension to the belt 105. For this purpose, the idler roller 109 is mounted upon the upper free end of a strap 110 which is pivoted, as at 29, at its lower end to the sub-frame member 30. A spring 112, connected at one end to the horizontal frame member 15, as at 113, and at its other end to the free end of the strap 110, serves to apply the desired tension to the belt 105. The relative diameters of the large pulley 108 on the shaft 25 and of the small pulleys 106 and 107 on the finishing roll shafts are such that the finishing rolls are driven at a peripheral speed about 50% faster than the speed of travel of the web W. The direction of the finishing rolls 64 and 65 is opposite to that of the paper at the points of contact between the paper web and the finishing roll surfaces.

The backing roll 62 is driven from the shaft 25 by means of sprockets 115 and 116, mounted on the helper roll shaft 117 and the shaft 25, respectively, through a sprocket chain 118. The driving connections for the backing roll 62 and for the fountain roll 35 are such that the two rolls are driven in opposite directions but at the same surface speed.

The roll 71 in the suction traction mechanism 70 is driven from the shaft 25 by means of a chain 120 trained around sprockets 121 and 122 secured to the shaft 123 of said roll 71 and to the shaft 25, respectively. The speed at which the roll 71 is driven in such as to put the desired tension on the web W as the web is drawn past the finishing rolls 64 and 65 and held in light contact therewith by means of the intermediate roller 68.

By way of example, if the paper speed is 2400 inches per minute, the surface speed of the reverse finishing rollers 64 and 65 is 3600 inches per minute and in the opposite direction to the direction of travel of the web. In general, the finishing rolls are driven approximately 50% faster than the paper web, since this relative speed has been found to give most satisfactory results in the spreading and finishing of the coating applied to the web at the fountain roll.

The operation of the machine will now be described.

In starting up the machine, the fountain roll 35 may be in its lowered position, although that is not necessary. The leading end of the web W is led over the stationary shaft 20 between the guide flanges 20a, over the roll 19, under the roll 18, over the roll 17, and under the roll 16, and thence over the helper roll 21. From the helper roll 21, the leading end of the web is fed between the fountain roll 35 and the backing roll 62 and thence upwardly under the finishing roll 64 and over the intermediate roll 68 and under the second finishing roll 65. The web is then led upwardly and laid over the surface of the suction traction mechanism 70 to rest on the perforated belt 73. Power is then applied to

the machine through the pulley 27 to start up the machine, and at the same time suction is applied through the connection 91 to the suction box 80. Sufficient suction is applied to cause the paper to be held against the traveling belt 73 and to travel at the same speed as the belt.

At this point, if the fountain roll 35 is not already in its operative position, the lever 42 is manipulated to elevate the fountain roll to such position, and any adjustment that may be necessary is made by means of the finer adjustment mechanisms 142. The coating composition is picked up on the surface of the fountain roll 35 and carried to the nip N where the composition is transferred to the under surface of the traveling web W. The amount of coating so applied is, of course, controlled by the degree of contact pressure maintained at the nip between the surfaces of the fountain roll and the backing roll, and also by the viscosity and other characteristics of the coating composition itself. The finishing rolls 64 and 65 then act upon the still moist coating as the web passes in contact with said rolls. The light contact between the reversely driven highly polished surfaces of the finishing rolls 64 and 65 and the coating on the web W serves to smooth and distribute the coating uniformly over the surface of the web. The suction traction mechanism 70 at all times maintains the desired degree of tension on the web as it is being acted upon by the reverse finishing rolls.

The rolls 16, 17, 18 and 19 may or may not be allowed to rotate in their bearings. It is sometimes found desirable to hold one or more of these rolls stationary, and in order to do this it is sufficient merely to place wedges between the bearings and the ends of the rolls to keep them from turning. In this way, the desired amount of tension is placed upon the web to cause the web to hug tightly against the backing roll 62. The helper roll 21 aids in advancing the web to the nip N between the fountain roll and backing roll, but still enables the proper amount of tension to be placed upon the web ahead of the nip N. It will be noted that the web is caused to contact and hug the surface of the backing roll 62 before it reaches the nip itself. This lessens the possibility of the coating material finding its way between the upper surface of the web and the surface of the backing roll 62.

After being coated on the machine described, the coated web, in the case of wallpaper, will be advanced to a festooning apparatus where the coating will be air-dried. For the purposes of the present invention, however, it is immaterial what further processing is effected after the coated web leaves the machine of my invention. The important thing is to apply the coating uniformly and finish the coated surface so as to take a printed design most satisfactorily.

It will, of course, be understood that various details of construction may be varied through a wide range without departing from the principles of this invention and it is, therefore, not the purpose to limit the patent granted hereon otherwise than necessitated by the scope of the appended claims.

I claim as my invention:

1. In a web coating machine, a frame, a color pan, a fountain roll mounted from said color pan, a sub-frame for said color pan pivotally mounted from said frame, cam means supporting the free end of said sub-frame, means for operating said cam means for raising and lowering said pan and fountain roll as a unit and threaded adjusting means mounted on said frame and acting through said cam means for finer adjustment of the height of said unit.

2. In a web coating machine, a frame, a color pan, a fountain roll mounted from said color pan, a sub-frame for said color pan pivotally mounted from said frame, cam means supporting the free end of said sub-frame, means for operating said cam means for raising and lowering said pan and fountain roll as a unit, threaded adjusting means mounted on said frame and acting through said cam means for finer adjustment of the height of said unit, a belt and pulley drive for said fountain roll and a spring tensioned idler roll for tension said belt for any adjusted position of said unit.

3. In a web coating machine, a frame, a backing roll mounted in stationary bearings from said frame, a color pan, a fountain roll mounted from said color pan, a sub-frame for said color pan pivotally mounted from said frame, cam means supporting the free end of said sub-frame, means for operating said cam means for raising and lowering said pan and fountain roll as a unit to obtain rough adjustment of said fountain roll relative to said backing roll, and threaded adjusting means mounted on said frame and acting through said cam means for finer adjustment of said fountain roll relative to said backing roll.

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