April 7, 1942. W. RECHT 2,278,563

COATING MACHINE FOR COATING SHEETS OF MATERIAL

Filed June 30, 1937 4 Sheets-Sheet 1

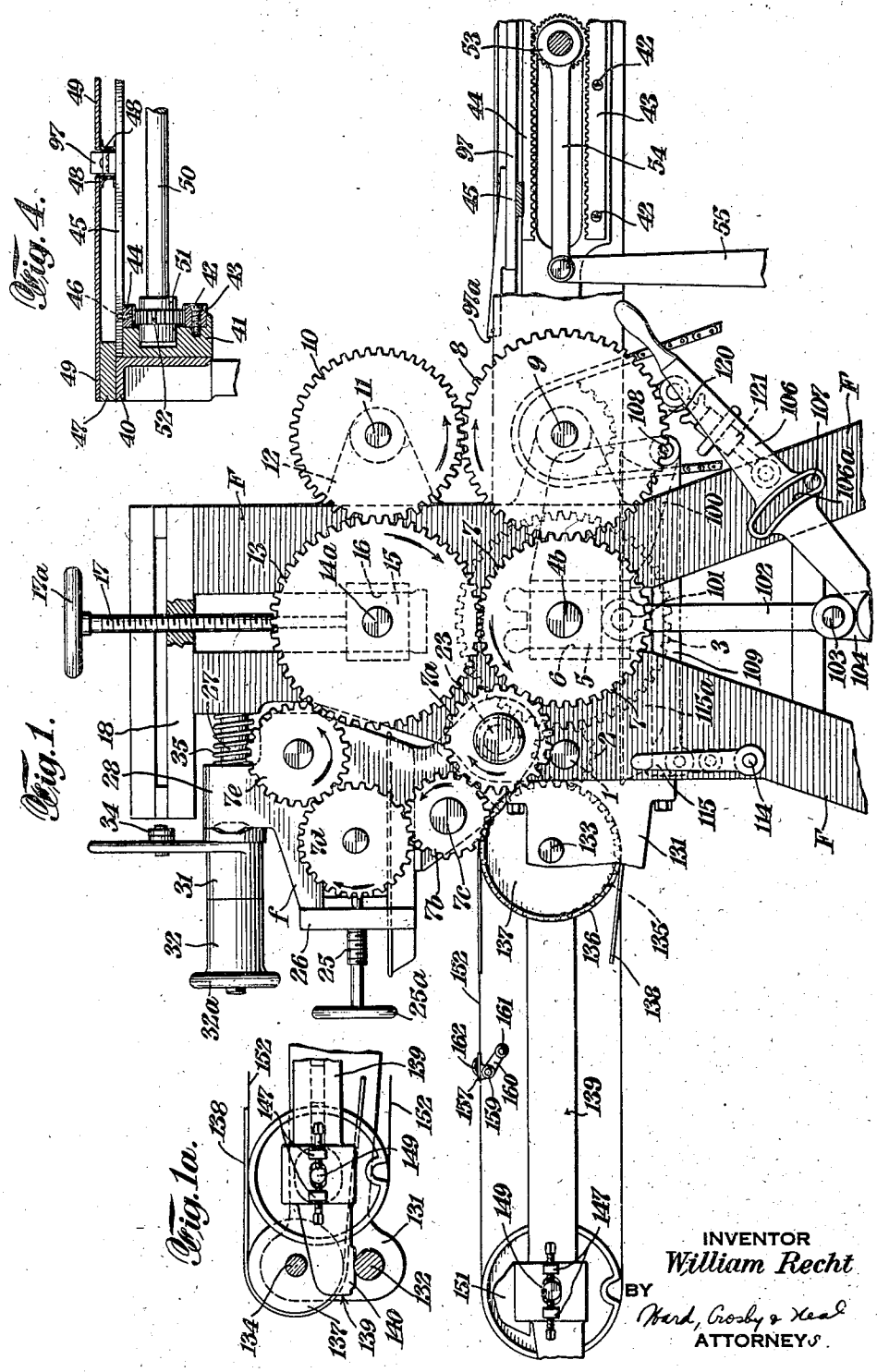


Fig. 4.

Fig. 1.

Fig. 1a.

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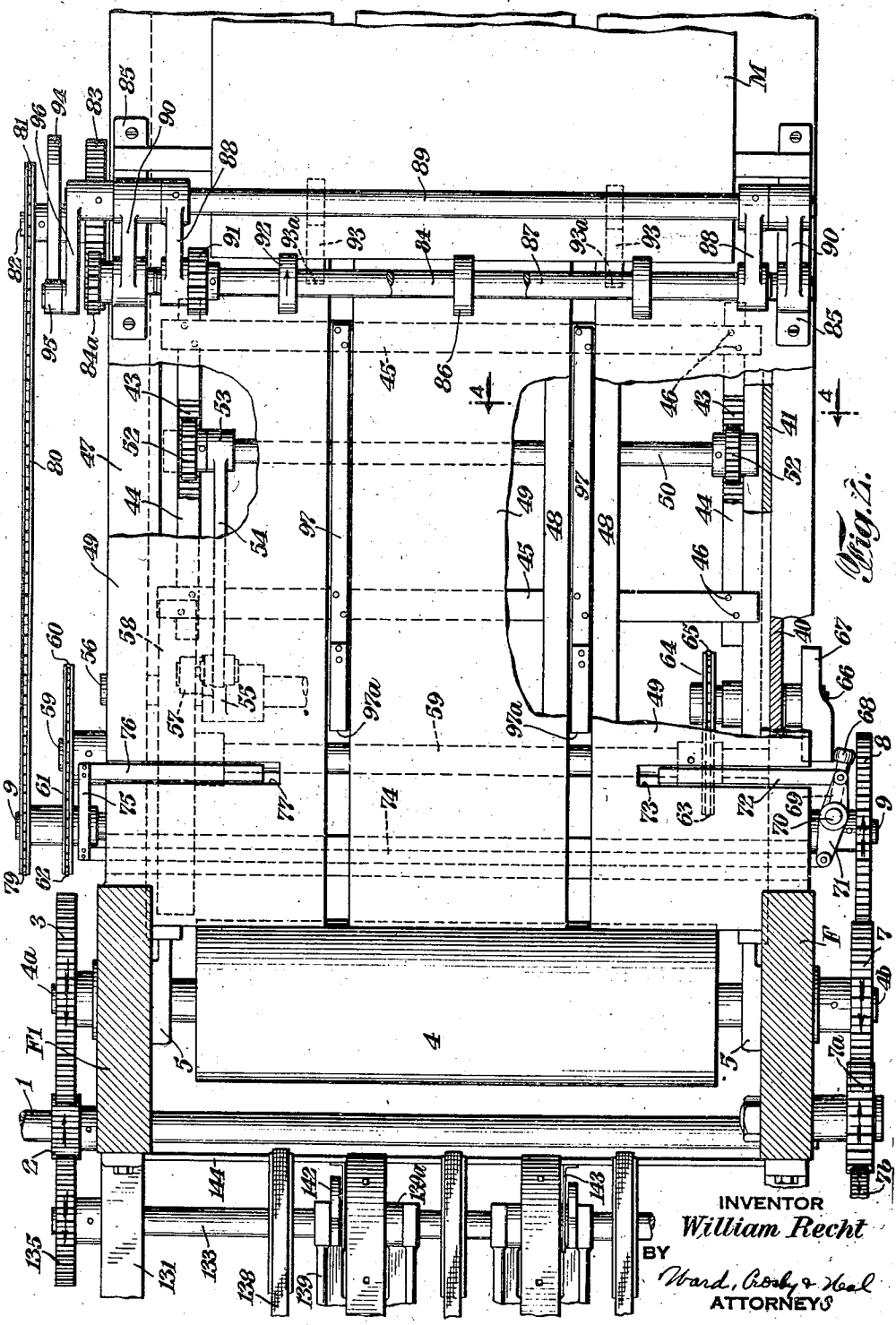


Fig. 2.

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Fig. 2a.

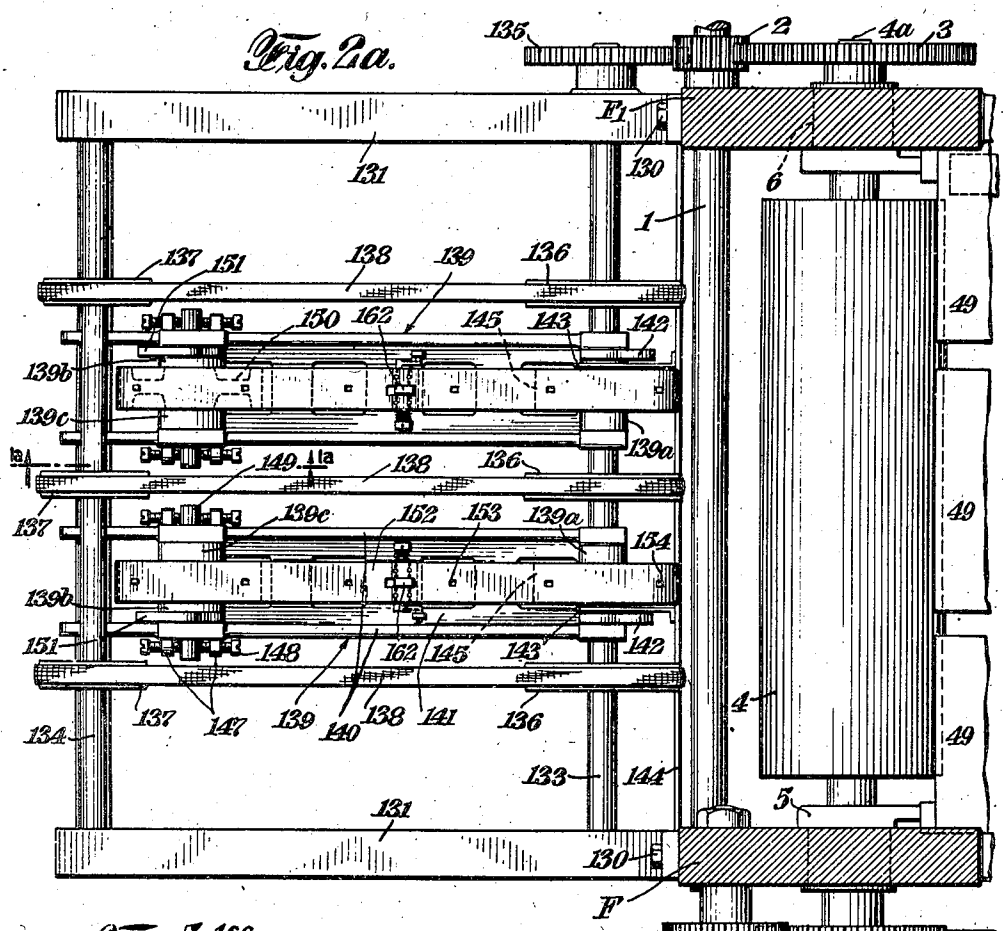


Fig. 5.

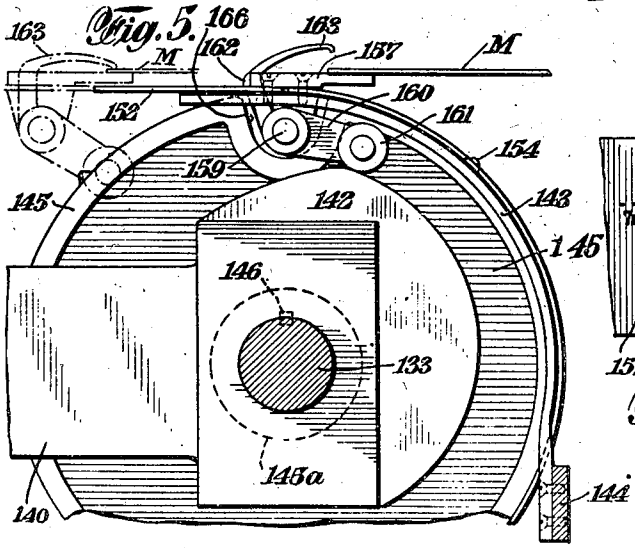
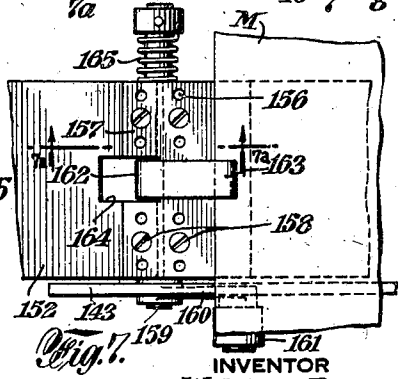


Fig. 7.



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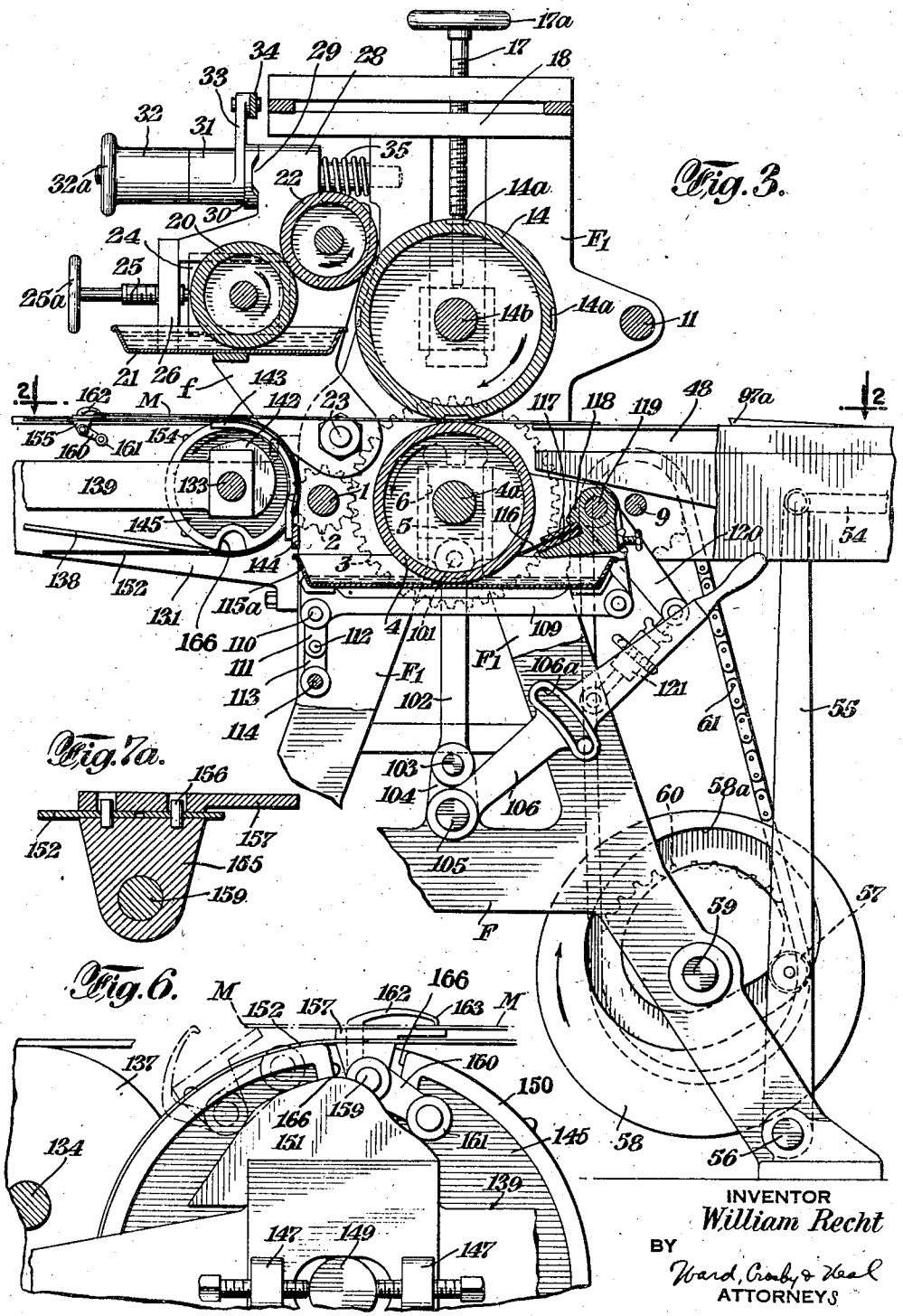


Fig. 3.

Fig. 7a.

Fig. 6.

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Patented Apr. 7, 1942 2,278,563

UNITED STATES PATENT OFFICE

2,278,563

COATING MACHINE FOR COATING SHEETS OF MATERIAL

William Recht, Woodmere, N. Y., assignor to General Printing Ink Corporation, New York, N. Y., a corporation of Delaware

Application June 30, 1937, Serial No. 151,090

3 Claims. (Cl. 91—48)

My invention relates to machines utilizable for applying a coating of liquid material such, for example, as ink, varnish, paint or the like to sheets of material of a desired character.

My invention has particular reference to coating machines wherein the composition rollers ineffectively or improperly advance the sheets of material through the coating zone by reason of the fact that line, spot or other areas of such composition rollers are below the normal coating surfaces thereof.

Various other objects, features and characteristics of my invention will become apparent from the following detailed description.

My invention relates particularly, although not necessarily, to a coating machine of the general type disclosed in Lipton application Serial No. 138,512, filed April 23, 1937, which has become U. S. Letters Patent No. 2,236,239, granted March 25, 1941.

For an understanding of my invention and for an illustration of one of the forms thereof, reference is to be had to the accompanying drawings, in which:

Figure 1 is an elevational view, partly in section and partly broken away, showing a coating machine as constructed in accordance with my invention;

Fig. 1*a* is an elevational view showing the discharge end of the coating machine;

Fig. 2 is a horizontal sectional view, partly in plan, and is taken substantially on the line 2—2 of Fig. 3 looking in the direction of the arrows;

Fig. 2*a* is a horizontal sectional view, partly in plan, showing the discharge end of my novel coating machine;

Fig. 3 is a vertical sectional view, partly in elevation, and is taken substantially on the line 3—3 of Fig. 2 looking in the direction of the arrows;

Fig. 4 is a vertical sectional view, partly in elevation, and is taken on the line 4—4 of Fig. 2 looking in the direction of the arrows;

Figs. 5 and 6 are enlarged elevational views, partly in section, showing two positions of the sheet-gripping mechanism of my invention;

Fig. 7 is an enlarged plan view showing a part of the sheet-gripping mechanism; and

Fig. 7*a* is a fragmentary elevational view of the arrangement shown in Fig. 7.

Referring to the drawings, F, F1 represent spaced frame members of the same general character disclosed in the aforesaid Lipton application Serial No. 138,512, filed April 23, 1937, these frame members being connected together and braced in any suitable manner. Suitably supported by said frame members F, F1 is a horizontal drive shaft 1 adapted to be rotated by an electrical motor or other suitable source of power, not shown.

Secured to one end of the shaft 1 and rotatable therewith is a pinion 2, Figs. 2 and 2*a*, which meshes with and drives a gear wheel 3 secured to and rotatable with the extreme end 4*a* of one shaft extension of a supporting roller 4 formed from suitable material as known in the art, the shaft extensions of said roller 4 being mounted in bearings formed in the respective blocks 5 disposed for slidable movement in vertical slots 6 formed, respectively, in the frame members F, F1, these blocks 5 being suitable supported for vertical movement in the manner hereinafter described. At the side of the supporting roller 4 opposite the aforesaid shaft end 4*a*, the shaft extension of said roller 4 terminates in an end 4*b* to which is fixed a gear wheel 7 meshing with and driving a gear wheel 8 secured to and rotatable with one end of a shaft 9 extending transversely through and supported in bearings formed by brackets carried by the frame members F, F1. The gear wheel 8 meshes with and drives an idler gear wheel 10 mounted on a stub shaft 11 supported in a bearing bracket 12 secured to the frame member F. Disposed in meshing relation with respect to the gear wheel 10 is a gear wheel 13 secured to and rotatable with the extreme end 14*a* of one shaft extension of a composition roller 14, the shaft extensions of which are mounted, respectively, in bearing blocks 15 slidable in the respective vertical slots 16 formed in the frame members F, F1.

As well understood in the art, each of the bearing blocks 15 is biased upwardly by a helical spring, not shown. Further, as well understood, each bearing block 15 may be moved downwardly against the expansive force of the associated helical spring by a rod 17, each of these rods terminating in an upper hand wheel 17*a* and each rod 17 being threaded through a plate arrangement 18 suitably secured to the associated frame member.

It is well understood that apparatus of the character herein described necessarily comprises an arrangement for applying a suitable coating medium to the composition roller 14. Any suitable arrangement may thus be utilized but, preferably and as herein shown, this coating arrangement is of the character specifically described in the above noted Lipton application Serial No. 138,512, filed April 23, 1937.

Thus, as herein generally illustrated, the coating arrangement last noted comprises a fountain roller 20 which dips into a liquid coating medium contained in a receptacle 21, the fountain roller 20 rotatably engaging a transfer roller 22 which is adapted to engage the aforesaid composition roller 14. As shown, this coating arrangement further comprises a pair of spaced, supplemental frame members *f*, *f* pivoted, respectively, to the main frame members F, F1 at

23. Associated with these frame members *f*, *f* is a support for the receptacle 21 and, further, said frame members *f*, *f* directly support the shaft extensions for the transfer roller 22. As regards the fountain roller 20, each shaft extension thereof is rotatably supported in a block 24 and each of these blocks is slidably supported for horizontal movement in a slot formed in a frame member *f*. Coactable with each block 24 is a screw member 25 having a hand wheel 25*a*, each screw member being threaded through a plate 26 suitably secured to the adjacent frame member *f*.

The coating arrangement thus described constitutes a fountain assembly which may be adjusted toward or from the composition roller 14 by movement thereof on the pivots 23. To this end, each of the frame members F, F1 has a fixed member 27 secured thereto and projecting horizontally therefrom, the respective members 27 extending loosely through passages formed in the upper sections 28 of the frame members *f*, *f*, respectively. The front face of each of these frame member upper sections comprises a cam surface 29 coactable with an adjacent cam surface 30 formed on a sleeve 31 loosely mounted on the adjacent projecting member 27 which extends therethrough. The extreme front end of each member 27 has a sleeve nut 32 threaded thereto, each sleeve nut comprising an operating hand wheel 32*a*. Each sleeve 31 has an arm 33 projecting therefrom and these arms are connected by a link 34 whereby actuation of said arms 33 and the link 34 causes the fountain assembly to be moved toward or from the composition roller 14 by reason of the camming effect produced between the cam surfaces 29 and 30, said fountain assembly being biased in a counter-clockwise direction, Fig. 3, by helical springs 35 associated with the respective fixed members 27.

As shown in Fig. 1, the power for operating the fountain roller 20 and the transfer roller 22 is obtained from the hereinbefore described driven gear wheel 7. Thus, as shown, the gear wheel 7 meshes with and drives a gear wheel 7*a* loosely mounted on a stub shaft formed as an extension of the adjacent pivot 23. The gear wheel 7*a* meshes with and drives a gear wheel 7*b* loosely mounted on a stub shaft 7*c* projecting horizontally from the adjacent frame member *f*, this gear wheel 7*b* meshing with and driving a gear wheel 7*d* secured to and rotatable with one shaft end of the fountain roller 20. The gear wheel 7*d* meshes with and drives a gear wheel 7*e* secured to and rotatable with one shaft end of the transfer roller 22. The gear wheel 7*e* is so positioned that it does not mesh with the above described gear wheel 13.

With the form of the invention herein shown, individual sheets of material M are fed toward and between the supporting roller 4 and composition roller 14 by means known to the art as "Drop roller feeding mechanism." As herein shown, mechanism of the character last noted comprises a pair of spaced, horizontal side frames 40, 40 supported in fixed position in any suitable manner and each frame 40 carrying a guide channel member 41, Fig. 4. Suitably secured, as by the screws 42, to the lower surface of each channel member 41 is a rack member 43, these rack members being disposed horizontally with the rack teeth thereof facing upwardly, Figs. 1 and 4. Disposed above the fixed rack members 43 are the respective movable rack members 44 to which the transverse bars 45 are secured by screws 46, the ends of these bars 45 slidably engaging the respective channel members 41, Fig. 4. The end of each bar 45 is confined in a guide slot defined by the upper surface of a channel member 41, the vertical surface of the adjacent side frame 40 and a member 47 which is suitably secured to the side frame 40 disposed therebeneath. These members 47 extend longitudinally of the machine and are disposed in parallel relation with respect to two sets of channel members 48 which are supported at their ends in any suitable manner. The members 47 and the channel members 48 serve as supports for a plurality of top plates 49 along which the sheets M pass in the manner hereinafter described.

Disposed transversely of the machine is a horizontal shaft 50 to the ends of which the respective sleeves 51 are secured, these sleeves being rotatably supported by the lower channel-defining surfaces of the members 41, Fig. 4. Each sleeve 51 carries a pinion wheel 52 and each pinion wheel is disposed in meshing engagement with respect to the adjacent set of fixed and movable rack members 43, 44.

Rotatably disposed on the shaft 50 is a collar 53 having an arm 54 projecting therefrom, this arm being pivoted to an upstanding lever 55 which, at its lower end, is pivoted at 56 to the frame member F, Fig. 3. The lever 55 carries a laterally extending follower 57 coactable with a cam groove 58*a* formed in the face of a disk 58 secured to and rotatable with a horizontal shaft 59 having bearings in the frame members F and F1. This shaft 59 has a sprocket wheel 60 secured thereto, this sprocket wheel 60 being driven by a sprocket chain 61 which, in turn, is driven by a sprocket wheel 62 secured to and rotatable with the aforesaid shaft 9.

At its end remote from the sprocket wheel 60, the shaft 59 carries a second sprocket wheel 63 which drives a sprocket chain 64, the latter, in turn, driving a sprocket wheel 65 rotatably mounted on a stub shaft 66 having a bearing in the adjacent side frame 40. Secured to and rotatable with the stub shaft 66 at the end thereof opposite the sprocket wheel 65 is a cam disk 67 having a cam surface with which is coactable a roller 68 secured to one end of a lever 69 oscillatory with a vertical shaft 70 suitably supported on the disclosed mechanism. Secured to the shaft 70 is a second lever 71 which, at the end thereof toward the right, Fig. 2, has a bar 72 pivoted thereto, this bar resting upon the adjacent side frame 40 and being freely slidable in a slot 73 formed transversely in the adjacent top plate 49. Secured to the end of the lever 71 toward the left, Fig. 2, is a link 74 which extends transversely across the machine and, at its remote end, carries a member 75 to which is secured a bar 76 corresponding with the aforesaid bar 72, the bar 76 resting upon the adjacent side frame 40 and being freely slidable in a slot 77 formed transversely in the adjacent top plate 49.

The aforesaid shaft 9 has a second sprocket wheel 79 secured thereto for rotatable movement therewith, this sprocket wheel 79 driving a sprocket chain 80 which, in turn, drives a sprocket wheel 81 secured to and rotatable with a stub shaft 82 rotatable in a bearing formed in the adjacent side frame 40. This stub shaft has a gear wheel 83 rotatable therewith, this gear wheel 83 meshing with and driving a gear wheel 84*a* secured to and rotatable with a lower shaft 84 extending transversely of the machine and rotatable in bearings formed in brackets 85

secured to the side frames 40, respectively, this shaft 84 carrying a plurality of disks 86 spaced therealong.

Disposed vertically above the shaft 84 is a shaft 87 rotatable in bearings formed in the ends of the respective arms 88 secured to and oscillatory with a shaft 89 mounted in bearings formed in the ends of arms 90 formed integrally with the respective brackets 85. The aforesaid shaft 84 carries a gear wheel, not shown, which is disposed beneath, meshes with and drives a gear wheel 91 secured to and rotatable with the shaft 87. Said shaft 87 also carries a plurality of spaced disks 92 which are disposed above and coactable with the aforesaid rollers 86, respectively. Disposed adjacent the outer sets of disks 86, 92 are the respective pivoted stop members 93 each of which comprises an upturned end 93a, these stop members being utilized as hereinafter described.

The hereinbefore described stub shaft 82 has a cam disk 94 rotatable therewith. Coactable with said cam disk is a roller 95 carried by the end of a lever 96 secured to one end of the aforesaid shaft 89 and oscillatory therewith.

As hereinbefore described, the bars 45 are secured to the movable rack members 44. As shown in Figs. 1, 2 and 3, a pair of spaced pusher bars 97 are secured to these bars so as to be movable therewith, these bars comprising the respective transversely alined pusher surfaces 97a and said pusher bars being disposed between the spaced top plates 49 as shown particularly in Fig. 2.

The above described blocks 5 have plates 100, 100 formed integrally therewith or suitably secured thereto, respectively, these plates being disposed immediately adjacent the respective interior surfaces of the frame members F, F1 and the respective shaft extensions of the supporting roller 4 extending loosely therethrough. Secured to each of the plates 100 is a transverse pin 101 and, to each pin 101, there is pivoted a downwardly extending link 102, the lower end of each link 102 being pivotally connected, by a pin 103, to a lever arm 104 and the lever arms 104 being secured to and oscillatory with a shaft 105 extending horizontally between and mounted in bearings in the frame members F and F1. The shaft 105, at one end thereof, has secured thereto a lever arm 106 which, as shown in Figs. 1 and 3, may comprise an arcuate slot 106a cooperative with a pin 107 carried by and projecting from the adjacent frame member. Preferably, the shaft 105 carries a suitable counter-balancing weight, not shown.

Toward the front of the machine, the aforesaid plates 100, 100 carry a horizontally disposed transverse rod 108, Fig. 1, to which, adjacent each end thereof, a supporting bar 109 is pivoted, these supporting bars 109 extending toward the rear of the machine and, at their rear ends, carrying a transverse rod 110 to which is pivoted the respective links 111, each of these links being pivoted, toggle-fashion, at 112 to a link 113 and the links last named having their lower ends fixed to and rotatable with a shaft 114 extending horizontally between and mounted in the frame members F, F1, said shaft 114, exteriorly of and adjacent the frame member F, having an actuating lever 115 secured thereto for oscillatory movement therewith. As clearly appears, the arrangement comprising the bars 109 forms a stable support for a pan or receptacle 115a.

Coactable with the aforesaid supporting roller 4 is a scraper blade 116 formed from suitable spring steel, or equivalent, said scraper blade being clamped between members 117 which are suitably mounted in a holder 118 carried by a supporting shaft 119. On this supporting shaft 119, the holder 118 may be moved in an oscillatory manner by the arm 120 which is controlled for oscillatory movement by the nut member 121, Fig. 3.

The receptacle 115a is adapted to contain a liquid agent such, for example, as a liquid agent of the same character as is contained in the receptacle 21 of the coating assembly. The supporting roller 4 dips into the liquid agent contained in the receptacle 115a so that any of the coating agent which is transferred to said supporting roller 4 from the coating roller 14, particularly at the edges of said supporting roller, is kept in moist condition so that it may readily be removed by the scraper blade 116. Further, this liquid agent in the receptacle 115a lubricates the entire peripheral surface of the supporting roller 4 so as to prevent the formation of dry areas with which said scraper blade 116 would otherwise contact with resultant undue wear of the interengaging parts.

The actuating lever 115 may be moved in a counter-clockwise direction, Fig. 1, so that, by motion transmitted through the links 113 and 111, the bars 109 are moved counter-clockwise, Fig. 1, around the rod 108 whereby the receptacle 115a may assume a tilted relation. When thus positioned, said receptacle 115a may readily be grasped by the hands of the operator, removed, cleaned and then returned to the position shown.

When the supporting roller 4 is to be lowered from the position thereof where it contacts with the composition roller 14, the lever arm 106 is moved clockwise, Figs. 1 and 3, and, in so doing, the supporting members 100 are moved downwardly under the control of the lever arms 104, the links 102, etc. As hereinbefore stated, these members 100 support the shaft extensions of said supporting roller 4.

When it becomes desirable to remove the scraper blade assembly for cleaning or other purposes, the nut 121 may be manipulated to thereby swing the arm 120 in a counter-clockwise direction, Fig. 3. Thereafter, the scraper blade assembly comprising the scraper blade knife 116 and the supporting blades 117 may readily be detached from the holder 118 and subjected to a desired cleansing operation whereupon, in as simple a manner, the scraper blade assembly may be returned to its operative position.

It is to be understood that the supporting arrangement for the receptacle 115a, the lowering and elevating arrangement for the supporting roller 4 and the adjusting arrangement for the scraper blade knife 116 may be of the character specifically described in the aforesaid Lipton application Serial No. 138,512, filed April 23, 1937.

As hereinbefore stated, the fountain assembly as disclosed is of the same character as illustrated and described in said Lipton application Serial No. 138,512, filed April 23, 1937, and, therefore, it is to be understood that the hand wheel 25a may be rotated in one direction or the other to cause the fountain roller 20 to move laterally on its horizontal axis so that the pressure with which said fountain roller engages the transfer roller 22 may be adjusted to a desired extent. Thereafter, when the fountain assembly is held toward the composition roller 14, the hand wheels 32a may be rotated in one direction or the other to thereby slightly move the foun-

tain assembly either toward or from said composition roller 14 whereby the transfer roller 22 is caused to engage said composition roller 14 with a desired degree of pressure. Subsequently, by actuation of the arms 33 and the link 34, the fountain assembly may be moved as a unit either toward or from the composition roller 14 for the useful purpose described in said Lipton application Serial No. 138,512, filed April 23, 1937.

With the mechanism in operative position as shown in Figs. 1 and 3, the drive shaft 1 is rotated in a clockwise direction, Figs. 1 and 3, to thereby rotate the gear wheel 3, the supporting roller 4 and the gear wheel 7 in a counterclockwise direction, Figs. 1 and 3. By reason of the intermeshing relation between the gear wheels 7, 8, 10 and 13, it results that said gear wheel 13 together with the composition roller 14 are rotated in a clockwise direction, Figs. 1 and 3.

The gear wheel 7 also meshes with the gear wheel 7a and the latter, in turn, meshes with and drives the gear wheel 7b, the last named gear wheel 7b meshing with and driving the gear wheel 7d associated with the fountain roller 20, and said gear wheel 7d meshing with and driving the gear wheel 7e associated with the transfer roller 22. The various gear wheels 7a, 7b, 7d and 7e last named rotate, respectively, as indicated by the arrows shown thereon in Fig. 1.

The hereinbefore described gear wheel 8, which is rotated by power transmitted thereto from the gear wheel 7, is mounted on the shaft 9 which extends transversely of the machine and it is this shaft 9 which carries the hereinbefore described sprocket wheels 62 and 79.

In response to clockwise rotation of the shaft 9, Figs. 1 and 3, the sprocket wheel 62 is rotated in the same direction so that the sprocket chain 61 produces clockwise rotation of the cam disk 58, Fig. 3. As a result of such rotation of the cam disk 58, the lever 55 is oscillated to thereby produce to-and-fro movement of the shaft 50 along the stationary rack members 43. These stationary rack members are in meshing relation with respect to the gear wheels 52 and, therefore, it results that the movable rack members 44 are caused to reciprocate toward and from the coating zone, i. e., the area of contact between the supporting roller 4 and coating roller 14. As hereinbefore described, the pusher bars 97 are associated with the movable rack members 44 and, therefore, it results that the pusher surfaces 97a are reciprocated toward and from said coating zone.

The shaft 59 carries the cam disk 58 and it also carries the sprocket wheel 63 which drives the sprocket chain 64 whereby the cam disk 67 is rotated to thereby effect oscillatory movement of the shaft 70 and the lever 71 carried thereby. In response to such oscillatory movement of the lever 71, the bars 72 and 76 are moved in unison either toward the center of the machine or from the center of the machine for the purpose hereinafter described.

The hereinbefore described shaft 9 also carries the sprocket wheel 79 which meshes with and drives the sprocket chain 80, the latter operating the sprocket wheel 81 to thereby rotate the stub shaft 82. The gear wheel 83 on said stub shaft 82 operates the gear wheel 84a to thereby rotate the shaft 84 and, by the described intermeshing gear wheels on said shaft 84 and the shaft 87, it results that the shafts 84 and 87 are rotated in unison and in opposite directions, respectively.

The stub shaft 82 also carries the cam disk 94 and the latter coacts with the roller 95 and lever 96 to periodically oscillate the shaft 89 in its bearings formed at the ends of the respective arms 80. As a result, the shaft 87 is periodically elevated or lowered so that the disks 92 are periodically moved toward or from the respective disks 86.

The sheets of material may be disposed in suitable stacked relation so that the operator may grasp a sheet M and move the same toward the upturned ends 93a of the respective stop members 93 as shown in Fig. 2. The forward edge of the sheet M immediately engages such stop meter sections 93a, the shaft 87 and disks 92 being elevated at this time. Thereupon, the cam disk 94 permits the parts last noted to be lowered whereupon, as soon as the stop sections 93a are lowered, the rotation of the shafts 84a and 87 causes the sets of coacting disks 86, 92 to move the sheet M from right to left, Fig. 2.

The timing is such that, as the sheet M passes beyond the sets of disks, the pusher surfaces 97a are in their rearward positions toward the right, Fig. 2. Therefore, when the rear surface of the sheet M passes beyond the sets of disks 86, 92, it drops in front of the pusher surfaces 97a. The latter, under the control of the cam disk 58, immediately move from right to left, Fig. 2, whereby the sheet M is positively fed between the supporting roller 4 and the composition roller 14.

While the action last named is proceeding, the bars 72 and 76, under the control of the cam disk 67, are held in such position that by coaction with one or both of the respective edges of the sheet M, the latter is maintained in a properly alined position transversely of the machine.

In normal operation, the series of actions described above are repeated in a continuous manner so that, in timed relation the sheets M are fed toward and between the supporting roller 4 and the composition roller 14.

In accordance with the invention, an arrangement is provided so that each sheet M may be gripped and moved under control while the same passes from right to left, Fig. 3, between the supporting roller 4 and composition roller 14.

To this end, as shown particularly in Fig. 2a, the frame members F, F1 have secured thereto by bolts 130, or equivalent, the respective supporting members 131, 131 which extend from right to left, Fig. 2a, in a horizontal direction or substantially so. At their ends removed from the frame members F, F1, the members 131, 131 are connected together and braced by a horizontal tie member 132, Fig. 1a.

Disposed in parallel relation and rotatable in suitable bearings formed in the members 131, 131 are the shafts 133 and 134, the shaft 133 being disposed adjacent the frame members F, F1 and the shaft 134 being at the remote end of said members 131, 131. One end of the shaft 133 extends beyond the adjacent member 131 and there carries a gear wheel 135 which meshes with and is driven by the aforesaid gear wheel 2. Between the members 131, 131, the shaft 133 carries a plurality of spaced pulleys 136 which are disposed in alinement with the respective similar pulleys 137 secured to the shaft 134. Engageable with each set of the longitudinally alined pulleys 136, 137 is an endless belt 138 formed from canvas or other suitable material.

Supported by the shaft 133 and the tie member 132 are a plurality of structures 139 each of which comprises a pair of spaced members

140 joined by a web section 141. As indicated in Fig. 5, the structures 139 extend from the shaft 133, by which they are loosely supported, toward and are supported by the tie member 132, Fig. 1a. As illustrated in Fig. 2a, there are two of the structures 139 and each, adjacent the shaft 133, has a fixed cam disk 142 secured thereto in any suitable manner. Disposed immediately adjacent each cam disk 142 is a shroud member 143, each of these, as shown in Fig. 5, being secured to a bar 144 extending transversely between and secured to the frame members F, F1. Disposed between each shroud member 143 and a part 139a of the structure 139 is a sprocket wheel 145. The shaft 133 extends through the hubs 145a of these sprocket wheels and each hub is keyed to said shaft as indicated at 146, Fig. 5.

At their ends adjacent the tie rod 132, each face of each structure 139 comprises a pair of projecting lugs 147 and each lug has a set screw 148 threaded therethrough. These set screws 148 adjustably support the respective axles 149 on each of which is loosely mounted a sprocket wheel 150 corresponding with the aforesaid sprocket wheel 145, each sprocket wheel 150 being disposed between sections 139a, 139c of the associated structure 139. Furthermore, each structure 139, at the end thereof adjacent the aforesaid tie member 132, carries a fixed cam disk 151.

As clearly appears from a consideration of Fig. 2a, each pair of sprocket wheels 145, 150 are alined longitudinally of the machine and each of said pairs of sprocket wheels 145, 150 has associated therewith an endless belt 152 formed from thin sheet steel or equivalent, each belt 152 being provided with sprocket holes 153 adapted to coact with sprocket teeth 154 formed on the respective sprocket wheels 145 and 150.

Referring to Figs. 7 and 7a, there is shown as associated with each belt 152 a bearing support 155 from the upper flat face of which project a plurality of lugs 156 disposed in two parallel rows. The ends of each belt 152 are perforated in correspondence with the spacing of the lugs 156 and, therefore, it follows that the belt ends may be brought closely together and then passed downwardly over the respective rows of lugs 156 whereupon a plate 157 may be associated with said lugs and secured in fixed position by screws 158 which extend through said plate 157 and are threaded into the adjacent surface of the bearing support 155.

Supported for free oscillatory movement in each bearing support 155 is a shaft 159 which, at one side of the associated belt 152, has an arm 160 secured thereto, this arm carrying a cam roller 161. Secured to each shaft 159 is an upwardly extending arm 162 which terminates in a gripping finger 163 adapted to coact with a rear section of the aforesaid plate 157 whereby the sheets M are conveyed from right to left, Figs. 1 and 2a, in the manner hereinafter described. The arm 162 and finger 163 extend upwardly through an opening 164 formed in the bearing support 155 and the belt 152. Each finger 163 is suitably biased toward the adjacent plate 157 by a spring 165 coiled around the projecting end of each shaft 159 opposite the arm 160, each spring 165 having one end thereof secured to the associated shaft and the other end thereof secured to the associated bearing support 155.

As shown in Figs. 5 and 6, the periphery of each of the sprocket wheels 145 and 150 is provided with a transverse slot 166, these slots 166, during operation of the mechanism, receiving the respective bearing supports 155 as they follow their respective paths of movement.

As indicated in Fig. 1, the upper spans of all the belts 138 and 152 are disposed in horizontal alinement. This, however, is not true with respect to all of the lower spans of said belts because, as shown, the pulleys 137 are smaller in diameter than the pulleys 136 and, therefore, the lower spans of the belts 138 are inclined upwardly in a direction extending from right to left, Fig. 2a.

As illustrated in Fig. 2a, the gripping units comprising the respective fingers 163 are in alinement transversely of the machine. In order that this transverse alinement may be obtained with nicety, the set screws 148 may be adjusted in an obvious manner to thereby shift the axles 149 as required. Further, said set screws 148 may be adjusted in one direction or the other when it becomes necessary to change the tension of the belts 152.

In response to operation of the shaft 133, as hereinbefore described, the gear wheel 2 transmits rotative movement to the gear wheel 135 whereby the shaft 133 is rotated in a counterclockwise direction, Figs. 1, 3 and 5. This shaft 133 carries all of the sprocket wheels 136, 145 and, therefore, all of the belts 138, 152 are rotated in such direction that the upper belt spans thereof move from right to left, Fig. 1.

The gripping units comprising the gripping fingers 163 are alined transversely of the machine and, normally, said gripping fingers 163 are biased toward the respective plates 157. Inasmuch as said gripping units are transversely alined, as stated, the cam rollers 161 engage the respective cam disks 142 at substantially the same time whereby each gripping finger 163 is moved to a position as indicated by the full lines in Fig. 5. Just after the gripping unit shown in Fig. 5 passes beyond the full-line position thereof, the cam roller 161 comes into engagement with the low surface of the cam disk 142 whereby the associated spring 165 becomes effective to move the gripping finger 163 toward closed position as shown by the broken lines of Fig. 5.

The gripping fingers 163 remain in closed position as just stated while they move from right to left, Fig. 1, and they thus remain in closed position until the cam rollers 161 engage the respective cam disks 151 whereupon, as shown in Fig. 5, the fingers 163 are moved to open position.

When the cam rollers 161 engage the respective cam disks 142, the ends of the shafts 159 and the associated collars of the arms 160 tend to move pivotally about axes defined by the respective rollers 161. This movement is prevented by the shroud members 143 which are so disposed that they prevent the described pivotal movement of the respective ends of the shafts 159.

The hereinbefore described gear arrangement is such that the above noted pusher surfaces 97a convey each sheet M forwardly through the machine at the same rate of speed as the speed at which the supporting roller 4 and composition roller 14 advance the sheet in a direction from right to left, Fig. 3. Further, the speed of the gripping units comprising the gripping fingers 163, when moving solely in a horizontal path, Fig. 1, is the same as the speed above noted at which the rollers 4 and 14 advance each sheet M.

Accordingly, by properly relating the parts, the aforesaid gripping units may be caused to rise

upwardly so that the cam rollers 161 are controlled by the respective cam disks 142 just as a sheet M is being advanced from right to left, Fig. 5, under the control of the pusher surfaces 97a. Just before said sheet M reaches the position shown in Fig. 5, the plates 157 reach their uppermost positions, and move into engagement with the lower surface of the sheet M. At this time, the gripping units start moving in a horizontal direction toward the discharge end of the machine and the sheet M while supported by the belts 138, 152 move therewith and at the same rate of speed, such movement being effected by the pusher surfaces 97a. Further, at this time, the cam rollers 161 come into engagement with the respective low surfaces of the cams 142 and, therefore, under the influence of the respective springs 165, the gripper fingers 163 engage the top surface of the sheet M.

Soon thereafter, the pusher surfaces 97a reach their most advanced positions toward the rollers 4 and 14 whereupon said pusher surfaces 97a start returning toward the front end of the machine. Accordingly, under the control of the described gripper units, movement of the sheet M between the rollers 4 and 14 is completed and, thereafter, some further horizontal movement of said sheet M continues. Soon, however, the cam disks 151 open the gripper units and free the sheet M which, in its freshly coated condition, may be removed from the machine in any suitable manner. Meanwhile, the gripper units return to the full-line position shown in Fig. 5 so as to be in a position to grip and convey the succeeding sheet M to the discharge end of the machine.

In this manner, one after another, the individual sheets M are conveyed or transported through the machine. Since there is an overlapping period when each sheet is under the combined control of the pusher surfaces 97a and the gripper units comprising the fingers 163, it results that said sheets are never dependent upon the conjoint effect of the rollers 4 and 14 for advancing the sheets through or discharging them from the machine.

An arrangement of the character described is highly advantageous and desirable in connection with a machine as disclosed wherein the composition roller 14 is shown as having areas 14a thereof which are cut out and hence disposed below the normal coating surface of said composition roller 14. Composition rollers of this character are used for spot or zone coating operations and, as will be understood, such composition rollers, by reason of the presence of the aforesaid depressed areas 14a, may be incapable of advancing the coated sheets so as to cause them to move far enough to clear the rollers 4 and 14. Therefore, it is highly desirable that the described sheet-gripping and conveying mechanism be provided at the discharge end of the machine and, further, such mechanism should be synchronized with the sheet-advancing mechanism which is disposed at the input side of the rollers 4 and 14.

While the invention has been described with respect to a certain particular preferred example which gives satisfactory results, it will be understood by those skilled in the art after understanding the invention, that various changes and modifications may be made without departing from the spirit and scope of the invention and it is intended therefore in the appended claims to cover all such changes and modifications.

What is claimed as new and desired to be secured by Letters Patent is:

1. In a coating machine comprising supporting and composition rollers between which plane sheets of material pass along a path defined by a horizontal plane extending substantially tangentially with respect to said rollers in the coating zone thereof, means for moving the plane sheets of material toward and between said rollers, means at the discharge end of said coating machine for successively drawing the plane sheets of material between and from said rollers in the same general direction defined by said horizontal plane, said last named means comprising a plurality of endless members extending in the direction of sheet movement, transversely aligned gripper units carried by the respective endless members, means for actuating said gripper units to grip a sheet delivered thereto from said rollers, and means for actuating said gripper units to release said sheet after it has been moved beyond said rollers.

2. In a coating machine comprising supporting and composition rollers between which plane sheets of material pass along a path defined by a horizontal plane extending substantially tangentially with respect to said rollers in the coating zone thereof, means for moving the plane sheets of material toward and between said rollers, means at the discharge end of said coating machine for successively drawing the plane sheets of material between and from said rollers in the same general direction defined by said horizontal plane, said last named means comprising a plurality of endless members extending in the direction of sheet movement, transversely aligned gripper units carried by the respective endless members, means for actuating said gripper units to grip a sheet delivered thereto from said rollers, means for actuating said gripper units to release said sheet after it has been moved beyond said rollers, and means comprising a plurality of endless belts for supporting each sheet as it is moved under the control of said gripper units.

3. In a coating machine comprising supporting and composition rollers between which plane sheets of material pass along a path defined by a horizontal plane extending substantially tangentially with respect to said rollers in the coating zone thereof, means for moving the plane sheets of material toward and between said rollers, means at the discharge end of said coating machine for successively drawing the plane sheets of material between and from said rollers in the same general direction defined by said horizontal plane, said last named means comprising a plurality of endless members extending in the direction of sheet movement, transversely aligned gripper units carried by the respective endless members, means for actuating said gripper units to grip a sheet delivered thereto from said rollers, and means for actuating said gripper units to release said sheet after it has been moved beyond said rollers, said moving means, said rollers and said gripper units serving to move each sheet at the same speed and said gripper units gripping each sheet prior to the time that it is released by said moving means.

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