

June 2, 1942.

C. W. MAYER ET AL

2,285,041

COATING MACHINE

Filed Aug. 8, 1938

7 Sheets-Sheet 1

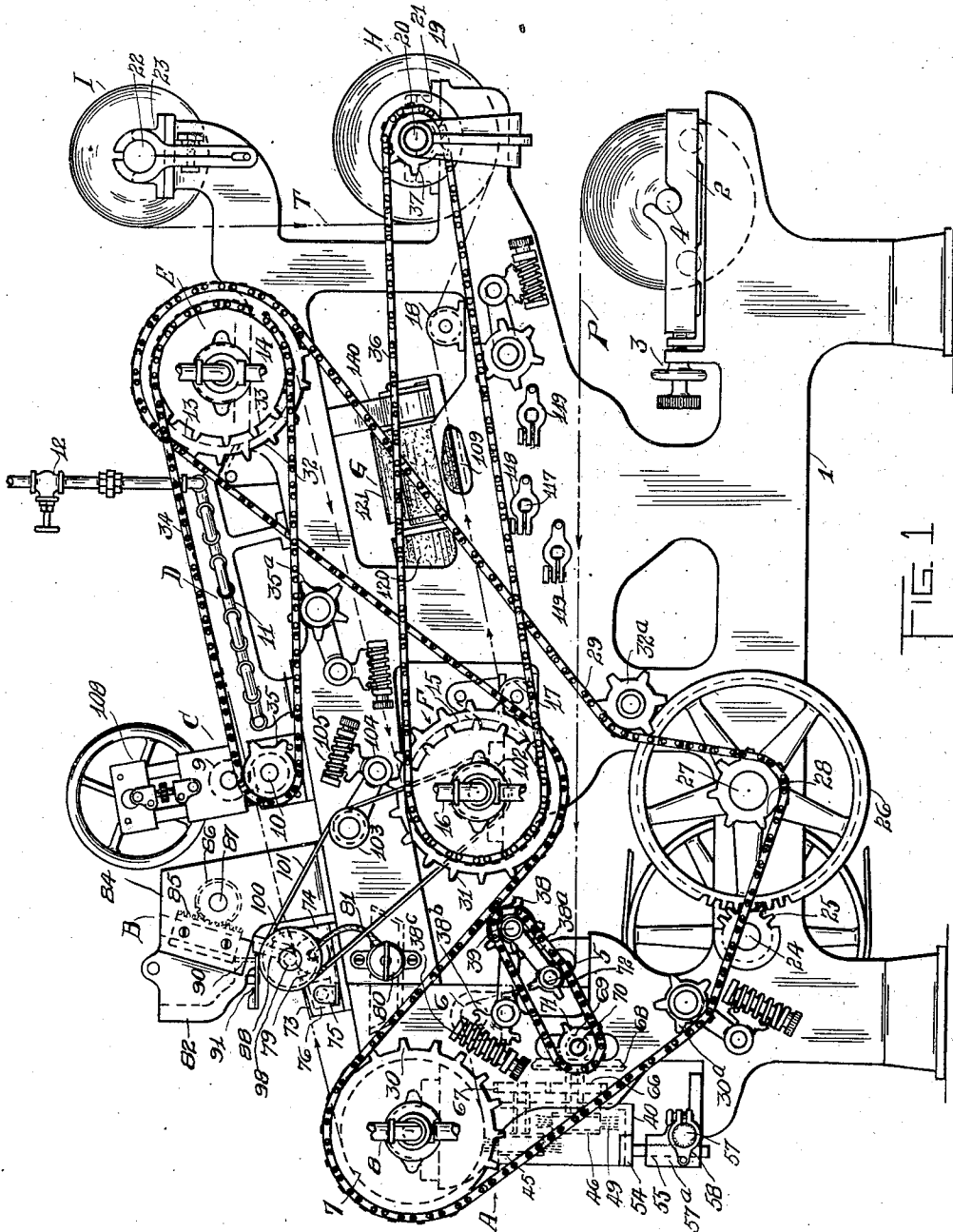


FIG. 1

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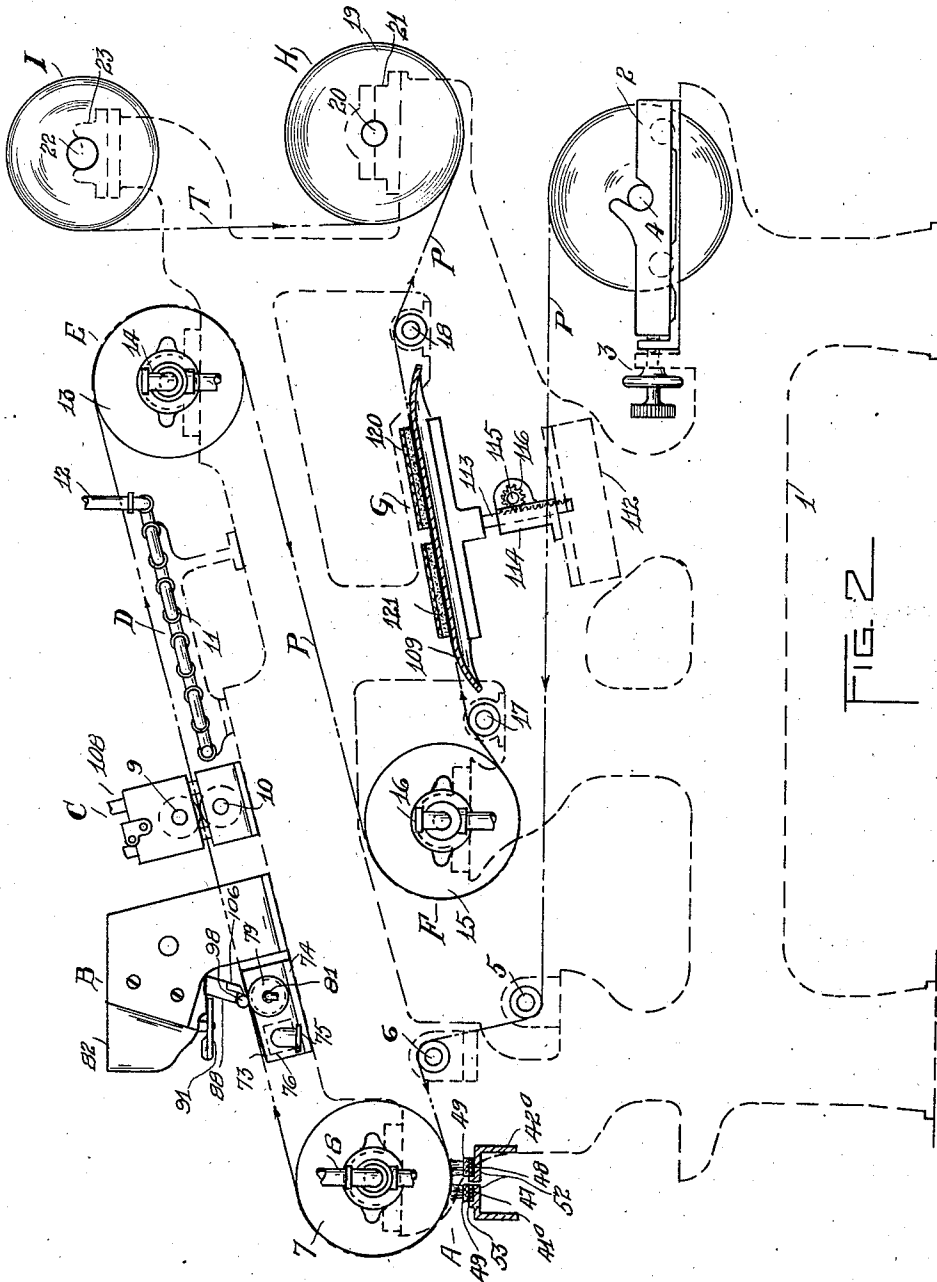
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7 Sheets-Sheet 2



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FIG. 4

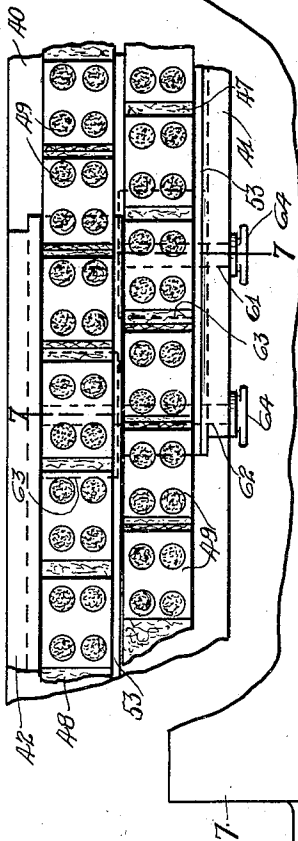
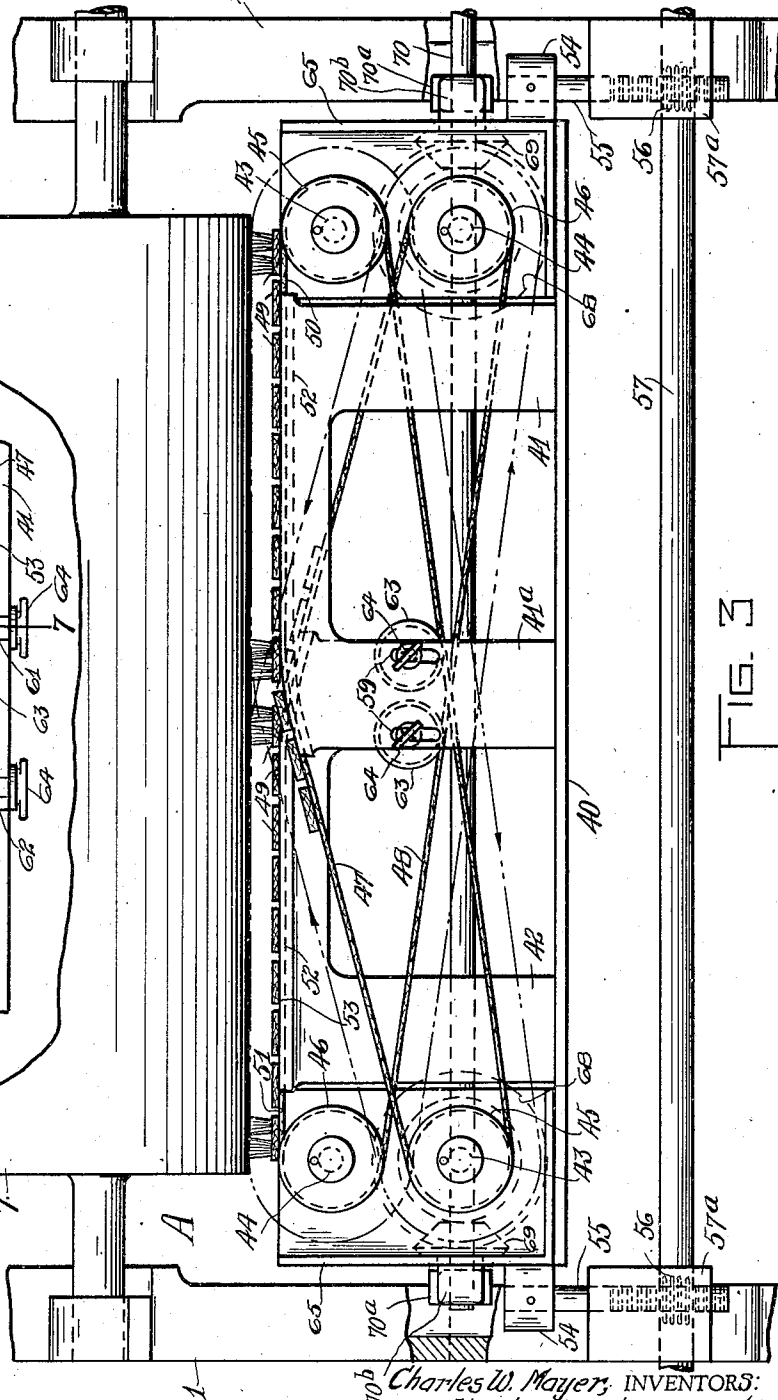


FIG. 3



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COATING MACHINE

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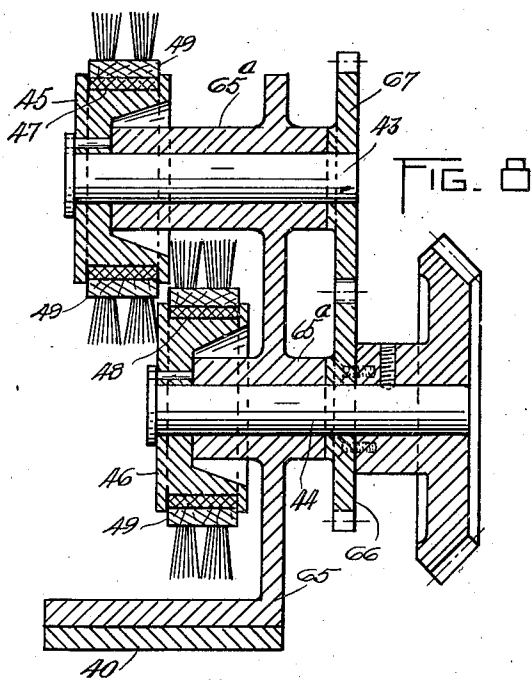
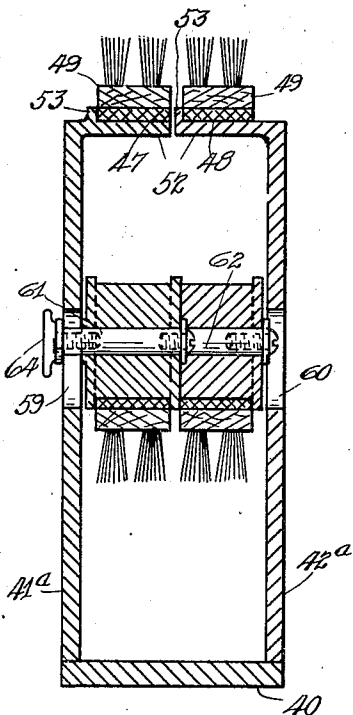
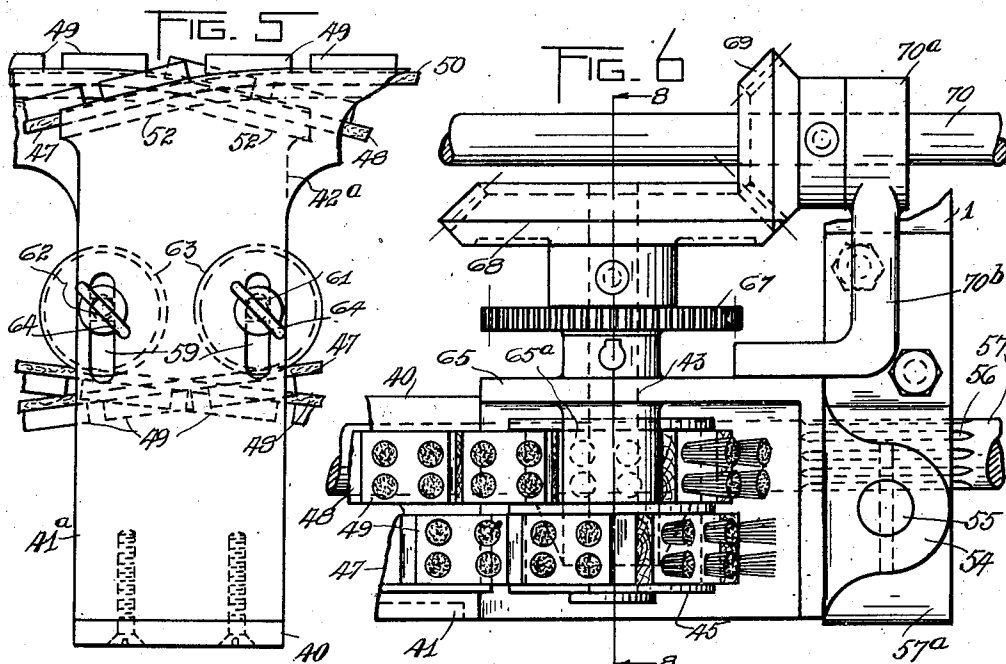


FIG. 7

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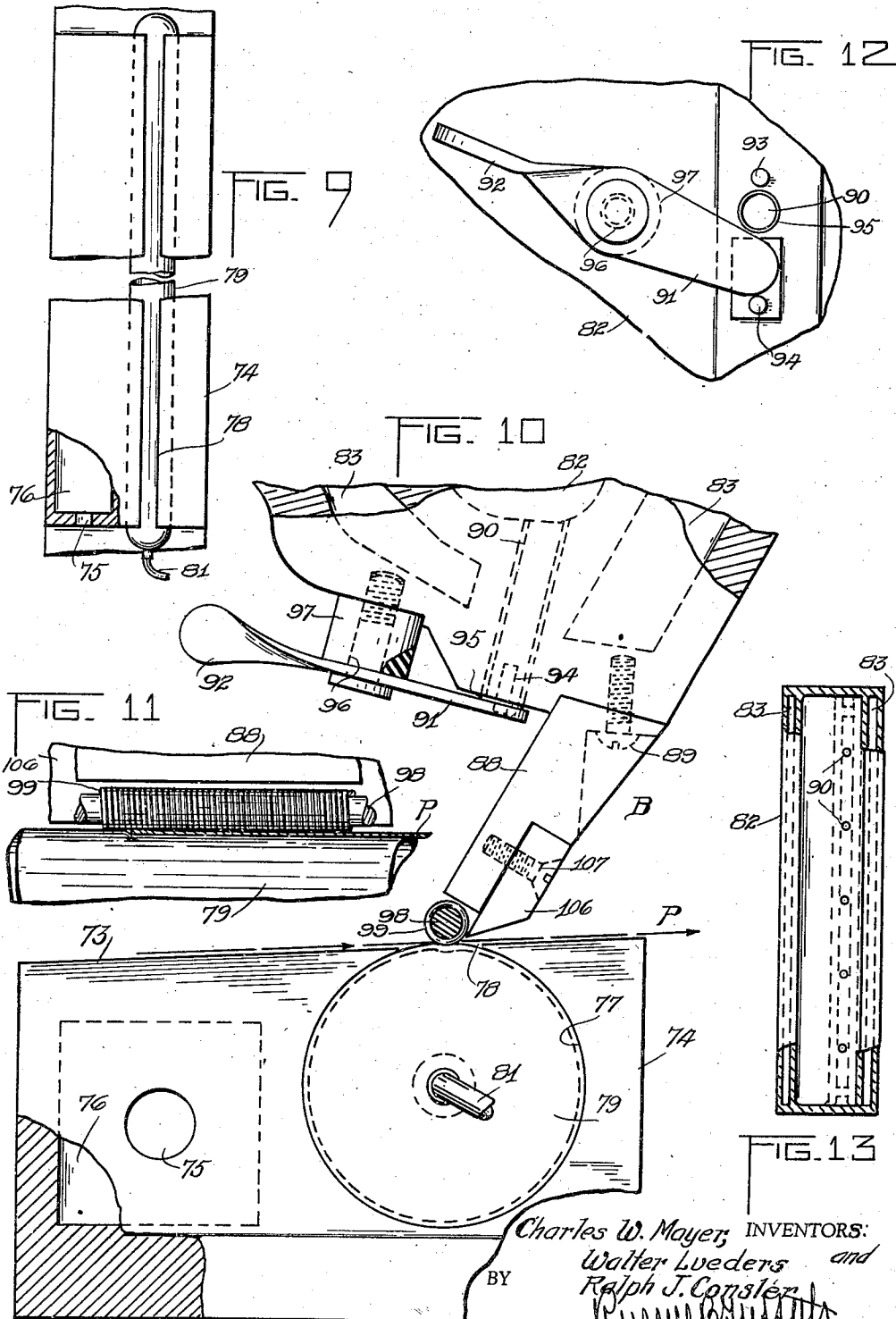
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COATING MACHINE

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COATING MACHINE

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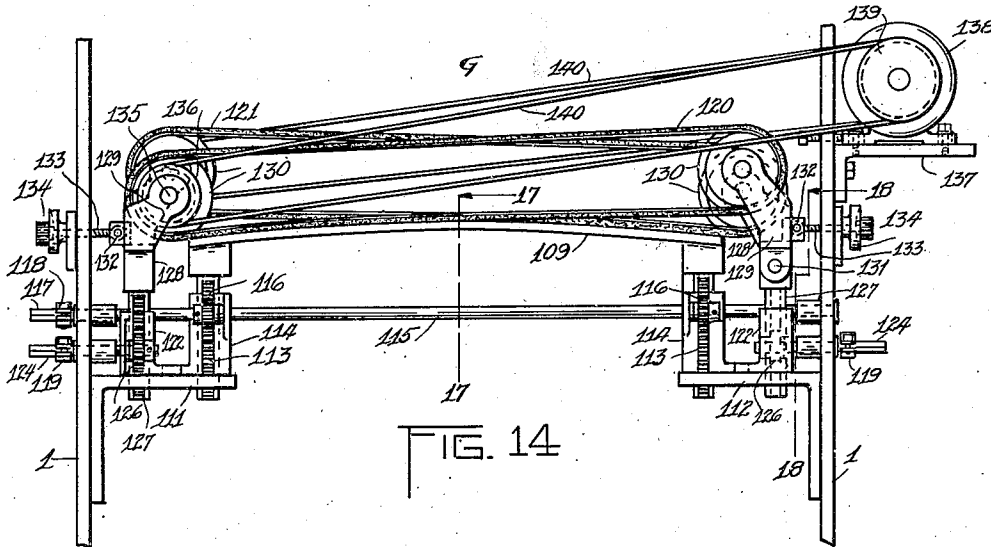


FIG. 14

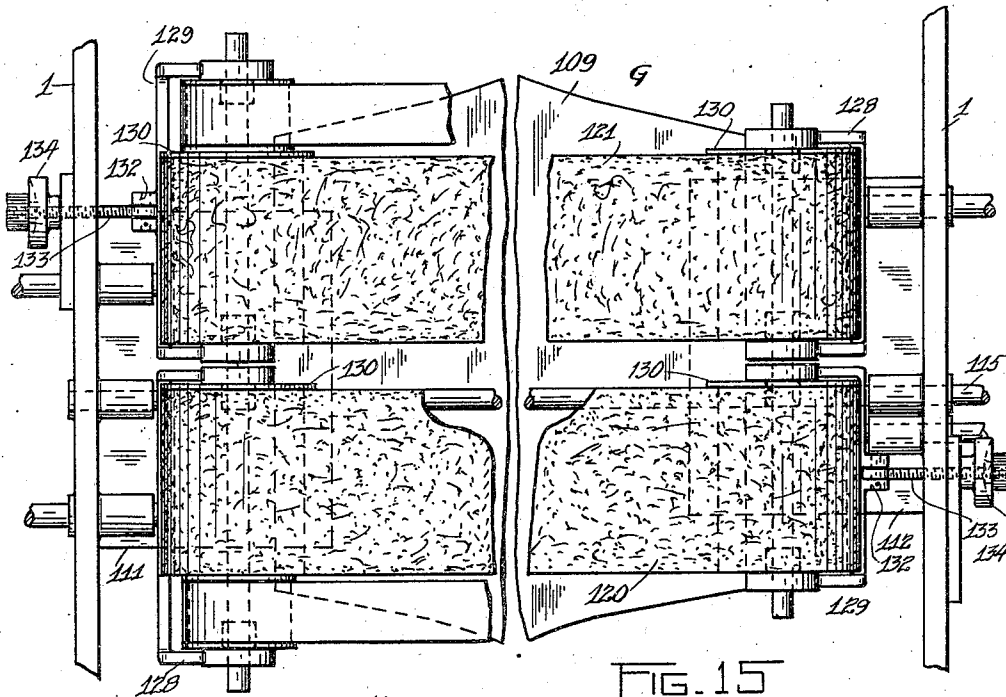


FIG. 15

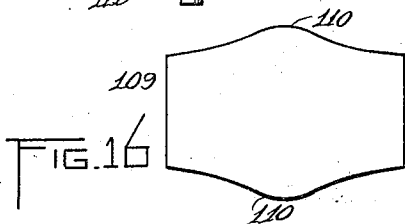


FIG. 16

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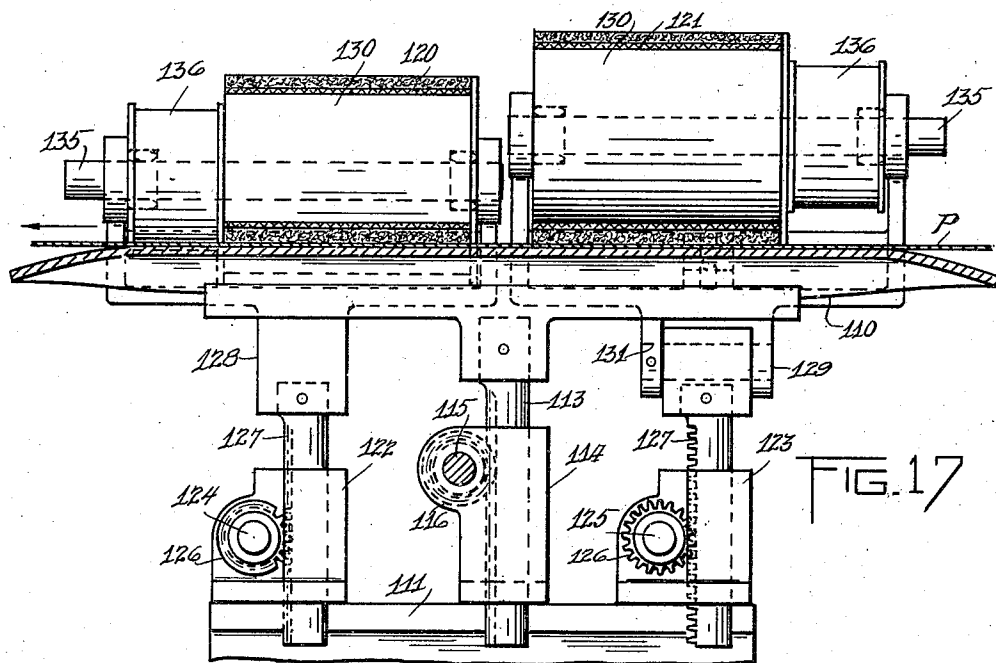


FIG. 17

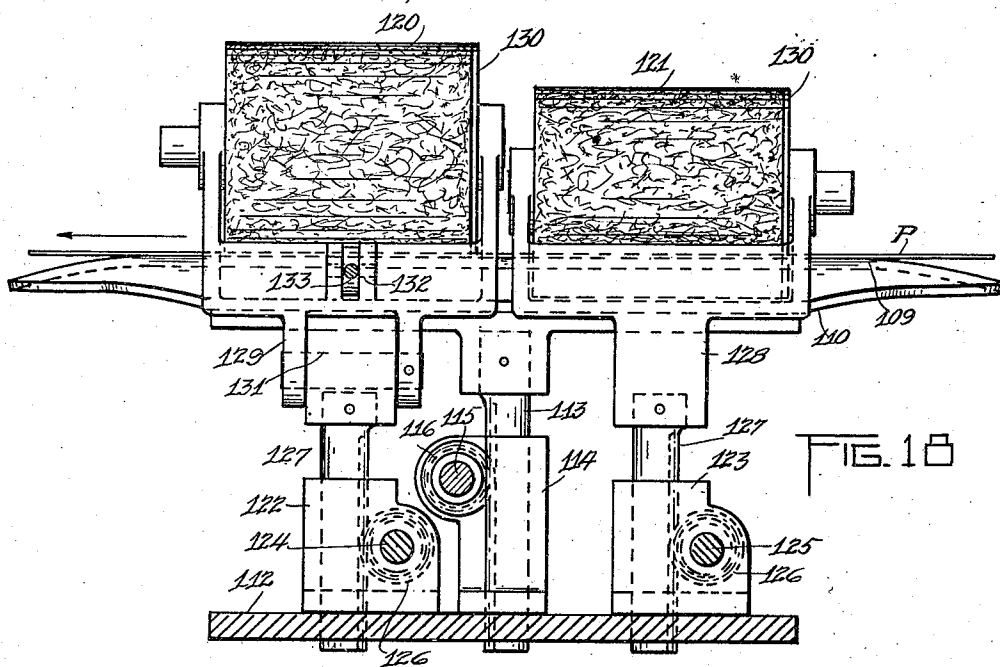


FIG. 18

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UNITED STATES PATENT OFFICE

2,285,041

COATING MACHINE

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Application August 8, 1938, Serial No. 223,622

10 Claims. (Cl. 91—13)

Our present invention relates to coating machines and more particularly to machines for applying a liquid coating to a continuous web of paper or similar material as it passes from a supply or mill roll to ultimate winding in a finished state on a take-up roll, and the invention has for its object to provide an improved and efficient machine of this character that will work with rapidity and produce a finished coated product of exceptional quality. The improvements are directed in part toward the means for applying and spreading the viscous dope upon the web; toward the means for controlling its temperature and hence its viscosity; toward means for properly surfacing and spreading the receiving web before it goes to the dope spreader; toward means for insuring the coating of the paper or similar material to its extreme edges so that trimming is not thereafter required, and toward means for burnishing and imparting uniformity and luster to the coated web before it is wound as a finished product upon the take-up roll. To these and other ends, the invention resides in certain improvements and combinations of parts, all as will be hereinafter more fully described, the novel features being pointed out in the claims at the end of this specification.

In the drawings:

Fig. 1 is a side elevation of a coating machine constructed in accordance with and illustrating one embodiment of our invention, the details of various elements of the machine having been made subservient in this view to a clear portrayal of the general scheme of the driving gear;

Fig. 2 is a view similar to Fig. 1 but more diagrammatic in its nature, the same being addressed largely to making clear the path of the web as it proceeds through the machine;

Fig. 3 is a very much enlarged view broken away of the unit mechanism that spreads or flattens and prepares the web just before its passage into the dope applying area;

Fig. 4 is a fragmentary top plan view of a portion of the spreading device shown in Fig. 3 and on the same scale;

Fig. 5 is a fragmentary front elevation of the unit of Fig. 3 further enlarged;

Fig. 6 is a fragmentary top plan view of the driving mechanism of the unit of Fig. 3 still on the same scale;

Fig. 7 is a detail vertical section taken substantially on the line 7—7 of Fig. 4;

Fig. 8 is a detail vertical section taken substantially on the line 8—8 of Fig. 6;

Fig. 9 is a detail plan view partially in section, 55

broken away, and enlarged of the lower contact member for the web that opposes the dope applicator;

Fig. 10 is an enlarged elevation partly in section and broken away of the dope applicator viewed from the same side of the machine as appears in Fig. 1;

Fig. 11 is an enlarged fragmentary view of certain elements of the dope applicator;

Fig. 12 is an enlarged fragmentary bottom plan view of one of the cut-off valves of the dope applicator;

Fig. 13 is a top plan view partly in section of the dope box on the scale of Fig. 1 or much reduced in scale from the related figures on the same sheet;

Fig. 14 is a rear elevation, enlarged and viewed from a plane transverse to the main, of a unit or station of the machine embodying a smoothing and burnishing device that acts upon the coated web as a last treatment before it goes to the take-up roll;

Fig. 15 is a top plan view further enlarged of the unit or mechanism of Fig. 14 partly broken away through the center and otherwise;

Fig. 16 is a detail on a small scale showing a top plan view outline of the bed incorporated in the unit mechanism of Figs. 14 and 15;

Fig. 17 is an enlarged vertical section taken substantially on the line 17—17 of Fig. 14 looking in the direction of the arrows, and

Fig. 18 is a similarly enlarged section taken on the line 18—18 of Fig. 14 looking in the direction of the arrows.

Similar reference numerals throughout the several views indicate the same parts.

It will be assumed for the purposes of explaining the illustrated embodiment of the invention that this machine is utilized for the specific function of applying to a web of paper tissue a wax and carbon coating as in the manufacture of type-writer or manifold carbon paper. The mixture of wax and pigment such as carbon particles held in suspension has its desired viscosity at the point of application controlled largely by temperature and after application the coating is cooled or set on the body or carrying web and with certain other intermediate treatments finally wound upon a take-up roll that constitutes the finished bulk product.

To first give a general idea of the course of treatment of the web itself in its passage through the machine, we have prepared Fig. 2 of the drawings and now make particular reference thereto, it first being explained that the elevation of this

figure we shall call the "right" side of the machine, the front thereof being at the left and the rear of the machine at the right. It embodies a main frame indicated generally at 1 and consisting of two side pieces suitably joined together in the manner of machinery of this type. At a relatively low point at the rear of the machine there is supported in open journal bearings 2 having suitable adjusting mechanism for regulating tension thereon, as generally indicated at 3, a mill roll spindle 4 on which is wound a given supply of paper P, the course of which therefrom is shown in dot and dash lines. From the mill roll the web proceeds forwardly (and thereafter as indicated by the arrows) under and over guide rolls 5 and 6, respectively, and thence upwardly and rearwardly around a hollow preliminary heating roll 7 having suitable piping connections 8 for hot water or steam. This last is what we call generally station A for the treatment of the web preparatory to receiving its coating. Such station includes a brushing and stretching unit that traverses the web as held against the roll 7 transversely from the center in opposite directions toward both lateral edges. It has a multiple function. It cleans the paper by removing lint or free paper fibers; it stretches the paper laterally to the fullest degree and it insures intimate contact thereof with the surface of such preliminary heating roll 7.

From the latter roll and station A the web proceeds rearwardly, preferably at the upward incline shown, and almost immediately passes through station B. This station includes a dope box or source of supply of the viscous liquid that constitutes the coating and also particular means concerned with this invention for effecting proper application of the dope to the surface.

In rear of station B is embossing station C where the freshly coated web passes between suitable rolls 9 and 10 for impressing thereon if desired figures or markings in the nature of water marks as used in general paper manufacture.

Next beyond station C (still progressing rearwardly) is heating station D wherein a radiating element beneath the travelling web and under exact temperature control maintains the coated surface at a proper temperature to allow the coating to set to a desired degree. This station is depicted as a horizontal bank of hot water or steam coils 11 having a control inlet 12 and need not be further described in this specification.

Beyond and rearwardly of station D is cooling station E. We say cooling station, although in some instances and for particular purposes under then existing conditions of operation it might be another heating station. This is immaterial, however, as the element consists essentially of a hollow roll 13 like roll 7 and similarly provided with intake and exhaust water or steam fittings 14.

From station E, after passing around and below it, the coated web P continues forwardly as indicated around another cooling roll 15 constituting station F which roll is fitted at 16 like stations A and E and here the final cooling and setting is accomplished. From thence it passes rearwardly again over a guide roll 17 through a final treatment station marked G. It will be noted by tracing the web that at this point the coated side is uppermost and the function of the unit here located is to again stretch the web transversely from the center toward both lateral margins; burnish the coated surface to a high gloss while

insuring its evenness for uniform results in manifold use and to make sure that no wrinkles exist therein. Thereafter the web passes over guide roller 18 to the final station H at the rear of the machine where it is accumulated in a winding roll 19 supported by a mandrel 20 in suitable bearing blocks 21 on the frame 1.

It is not essential to this invention but, in order to interpose a protective covering over the coated surface in its tightly wound convolutions in roll 19, we provide a mill roll of tissue I on a mandrel 22 in journal blocks 23 at the top rear of the machine, which tissue web, indicated at T, is drawn off downwardly onto the roll 19 coincidentally with the web P, as indicated.

It will be next convenient to describe the general driving set-up whereby power is communicated to most of the instrumentalities located at the various stations that have been outlined. For this purpose, reference is to be had mainly to Fig. 1 but in conjunction with the more diagrammatic outline of Fig. 2 just traversed. The main drive shaft 24 through a pinion 25 drives a gear 26 on a driven shaft 27 provided with a sprocket 28. This sprocket is the prime mover of a relatively long sprocket chain 29. Such chain carries first over a jockey sprocket 30a having adjustment for tightening the chain to a sprocket 30 on the preliminary heating roll 7, thence rearwardly and downwardly around a sprocket 31 on roll 15, thence upwardly and rearwardly over a sprocket 32 on roll 13 and finally downwardly and forwardly over idler sprocket 32a to the first mentioned driving and driven elements.

There are offshoots of this main line of driving power communication. The shaft of roll 13 at station E is provided with another sprocket 33 through which a chain 34 drives through a sprocket 35 with a tension adjusting jockey 35a the lower roll 10 at the embossing station C. Another sprocket on the shaft 15 at station F carries a chain 36 travelling over a sprocket 37 on the shaft 20 of the take-up roll at station H to drive the latter. Also, as the main driving chain 29 passes from the sprocket 30 on the roll 7 of station A to the sprocket 31 on roll 15 of station F, it meshes with and drives a spur sprocket 38 on a stud shaft 39 for the purpose of activating the web brushing mechanism of station A in a manner to be described.

For a detailed description of this station A mechanism, reference will next be had to Figs. 3 to 8. Spanning the machine at the front between the side plates of the main frame 1 is a subsidiary frame 40. It comprises and supports front and rear vertically disposed plates 41 and 42 that are rigid with respect to that frame and consist of aligned central columns 41a and 42a. At each end thereof, the subsidiary frame 40 carries brackets 65 and suitable bearings 65a in the two brackets support shafts 43 and 44 in pairs, which in turn carry pairs of pulleys 45 and 46 that support belts 47 and 48 that run transversely of the paper web P in opposite directions from the center toward the opposite margins of such web beneath the roll 7 of station A. The belts 47-48 are furnished with brush blocks 49 as flexible units capable of passing over the pulleys aforesaid. The axes of the shafts 43 and 44 are arranged in a parallelogram as viewed from the front of the machine so that from that aspect the belts 47 and 48 intersect or cross each other. Nevertheless, the upper reaches 50 and 51 of the belts travel as indicated

by the arrows in opposite directions in parallelism to a longitudinal tangential line on the circumference of roll 7 from which line they are offset from front to rear of the machine. This is because front and rear plates 41 and 42 (Fig. 7 particularly) have top flanges 52 fitted with rails 53 that support and guide these upper reaches of the brush belts.

The purpose of all this, as previously indicated, is that as the paper web P comes onto the hot heat adjusted roll 7 of station A, it is (from underneath with respect to this roll) thoroughly brushed and stretched laterally, its surface being glossed and denuded of free fibers and it being presented for treatment in the course of its further progress in a thoroughly flat and unwrinkled condition.

To regulate this brushing contact, that is the intensity of the pressure against the web and roll 7, arrangement is made whereby the subsidiary frame 40-41-42 with the belts and the shafts and bearings therefor carried by such frames may be raised and lowered on the main frame 1. For this purpose, the bearing brackets 65 on frame 40 (Figs. 3 and 6) are provided with lateral lugs 54 in which are fixed depending rack pins 55. The teeth on these rack pins are engaged by teeth 56 cut in a transversely extending shaft 57 having bearings in brackets 57a supported on the main frame 1 and in which brackets the said rack pins are guided for vertical movement. A crank (not shown) is applied to this shaft to turn it and raise and lower the said unit at station A through the mesh with the rack pins and in its set position it is secured by a split friction brake indicated generally at 58 in Fig. 1 that is tightened against the shaft.

Aside from the raising and lowering of the subsidiary frames 40-41-42, the brushing pressure and general travel of the belts 47 and 48 is dependent to some extent upon the tension of the belts themselves. To regulate this, the central standard portions of the plates 41 and 42 are provided with slots 59 and 60 (Fig. 7) in which slide the ends of studs 61 and 62 on which turn jockeys or idlers 63. These studs may be appropriately positioned and secured in their slots by wing nut fastening devices 64.

The driving of belts 47 and 48 on frame 40 is accomplished in consonance with the general operation of the machine through the fact that the lower shafts of the pairs 42-43 and 44-45 project rearwardly beyond their bearing brackets 65 and have fixed thereon gears 66 meshing with gears 67 on the upper shafts 43 and 44 whereby all of these four shafts 42-43 and 44-45 are driven in unison. The ends of the said lower shafts are provided with bevel gears 68 meshing with bevelled pinions 69 (Fig. 6) on a transverse shaft 70. This shaft floats with the subsidiary frame 41, being supported in bearings 70a on arms 70b extending rearwardly from brackets 65.

Referring now again to Fig. 1, shaft 70 carries a sprocket 71 over which runs a sprocket chain 72 that connects it with spur sprocket 33 previously described, which spur sprocket meshes with main driving chain 29. This spur sprocket 33 is mounted on an arm 33a having a segment 33b meshing with a hand adjusting work 33c so that in the raising and lowering of the brushing devices of this station A the proper driving tension and contact may be maintained with respect to both chains 72 and 29, as will be under-

stood, compensating for the consequent changes in the turning axes of the sprocket gears.

It will be noted that the whole mechanism of this brushing device at station A is mounted on and carried by the brackets 57a at the front of the machine, is not otherwise connected to the main frame 1 and can be applied or removed as a unit. It can be individually assembled complete and the machine as a whole can be sold with or without this attachment on the preference of the purchaser.

The web having thus been brushed free of surface fibers at station A and preliminarily heated by roll 7 of that station, it is in condition to proceed to station B and receive on its upper side the coating of hot wax or other dope, the web proceeding forwardly and then rearwardly around this roll 7.

Station B in the present embodiment consists of devices best shown in Figs. 9 to 13 and, of course, in general in Figs. 1 and 2. Mounted on top of frame 1 in rear of roll 7 to extend transversely from side to side is a hot table 73 (Figs. 1 and 10), the surface thereof being preferably slightly upwardly inclined in the direction of travel. The table is in the form of a cored box 74 having suitable steam or hot water circulation openings, as indicated at 75, communicating with the interior chest shown broken away at 75. Within the box 74 adjacent to the chest is a cylindrical cavity 77 running longitudinally thereof from side to side of the machine and transversely to the path of the web. It communicates with the surface of the table 73 where it intersects the same through a narrow longitudinal opening 78 providing a slot or mouth clearly shown in Fig. 9.

Enclosed within the cavity 77 is a flexible pneumatic tube or bag 79 extending from end to end. It is preferably of soft rubber. It is detachable, that is, it can be drawn out longitudinally when deflated and it is filled with air at a controlled pressure. We have shown in the present instance as a means for inflating and regulating the pressure a conventional hand pump 80 mounted on the side of the frame 1 (Fig. 1) and connected to the bag by a tube 81. When the bag is pumped up to the proper extent it will protrude slightly through the opening 78 and present its surface to a desired degree above the plane of the surface of table 73.

The web P travels lightly over this soft protrusion or air cushion and at that exact point first comes in contact with the liquid dope that is to provide the coating.

The dope supply is carried in an elongated tank 82 jacketed at 83 for heating by water or steam from a suitable controlled source. It spans the frame 1, being supported at each side by brackets 84 upon which it slides up and down in suitable guides. It carries racks 85 indicated by dotted lines in Fig. 1 that mesh with pinions 86 on hand shaft 87 running through the brackets 84 so that the tank and its equipment can be raised and lowered at will and carried toward and from the travelling web. Depending from the underside of the tank is a forwardly inclined plate 88 secured to its bottom by screws 89. Extending through said bottom and communicating with the interior are a plurality of discharge or drain holes 90 arranged in a row longitudinally of the tank, as shown in Fig. 13. Through these holes the dope drains at a controlled rate onto the inclined plate 88 over which it flows in a

film that is generally uniform from side to side of the web due to the multiplicity of spaced openings. These openings are controlled by pivoted cut-off valves 91 having finger pieces 92 and arranged so that their rear ends between stops 93 and 94 may slide across the drain openings partially or totally selectively closing them. To insure a close sealing contact, the discharge ends are provided with projecting collars 95 and the pivots 96 of the valves or shut-offs 91 are provided with thick rubber washers 97 that maintain the contact under yielding pressure.

Supported in bearings in suitable lateral end extensions of the plate 88 is a relatively small rotary equalizer shaft 98. It consists of a rod or bar on which has been tightly wound in adjacent helical convolutions a wire 99, as appears in Figs. 10 and 11. The rod or shaft projects beyond the bracket 84 at the right or driving side of the machine where it carries a pulley 100 whereby the shaft is driven through a belt 101 passing thereover to a pulley 102 on the shaft of cooling roll 15 at station F. An intermediate jockey pulley 103 on an arm pivoted at 104 regulates the tension through a worm and segment adjusting mechanism indicated generally at 105.

The equalizer shaft 98 is below and closely adjacent to the lower end of the inclined plate 88 to receive the film of dope therefrom, rotates in a counterclockwise direction in Figs. 1 and 10, that is, it travels with instead of against the surface of the web and it registers with the opening 78 in the table 73. Behind it is a supporting blade 106 secured to the plate 88 at 107, which blade, as shown, in connection with the lower edge of plate 88, forms a sort of pocket for the equalizer. The equalizer is so long and of such relatively small diameter that it would otherwise be apt to bend or give and the function of this blade 106 is to counteract that tendency and hold it to its axis.

As previously described, the pneumatic bag 79 provides a soft protruding ridge through the table opening 78 against which the web travels. The elevation of the dope pan mechanism carrying the equalizer 98 is so regulated on the one hand and the pressure in the bag 79 covering the extrusion of the under rubber cushion through slot 78 is so proportioned thereto that the equalizer rod will gently press the paper into a sort of dimple in the rubber surface as an attempt has been made to show in Figs. 10 and 11. Perhaps more logically, the pneumatic surface may be said to press the web up gently into uniform contact from side to side with the dope covered surface of the equalizer 98. At any rate, the equalizer and the supporting blade 106 and associated parts form a wave of dope descending from plate 88 onto the web that is spread by the rotation of the spiral surface of the equalizer so that it forms a perfectly even and continuous coating of uniform thickness and quality. Any small lumps or other impurities that inevitably occasionally find their way into the dope are taken care of by the cushion which simply yields to them and lets them pass on to constitute a purely localized blemish whereas in other types of applicators such bodies are apt to be caught and cause streaks for long distances on the coating before they are discovered.

At this point, an important function and advantage of the pneumatic contact from beneath is pointed out. Heretofore, in such machines, it has been a practice to run a paper web wider than the finished product strip desired and trim

down the edges to the proper width because the coating devices would not carry the coating to the very edges with any uniformity. The result of this was, of course, a loss in material and labor. With the present invention, the bag 79 or pneumatic support for the web at the coating point being longer than the web, it presses it against the equalizer to the very edges of the margins as we have attempted to show in Fig. 11. To put it another way, the web P is, at the point of application, imbedded in the soft under support between it and the periphery of the equalizer against which it is pressed.

The wax and carbon dope of the present embodiment of the invention is particularly sensitive to heat in the matter of its viscosity and spreading capabilities. With the structure described, a function of the heated table 73 is to maintain the dope in that region and at the point of application at the same temperature that it leaves the feed tank even though in the meantime it has passed as a film over plate 88. By so regulating the heat above and the heat below together with adjustment of the shut-off valves 21, the flow can be nicely proportioned to the speed and absorptive qualities of the particular web.

The coated web now travels rearwardly with the coating unset to next meet the embossing station C which has already been adequately described so far as the present invention is concerned. The mechanism shown generally at 108 in Fig. 1 is obviously for the purpose of regulating the pressure between the rolls 9 and 10. The same may be said of station D where the heat radiation upon the web is regulated during the setting of the dope while the functions of stations E and F were covered in the introductory outline.

Beyond station F the web travels rearwardly toward winding station H with its coated side uppermost, the same having been cooled and set. However, we interpose at this point, as previously indicated, the smoothing and burnishing station G that greatly improves the quality of the surface and insures an unwrinkled uniform winding on the roll 19. This burnishing station is a self-contained unit, as is station A, and operates in a similar manner to some extent but, because of the change in progress of the coating operating at this point and for other structural reasons, we provide a different arrangement shown in detail in Figs. 14 to 18 inclusive. Here, instead of guiding the burnishing belts in the plane of the paper, we guide the paper to the planes of the burnishing belts.

Immediately in rear of the roll 15 is a table 109 of the general plan shown in miniature in Fig. 16 and of sufficient width to support the whole web from edge to edge in intimate contact therewith and over this table the coated and cooled web next passes, the front and rear edges of the table being provided with rounded or cam lips 110. The table is supported between the side frames 1 of the main structure on separate brackets 111 and 112 which also carry most of the mechanism of this unit.

The table 109 is adjustably supported to be raised and lowered at will toward and from the natural plane of the web in passing from station F to station H and for this purpose each end 110 of the table (considered as extending transversely between the lateral frame pieces 1) is provided with a depending rack bar 113 (see particularly Figs. 2 and 14). These rack bars are guided in

posts 114 rising from the separate brackets 111 and 112. In the same posts are bearings for a transverse shaft 115 having pinions 116 meshing with the said rack bars respectively. An end of shaft 115 projects from the right side of the machine, as shown at 117, and is squared to receive a hand crank whereby the rotation of the shaft to the right through the rack bars raises the table and lowers it on the reverse.

At this point it may be pointed out that this adjusting shaft 115 is also fitted with a detachable hand clamped friction lock 118 like the lock 58 previously described in connection with the elevating mechanism at station A and other brake type locks indicated at 119 are similarly used on other adjusting shafts hereinafter described to hold them in set position, but these are known mechanical elements and they will not be again referred to specifically.

In general, it is desired to raise the web over guide rolls 17 previously described and thence over table 109, guide roll 18 and downwardly again toward the winding roll 19 at station H but the elevating and depressing mechanism for the table with which we are now concerned in the description is more particularly for the purpose of regulating its contact with the brushing and burnishing devices about to be described.

These burnishing and smoothing devices consist of companion belts 120 and 121, the lower reaches of which run closely parallel but are crossed, as shown in Fig. 14, and travel in opposite directions. The table is also rounded on a longitudinal axis, that is, it dips downwardly from the raised center toward each side of the main frame. Both belt reaches contact it (or the web is travelling on it) at or near its center so that one belt progresses downwardly in one direction toward one edge of the web and the other oppositely, the two belts together smoothing and stretching the web from its center for the purposes previously announced.

The belts are flexible belts covered with a soft material such as wool that will effect this spreading and stretching action but will not injure the coating but improve its surface.

The belts 120 and 121 are mounted, as will now be described, so that they may also be raised and lowered with reference to the table and also so that the tension on each may be independently controlled, all to effect the proper brushing contact. Except for the crossed relationship and the elevation of the live and dead pulleys, which are of course reversed, the two belt systems are identical, so they can be described together with the same reference numerals.

Also fixed on the brackets 111 and 112 on opposite sides of the posts 114 are similar posts 122 and 123 with bearings for short hand crank elevating shafts 124 and 125. These shafts carry gears 126 meshing with the teeth of rack bar stems 127 carrying yokes 128 and 129 supporting pulleys 130 over which the burnishing belts run in the two sides of the machine. The yokes 129 are pivoted on their stems by wrist pins 131 and have pivoted thereto at 132 (Fig. 14) screws 133 provided with operating and locking thumb nuts 134 that react against the frame pieces 1 on opposite sides. Thus it will be seen that by a hand adjustment of these screws on the movable yoke of each pair of belt pulleys the belt thereof may be tightened or loosened. Adjacent to the right side of the machine, Fig. 17 (left of Fig. 14), both the adjustable and the non-adjustable pulleys of the respective belts have their shafts 135 fitted

with driving pulleys 136. At the left side of the machine (appearing at the right in Fig. 14) an outside bracket 137 on the frame 1 supports a motor 138 having a pulley 139 on each end of its shaft over which runs a drive belt 140 that goes to one of the pulleys 136. All of these pulleys have the same pitch diameter so that both the driving belts and both the burnishing belts will be driven in exactly the same way at the same speed. These driving belts pass from the motor across to the more remote pairs of pulleys of the two belts for obvious mechanical reasons.

Attention is called to the fact that as so constructed the brush mechanism of station G like that of station A is self-contained and constitutes an individual unit readily applied to and removed from the machine and with which the machine may or may not be equipped at the option of the purchaser or according to the nature of the work in hand, as in the application of coatings of some descriptions which might not be necessary or desirable. The brackets 111 and 112 carrying this unit are separate from the main frame, as shown and described, and attached parts arranged outside of the main frame are of a detachable nature.

The prevention of wrinkling of the coated web as it passes onto the winding roll is a more important function of this station G than the mere burnishing, and still another important function thereof resides in the effect that the belts have on the structure of the coating itself. The grain of the paper runs longitudinally and the grain of the coating, because of the nature of the application, runs longitudinally also up to this point. However, the belts reverse the grain of the coating, that is, dispose it transversely and homogenize the body thereof so that there are no fine longitudinal lines remaining as in most carbon papers. In fact, these belts actually stretch the coating laterally so that a surface tension that would otherwise tend to make it curl from the sides toward the center is destroyed and the tendency of the paper to similarly curl from the sides inwardly because of its longitudinal grain is thereby counteracted. The result is that when the carbon paper is removed from the roll and cut into sheets it lies flat or curls less readily than would otherwise be the case.

The remainder of the progress of the web and its final disposition have been previously described.

It will be understood that in an organized machine of this general nature, the character of the web being coated and the nature of the coating applied thereto may require obvious modification of the treatments above described. Such description had in mind the coating of a tissue paper web with carbon wax, but such departures will suggest themselves to those skilled in the art without departing from the spirit of the invention.

We claim as our invention:

1. In a web coating machine of the character described, the combination with a main frame carrying a plurality of devices for driving, guiding and supporting a travelling web, of a preliminary heating station for the web embodying a heat controllable roll over which it is guided, a subsidiary frame on the main frame adjacent to said roll having two tracks offset from each other side by side and each comprising an upwardly inclined portion meeting that of the other at the longitudinal center of the roll, two brush belts running in the tracks in opposite directions

on the longitudinal center of the roll toward the margins of the web for smoothing the web laterally while on the roll said brushes initially contacting the roll at the same circumferential line, and means for thereafter depositing a coating of dope upon the web.

2. In a paper web treating machine, the combination with a web supporting and guiding element including a table having a raised center and sloping downwardly therefrom toward its edges, of a pair of brushing belts cooperating therewith and embodying web contacting under reaches offset from each other and travelling in opposite directions in parallelism from the center toward the respective edges of the web to brush the latter from the center outwardly, said belts being otherwise in crossed relationship with each other and the said under reaches being at the angles of and inclined along the slopes of the table to press the web against the latter.

3. In a web coating machine, the combination with a main frame carrying a plurality of devices for driving, guiding and supporting a travelling web, of a device for spreading dope on the web, means for supplying dope to said device, a cooling roll, winding means, and brushing means arranged between said last two mentioned means for smoothing and burnishing the coated web from its center toward its opposite sides, said brushing means being detachable and replaceable as a unit on the frame of the machine.

4. In a web coating machine, the combination with a main frame carrying a plurality of devices for driving, guiding and supporting a travelling web including a table over which the web passes, said table having a raised central portion and being inclined downwardly therefrom in both directions toward the lateral margins of the web, of two brushing belts having parallel reaches running in opposite directions and crossed with respect to each other, said reaches respectively engaging against the two inclines to burnish and stretch the web from its center toward its margins, and means for driving the belts.

5. In a web coating machine, the combination with a main frame carrying a plurality of devices for driving, guiding and supporting a travelling web including a table over which the web passes, said table having a raised central portion and being inclined downwardly therefrom in both directions toward the lateral margins of the web, of two brushing belts having parallel reaches running in opposite directions and crossed with respect to each other, said reaches respectively engaging against the two inclines to burnish and stretch the web from its center toward its margins, means for raising and lowering the table toward and from the belts, and means for driving the latter.

6. In a web coating machine, the combination with a main frame carrying a plurality of devices for driving, guiding and supporting a travelling web including a table over which the web passes, said table having a raised central portion and being inclined downwardly therefrom in

both directions toward the lateral margins of the web, of two brushing belts having parallel reaches running in opposite directions and crossed with respect to each other, said reaches respectively engaging against the two inclines to burnish and stretch the web from its center toward its margins, means for driving the belts including a pair of pulleys for each, and means for lowering and raising the pulleys toward and from the table.

7. In a web coating machine, the combination with a main frame carrying a plurality of devices for driving, guiding and supporting a travelling web including a table over which the web passes, said table having a raised central portion and being inclined downwardly therefrom in both directions toward the lateral margins of the web, of two brushing belts having parallel reaches running in opposite directions and crossed with respect to each other, said reaches respectively engaging against the two inclines to burnish and stretch the web from its center toward its margins, means for driving the belts including a pair of pulleys for each arranged at opposite sides of frame, one pulley of each pair being mounted upon a pivoted yoke, and means on the frame for rocking said pivoted pulleys to tighten or loosen the belts.

8. In a web coating machine, the combination with web supporting, feeding and guiding means including a table over which the web passes, said table embodying an elongated slot extending transversely of the path of the web, of means for applying dope to the web including an equalizer rod for spreading the same arranged above the slot, and an air inflated flexible tube beneath the table arranged to protrude through the slot and press the web against the spreading device.

9. In a web coating machine, the combination with a web supporting, feeding and guiding means including a steam chest, the top of which constitutes a table over which the web is passed, said chest being provided with a cavity and the table being provided with a slot communicating with the cavity and extending transversely of the path of the web, of an elongated dope spreading device arranged above the table in register with the slot, means for supplying dope thereto, and a flexible pneumatic tube arranged in the cavity in the chest and adapted to protrude through the slot in the table to press the web against the spreading device.

10. In a web coating machine, the combination with web supporting, feeding and guiding means, of means for depositing dope upon the web embodying a plate down which a film of dope may flow, an equalizer rod under the lower edge of the plate for spreading the dope on the surface of the web, and a supporting blade carried by the plate in rear of the rod and having its edge projecting forwardly beneath the rearward overhanging curvature of rod.

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