

Feb. 9, 1965

I. L. NELSON ET AL
CARTON COATING APPARATUS

3,169,081

Filed May 14, 1959

5 Sheets-Sheet 1

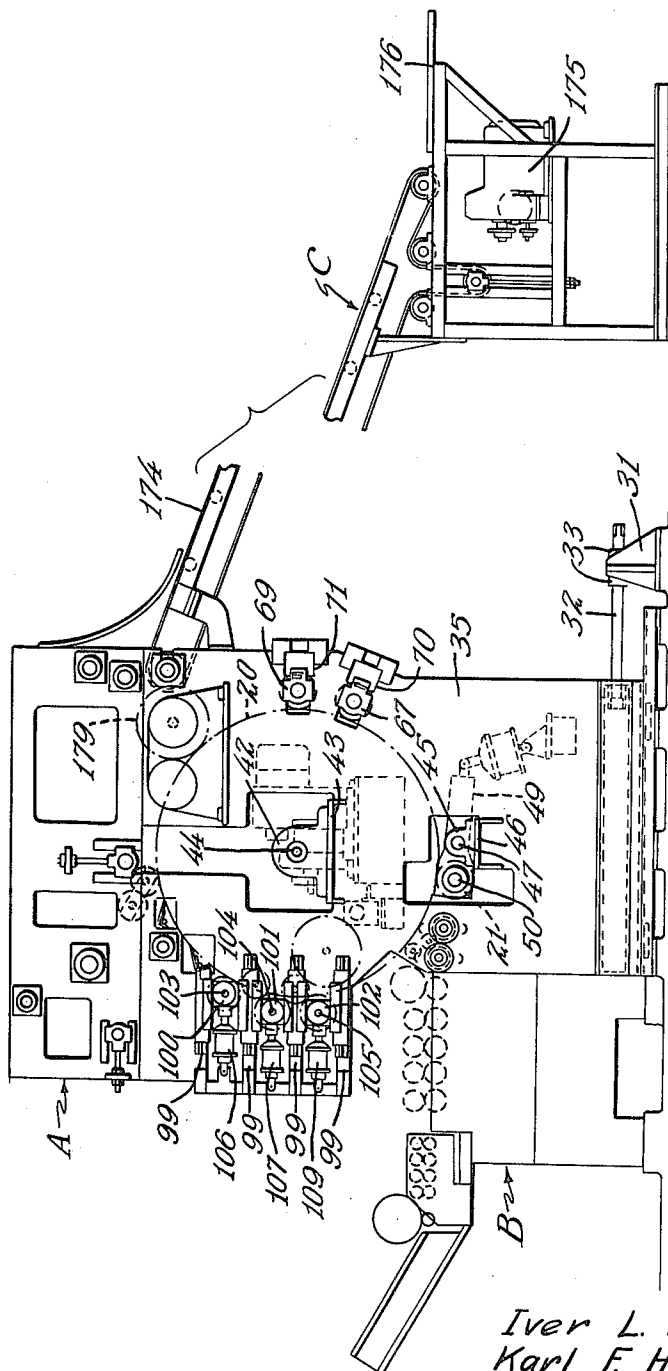


FIG. 1

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5 Sheets-Sheet 2

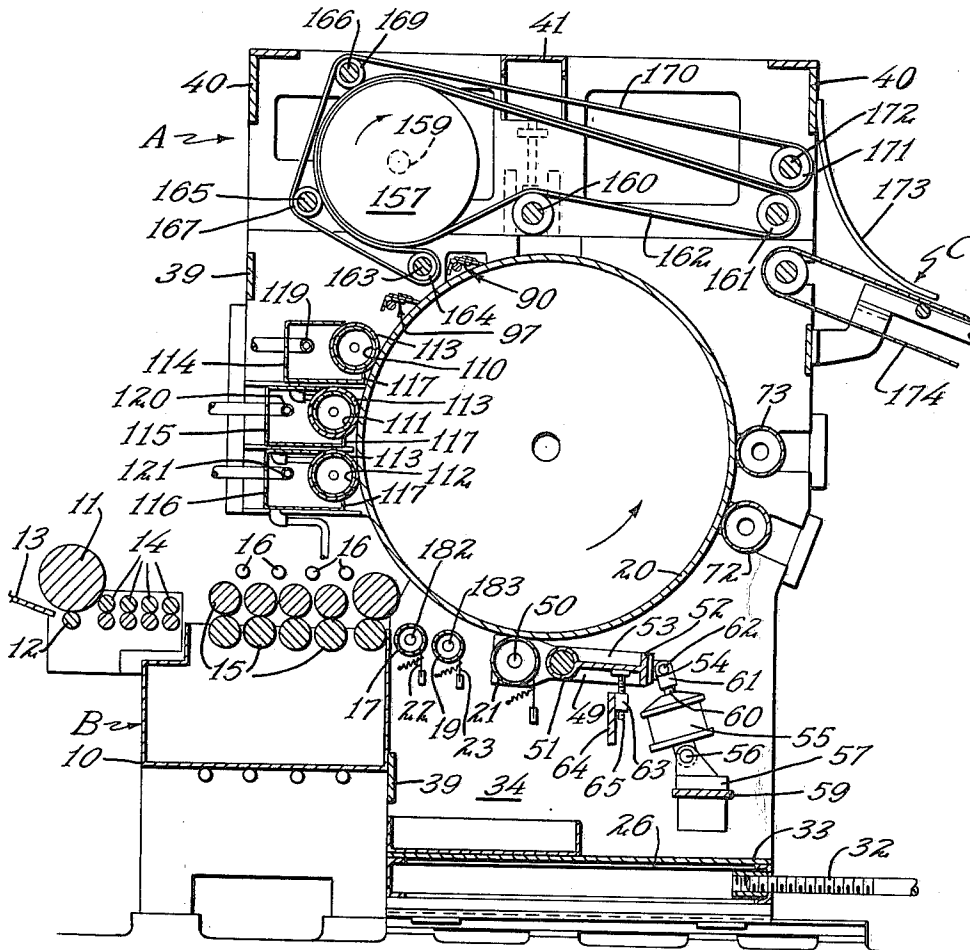


FIG. 2

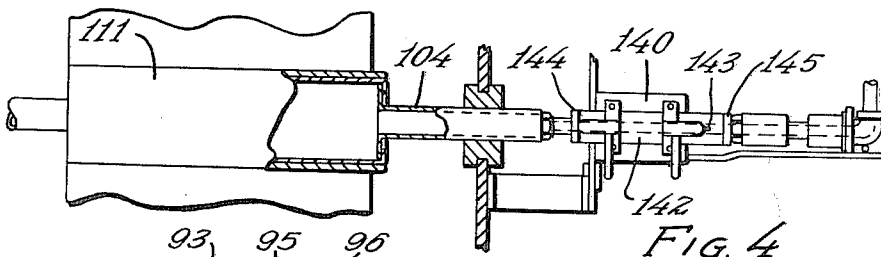


FIG. 4

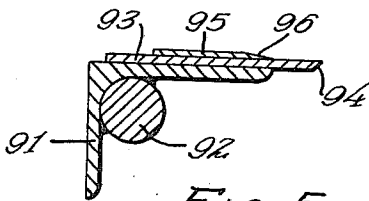


FIG. 5

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5 Sheets-Sheet 3

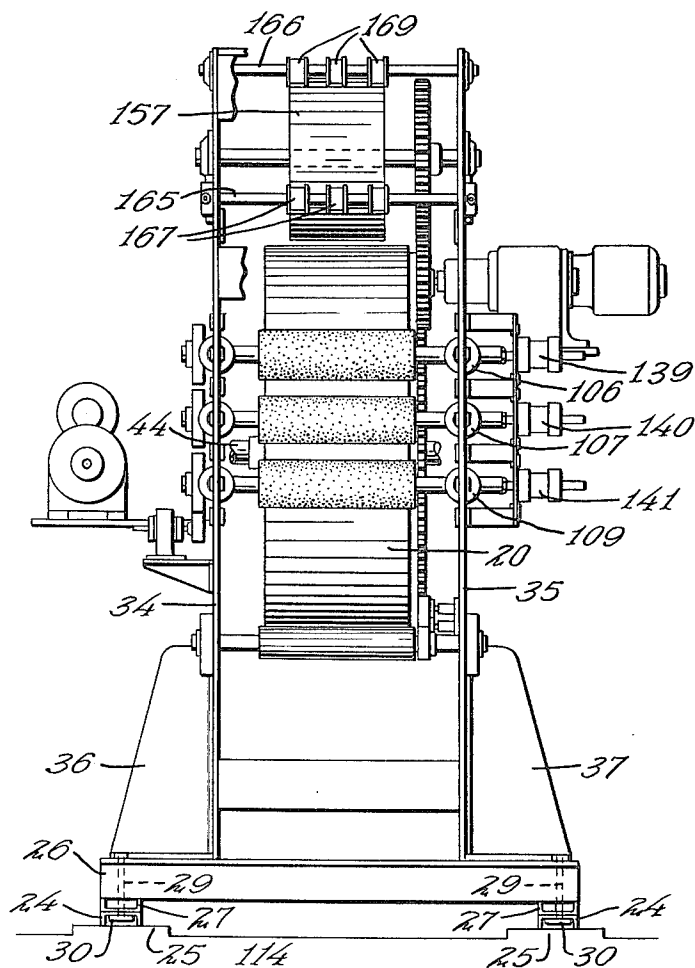


FIG. 3

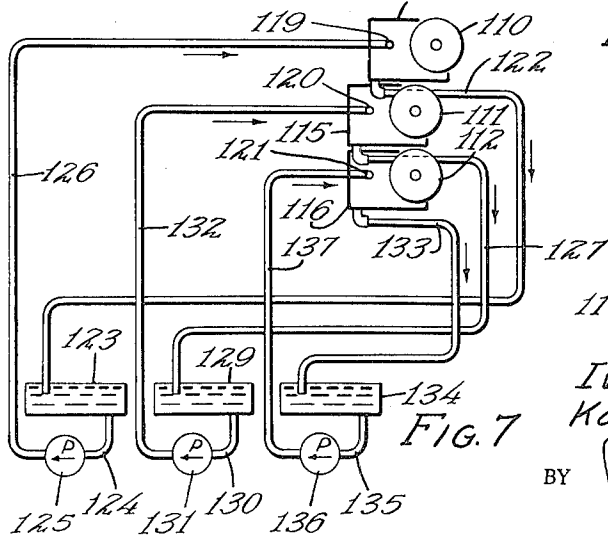


FIG. 7

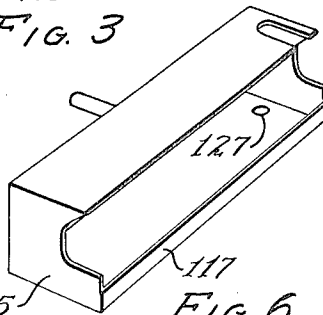


FIG. 6

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5 Sheets-Sheet 4

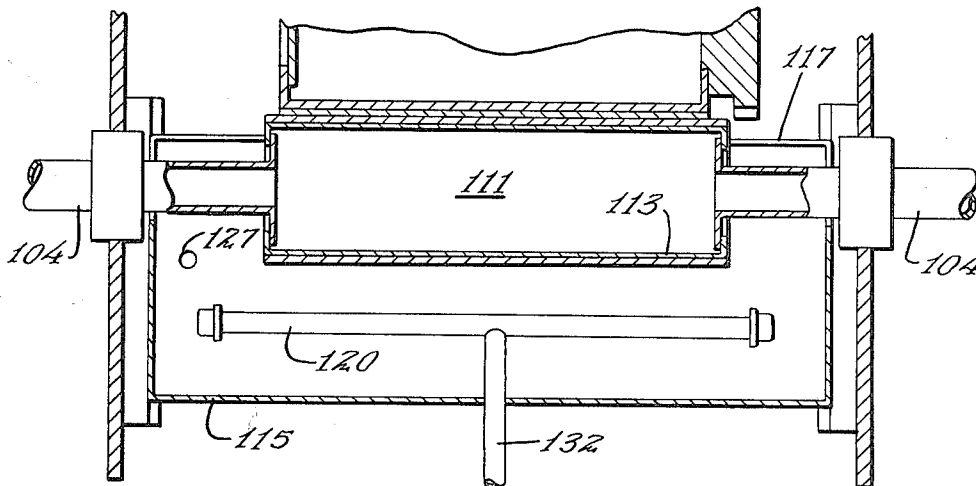


Fig. 8

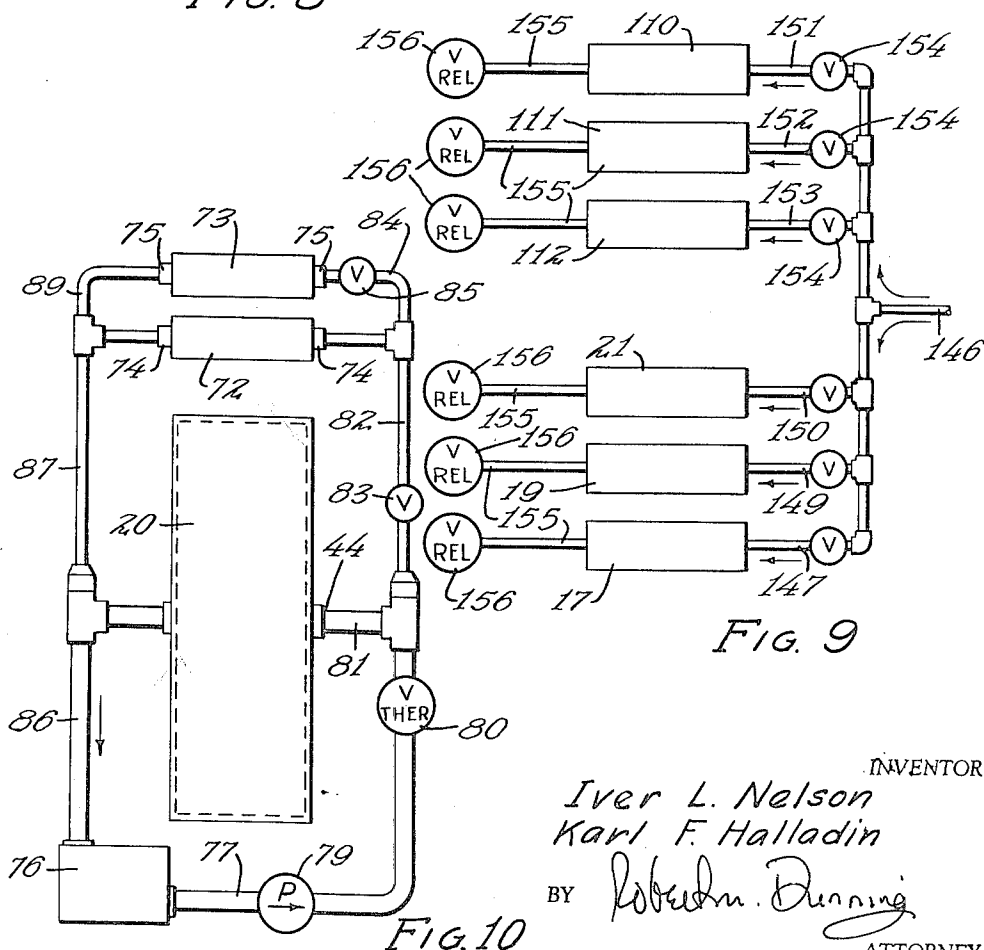


Fig. 9

Fig. 10

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5 Sheets-Sheet 5

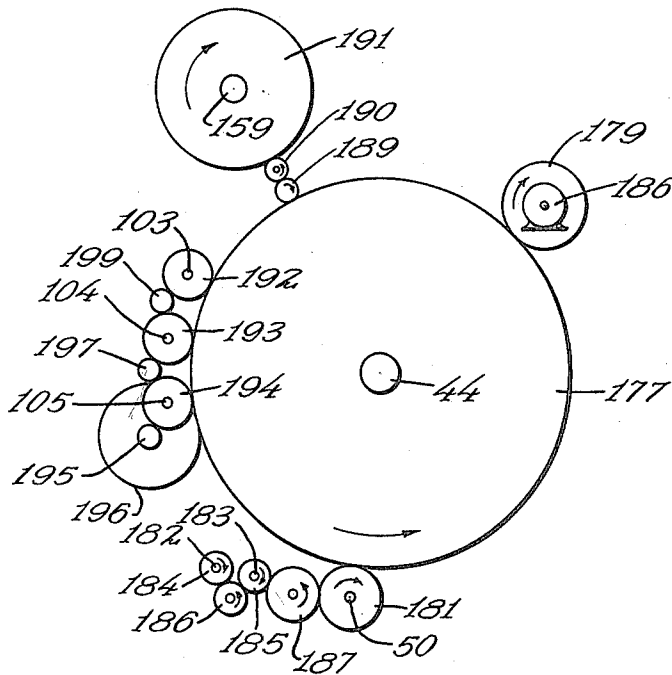


FIG. 11

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1

3,169,081

CARTON COATING APPARATUS

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1 Claim. (Cl. 118-60)

This invention relates to an improvement in carton coating apparatus and deals particularly with an apparatus for applying a high gloss surface to carton blanks and similar sheets of paper board.

For many years the coating of cartons with thermoplastic coating such as wax and the like has been practiced. For example, cartons which are designed to contain greasy materials such as butter and butter substitutes have been coated with wax to protect the cartons from absorbing parts of the product. It has been usual practice to apply the hot wax to the surface of the carton blanks and to immediately guide the coated cartons through a bath of water or the like to cool the coating and to set the coating on the paper board. During recent years, it has been found desirable to provide cartons of various types with an extremely high gloss finish which makes the cartons thus coated stand out when placed among packages of competing goods.

While high gloss finishes have been available for some years, these coatings were usually provided by varnishing the surface of the coating or by coating the board with a high gloss lacquer. Cartons coated in this manner are relatively expensive due to the fact that coatings of this type must be dried for a considerable period of time before they can be stacked. Due to the fact that volatile solvents are used in the coatings, it has been common practice to dry the cartons in a drying tunnel which collects and exhausts the fumes from the solvents. Furthermore, such coatings are likely to provide a permanent odor which prevents their use in conjunction with products which have a tendency to pick up such odors. It is an object of the present invention to avoid these previous difficulties.

An object of the present invention resides in the provision of an apparatus capable of applying a thermoplastic coating to a surface of the blanks and to immediately thereafter press the coated surface of the cartons against a highly polished surface which tends to smooth the coating and to provide a glossy highly polished appearance thereto. While the cartons remain in contact with the highly polished surface, the cartons are cooled sufficiently to set the coating. The cartons are then removed from the highly polished metal surface and conveyed from the apparatus so that they may be stored or packed.

One of the difficulties which has been experienced in following the method described lies in the fact that the carton blanks tend to adhere to the highly polished cooling surface and are difficult to remove therefrom. This creates two problems. In the first place, when difficulty is experienced in stripping the blanks from the surface, the glassy surface of the carton blanks may be readily injured. In the second place, if any of the coating remains on the highly polished cooling surface, this material is applied to subsequent carton blanks tending to produce a mottled or irregular surface.

We have found that by coating the highly polished surface with a silicone solution prior to the application of the carton blanks thereto, the blanks may be stripped from this surface without visual damage to the glossy surface. Due to the fact that a film of the silicone solution is upon the cooling surface when the blanks are applied thereto, the tendency of the coating to adhere to the polished surface may be reduced to such an extent that any coating remaining upon the cooling surface may

2

be readily removed before other carton blanks are applied thereto.

A feature of the present invention resides in the provision of a cylinder having a highly polished mirror like finish usually of chrome plating or the like which may contain a cooling liquid capable of maintaining the temperature of the roll or drum below the melting temperature of the coating. The surface of the drum is sufficiently rigid so that the coated surface of the blanks may be pressed there against under substantial pressure. This action causes the blanks to be adhered to the highly polished surface with a strong enough bond so that the cartons will remain in place on the drum during a part of its rotation. At the same time, the silicone coating which is applied to the surface of the drum permits the carton blanks to be stripped from the drum at a predetermined point in the drum rotation. By having the drum surface rigid and relatively unyielding, an intimate contact between the blanks and the drum is maintained from the time the blanks are applied to the surface of the drum to the time they are stripped from the surface thereof.

A feature of the present invention resides in the provision of a pressure roller which is urged toward the surface of the drum with a predetermined pressure. Means are provided for limiting the movement of the pressure roller toward the drum so that the pressure roller remains at all times spaced from the surface of the drum a distance somewhat less than the thickness of the paper board blanks. Accordingly, when the blanks are fed between the pressure roller and the drum, they are urged into intimate contact with the drum and remain in contact with the rigid surface until stripped therefrom.

A further feature of the present invention resides in the relationship between the drum and the carton blank coating apparatus. The discharge of the coating apparatus is positioned closely to the surface of the drum, preferably near the bottom of the drum. As the blanks leave the coating apparatus, they pass over a pair of heated rollers which assist in maintaining the coating in a molten state. Furthermore, the pressure roller which applies the blanks to the drum is usually heated to insure the plastic state of the coating as the blanks are applied to the drum. If desired, additional pressure rollers may be provided about the periphery of the drum which are cooled to assist in cooling the blanks. Such cooling pressure rollers are particularly useful in conjunction with paper board of substantial thickness which may tend to retain heat for a longer period of time.

A further feature of the present invention resides in the provision of a series of rollers having absorbent surfaces which are in contact with the surface of the drum and which rotate in baths of liquid or in conjunction with liquid sprays. These liquid applying surfaces are individually controlled so that one or more of these rollers may be selectively moved into contact with the surface of the drum. Each of these rollers is preferably supplied with liquid from an individual supply tank and by a separate supply pump. As a result, the apparatus is adaptable to various conditions and various coatings as desired. For example, when the coating which is applied has an unusual tendency to adhere to the surface of the drum, the first absorbent roller of the series may be used to apply a solvent material to the surface of the drum to assist in cleaning the drum. The absorbent coated rollers preferably rotate at a different speed of rotation than the drums so that the surface speed of the absorbent rollers is different from the surface speed of the drum thus providing a wiping action which tends to spread the liquid more evenly and to assist in removing any foreign material from the drum. One or more of the remaining rollers may be used to

3

apply the silicone solution to the drum, and one or more of the rollers may be rotated in a relatively dry state so as to provide a buffing action and additional cleaning action on the surface of the drum.

These and other objects and novel features of the present invention will be more clearly and fully set forth in the following specification and claim.

In the drawings forming a part of the specification:

FIGURE 1 is a side elevational view of the high gloss coating apparatus showing the general arrangement of parts.

FIGURE 2 is an enlarged cross sectional view through a portion of the apparatus illustrated in FIGURE 1.

FIGURE 3 is an end elevational view of the apparatus, portions thereof being removed or broken away to better disclose the construction.

FIGURE 4 is a detailed elevational view, partly in section, showing one of the silicone applying rollers and the means for oscillating the same.

FIGURE 5 is a sectional view through one of the doctor blades employed for stripping the carton blanks from the drum.

FIGURE 6 is a perspective view of one of the roller enclosures.

FIGURE 7 is a diagrammatic view showing the system for circulating silicone and other fluids through the fluid applying rollers.

FIGURE 8 is a horizontal sectional view through one of the fluid applying rollers and the enclosure into which it extends.

FIGURE 9 is a diagrammatic view showing the circulation and control of steam through various heated rollers.

FIGURE 10 is a diagrammatic view showing the circulation of cooling fluid through the drum and the cooling rollers.

FIGURE 11 is a diagrammatic view showing the drive mechanism.

The high gloss finishing machine is indicated in general by the letter A and is used in conjunction with a coating application apparatus B and a discharge conveyor C. The coating application device B is of generally conventional construction and includes a tank 10 which is heated by any suitable means and which is designed to contain the coating in a molten condition. A feed wheel 11 and cooperable feed roller 12 remove carton blanks from a feed board 13 and feed them between pairs of feed rollers 14 and between pairs of rollers 15. The molten coating is fed through supply pipes 16 to the upper rollers of the pairs of rollers 15 to apply a film of coating to the upper surfaces of the carton blanks. In actual practice all of the rollers are rotated in unison to carry the blanks through the coating apparatus B.

After leaving the coating apparatus B, the carton blanks are carried by hollow steam heated rollers 17 and 19 to the nip between the drum 20 and pressure roller 21. Doctor blades 22 and 23 engage against the surfaces of the heated rollers 17 and 19 respectively to remove any excess coating which might otherwise collect on these rollers.

In the coating finishing apparatus A, a pair of inverted channels 24 are secured in parallel relation on a suitable base 25. The device A includes a base frame 26 formed of channel members and a pair of channel rails 27 are welded or otherwise affixed beneath the base frame 26. The channels 24 are provided with their base surfaces uppermost while the channels 27 are provided with their base surfaces lowermost. The channels 27 are provided with apertures through which clamping bolts 29 may extend. The upper surfaces of the channels 24 are longitudinally slotted to accommodate these bolts 29. Clamping plates 30 are slidably supported within the channels 24, these plates 30 acting as nuts for the clamping bolts 29. Thus the base frame 26 may be moved

4

longitudinally of the supporting rails or channels 24 to adjust the position of the entire apparatus to some extent.

A bracket 31 is anchored to the base support in any suitable manner and a shaft 32 extends through the bracket 31 and is held from axial movement with respect thereto by suitable collars 33. An end of the shaft 32 is threaded as indicated in FIGURE 2 of the drawings and extends through an internally threaded sleeve 33 secured to the end of the base frame 26. By rotation of the shaft 32 when the clamping bolts 29 are loosened, the apparatus may be moved longitudinally of the supporting rails.

The base frame 26 acts to support a pair of side plates 34 and 35 in parallel spaced relation. Gusset plates 36 and 37 assist in holding the plates 34 and 35 in proper vertical spaced relation. The plates 34 and 35 are also held in proper relation by cross members 39 (see FIGURE 2) and by angle members 40 and a transverse channel member 41 near the upper ends of the frame side.

As is best indicated in FIGURE 1 of the drawings, bearings 42 are mounted upon suitable brackets 43 on the side plates 34 and 35 and support a shaft 44 which forms the axis of the drum 20. The drum 20 is a hollow cylindrical drum having a plated and highly polished mirror like surface. It is important that the surface of the drum be highly polished and effectively finished for the proper operation of the apparatus.

A pair of opposed bearings such as 45 are mounted on the side plates 34 and 35 by means of brackets 46. The bearings 45 support pivots 47 to pivotally support lever arms 49. The pressure roller 21 is mounted upon a shaft 50 extending between the ends of the lever arms 49. The lever arms 49 are connected by a tubular bearing 51, a cross member 52, and a connecting web 53 extending from the tubular bearing 51 and the cross member 52 which is at the ends of the levers opposite the ends supporting the shaft 50.

An ear 54 projects from the cross member 52 intermediate the ends thereof. A pneumatic cylinder 55 is pivotally connected at 56 to a bracket 57 mounted upon a cross member 59 and the piston within the cylinder 55 is connected by a piston rod 60 to a clevis 61 which is pivotally connected to the ear 54 as indicated at 62. The cylinder 55 is arranged to exert a pre-determined pulling force upon the lever arms 49 tending to pivot the pressure roller 21 toward the surface of the drum 20. By varying the pressure in the cylinder 55, the force upon the roller may be varied.

An internally threaded sleeve 63 is mounted upon a cross member 64 between the side plates 34 and 35 and a stud 65 extends through the sleeve 63 and abuts against the web 53 to limit the clockwise movement of the levers 49. The stud 65 is set so as to normally space the periphery of the pressure roller 21 from the surface of the drum 20 a distance less than the thickness of the paper board being coated. As a result, the carton blanks which are fed between the pressure roller 21 and the drum 20 act to pivot the levers 49 to a slight extent but exert a strong force pressing the carton blanks against the highly polished surface of the drum 20.

Pairs of bearings 67 and 69 are mounted in radially extending slots 70 and 71 respectively in the side plates 34 and 35 for radial movement toward or away from the surface of the drum 20. The bearings 67 and 69 support rollers 72 and 73 which may be moved radially toward or away from the drum surface.

As indicated diagrammatically in FIGURE 10 of the drawings, the drum 20 is hollow as are also the rollers 72 and 73. A supporting shaft 44 of the drum 20 is also hollow as are the stub shafts 74 and 75 supporting the rollers 72 and 73 respectively. A source of cooling fluid such as the reservoir 76 which may be refrigerated if desired is connected by a connection 77 to the pump 79 which pumps fluid through the thermostatic valve 80 to

the connection 81 leading to the drum shaft 44. The reservoir 76 is shown too small in proportion to the size of the drum and rollers but the view is merely for the purpose of illustration. A connection 82 including a control valve 83 leads to the hollow shaft 74 of the roller 72 and another connection 84 including a control valve 85 connects the fluid supply line to the hollow shaft 75 of the roller 73. A return connection 86 leads from the drum 20 to the reservoir 76 and return connections 87 and 89 extend from the roller 72 and 73 to the reservoir.

The drum 20 may be cooled by the cooling fluid to any desired degree. Furthermore, the cooling fluid may also be circulated through the rollers 72 and 73 if additional cooling of the carton blanks is required. The cooling fluid is designed to dissipate the heat transmitted to the drum by the molten coating on the carton blanks and cooling fluid is maintained at a proper temperature through the thermostatic valve 80 which opens to permit the circulation of fluid when the temperature within the drum exceeds a predetermined maximum.

A doctor blade 90 is mounted extremely close to the surface of the drum 20 to strip the carton blanks from the surface. As is indicated in FIGURE 5 of the drawings, the doctor blade includes an angle bar 91 mounted upon a shaft 92 and supporting a blade 93 having a wedge shaped end 94 designed to extend substantially tangent to the surface of the drum 20. An auxiliary plate 95 and a wedge shaped forward end 96 tends to deflect the cartons away from the blade 93 to the outlet conveyors which will be later described.

A second doctor blade 97 similar to the doctor blade 90 may extend against the surface of the drum 20 to provide an auxiliary means of removing any coating which has been deposited upon the surface of the drum off this drum.

As indicated in FIGURE 1 of the drawings, the frame sides 34 and 35 are provided with a series of generally parallel slides 99 extending in a direction generally radial to the axis of rotation of the drum. These slides 99 support pairs of bearings 100, 101 and 102 which support hollow roller shafts 103, 104 and 105 respectively. The bearings 100, 101, and 102 are moved toward and away from the periphery of the drum by means of fluid cylinders 106, 107 and 109 which are anchored to the frame and which include piston rods connected to a bearing block. Shafts 103, 104 and 105 support rollers 110, 111 and 112 respectively each of which is preferably provided with a soft absorbent surface such as 113. It will be understood that any or all of the rollers may be moved against the surface of the drum by directing fluid under pressure to the fluid cylinders 106, 107 and 109 which are provided in pairs, each pair controlling the position of a corresponding roller. The pressure with which the rollers are urged against the drum may be varied by varying the fluid pressure.

As indicated in FIGURE 2 of the drawings, each of the rollers 110, 111 and 112 is enclosed within a generally rectangular enclosure, the enclosures being indicated by the numerals 114, 115 and 116. The walls of the enclosures which are nearest the surface of the drum 20 are cut away to permit the roller to project beyond the enclosures and into contact with the drum surface. The lower portions 117 of the walls of the enclosures through which the rollers project remain intact to provide a sump at the bottom of each enclosure for collecting excess fluid. A drain or return line is connected to the bottom of each enclosure to permit the circulation of a fluid therethrough.

With reference now to FIGURE 7 of the drawings, it will be noted that each of the enclosures 114, 115 and 116 are provided with a spray head, the spray heads being indicated at 119, 120, and 121. The upper receptacle 114 is provided with a drain line 122 connected to a reservoir 123 into which excess fluid may flow. The reservoir 123 is connected by a conduit 124 to a pump 125, the

outlet of which is connected by a conduit 126 to the spray head 119. Thus the fluid within the reservoir 123 may be sprayed upon the roller 110 when the pump 125 is in operation.

The second receptacle 115 is provided with a drain line 127 which directs excess fluid through a reservoir 129. The reservoir 129 is connected by a conduit 130 to the pump 131, the discharge of which is connected by a conduit 132 to the spray head 120. Thus when the pump 131 is in operation, liquid may be sprayed upon the surface of the roller 111.

In a similar manner, the receptacle 112 is provided with a drain line 133 which communicates with a reservoir 134. A conduit 135 connects the reservoir 134 to a pump 136, the discharge of which is connected by a conduit 137 to the spray head 121. Thus when the pump 136 is in operation, liquid is sprayed upon the roller 112.

From the foregoing description it will be clear that liquid may be selectively pumped to any of the rollers and due to the fact that the pumping systems and reservoirs are separate, different liquids may be applied to the surface of the drum. As an example, a cleaning or solvent liquid may be pumped to the spray 119 of the uppermost receptacle 114 to apply a cleaning fluid to the surface of the drum. The silicone solution may be pumped to the spray head 120 adjoining the roller 111 to apply silicone to the surface of the drum. The roller 112 may merely act as a buffing means and means of more effectively spreading the silicone over the drum surface or may be used to apply additional silicone to the drum surface.

The hollow shafts 103, 104 and 105 may be reciprocated by fluid cylinders 139, 140 and 141. As is diagrammatically illustrated in FIGURE 4 of the drawings, fluid to the cylinders, such as the cylinder 140 may be controlled by an automatic reversing valve 142, the piston of which is controlled by a slidable push rod 143 engageable with projections 144 and 145 which are movable with the roller shaft 104. In view of the fact that reversing valves of this general type are in common use, the detail of construction is not illustrated. It is only of interest to state that the reciprocation of the rollers is caused by the direction of fluid under pressure first to one end and then to the other of the operating cylinders, the valve 142 changing the direction of the flow of the fluid at the end of each stroke.

With reference now to FIGURE 9 of the drawings it will be seen that a steam supply line 146 is connected to conduits 147, 149 and 150 leading to the feed rollers 17 and 19 and the pressure roller 21 respectively. The steam line, 146 is also connected to conduits 151, 152 and 153 leading to the fluid applying rollers 110, 111 and 112 respectively. The valve such as 154 controls the various steam lines so that these rollers may be maintained at normal temperatures if preferred. For example, while it is preferable to heat the feed roller 17 and 19 and the pressure roller 21, it is not under all conditions necessary to heat the fluid application rollers. The outlets 155 are controlled by release valves 156 usually connected to a condenser or to the drain.

FIGURE 8 of the drawings indicates the usual shape of the spray nozzles 119, 120 and 121. The spray nozzles are normally merely an elongated tube having spray apertures spaced throughout its length and centrally connected to the fluid supply lines such as 132.

FIGURES 1 and 2 of the drawings disclose the outlet or discharge conveyor which receives the finished carton blanks and delivers them to the discharge conveyor C. A drum or pulley 157 is pivotally supported by a shaft 159 in a direction generally laterally of the doctor blade 90 or so that its lower periphery is to one side of the doctor blade 90. A pulley 160 is pivotally supported generally above the drum 20 and an additional pulley 161 is provided near the outlet side of the apparatus A which is opposite the side into which the carton blanks are fed.

An endless belt 161 extends around the pulleys 157 and 162 and over the intermediate pulley 160 as indicated.

A transverse shaft 163 is supported by suitable bearings between the side plates 34 and 35 and support spaced pulleys 164 which may be seen in FIGURE 3 of the drawings. The pulleys 164 are located closely adjacent the doctor blade 90 so that carton blanks stripped from the drum 20 will pass over the pulleys 164. Additional shafts 165 and 166 are supported in angularly spaced relation about one side of the pulley 157 and these shafts support the pulleys 167 and 169 respectively over which the endless belts 170 are trained. The belt 170 also extends about pulleys 171 mounted on a transverse shaft 172 positioned above the pulley 161 and spaced so that one side of the endless belts 170 encircle the drum 157 outwardly of the belt 162 and extend parallel to and in substantial contact with the upper reach of the belt 162. As a result, the carton blanks are fed between the belts 162 and 170 until they reach the ends of the belt extending around the pulleys 161 and 171. From here the carton blanks are directed downwardly by deflecting springs 173 onto the outlet conveyor 174.

The outlet conveyor 174 forms a part of the conveyor unit C which is powered by a separate motor 175 and merely carries the blanks down the conveyor to a discharge table 176. The conveyor 174 travels at a much lower speed than the conveyor belts 162 and as a result the carton belts are deposited on the discharge conveyor belt 174 in overlapping or feathered relationship which simplifies the removal of the carton blanks from the conveyor and the stacking and packing of these blanks.

While the drive mechanism for driving the various elements is not an important feature of the present invention, it might be stated that the drum 20 is driven by a gear 177 which meshes with a drive gear 179 connected to the drive motor 180. The gear 177 rotates a gear 181 on the shaft 50 of the pressure roller 21. The feed roller 17 and 19 may be driven by the gear 181. The shaft 182 and 183 of the feed roller 17 and 19 are provided with gears 184 and 185 which are rotated in the same direction through an idle gear 186. An idle gear 187 may also provide a connection between the gear 185 and the gear 81.

The gear 177 may also act through a pair of idle gears 189 and 190 to rotate a gear 191 on the shaft 159 of the conveyor pulley 157. The gear 190 may if desired also rotate the shaft 163 to drive the conveyor belts 162.

Gears 192, 193 and 194 may be provided on the shafts 103, 104 and 105 which support the fluid applying rollers 110, 111 and 112, a gear 195 on the shaft of the motor 196 may drive the gear 194 which in turn rotates the gear 193 through an idler gear 197. The gear 193 may rotate the gear 192 through an idler gear 199. By providing a separate source of power for the fluid applicator rolls these rolls may be driven at a different peripheral speed from that of the drum 20 so as to produce a wiping action against the drum.

We have found that our carton finishing apparatus functions very effectively with carton blanks coated with paraffin wax or micro crystalline wax. This wax may contain a small amount of low molecular polyethylene. The percentage of polyethylene is usually 5% or lower in order to provide a hard finished surface and extremely good results have been provided using the wax alone. As a specific example, the wax employed may be that

known as "Be square" wax produced by the Bereco Wax Co. One such wax has a melting point of between 190 and 195 degrees Fahrenheit while the other used has a melting point of 180 to 185 degrees Fahrenheit. Either of these waxes or mixtures thereof may be used effectively with or without up to 5% polyethylene.

As examples of the temperatures which have been effective, the drum temperature often employed has been from 80 degrees to 100 degrees F. The temperature of the wax coating has been maintained at about 270 degrees to 290 degrees F. The temperatures which are maintained depend to some extent upon the speed and number of cartons going through the apparatus.

The feed rollers 17 and 19 and the pressure roller 21 are normally heated to a temperature of about 270 degrees to 280 degrees F. or the temperature corresponding to 90 pounds steam pressure. While these temperatures are merely given as examples, they have been found suitable for producing a carton blank surface which is extremely glossy in appearance and which enhances the appearance of the printed surfaces of the cartons.

In accordance with the patent statutes, we have described the principles of construction and operation of our improvement in carton coating apparatus, and while we have endeavored to set forth the best embodiment thereof, we desire to have it understood that changes may be made within the scope of the following claim without departing from the spirit of our invention.

We claim:

An apparatus for applying a high gloss surface on carton board sheets including a drum having a highly polished surface, a substantially horizontal shaft supporting said drum, a pressure roller substantially beneath said drum and cooperable with said drum to press the upper surface of said board against said drum, means for applying a coating to the upper board surface, means for maintaining said drum at a temperature below the melting point of said coating, means located at a point more than one hundred eighty degrees from said pressure roller in the direction of travel of said drum for stripping said blanks from the drum surface while the coated surface is lowermost, pulley means arranged on a substantially horizontal axis above the level of said drum, a first endless conveyor positioned to receive blanks stripped from said drum and guide said blanks about said pulley and to extend laterally therefrom, and a second endless conveyor extending about said pulley means engageable with the upper surfaces of the inverted blanks to guide them about said pulley means to extend laterally therefrom beneath said first conveyor and on which said blanks are carried after being reinverted to position the coated surface uppermost.

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