

March 5, 1946.

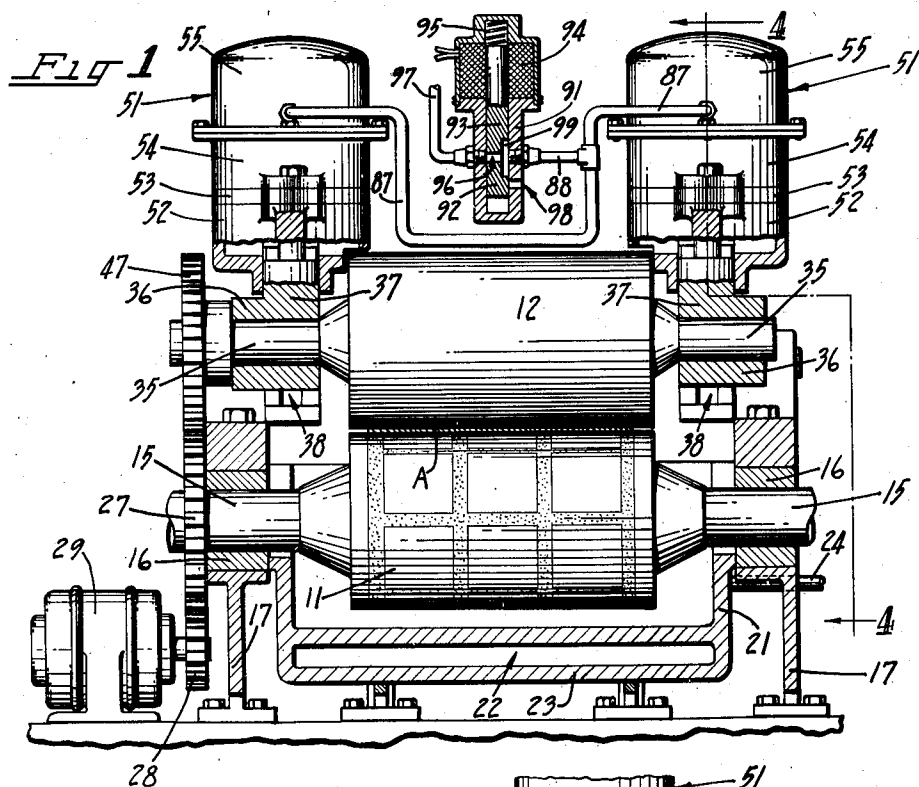
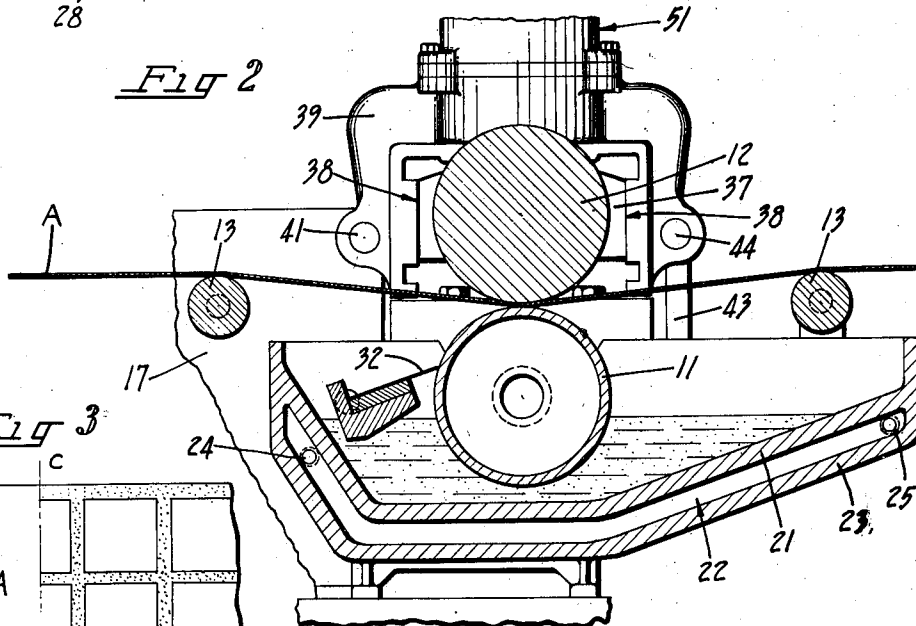
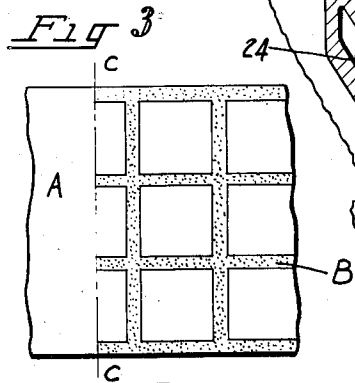
R. E. J. NORDQUIST

2,395,903

COATING MACHINE

Filed Jan. 18, 1941

2 Sheets-Sheet 1



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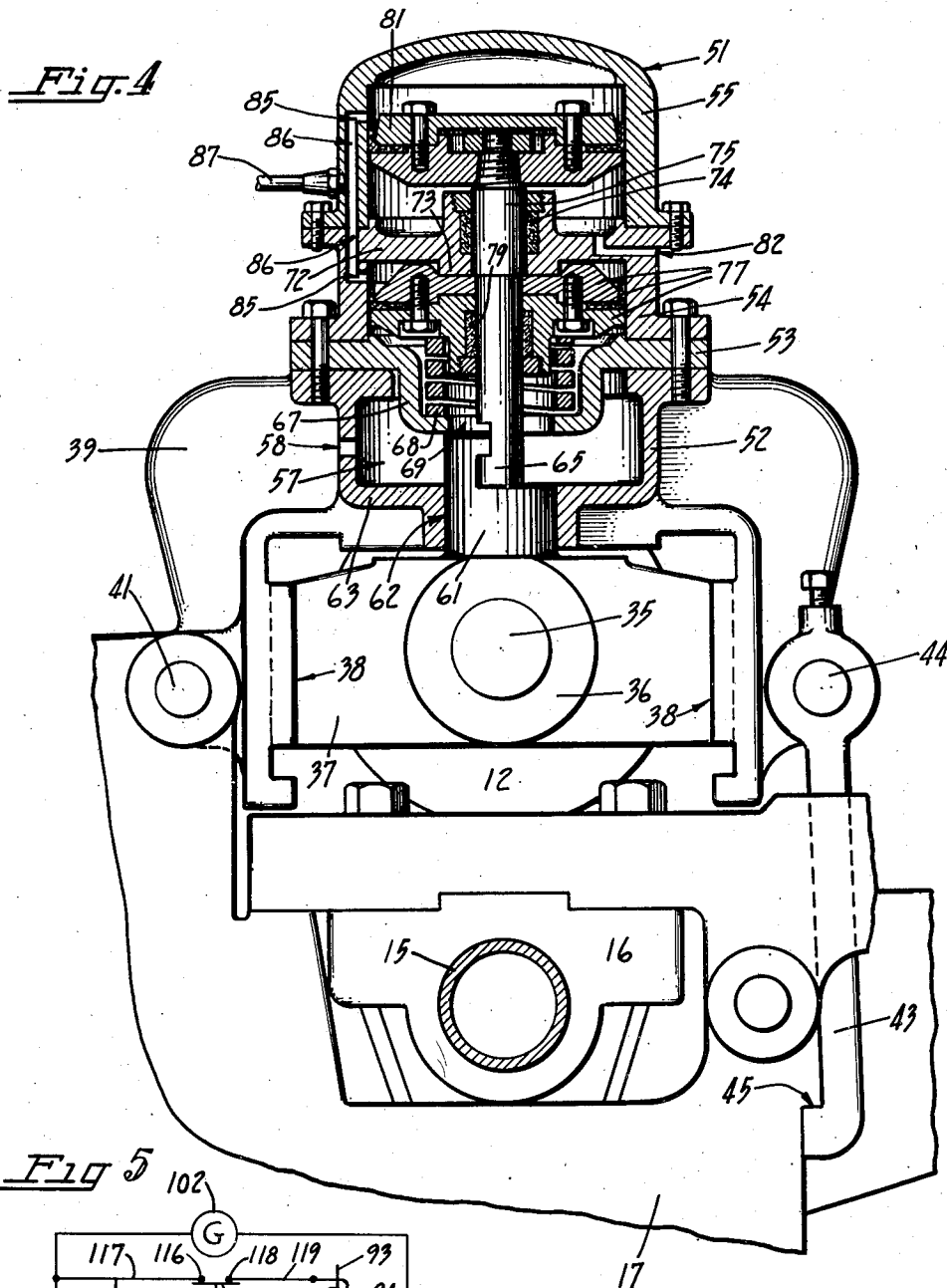
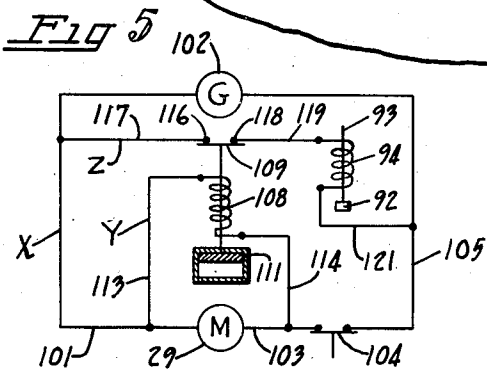
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2 Sheets-Sheet 2



UNITED STATES PATENT OFFICE

2,395,903

COATING MACHINE

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9 Claims. (Cl. 91—51)

The present invention relates to a coating machine for applying a film of fluid coating substance to a web of material passed between a pressure roller and an applying roller operating in a bath of the coating substance and has particular reference to a pressure device for maintaining the pressure roller in operative position relative to the applying roller.

In machines for applying coating materials to web stock it is sometimes necessary to stop the machine during the coating operation. Where heat is used to maintain the coating material in a fluid condition it is desirable to remove the web from the applying roller by raising the pressure roller so that the web will not be burned while the machine is idle.

In stopping the machine the momentum of the machine parts keep the web in motion after it has been removed from the applying roller and hence the place on the web where the coating material terminated will be advanced some distance from the applying roller when the latter finally comes to a standstill. Thus when the machine is again started and the web returned to engagement with the applying roller for continuing the coating operation there will be a blank space or skip on the web extending from the place where the coating terminated.

The present invention contemplates overcoming this difficulty by holding the pressure roller against the web and the web against the applying roller until the latter comes to a dead stop. This is done by means of time delay and pressure devices which release the pressure roller a predetermined period after the machine stops. This insures that the pressure roller will separate from the applying roller and carry the web with it thereby releasing the web from the applying roller at the point where the coating terminated. Hence when the web is again returned to the applying roller, when the machine is again started, the coating will continue from the point where it left off and thus skips or non-coated portions in the web will be prevented.

An object of the invention is the provision of a coating machine having a pressure roller and an applying roller between which a web to be coated is passed, wherein the pressure roller keeps the web in engagement with the applying roller until the latter comes to a stand-still when the machine is stopped and thereafter releases the web from the applying roller until the machine is again started so that the coating of the web will continue from the place where it left off and

thereby prevent skips or uncoated portions on the web caused by stopping of the machine.

Another object of the invention is the provision of such a machine wherein compressed air pressure devices and time delay control devices operating in conjunction with the motive power of the machine are utilized to effect the timed release and the return of the web relative to the applying roller so that a continuous coating of the web may be insured.

Numerous other objects and advantages of the invention will be apparent as it is better understood from the following description, which, taken in connection with the accompanying drawings, discloses a preferred embodiment thereof.

Referring to the drawings:

Figure 1 is a transverse vertical section through a coating machine embodying the instant invention, with parts broken away;

Fig. 2 is a longitudinal vertical section through the machine shown in Fig. 1, with parts broken away;

Fig. 3 is a fragmentary portion of the web being operated upon and showing how the coating terminates when the machine ceases operation;

Fig. 4 is an enlarged vertical sectional view taken substantially along the broken line 4—4 in Fig. 1; and

Fig. 5 is a wiring diagram of the electric apparatus used in the machine.

As a preferred embodiment of the invention the drawings disclose the principal parts of a coating machine of the character utilized for applying a hot fluid thermoplastic adhesive in a predetermined design to one side of a substantially continuous web A of fibre material such as heavy paper from which containers or fibre cans are made. The web may be fed into and away from the machine in any suitable manner.

While in the machine, the web is fed by upper and lower cooperating rollers between which the web passes. These rollers constitute an adhesive applying roller 11 (Figs. 1 and 2) and a pressure roller 12. The pressure roller 12 presses the moving web against the applying roller 11. During its travel through the machine, the web is held taut by spaced, parallel idler rollers 13.

The adhesive applying roller 11 is formed with trunnions 15 which are journaled in bearings 16 carried in side frames 17 which constitute the main frame of the machine. The roller is preferably of the intaglio type and rotates in a bath of heated thermoplastic adhesive retained in a reservoir 21 disposed between the side frames. The adhesive is maintained in a liquid condition

by a heating medium such as hot water, hot oil, steam or the like which is circulated through a space 22 in a jacket 23 which surrounds the reservoir. An inlet pipe 24 and an outlet pipe 25 secured in the jacket provide for the circulation of the heating medium through the jacket space.

The adhesive applying roller 11 is rotated by a gear 27 which is carried on one of the trunnions 15. This gear meshes with a driving pinion 28 mounted on the rotor shaft of an electric motor 29.

Hence as the roller rotates in the bath of adhesive it picks up the adhesive and carries it up toward the web. All of this picked-up adhesive except that contained within the pockets or intaglio recesses of the roller is scraped off by a doctor blade 32 which is located within the reservoir and which bears upon the periphery of the intaglio roller. It is this pocketed adhesive that is applied to the moving web in the same pattern as that on the surface of the intaglio roller. By way of example one such applied pattern of adhesive is shown on the web in Fig. 3 and is indicated by the letter B.

If desired the adhesive applying roller 11 may be maintained in a heated condition. For this purpose the roller and its trunnions 15 are made hollow so that a liquid heating medium may be circulated through them.

The pressure roller 12 is preferably mounted above the adhesive applying roller 11. This pressure roller is formed with trunnions 35 (Fig. 1) which are journaled in bearings 36 formed in vertically movable slide blocks 37 (see also Figs. 2 and 4). The slide blocks are retained in slide-ways 38 formed in a hingedly mounted auxiliary frame 39 which is mounted on a pivot shaft 41 secured in the side frames 17.

This construction of auxiliary frame permits of swinging frame and pressure roller back and out of the way when it is desired to clean the machine. When the auxiliary frame and the pressure roller are in operative position, as shown in the drawings, the frame is locked against displacement by latch members 43. At one end, these latch members are mounted on pivot pins 44 secured in the auxiliary frames, while at the other end each latch member engages with a shoulder 45 on the side frames.

The pressure roller 12 is rotated in unison with the adhesive applying roller 11 by a gear 47 which is mounted on trunnions of the pressure roller. Gear 47 meshes with and is driven by the adhesive applying roller gear 27.

Under operating conditions the pressure roller 12 is forced down against the web which in turn is held against the adhesive applying roller 11 with a predetermined force or pressure. This is effected by compressed air pressure devices or units generally indicated by the numeral 51. There is one of these devices on each side of the machine and they are connected with the pressure roller slide blocks 37. The two devices are identical in construction and they operate in unison as will now be explained.

Each pressure device 51 includes a four part cylinder housing which comprises a lower section 52 (Fig. 4), a plate section 53, an intermediate or auxiliary cylinder section 54, and an upper or main cylinder section 55. These sections are all provided with flanges which are secured by bolts, as shown in the drawings, to hold the housing sections in place.

The lower housing section 52 of each device is formed as a part of the auxiliary frame 39 and

encloses a compartment 57. This compartment is open to the atmosphere by way of a port or vent 58 formed in a side wall of the housing section. A stem 61 on the slide block 37 extends up into the compartment 57 through a clearance hole 62 formed in a bottom wall 63 of the housing section. Within the compartment the stem interlocks with a vertical piston rod 65 which extends up through all of the other housing sections and which terminates within the upper section 55.

The plate section 53 of each device rests on top of the bottom section 52 and is formed with a pocket casing 67 which extends down into the bottom compartment 57. The pocket casing retains a compression spring 68. The bottom of the casing is formed with a clearance hole 69 through which the piston rod 65 extends.

The intermediate or auxiliary cylinder section 54 of each device rests on top of the plate section 53. The upper end of the section is closed with a disk wall 72 which is formed with a bearing 73. The bearing supports a stuffing box 74 for a shouldered portion 75 of the piston rod 65. Within the auxiliary cylinder section 54 there is also an auxiliary piston 77 which is loose on the piston rod 65 and which is supported on the compression spring 68.

The spring 68 maintains the piston in engagement with the shouldered portion 75 of the piston rod and thus normally supports and retains the piston rod and the slide block 37 connected therewith in a raised position. In such raised position the pressure roller 12, carried in the slide block, is spaced above and out of engagement with the adhesive applying roller 11. A stuffing box 79 is provided in the auxiliary piston for the piston rod.

The upper or main cylinder section 55 of each device rests on top of the auxiliary cylinder section 54 and contains a main piston 81 which is secured to the upper end of the piston rod 65. Below the piston the interior of the main cylinder section is open to the atmosphere by way of a channel 82 formed in the disk wall 72 of the auxiliary cylinder section. The inner end of the channel communicates with the interior of the main cylinder 55 while its outer end communicates with the outside atmosphere.

Compressed air is introduced into the interior of the main cylinder section 55 of each device above the main piston 81 and also into the auxiliary cylinder section 54 above the auxiliary piston 77. This is done by way of ports 85 and a channel 86 formed in the side walls of the cylinder sections. The channel 86 communicates with a pipe 87, one end of which is threaded into the side wall of the main cylinder section 55.

The pipes 87 from both pressure devices 51 communicate with a lead pipe 88 (Fig. 1) which is connected into a casing 91 of a slide valve 92. The valve is formed on a stem 93 which extends into an electric solenoid 94. The solenoid end of the valve stem is backed up by a compression spring 95. The solenoid is connected into a source of electric energy and is operated by being energized and deenergized at predetermined times as will be hereinafter explained in connection with the wiring diagram of Fig. 5.

When the machine is operating, the solenoid 94 is maintained energized and the valve 92 is held in lifted position and against the resistance of the spring 95. A valve port 96 at such time is in registry with the end of the lead pipe 88 in the valve casing. In this position of the valve,

the port 95 is also in registry with the end of a main supply pipe 97 which leads from any suitable supply of compressed air. The machine end of this pipe is threaded into the valve casing 91 on the side opposite the lead pipe 88.

With the valve 92 in this open position, compressed air flows through the main supply pipe 97, valve port 86, lead pipe 88, pipes 87 and into the main cylinder 54 and the auxiliary cylinder 54 of each air pressure device 51. The air pressing against each main piston 81 forces downwardly its piston rod 65, the stem 61 and the slide block 37 on that side. This evenly forces the pressure roller 12 down against the web A and toward the adhesive applying roller 11. It is this pressure that maintains the web A in engagement with the adhesive applying roller.

The air entering the auxiliary cylinder 54 of each device presses down on the respective auxiliary piston 77 and thus compresses the corresponding spring 68 in the cylinder on that side of the machine. This relieves each main piston of the extra load of compressing the spring and insures more efficient operation of the device.

When the machine stops operating, it is desirable to relieve the pressure on the pressure roller 12 and to bring the web A out of engagement with the adhesive applying roller to prevent burning of the paper or fibre web as hereinbefore mentioned. This is done by deenergizing the solenoid 94.

When the solenoid 94 is deenergized the valve spring 95 shifts the valve 92 in its casing 91 and thereby moves the valve port 96 out of registry with the main air supply pipe 97. This cuts off the supply of air to the air pressure units 51. In this closed position of the valve, the valve port 96 is in registry with an atmosphere port 98 cut through the wall of the valve casing. Communication between atmosphere and the lead pipe 88 is obtained at such time, such communication being effected by way of an elongated extension 99 of the valve port 96.

Hence the interiors of the cylinder sections 54, 55 of the two pressure units are open to the atmosphere the air pressure therein having been immediately dissipated by movement of the valve 92. The compression spring 68 in the auxiliary cylinder 54 of each device is expanded when the parts are in this condition and each auxiliary piston 77 is in its raised position. At the time of the change from pressure to atmosphere each piston 77 pressing against the shouldered portion 75 of the piston rod 65 raises the rod, its associated main piston 81 and the slide block 37 connected therewith. This lifts or elevates the pressure roller 12 from operative engagement with the adhesive applying roller 11.

The web A follows the pressure roller 12 and hence moves out of engagement with the adhesive applying roller. Further application of the adhesive to the web in the pattern B thus terminates at once. The web thereupon remains in its relative position until it and the pressure roller are again returned to operative position against the adhesive applying roller.

In a conventional machine not equipped with the present adhesive applying control, the pressure roller and web when abruptly shifted away from the adhesive roller moves out of proper position. At such time the momentum of the moving parts of the machine maintains the advancing web in motion until the machine comes to a dead stop, as hereinbefore explained. It is

this momentum that causes skips or uncoated portions in the adhesive pattern on the web.

In the present invention, to prevent these skips in the adhesive pattern whenever the machine stops, provision is made for maintaining the pressure roller 12 in engagement with the web and the web with the applying roller until the machine has actually come to a dead stop. This is preferably done by prolonging the air supplied to the pressure devices by maintaining the compressed air in force in the cylinders 54, 55. The air pressure is maintained by a time delay device connected with the electric apparatus in the machine and for this feature reference should now be had to the wiring diagram in Fig. 5.

The wiring diagram includes a machine motor circuit X, a time-delay circuit Y, and a solenoid circuit Z. The motor circuit includes the electric motor 29 which is the source of power for operating the machine. This motor is connected by a lead wire 101 to a suitable source of electric energy such as a generator 102 and is also connected by a lead wire 103 to one side of a service switch 104. The opposite side of the switch is connected by a wire 105 to the generator. Hence when the switch 104 is closed, electric energy from the generator 102 flows along the circuit and operates the motor 29.

The time delay circuit Y is a parallel circuit and includes a solenoid relay 108 having a switch element 109 connected with a time delay device 111 such as a dash pot or other suitable mechanical or electrical time delay mechanism. One side of the solenoid relay 108 is connected by a wire 113 to the main lead wire 101 of the motor circuit while the opposite side of the solenoid relay is connected by a wire 114 to the motor lead wire 103.

Hence when the motor circuit X is closed, part of the electric energy passing along the circuit also flows along the time delay circuit Y. This energizes the solenoid relay 108 and keeps its switch element 109 closed.

The switch element 109 is included in the solenoid circuit Z and closes against a contact 116 of a wire 117 which connects with the motor circuit wire 101 and also closes against a contact 118 of a wire 119 which connects into the coil of the air valve solenoid 94. The solenoid is also connected by a wire 121 to the motor circuit wire 105. Hence as long as the switch element 109 is maintained closed against the solenoid circuit contacts 116, 118, electric energy from the motor circuit passes along the solenoid circuit and thereby maintains the solenoid 94 energized and thus keeps the air valve open so that compressed air will be introduced into the cylinders 54, 55 of the air pressure units 51 as hereinbefore explained.

Stopping of the machine for any reason is effected by opening the motor circuit switch 104. Opening of the switch breaks the motor circuit and hence the motor commences to coast to a stop. At the same time, this breaking of the motor circuit breaks the time delay circuit Y and thus the solenoid relay 108 becomes deenergized. Deenergization of the solenoid relay 108 sets the time delay device 111 in operation.

The time delay device 111 is set to operate for a predetermined period of time which is sufficient to allow the machine to come to a dead stop. At the termination of this period of time the delay device opens the switch element 109 of the solenoid relay 108 and thus breaks the solenoid circuit Z. This deenergizes the solenoid 94 and immediately the

compressed air control valve 92 operates to cut off the flow of compressed air and to open each of the cylinders 54, 55 to the atmosphere, as hereinbefore explained. Springs 68 are thus permitted to move the pressure roll 12 out of operative engagement with the web and adhesive applying roller 11.

In this manner the web A is maintained in engagement with the adhesive applying roller 11 until both the roller and the web have come to a dead stop. The web may then be released from the roller without throwing out the surface relationship of the two. Since neither the web is advanced along its length nor the adhesive applying roller rotated while the machine is stopped the adhesive pattern already applied to the web and that subsequently to be applied will not be out of registry.

When the machine is again started by closing of the motor circuit switch 104 the air valve 92 is immediately opened and compressed air, entering the cylinders 54, 55 of the air pressure units, immediately returns the web to the adhesive applying roller 11 and the application of the adhesive pattern begins at the place where it was interrupted when the machine stopped. This is indicated on the web in Fig. 3 by a dot and dash line c-c. Thus skips in the adhesive pattern are entirely eliminated.

It is thought that the invention and many of its attendant advantages will be understood from the foregoing description, and it will be apparent that various changes may be made in the form, construction and arrangement of the parts without departing from the spirit and scope of the invention or sacrificing all of its material advantages, the form hereinbefore described being merely a preferred embodiment thereof.

I claim:

1. In a machine for applying a coating fluid to a web of material, the combination of a pair of cooperating movable elements between which the web of material is passed to receive a film of the coating fluid when the machine is in operation, means for controlling the movement of said elements, means for separating said elements when the machine stops operating to free the web and thereby to terminate the application of the coating fluid to the web, and electro-mechanical means responsive to the actuation of said controlling means for actuating said element separating means after a predetermined time interval sufficient to maintain the web engaging surfaces of the elements in exact relation to the surface of the web when movement of said elements is terminated by shutting down the machine.

2. In a machine for applying a coating fluid to a web of material, the combination of a rotatable applying roller for depositing a film of the coating fluid on the web, a rotatable pressure roller mounted in the machine for bodily movement relative to said applying roller for engaging the web and pressing the same against the applying roller, means for applying a predetermined air pressure on said roller to maintain the same in operative engagement with said web and said applying roller, a valve for controlling the introduction of compressed air to said pressure roller, an electric motor disposed in driving engagement with said rollers for rotating the same, and electric means connecting with said motor and said valve, said electric means including time delay instrumentalities for operating said valve to maintain the air pressure on said pressure roller for a predetermined period of time after said motor is shut down to stop the machine and allow the rollers to

come to a stand-still while the web is in engagement with the applying roller, whereby to terminate the coating operation at a locality on the web from which the coating operation may be resumed when the machine is again started without interruption to the coated film on the web.

3. In a machine for applying a coating fluid to a web of material, the combination of a pair of cooperating rotatable rollers between which the web of material is passed to receive a film of the coating fluid, means for rotating said rollers, one of said rollers being separable from the other, a movable mounting for said separable roller, an air cylinder disposed adjacent said mounting and having a main piston and an auxiliary piston each connected with said mounting, a compression spring normally urging said pistons and said movable mounting and its roller away from the other of said rollers, a compressed air line connected to said cylinder for moving said pistons and said roller mounting in a direction towards the other of said rollers, a valve in said air line operative to admit compressed air through said line to said cylinder to press said separable roller against the web during the coating operation, means communicably connected to said valve to maintain the air pressure in said cylinder for a predetermined time interval after said rotating means has been shut down sufficient to allow the machine to come to a full stop, and means for moving said valve to relieve said air pressure to permit said spring to exert pressure on said pistons and move said separable roller away from the remaining roller when the coating operation is terminated.

4. In a machine for applying a coating fluid to a web of material, the combination of a pair of cooperating rotatable rollers between which the web of material is passed to receive a film of the coating fluid, one of said rollers being separable from the other, a movable mounting for said separable roller, a shouldered piston rod connected to said mounting, a main piston fixed on said rod, an auxiliary piston loosely mounted on said rod, a compression spring normally urging said loose piston against the shouldered portion of the rod, a cylinder for housing said pistons, a compressed air line connected to said cylinder for introducing compressed air therein for moving said pistons in a direction to force said separable roller into operative engagement with the other of said rollers and to compress said spring, a valve in said air line for controlling the air pressure on said pistons, said valve in one position admitting air under pressure to said loose piston to force the same against the spring to compress the latter and to relieve the load on the fixed piston, said admitted air also creating a pressure on the fixed piston and the parts connected therewith for pressing the separable roller against the web during the coating operation, said valve in another position cutting off the air supply while venting said cylinder to atmosphere to permit the spring to exert pressure against said loose piston to shift the piston rod and said connected mounting to move the separable roller away from the remaining roller for freeing the web therefrom to terminate the coating operation thereon, and control devices including time delay instrumentalities connected to and associated with said valve for moving the same to said first mentioned position when the machine commences operation, said control devices being further operative to permit the valve to be moved to the second of its said positions at the expiration of a predetermined time interval sufficient to al-

low the machine to come to a full stop, whereby to hold the air in force against said pistons and said rollers in operative engagement with one another until full stopping of the machine, so that the coating operation will terminate only when the web stops moving and at a locality thereon from which said coating operation may be continued without interruption of the coating on the web when the machine is again started.

5. In a machine for applying a coating fluid to a web of material, the combination of a pair of cooperating movable elements between which the web of material is passed to receive a film of the coating fluid when the machine is in operation, means for controlling the movement of said elements, means cooperating with said controlling means for holding said elements in operating engagement when the machine is in operation, means cooperating with said holding means for separating said elements when the machine stops to terminate application of the coating fluid to the web, and means cooperating with said holding means for retaining the elements in operative relation during stopping of the machine and while its moving parts are coasting to a standstill, said holding means and said retaining means being responsive to the actuation of said movement controlling means after a predetermined time interval sufficient to allow the machine to come to a full stop prior to actuation of said separating means, whereby to insure full coating of the web to an exact line from which application of the coating film may be continued without interruption of the coating when the machine is again started.

6. In a machine for applying a coating fluid to a web of material, the combination of a pair of cooperating rotatable rollers between which the web of material is passed to receive a film of the coating fluid when the machine is in operation, means for rotating said rollers, means for separating one of said rollers from the other when the rollers cease their rotation to free the web and to thereby terminate the application of the coating fluid to the web, means for holding the rollers against separation and in operative relation during stopping of the machine and for a time interval sufficient to permit its moving parts to come to a complete standstill, and means actuated after the machine has come to a full stop to render said holding means ineffective to further prevent separation of the rollers after said predetermined time interval to permit operation of said roll separating means, whereby to separate the web from one of said rollers and to insure full coating of the web to an exact line from which the application of the film may be resumed without interruption of the coating when the machine is again started.

7. In a coating machine for applying a coating fluid to a web of material, the combination of a rotatable applying roller for depositing a film of the coating fluid on the web, a rotatable pressure roller for pressing the web against the applying roller, means for rotating said rollers, means normally tending to move said web out of engagement with said applying roller, means for imparting a predetermined pressure to said pressure roller to maintain the web in engagement with the applying roller when the machine is in operation, and means for controlling the operation of said pressure imparting means, said con-

trol means including a time delay controlled valve having means for setting the same for a predetermined time interval, said valve being operable to render said pressure imparting means ineffective to further maintain said pressure roller in pressure engagement with the applying roller after said predetermined time interval sufficient to allow the machine to come to a complete stop, whereby to separate the web from said applying roller and insure full coating of the web to an exact line from which the application of the coating film may be resumed without interruption of the coating when the machine is again started.

8. In a coating machine for applying a coating fluid to a web of material, the combination of a rotatable applying roller for depositing a film of the coating fluid on the web, a rotatable pressure roller for pressing the web against the applying roller, means disposed and effective at opposite ends of the pressure roller for applying a predetermined amount of fluid pressure thereon to maintain the web in engagement with the applying roller when the machine is in operation, means normally tending to move said pressure roller out of engagement with said applying roller, means for rendering said pressure means ineffective to relieve the pressure on the pressure roller when the machine stops to permit the web to move out of engagement with the applying roller, and means for controlling the operation of said pressure applying means, said control means including a time delay controlled valve having means for setting the same for a predetermined time interval, said valve being operable to render said fluid pressure applying means ineffective to further maintain pressure between said rollers after said predetermined time interval sufficient to allow the machine to come to a full stop, whereby to insure full coating of the web to an exact line from which the application of the coating film may be resumed without interruption of the coating when the machine is again started.

9. In a machine for applying a coating fluid to a web of material, the combination of a rotatable applying roller for depositing a film of the coating fluid on the web, a rotatable pressure roller for pressing the web against the applying roller, means for rotating said rollers in timed relation, compressed air means connecting with said pressure roller for exerting a predetermined force on said roller to maintain the same in pressure operative engagement with said web and said applying roller, a valve for controlling the introduction of compressed air into said pressure device, and control means including time delay instrumentalities for holding said valve in position to maintain the compressed air pressure on said pressure roller while the machine is in operation and for a predetermined time interval sufficient to allow the machine to come to a complete standstill, said control means also including means for moving said valve to another position to shut off said compressed air means to discontinue pressure engagement between said rollers after the machine has come to a complete standstill, whereby to terminate the coating operation and the film of applied coating at a locality on the web from which such coating may be continued as an uninterrupted coating when the machine is again started.

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