Jan. 23, 1951 A. L. LOUCKS ET AL 2,539,147

APPARATUS FOR APPLYING VISCOUS MATERIAL IN THE FORMING OF CABLES

Filed May 23, 1946 2 Sheets-Sheet 1

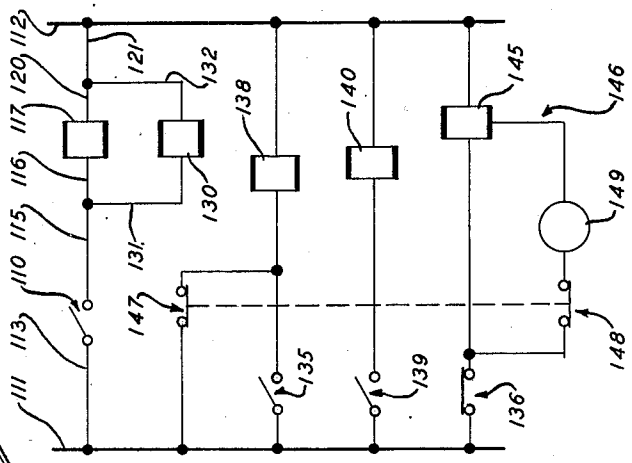

FIG. 3

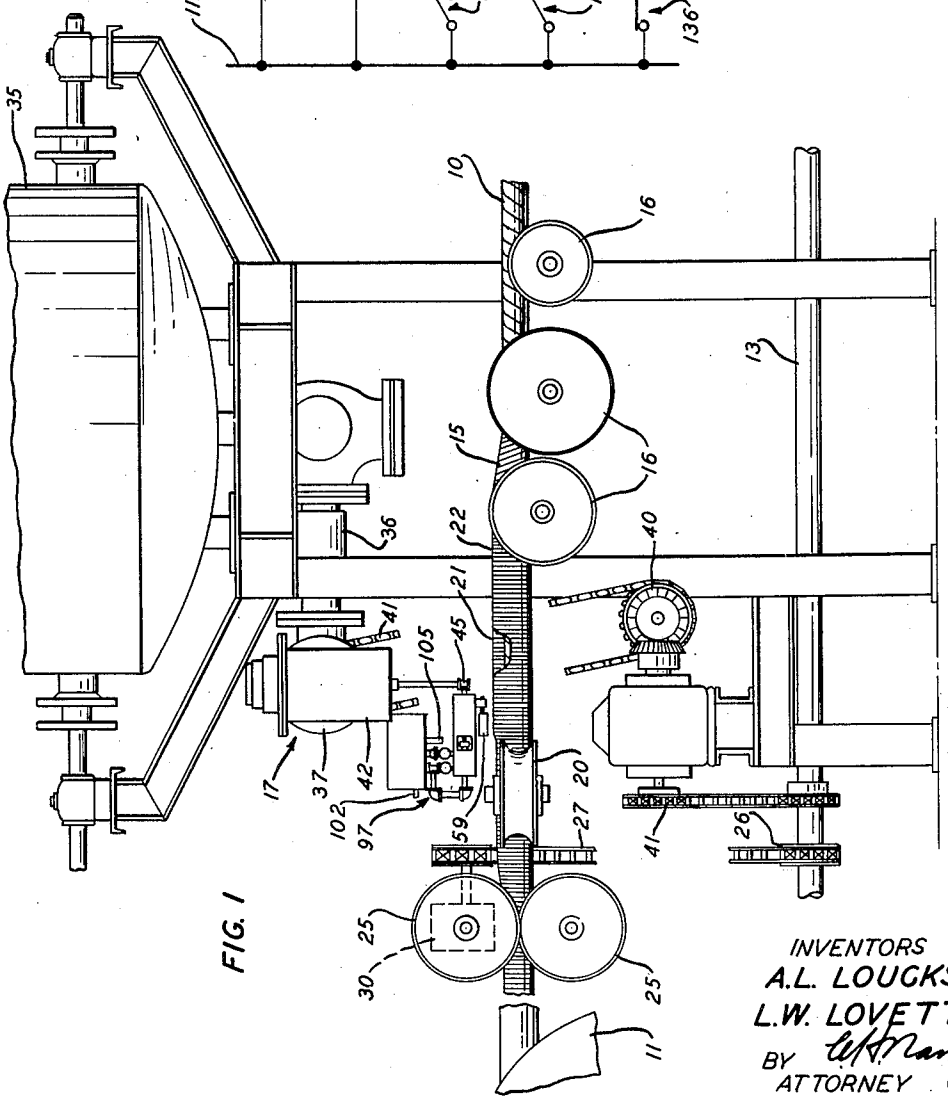

FIG. 1

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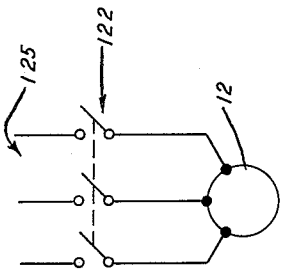

FIG. 4

FIG. 2

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2,539,147

APPARATUS FOR APPLYING VISCOUS MATERIAL IN THE FORMING OF CABLES

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Application May 23, 1946, Serial No. 671,836

2 Claims. (Cl. 91—43)

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This invention relates to apparatus for applying viscous materials to articles, and more particularly to apparatus for applying viscous plastic materials to continuously advancing cables.

In the manufacture of articles such as cables, sometimes a metallic strip is formed into a tube around a lead-sheathed cable, and a viscous cement is applied to the cable before the metallic strip is formed completely around the cable to waterproof and electrically insulate the cable. Machines for performing such functions are quite often heavy and lag somewhat in starting and stopping. In order to apply the cement uniformly to a cable around which metallic tape is being formed by such a machine, an applicator for applying the cement should be stopped and started in coordination with the operation of the entire machine. In the past, no means have been provided for closely coordinating the applicator with the rest of the machine.

An object of the invention is to provide new and improved apparatus for applying viscous materials to articles.

A further object of the invention is to provide apparatus for applying viscous plastic materials to cables uniformly.

An apparatus forming one specific embodiment of the invention includes means for advancing a lead-sheathed cable along a predetermined path and an electric motor for driving the cable-advancing means. An applicator supplies viscous plastic cement to the cable as it is advanced by the cable-advancing means and includes a supply line having a valve therein for opening and closing the supply line. A pneumatic cylinder designed to open and close the valve is controlled by an air valve and a solenoid, which controls the air valve. The solenoid is controlled by a control circuit of the motor. When the motor is stopped, a timer in the control circuit deenergizes the solenoid at a predetermined period of time thereafter so that the auxiliary valve is actuated to cause the pneumatic cylinder to close the valve in the supply line of the applicator after the cable-advancing means coasts to a stop.

A complete understanding of the invention may be obtained from the following detailed description of an apparatus forming a specific embodiment thereof, when read in conjunction with the appended drawings, in which:

Fig. 1 is a fragmentary, side elevation of a cable forming apparatus constituting one embodiment of the invention;

Fig. 2 is an enlarged, fragmentary, vertical section of a portion of the apparatus;

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Fig. 3 is a schematic view of an electrical control circuit, and

Fig. 4 is a schematic view of an electric motor controlled by the control circuit shown in Fig. 3.

Referring now in detail to the drawings, a lead-sheathed cable 10 is continuously advanced to the left, as viewed in Fig. 1, by a capstan 11 driven by an electric motor 12 (Fig. 4) through a line shaft 13 (Fig. 1). As the cable 10 is advanced, a corrugated copper strip 15 is advanced therewith and is formed by forming rolls 16—16 into the shape of a U and an applicator 17, which is disclosed. Copending application Serial No. 671,835, filed May 23, 1946, now Patent 2,494,050, granted January 10, 1950, discharges thermoplastic cement upon the cable 10 and into the U-shaped portion of the copper strip 15. The strip 15 and the cable 10 then pass through forming rolls, of which a forming roll 20 is shown, which tuck an edge 21 of the strip 15 under an edge 22 thereof. As the cable and the strip 15 pass from the forming rolls 20—20 they pass under forming rolls 25—25, which press the edge 22 into overlapping engagement with the edge 21 of the strip. The forming rolls 25—25 are driven through sprockets 26—26, a chain 27 and a gear reduction box 30. Other coverings are then applied over the formed copper strip 15 by the apparatus disclosed in above-mentioned Patent 2,494,050.

The applicator 17 includes a steam-jacketed melting kettle 35 in communication with a feed pipe 36 and a steam-jacketed constant displacement pump 37, which is driven by the line shaft through gearing 40 and a chain 41. The pump forces the viscous thermoplastic cement from the feed pipe 36 through a filter 42, and the cement passes from the filter through a supply pipe 45 connected to a passage 46 (Fig. 2) of a valve body 47. A valve closure member 48 having ends 49 and 50 is connected by a piston rod 51 to a piston 52. A discharge passage 55 directed at right angles to the passage 46 in the valve body 47 is in communication with an orifice 57 formed in a plug 56, which is threaded into a socket 58 formed in the valve body 47. A V-shaped divider 59 positioned directly below the discharge orifice 57 in the plug 56 divides the thermoplastic cement and guides it to opposite sides of the cable 10 (Fig. 1). Steam in steam passages 60—60 heats the valve body 47 so that the cement does not congeal in the valve body.

The piston 52 (Fig. 2) is slidably mounted in a cylinder 61, and when air under pressure is introduced to the left end of the cylinder 61, as

viewed in Fig. 2, the end 50 of the closure member 48 is forced against a valve seat 62, and the closure member 48 closes the passage 46 in the valve body 47 from the discharge passage 55 therein. The closure member 48 is slidably mounted in a bushing 64 and when air under pressure is supplied to the right end of the cylinder 61, the end 49 of the closure member 48 is moved into engagement with a valve seat 65 to open the passage 46 to the discharge passage 55, but to prevent flow of the thermoplastic cement past the end 49 of the closure member 48 and the valve seat 65. A coupling plug 66 is threaded into a socket 67 formed in the valve body 47 and has a threaded head 69 thereon. A tubular projection 70 has a tapped portion 71, and is screwed onto the threaded head 69 of the guide 66. The coupling plug and the projection 70 abut a gasket 72 and force the gasket 72 tightly against the valve body 47 to form a seal therewith.

A threaded boss 75 projects from an end 76 of the cylinder 61 having a bore 77 formed therein and is provided with a counterbore 80 in alignment with the bore 77, which guides the piston rod 51. A cap 81 screwed onto the threaded boss 75 forces an annular plug 82 against a packing 85 positioned in the counterbore 80 to prevent escape of air from the cylinder 61 along the piston rod 51.

An end 86 of the cylinder 61 has a tapped bore 87 therein in communication with a chamber 90 of the cylinder, which is provided with a tapped bore 91 near the end 86 thereof and a tapped bore 92 near the end 76 of the cylinder. A pipe 95 having an adjustable needle, reducing valve 96 therein is connected to one port of a four-way valve 99 of a solenoid valve assembly 97 of a well-known type, which is connected to a pipe 98 threaded into the tapped bore 91 in the cylinder 61. The pipe 95 is connected to a by-pass pipe 100 having a check valve 101 therein. The pipe 100 is threaded into the tapped bore 87 in the end 86 of the cylinder. The check valve 101 prevents the flow of air from the pipe 95 through the pipe 100 to the cylinder but permits flow of the air in the opposite direction. A supply pipe 102 leading from a supply of air under pressure is connected to a supply port of the four-way valve 99, and an exhaust pipe 105 is connected to an exhaust port of the four-way valve 99. A pipe 106 connected to another port of the four-way valve 99 has a valve 107 therein and is threaded into the tapped bore 92 in the cylinder 61.

The solenoid valve assembly 97 includes a solenoid 109 for actuating the valve 99 to connect the supply pipe 102 to the pipe 95 and to simultaneously connect the exhaust pipe 105 to the pipe 106 when the solenoid is not energized. When the solenoid is energized, it actuates the four-way valve 99 to connect the pipe 95 to the exhaust pipe 105 and to simultaneously connect the supply pipe 102 to the pipe 106.

To start the capstan 11, a switch 110 (Fig. 3) is closed. This closes a circuit from a conductor 111 of a power line to a conductor 112 thereof as follows: conductors 111 and 113, the switch 110, conductors 115 and 116, a relay winding 117 and conductors 120 and 121. When the relay winding 117 is energized, it closes a relay switch 122 (Fig. 4) whose contacts are in a three-phase power line 125 leading to the motor 12. This energizes the motor 12, which drives the line shaft 13 (Fig. 1) to drive the capstan 11, the applicator 17 and the forming rolls 25—25. The capstan 11 then advances the strip 15 and the cable 10 past the applicator 17.

When the switch 110 (Fig. 3) is closed, a relay winding 130 connected in parallel with the relay winding 117 by conductors 131 and 132 is energized, and closes a normally open relay switch 135 and opens a normally closed relay switch 136. When the relay switch 135 is closed, a relay winding 138 is energized and closes a switch 139 thereof. When the switch 139 is closed, a solenoid winding 140 of the solenoid 109 (Fig. 2) is energized, which actuates the four-way valve 99 to connect the pipe 106 to the supply pipe 102 and to connect the pipe 95 to the exhaust pipe 105. Air under pressure then flows into the right end, as viewed in Fig. 2, of the chamber 90 in the cylinder 61 and moves the piston 52 toward the left, and air is exhausted rapidly from the left end of the chamber 90 through the check valve 101 and the pipe 100 to the pipe 95. Thus, the pipe 100 and the check valve 101 by-pass the reducing valve 96 when air is exhausted from the left end of the chamber 90 of the cylinder 61 so that the piston 52 rapidly moves the closure member 48 out of engagement with the valve seat 62 and into engagement with the valve seat 65. When this occurs, the thermoplastic cement flows through the passage 46 in the valve body 47 and the discharge passage 55 in the valve body 47 and the orifice 57 formed in the block 56. The cement flows over the divider 59 into the U-shaped portion of the strip 15 (Fig. 1).

When the relay switch 136 is opened as described hereinabove, a solenoid winding 145 of a timer 146 is deenergized, which timer is of a well-known type and may be adjusted from a zero time delay to a time delay of a few minutes. This permits the timer 146 to reset to zero and timer switches 147 and 148 close. The timer switch 147 is in parallel with the relay switch 135 and in series with the relay winding 138 so that when either of these switches is closed, the relay winding 138 is energized so that the switch 139 is closed and the solenoid winding 140 is energized. The timer switch 148 is in series with a motor 149 of the timer 146, and the switch 148 and the motor 149 are in series with the relay switch 136 but are in parallel with the solenoid winding 145 of the timer 146.

To stop the apparatus, the switch 110 is opened, which deenergizes the relay winding 117 and the relay winding 130. When the relay winding 117 is deenergized, the relay switch 122 opens and the main motor 12 is deenergized. When the relay winding 130 (Fig. 3) is deenergized, the relay switch 135 opens and the relay switch 136 closes. The opening of the relay switch 135 does not deenergize the relay winding 138 because the timer switch 147, which is in parallel with the relay switch 135, is closed. Hence, the switch 139 remains closed so that the solenoid winding 140 remains energized, and as the motor 12, the line shaft 13 and the capstan 11 coast to a stop, the solenoid winding 140 is energized so that the valve stem 48 (Fig. 2) is held in its open position.

When the relay switch 136 is closed, the motor 149 and the solenoid winding 145 of the timer 146 are energized. After the motor 149 has run a predetermined period of time, the timer opens the timer switches 147 and 148. The opening of the switch 148 deenergizes the timer motor 149 but does not affect the solenoid winding 145, which remains energized until the relay switch 136 is again opened when the apparatus is restarted.

When the timer switch 147 is opened, the relay winding 138 is deenergized to open the switch 139, which deenergizes the solenoid winding 140. This causes the solenoid 109 (Fig. 2) to actuate the four-way valve 99 to connect the pipe 103 to the exhaust pipe 105 and to connect the supply pipe 102 to the pipe 95. Air under pressure then flows through the reducing valve 96 into the left end, as viewed in Fig. 2, of the chamber 90 in the cylinder 61, but is prevented by the check valve 101 from flowing through the pipe 100 into the chamber 90. The reducing valve 96 permits the air to flow slowly into the left end of the chamber 90 so that the closure member 48 is moved slowly into engagement with the valve seat 62 to close off the thermoplastic cement. Hence, the closure member 48 is moved slowly to a closed position. The total of the time that elapses between the deenergization of the motor 12 and the engagement between the closure member 48 and the valve seat 68 (Fig. 2) is equal to the period of time during which the capstan 11 coasts to a stop so that the flow of thermoplastic cement from the applicator 17 into the strip 15 is not stopped until the movement of the strip 15 and the cable 10 is stopped.

Operation

In the operation of the apparatus described hereinabove, the switch 110 is closed so that the motor 12 (Fig. 4) is energized and the capstan 11 (Fig. 1) is driven to advance the strip 15 and the cable 10 toward the left, as viewed in Fig. 1, through the forming rolls 16—16, 20—20 and 25—25, which form the strip into a shield upon the cable. When the motor 12 (Fig. 4) is energized, the winding 140 of the solenoid 109 (Fig. 2) is energized and the solenoid 109 actuates the four-way valve to connect the air supply pipe 102 to the pipe 106 and to connect the exhaust pipe 105 to the pipe 95. Air under pressure then flows rapidly into the right end of the cylinder 61, as viewed in Fig. 2, and is exhausted from the left end thereof rapidly through the pipe 100 and the check valve 101, whereby the piston 52 is moved rapidly to the left and the closure member 48 is moved out of engagement with the valve seat 62 and into engagement with the valve seat 65. The constant displacement pump 37 is started simultaneously with the starting of the motor 12, and forces the thermoplastic cement through the filter 42, the pipe 45, the passages 46 and 55 in the valve body 47 and the discharge orifice 57 at a predetermined rate of flow. The material strikes the V-shaped divider 59 and falls onto the cable 10 on both sides of the centerline thereof.

To stop the machine, the switch 110 (Fig. 3) is opened, and the capstan 11, the forming rolls 25—25 and the pump 37 come gradually to a stop. This lag in the stopping of the capstan 11 causes the cable 10 and the strip 15 to be advanced farther toward the left of the applicator 17, as viewed in Fig. 1. Hence, if the closure member 48 (Fig. 2) were moved to a closed position immediately when the switch 110 (Fig. 3) is opened, the portion of the cable 10 (Fig. 1) moved under the applicator 17 while the capstan 11 is stopping would have no cement applied thereto and would be bare when the apparatus was restarted. However, the timer 146 (Fig. 3) delays the start of the movement of the solenoid 109 and the reducing valve 96 (Fig. 2) in the pipe 95 slows the movements of the piston 52 and the closure member 48 toward the right, as viewed in Fig. 2, so that the passage 55 is slowly closed off from the passage 46 and is closed off therefrom in coordination with the stopping of the capstan 11. Hence, the portion of the cable 10 (Fig. 1) moved past the applicator 17 while the capstan 11 is stopping will receive substantially the same quantity of thermoplastic cement per unit of length thereof from the applicator 17 as has the rest of the cable 10 which has passed previously under the applicator 17. When the machine is restarted, the pump 37 starts immediately, and the closure member 48 is moved rapidly to the left, as viewed in Fig. 2, so that the thermoplastic cement is applied to the cable 10 at once. Hence, no bare portion of the cable 10 will be present.

The above-described apparatus is simple and effective in its operation and applies uniform quantities of thermoplastic cement to the cable 10 per unit of length of the cable. The opening and closing movements of the closure member 48 are coordinated closely with the starting and stopping of the entire apparatus so that all portions of the cable core 10 passing under the applicator 17 receive uniform quantities of the thermoplastic cement per unit of length of the cable core passing thereunder. The reducing valve might be opened up completely and the time delay of the timer 146 lengthened to equal that of the coasting time of the apparatus. Conversely, the time delay of the timer 146 might be reduced to zero and the needle valve 96 throttled sufficiently to make the time of closing movement of the valve stem 48 equal to the coasting time of the apparatus.

What is claimed is:

1. In a cable-forming machine including means for advancing a cable along a predetermined path, an electric motor, a power line for supplying electrical current to the motor, a switch for starting and stopping the motor, means for transmitting power from the motor to the cable-advancing means, said cable-advancing means serving to start rapidly when the motor is started and to stop slowly when the motor is stopped, a supply pipe having a discharge end and means for forcing thermoplastic cement through the supply pipe, a device for controlling the flow of thermoplastic cement through the supply pipe comprising a heated main valve body positioned adjacent to the path of the cable and being provided with a passage in communication with the discharge end of the supply pipe for directing the thermoplastic cement toward the cable, a closure member slidably mounted in the main valve body for closing off the passage therein, a cylinder having a port near the head end thereof and a second port near the other end thereof and mounted in alignment with the closure member, a piston mounted slidably in the cylinder, a piston rod connected rigidly to the piston and the closure member, a four-way valve being provided with a supply port, an exhaust port, a third port and a fourth port, a pipe for connecting the third port of the four-way valve to the first-mentioned port of the cylinder, a pipe for connecting the fourth port of the four-way valve to the other port of the cylinder, a supply line of fluid under pressure connected to the supply port of the four-way valve, a solenoid having a winding deenergizable after the switch is operated to stop the motor, said solenoid serving when the winding thereof is energized to actuate the four-way valve to connect the supply port thereof to the fourth port thereof and the exhaust port thereof to the third port thereof,

whereby the closure member is moved to open the passage in the main valve body, said solenoid serving when the winding thereof is deenergized to actuate the four-way valve to connect the supply port thereof to the third port thereof and the exhaust port thereof to the fourth port thereof, whereby the closure member is moved to close the passage in the main valve body, and means for slowing the closing action of the closure member to coordinate the closing of the passage in the main valve body with the stopping of the cable-advancing means.

2. In a cable-forming machine including means for advancing a cable along a predetermined path, an electric motor, a power line for supplying electrical current to the motor, a switch for stopping the motor, means for transmitting power from the motor to the cable-advancing means, said cable-advancing means serving to stop slowly when the motor is stopped, a supply pipe having a discharge end and means for forcing thermoplastic cement through the supply pipe, a device for controlling the flow of thermoplastic cement through the supply pipe comprising a heated main valve body positioned adjacent to the path of the cable and being provided with a passage in communication with the discharge end of the supply pipe for directing the thermoplastic cement toward the cable, a closure member slidably mounted in the main valve body for closing off the passage therein, a cylinder having a port near the head end thereof and a second port near the other end thereof and mounted slidably in the cylinder, a piston rod connected rigidly to the piston and the closure member, a four-way valve being provided with a supply port, an exhaust port, a third port and a fourth port, means including a reducing valve and a check valve by-passing the reducing valve for connecting the third port of the four-way valve to the first-mentioned port of the cylinder, a pipe for

connecting the fourth port of the four-way valve to the other port of the cylinder, a supply line of fluid under pressure connected to the supply port of the four-way valve, and a solenoid being deenergizable when the switch is operated to stop the motor, said solenoid serving when the winding thereof is energized to actuate the four-way valve to connect the supply port thereof to the fourth port thereof and the exhaust port thereof to the third port thereof, whereby the closure member is moved to open the passage in the main valve body, said solenoid serving when the winding thereof is deenergized to actuate the four-way valve to connect the supply port thereof to the third port thereof and the exhaust port thereof to the fourth port thereof, whereby the closure member is moved to close the passage in the main valve body.

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