March 2, 1954 T. A. DOURDEVILLE 2,670,622

APPARATUS FOR SURFACE-TREATMENT OF WOUND CLOTH BY STEAM IMPREGNATION, AND CONTROL DEVICES THEREFOR

Filed May 9, 1951 3 Sheets-Sheet 1

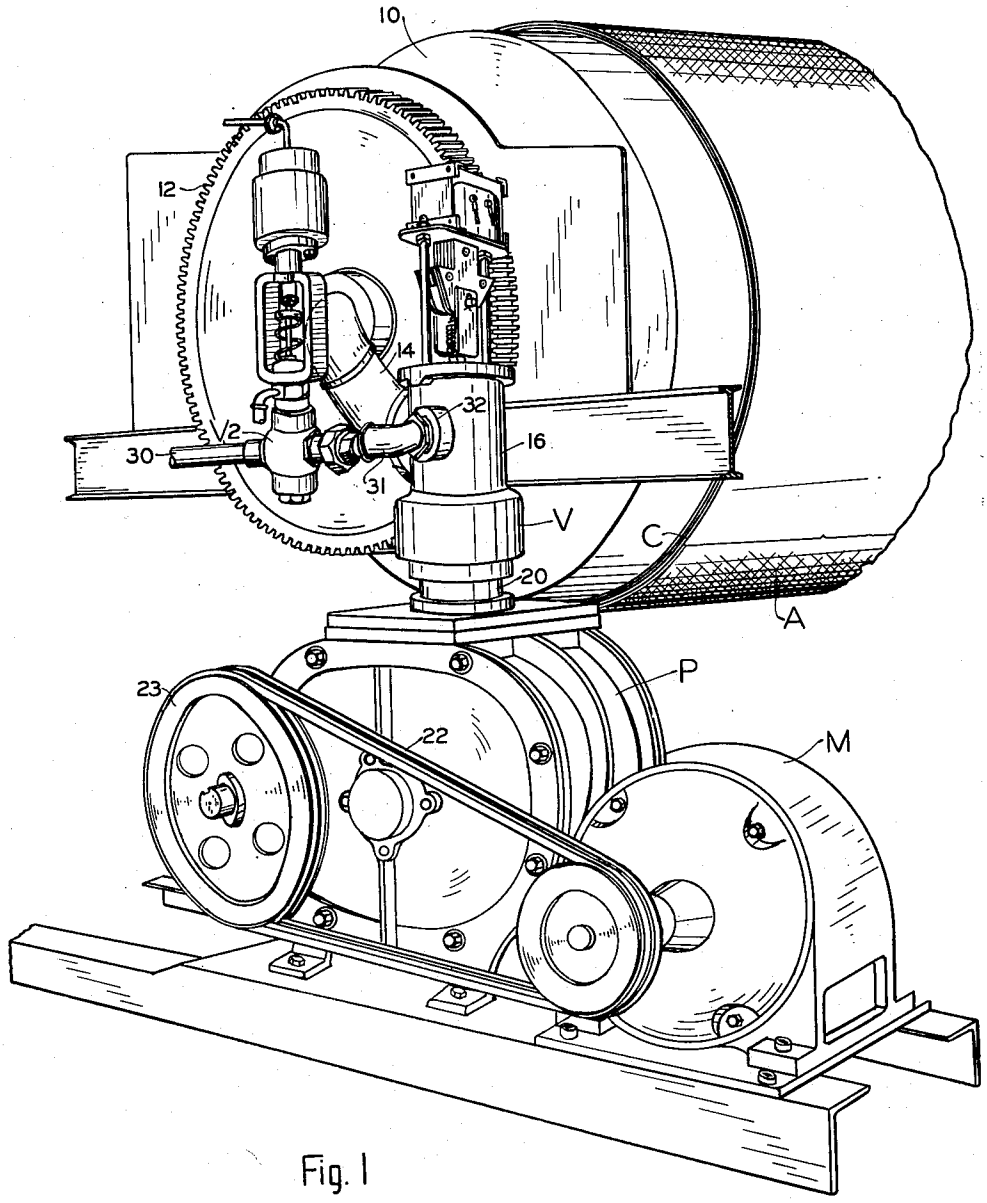


Fig. 1

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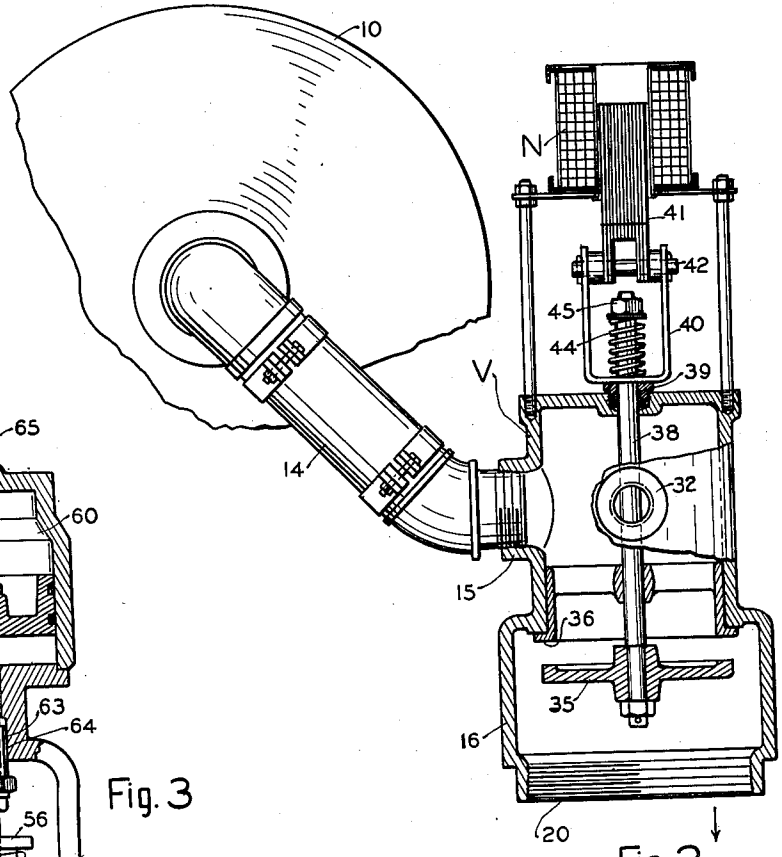


Fig. 2

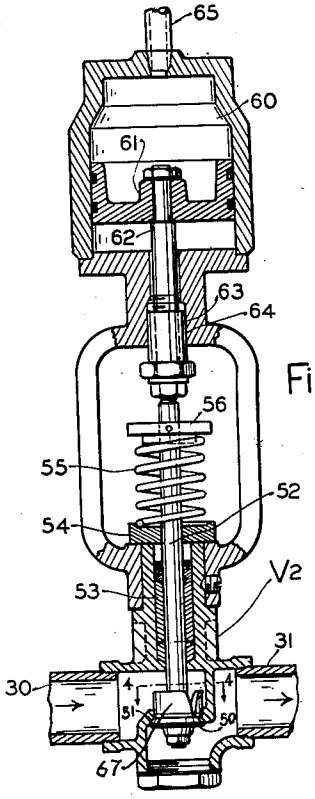


Fig. 3

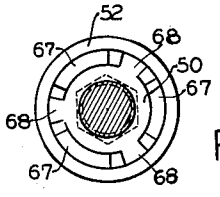


Fig. 4

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Fig. 5

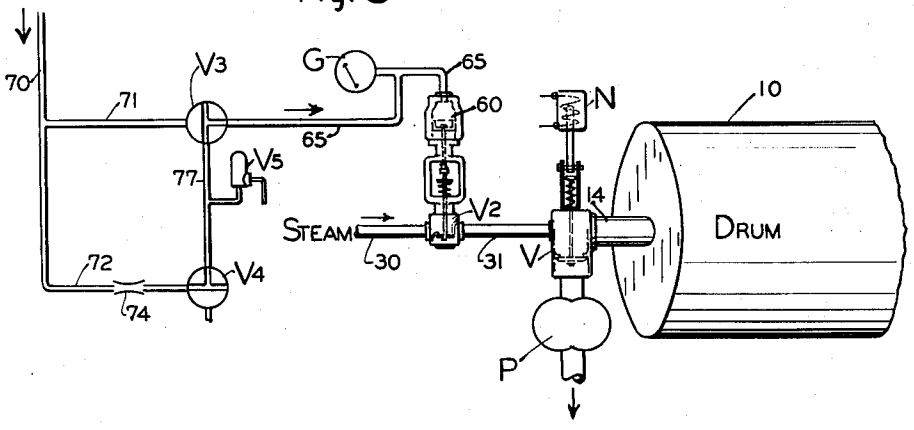
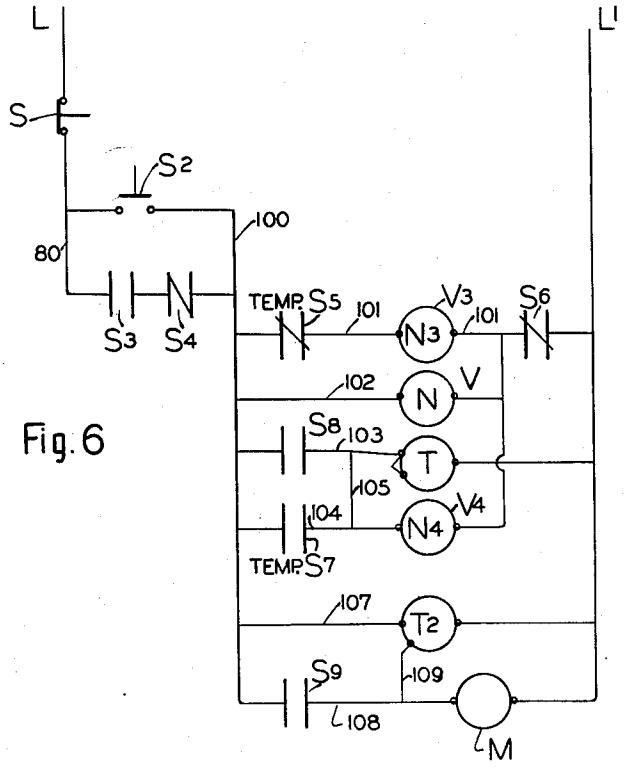


Fig. 6



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APPARATUS FOR SURFACE-TREATMENT OF WOUND CLOTH BY STEAM IMPREGNATION, AND CONTROL DEVICES THEREFOR

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3 Claims. (Cl. 68—8)

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This invention relates to improved apparatus for treating cloth in a cloth-finishing operation, and further relates to improved control devices for said apparatus and by which the desired treatment may be effectively and conveniently carried out.

Briefly stated, my improved treatment contemplates winding a long strip of cloth, commonly woolen or worsted, on a large perforated drum in many superposed layers and with an apron of canvas or similar material alternately disposed between the wound layers of cloth, and preferably also with several layers of the apron wound outside of the cloth. The winding is performed under substantial tension, and the wound cloth is held tightly rolled during the treatment thereof.

Steam under pressure is admitted to the inside of the perforated drum, and a pressure of 2 to 3 lbs. at the inner surface of the wound cloth is maintained until the steam has penetrated to the outer windings of the cloth and apron.

The rate of steam flow is then reduced, usually to about one-fourth, and the pressure at said inner cloth surface may drop to 1½ or 2 lbs. This lessened flow and lower pressure is maintained on the cloth for a brief period, such as 2 to 4 minutes. The steam is then shut off and the drum is connected to a relatively large vacuum or air pump, which exhausts the steam and any condensation from the cloth, and which draws outside air through the cloth to cool the cloth.

At the end of a definite period, say 2 to 4 minutes, the steam-treated and partially dried and cooled cloth may be removed from the drum. It will then be found that a superior surface finish has been imparted thereto.

I have also provided automatic electric and hydraulic controls by which the entire process may be carried out without manual attention.

My invention further relates to arrangements and combinations of parts which will be hereinafter described and more particularly set forth in the appended claims.

A preferred form of the invention is shown in the drawings, in which

Fig. 1 is a perspective view of parts of a cloth finishing machine in which my improved process may be conveniently carried out;

Fig. 2 is an end elevation of certain parts shown in Fig. 1, and with the large air valve shown in section;

Fig. 3 is a sectional elevation of the steam valve and its control devices;

Fig. 4 is a sectional plan view of the steam valve member, taken along the line 4—4 in Fig. 3;

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Fig. 5 is a diagrammatic view showing the hydraulic connections by which the previously described process may be carried out; and

Fig. 6 is a diagrammatic view of certain electrical devices and connections for automatically controlling the operation of the machine and particularly the operation of the hydraulic connections and associated parts shown in Fig. 2.

Referring to Fig. 1, I have shown parts of a cloth finishing machine including a large perforated drum 10 on which the cloth C to be finished and an apron A are wound in superposed layers, and preferably with several extra layers of apron wound outside of the cloth package. The winding is carried out under substantial tension, and the winding pressure is substantially maintained by the outer layers of the apron.

The drum 10 has a large gear 12 engaged by a suitable driving pinion (not shown) and by which the drum may be rotated at a desired speed and in a desired direction.

The hollow hub of the drum 10 is connected by a large flexible pipe 14 (Fig. 2) to a port 15 in the casing 16 of an air valve V. The outlet 20 of the valve V is connected to a large air exhaust or vacuum pump P (Fig. 1) driven by a motor M through a belt 22 and pulley 23.

Steam is delivered through a supply pipe 30 and valve V2 to a pipe 31 which enters the casing 16 of the valve V through a port 32 in the front face thereof.

The details of construction of the air valve are shown in Fig. 2, where the valve disc 35 is shown spaced below the annular valve seat 36, and is in the position which it occupies when the pump P is exhausting steam and air from the drum 10.

A valve rod 38 extends upward through a fixed bearing 39 and passes through an opening in a yoke 40 which is swiveled to the lower end of a solenoid plunger 41 by a cross pin 42. The rod 38 is connected to the yoke 40 through a compression spring 44 and nut 45, which spring connection prevents the disc 35 from striking its seat 36 with a hard and unyielding blow.

The solenoid plunger 41 slides freely in the solenoid N and the air valve V is closed whenever the solenoid N is energized. The control circuits are so devised that the air valve will be closed whenever the steam valve V2 is open.

The special construction provided for control of the steam valve V2 is clearly shown in Fig. 3, where a valve disc 50 of poppet-type abuts a conical seat 51 whenever the valve rod 52 is drawn upward.

The valve rod 52 extends upward through a packed bearing 53 and loosely through a collar

or disc 54 which supports and centers the lower end of a compression spring 55.

At its upper end, the spring 55 engages a collar 56 pinned to the upper end of the valve rod 52. The steam valve V2 is thus normally closed by the upward pressure of the spring 55.

A hydraulic cylinder 60 is mounted above the valve V2, and its piston 61 has a piston rod 62 extending downward into position to engage the upper end of the valve rod 52. A bushing 63 is secured to the lower end of the piston rod 62 and is slidable in a fixed bearing 64.

Pressure may be applied in the cylinder 60 (Fig. 5) through a supply pipe 65. When pressure is thus applied, the valve member will be depressed and steam will be admitted to the pipe 31 and thence through the air valve V and pipe 14 (Fig. 2) to the drum 10, it being understood that the air valve is closed to prevent steam blowing through the pump P at this time.

The valve disc 50 has an upstanding annular flange 67 having deep V-shaped recesses 68 therein, as shown in Figs. 3 and 4.

As the outer surface of the upstanding flange 67 is a sliding fit in the cylindrical upper part of the valve seat 51, the only passage for steam from the pipe 30 to the pipe 31 is through the portions of the V-shaped recesses 68 which are positioned below the cylindrical upper part of the valve seat. Consequently, the further the valve member 50 is depressed, the greater the steam flow, and as the valve member is raised, the steam flow is correspondingly reduced.

The spring 55 normally acts to close the valve V2, and the rate of flow is controlled by the compression of the spring by the piston 61 and associated parts.

The hydraulic connections for the control of the steam valve V2 are shown diagrammatically in Fig. 5. A substantial oil pressure, such as 100 lbs. per square inch, is maintained in a supply pipe 70 having branch pipes 71 and 72. A normally-closed three-way valve V3 is inserted between the pipe 71 and the pipe 65 leading to the cylinder 60. A suitable pressure gauge G may be mounted on the pipe 65. The valve V3 is shifted by a solenoid N3 (Fig. 6).

The pipe 72 is connected to a second three-way valve V4 through a restricted orifice device 74 by which the flow of oil is much reduced. The valve V4 is shifted by a solenoid N4 (Fig. 6).

If the valve V3 is turned anti-clockwise 90°, full oil pressure will be applied through the pipe 65 to the cylinder 60, and the steam valve V2 will be depressed and fully opened, thus allowing free flow of steam from the pipe 30 through the valve V2 and pipe 14 to the drum 10, it being understood that the air valve V is at this time closed by the solenoid N and associated parts.

When the valves V3 and V4 are in the positions shown in Fig. 5, direct and full flow through the pipe 71 is blocked off, but restricted flow takes place through the pipe 72 and the valve V4 and thence through a connecting pipe 77 and the valve V3 to the pipe 65 and cylinder 60.

A relief valve V5 is connected into the pipe 77 and prevents pressure in said pipe from rising above a relatively low point, as determined by the relief valve. Oil at this reduced pressure is delivered into the cylinder 60, but the pressure is not sufficient to fully compress the spring 55 (Fig. 3). Consequently, the valve member 50 rises part way, and the available portions of the recesses 68 are narrowed, thus reducing the steam flow.

At the end of a desired period, the solenoid N4 is deenergized and the valve V4 shifted clockwise 90° to its vented position, thus shutting off the pressure pipe 72 and connecting the pipe 77 to the exhaust. This vents the cylinder 60 and allows the steam valve 72 to fully close.

In the preferred form of my finishing apparatus, an automatic electrical control is provided for the several switches and valve solenoids. The electrical control connections are indicated diagrammatically in Fig. 6, which is supplied with current through line wires L and L1.

The switch S is a manual stop switch by which the process can be interrupted at any point. The switch S2 is a normally-open manual starting switch. The switches S3 and S4 control a holding or shunt circuit through a wire 80 and around the starting switch S2.

When S2 is closed, S3 will also be closed, thus closing the shunt circuit, and the shunt circuit will remain closed after the switch S2 has been released. The shunt circuit may thereafter be opened by the switch S4 when the finishing cycle is completed.

Both the holding circuit through the wire 80 and the direct circuit through the switch S2 connect with a distributing wire 100 having a plurality of parallel branch connections to the line wire L1.

The wire or connection 101 traverses a temperature switch S5, the solenoid N3 which operates the hydraulic valve V3 previously described, and a control switch S6. A branch wire 102 passes through the solenoid N which operates the main air valve V and is then connected into the wire 101. A branch wire 103 passes through a switch S6 and a timer T, and a branch wire 104 passes through a temperature switch S7 and the solenoid N4 which actuates the hydraulic valve V4. The wire 104 is then connected into the wire 101. A cross wire 105 directly joins the wires 103 and 104.

A wire 107 passes through a second timer T2, and a final wire 108 passes through a switch S9 and the starting mechanism of the motor M. The wire 108 is connected to the timer T2 by a wire 109.

The stop switch S is normally closed and when the starting switch S2 is closed, the line wire L is connected to the distributing wire 100. When switch S2 is closed, the switch S3 promptly closes to complete a holding circuit through the wire 80. The temperature switch S5 is normally closed and also the switch S6.

Current passes through the branch wire 101 to energize the solenoid N3 which shifts the valve V3 (Fig. 5) anti-clockwise 90° to apply full pressure in the cylinder 60 and to thereby open the steam valve V2. At the same time, current through the branch wire 102 energizes the solenoid N to close the air valve V, so that steam from the pipe 31 (Fig. 5) may pass directly through the pipe 14 to the drum 10.

After the steam has flowed long enough to raise the temperature of the temperature switch S5 to the desired point, the switch S5 opens, cutting out the solenoid N3 and allowing the valve V3 to return clockwise 90° to the position shown in Fig. 5. The temperature switches S5 and S7 are reversely coupled, so that when S5 is open, S7 is closed.

The closing of S7 completes the circuit through the solenoid N4, so that the valve V4 is turned

anti-clockwise 90° to the position shown in Fig. 5, and a reduced flow of steam at reduced pressure is supplied to the cylinder 60, whereupon the piston 61 (Fig. 3) partially rises and partially closes the steam valve V2.

At the end of the time interval determined by the timer T, the control switch S6 is opened, which in turn opens the branch circuits 101, 102 and 104. The solenoid N is thus released and the air valve V opens. The timer T simultaneously closes the switch S9 and starts the motor M which drives the air pump P. After a predtermined interval, the timer T2 opens the switch S4 and stops the motor M, thus completing the cycle. The apron may then be unwound and the cloth removed.

Having thus described my invention and the advantages thereof, I do not wish to be limited to the details herein disclosed, otherwise than as set forth in the claims but what I claim is:

1. In a cloth finishing machine having a perforated winding drum adapted to receive superposed layers of cloth to be finished, in combination, control mechanism effective to supply steam at a predetermined pressure to the cloth through the drum, control mechanism effective to thereafter supply steam at a less pressure to said drum and cloth, a temperature device to render said second mechanism operative and said first mechanism simultaneously inoperative, means to exhaust the steam and draw outside cooling air through the cloth and drum, and interlocking means effective to stop the supply of lower pressure steam and to start said exhaust means.

2. In a cloth finishing machine having a perforated winding drum adapted to receive superposed layers of cloth to be finished, in combination, a steam supply, control mechanism effective to admit steam at a predetermined pressure to the cloth through the drum, control mechanism effective to thereafter admit steam at a less but predetermined pressure to said drum and cloth, interlocking means effective to cause successive operation of said two control mechanisms, and a control device effective to initiate operation of said interlocking means on the occurrence of a predetermined temperature in said winding drum, and said control device including coupled but reversely-operating control switches.

3. In a cloth finishing machine having a perforated winding drum adapted to receive superposed layers of cloth to be finished, in combination, a steam supply, control mechanism effective to admit steam at a predetermined pressure to the cloth through the drum, control mechanism effective to thereafter admit steam at a less but predetermined pressure to said drum and cloth, interlocking means effective to cause successive operation of said two control mechanisms, and a control device effective to initiate operation of said interlocking means on the occurrence of a predetermined temperature in said winding drum.

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