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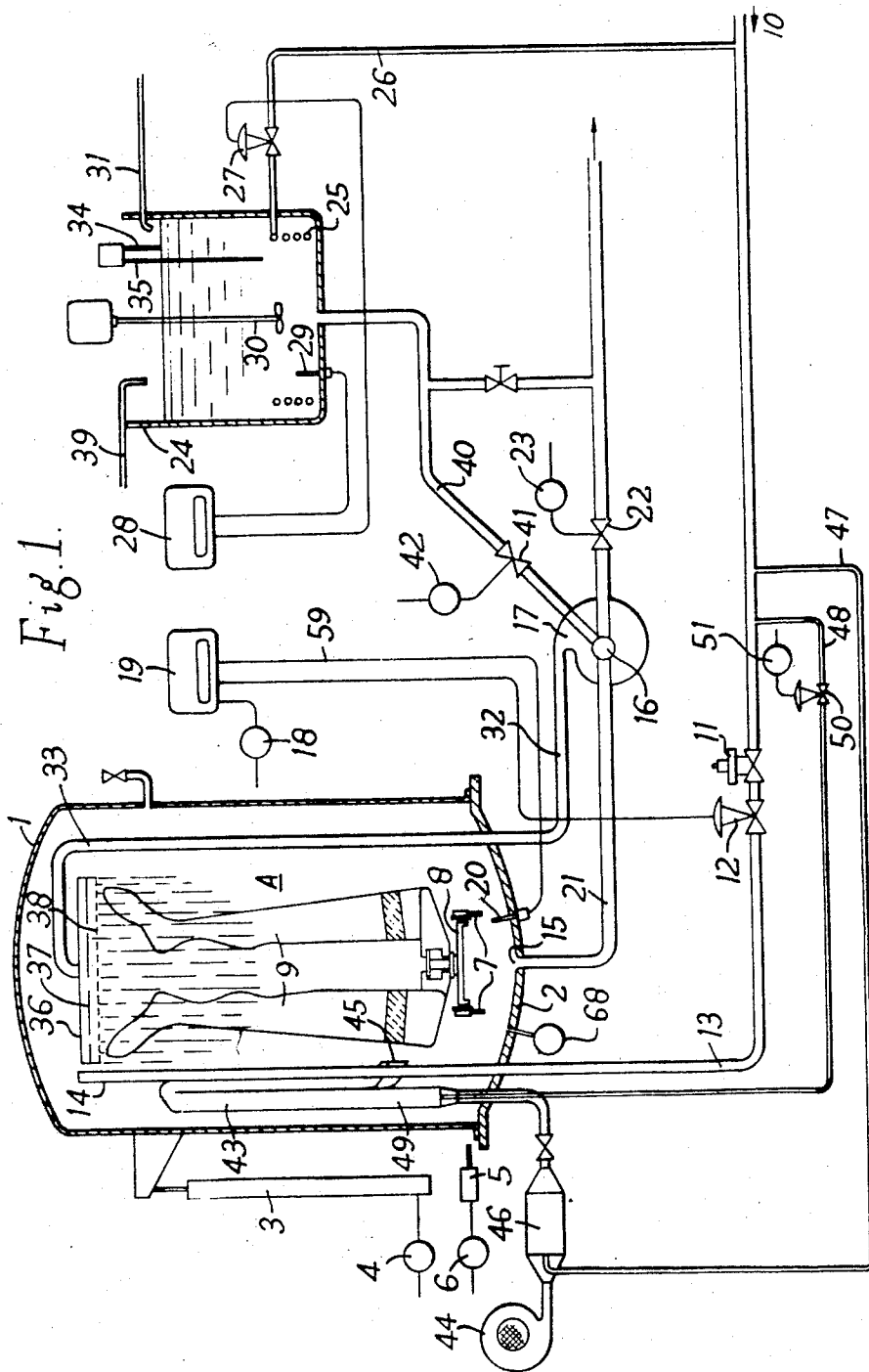
J. L. SWINDALL

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CONTROL SYSTEM FOR SELECTIVE TREATMENT OF GARMENTS

Filed Oct. 11, 1966

3 Sheets-Sheet 1



Sept. 23, 1969

J. L. SWINDALL

3,468,539

CONTROL SYSTEM FOR SELECTIVE TREATMENT OF GARMENTS

Filed Oct. 11, 1966

3 Sheets-Sheet 2

Fig. 2.

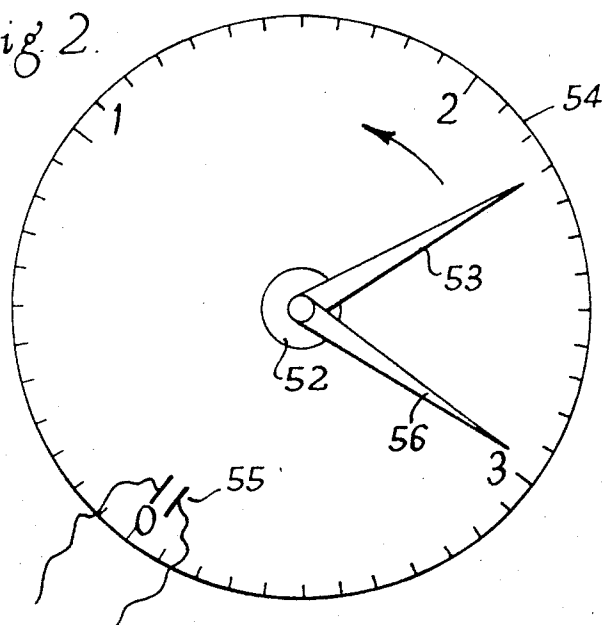
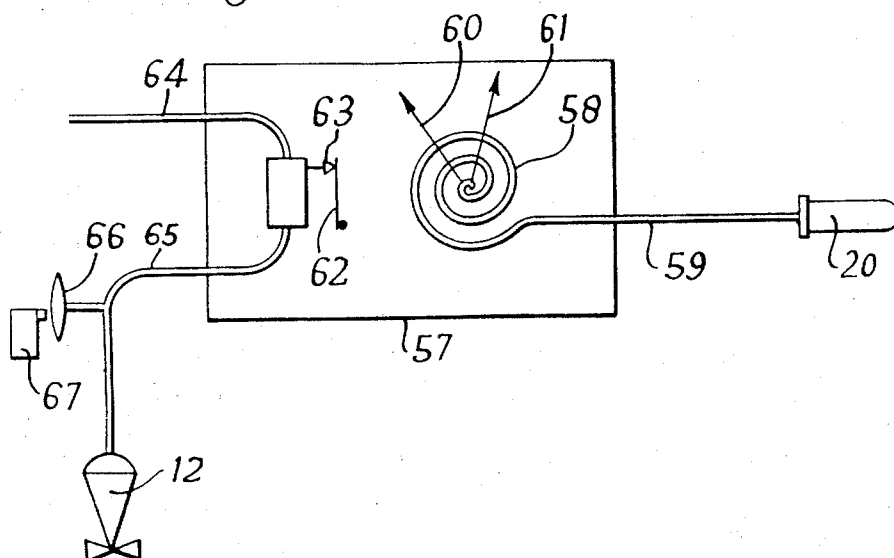


Fig. 3.



Sept. 23, 1969

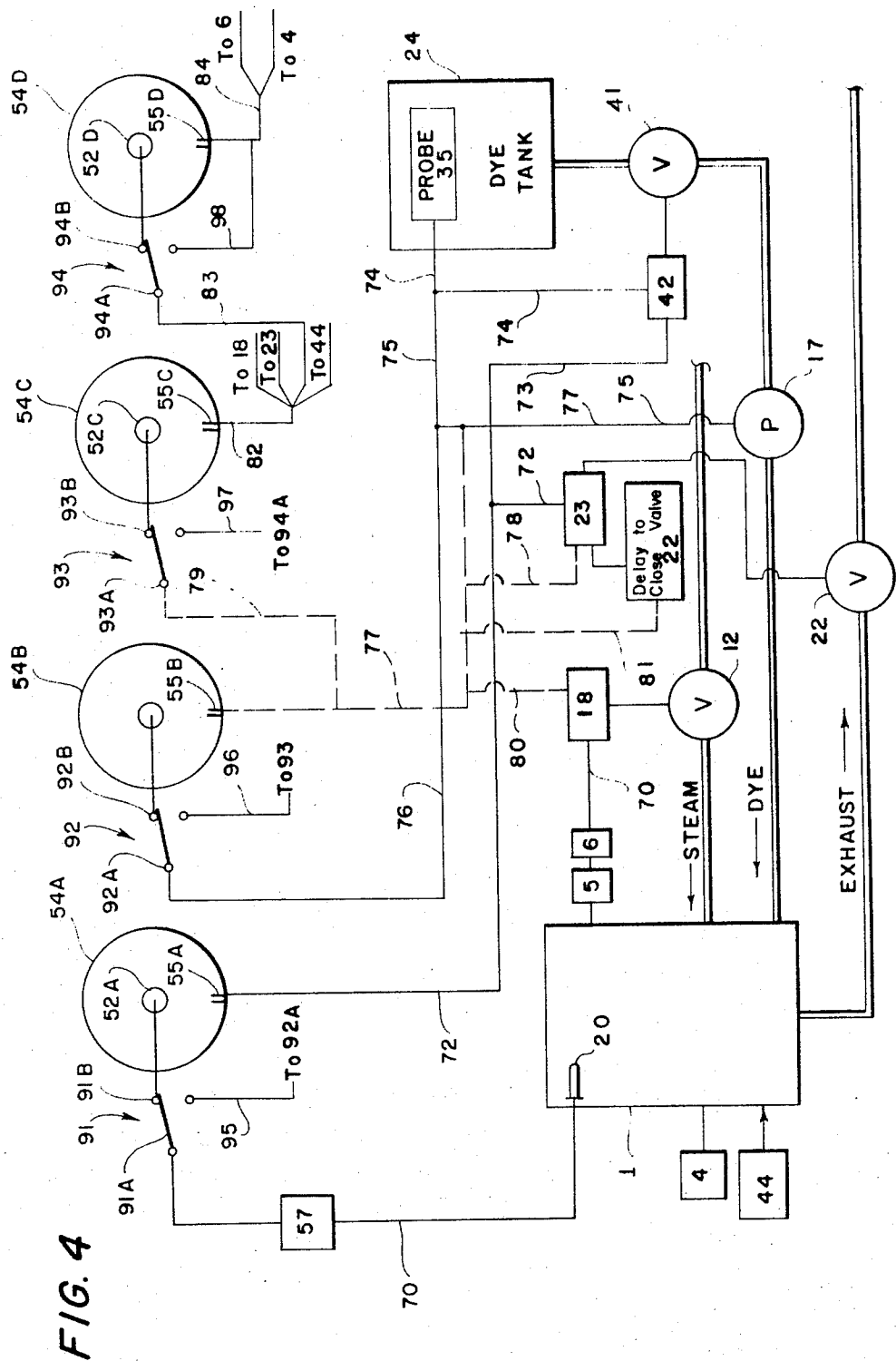
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3 Sheets-Sheet 3



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3,468,539

## CONTROL SYSTEM FOR SELECTIVE TREATMENT OF GARMENTS

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4 Claims

### ABSTRACT OF THE DISCLOSURE

In dyeboarding apparatus having structure for mounting a garment in a treatment zone and having apparatus for applying steam, dye and hot air to the treatment zone to preboard, dye, postboard and dry the garment, there is provided a control system which operates the apparatus to carry out the said operating steps automatically. In addition, a mechanism is provided for selecting at will any group of the said four operating steps so that only the selected steps will be carried out automatically, thereby excluding the non-selected steps.

This invention relates to the art of so-called dyeboarding, that is to garment finishing processes involving the dyeing and boarding (setting to shape) of the garments. A typical illustration of this process is the treatment of nylon stockings which are subjected to steam for boarding and are then dyed, sometimes at the same site. The boarding may take place before the dyeing, when it is termed preboarding, and/or subsequently to the dyeing, in which event it is referred to as post-boarding. In some dyeboarding processes, moreover, the dyed and boarded articles are dried by hot air.

It is the object of the present invention to provide a dyeboarding system which is devised to cater for an efficient, versatile, and adaptable control of such processes. Other objects and advantages of the invention will become clear as this specification proceeds.

Generally stated, this invention provides a system for the operation and control of a dyeboarding process which comprises an individual and adjustable timer for controlling each of the four potential processing stages of pre-boarding, dyeing, post-boarding, and drying, means whereby the commencement of each successive and chosen stage in the process is automatically initiated by completion of the preceding stage, and control means whereby any stage of the pre-boarding—dyeing—post-boarding—drying programme can be eliminated under the dictation of an operator.

As is immediately apparent, such a system will provide a user or operator with a tool which gives him a very flexible control of the process. If, for example, it is desired to treat the work, e.g. stockings, with the four stages enumerated, the system will enable this to be implemented in strict sequence (without delay in bringing each succeeding stage into effect), and the timers can readily be adjusted, quite independently of one another, to pre-select the duration of each individual stage. Further, the system can be quickly adapted to procedural variations, for example the post-boarding stage can be eliminated or, indeed, the dyeing stage can be omitted, without elaborate reassembly of the plant or time-wasting modification of the operating programme.

The system according to this invention will now be illustrated by a specific example and in reference to the accompanying drawings, in which:

FIGURE 1 is a diagrammatic illustration of a dyeboarding plant to which the invention has been applied.

FIGURE 2 is a diagrammatic illustration of a prototype process timer used in this system.

FIGURE 3 is a similar and diagrammatic illustration of a temperature controller used in the plant illustrated in FIGURE 1.

FIGURE 4 is a schematic view illustrating the operation of the invention.

The arrangement seen in FIGURE 1 of the drawings is a modified version of the dyeboarding plant which forms the subject of our prior British Patent No. 937,307 and basically comprises a retort constituted by a movable bell 1 and a fixed base 2. When the bell 1 is closed down it defines a closed chamber A in which the work is subjected to fluid treatment. The bell 1 can be raised and lowered by pneumatic jacks, one of which has been illustrated at 3, this being under the control of a solenoid valve 4. In its bottom position, in which it closes the retort, the bell 1 can be locked to the base 2 by locking devices which have been diagrammatically depicted at 5 and are under the control of solenoid valves 6.

Mounted above the base 2 is a fixed section of trackway 7 for reception of the wheels of a trolley 8 on which is supported a set of upstanding forms 9 for the stockings which are to be treated in the retort. As has been described in United States Patent Ser. No. 3,181,750 of common ownership herewith the stockings are dressed on the forms 9 outside the retort, and the carriage 8 is then pushed into the zone of chamber A, after which the bell is lowered to enclose the stockings for treatment.

Upstanding from the base 2 is a supply pipe 14 which is connected through a line 13 to a steam source 10. A steam admission valve 12 and a pressure restrictor valve 11 are incorporated in line 13. Provided centrally in the base 2 is an opening 15 to a drain pipe 21, the discharge from which is controlled by an exhaust valve 22 itself operable by a solenoid valve 23. The drain pipe 21 also communicates with a four-way valve 16 with a port to an impeller pump 17, the delivery side of which connects through a line 32 to a riser pipe 33 in the retort zone A. At its upper end the pipe 33 is downturned and carries a shower head 36 with an internal perforated baffle 37 and a perforated shower plate 38.

Also mounted in the base 2 is a temperature probe 20 (see below) which is electrically connected to a temperature controller 19 which is to operate one of the process timer controls provided in accordance with the present invention. Associated with temperature controller 19 is a solenoid valve 18 for operating steam admission valve 12 (see below).

The plant further includes a feed tank 24 from which dye liquor can be fed to the retort 1, 2. A coil 25 in the bottom of tank 24 is provided for heating the dye liquor so that it can be supplied in preheated condition to the retort, this coil 25 being connected through a pipe 26 to the steam line 13, under the control of a diaphragm-operated valve 27. A temperature sensing bulb 29 is arranged in the bottom of tank 24 and connects to a further temperature controller 28 of similar construction to controller 19 (see below), controller 28 being responsive to the temperature of the liquor in tank 24 to govern the supply of steam to coil 25, by opening and closing valve 27.

The tank 24 is fed by a water supply pipe 31 and a liquor supply pipe 39 and these components of a supply in tank 24 (proportioned by means which have not been illustrated) are intimately mixed by an agitator 30. Tank 24 also contains high level and low level probes, 34 and 35 respectively, having a function which will later be described. A delivery pipe 40 runs from the bottom of tank 24 to the fourway valve 16 so that liquor therefrom can be

forwarded by pump 17 to the shower head 36. Pipe 40 incorporates shut-off valve 41 controlled by a solenoid valve 42.

To provide for the blowing of hot air into the retort zone A to dry treated stockings, use is made of ducting 43 which also upstands from the base 2 and is connected to an air blower 44. It will be noted that the ducting 43 provides the air with a U-path which terminates in a nozzle 45 which is directed towards the lower part of the stocking forms 9, i.e. the stocking welts, so that the maximum air blow is applied to the part of the stocking which tends to retain the most moisture after dyeing. Although only one device 43 has been illustrated in the diagrammatic drawing, it will be understood that there will be a hot air duct at each side of the retort and that each of these ducts will open into a comparatively elongated nozzle so that a substantial blast of air will be directed over the complete set of stocking welts at each side of trolley 8.

The air from blower 44 is first passed through an internal heat exchanger 46 itself supplied with hot steam through branch 47 from steam line 13. A further branch 48 from the latter is passed to a battery of heat exchange tubes 49 in the first and longer limb of each U-shaped duct 43. The supply of steam through line 48 is controlled by a valve 50 itself governed by a solenoid valve 51.

The apparatus described is adapted to cater for the four garment-treating operations consisting of preboarding, dyeing, postboarding and drying, and is so devised as to allow for the selective performance of these four operations. It also caters for the quick regulation, at will, of the duration of each of these operations. To illustrate these possibilities, I will now describe the performance of a treatment involving the four steps in question, as if these are all to be carried out in the sequence indicated, and at the same time I shall expound the means which are used, in accordance with the invention, to implement the versatile system of control which allows for omission of any of these operations, interruption of the process at any point, and a variation of the period of any treatment stage, selectively under the quick control of an operator.

Starting from the situation in which one carriage-load of stockings has been finished in the closed retort whilst a fresh carriage loaded with untreated stockings stands ready outside the latter (as described in United States Patent No. 3,181,750), the retort bell 1 is raised at the end of a preset period (see below). When it reaches the upper position of its ascent it operates a machine switch to start the motor which propels the fresh carriage towards the retort, the fresh carriage pushes the finished carriage away from zone A and, when it has reached its central position in the treating zone, it abuts against and operates a microswitch. This closes a circuit which triggers the solenoid valve 4 and shuts off the admission of compressed air to jacks 3 (at this time extended) wherefore the latter will be slowly collapsed, through an air-bleed valve, to allow the retort bell 1 to descend slowly.

When it has reached its bottom position enclosing the fresh carriage, the bell 1 operates a second machine switch (not shown) to trigger the solenoid valve 6 controlling the bell-locking devices 5, again as described in United States Patent No. 3,181,750. In moving into their end locking positions, the devices 5 operate a third machine switch (not shown) to actuate the solenoid valve 18 which then operates valve 12 and initiates admission of steam into the closed retort, i.e. the performance of a preboarding treatment.

Simultaneously with the operation of solenoid valve 18, the closure of the third machine switch by the locking devices 5 operates a further solenoid valve 23 to open valve 22 in discharge conduit 21. This allows air to be dispelled from the retort by the incoming steam so as to avoid the formation in this retort of an air-steam mixture which could impair the uniformity of setting of the stockings during the boarding operation. In addition to opening valve 22, the solenoid valve 23 brings into operation

an auxiliary timing device (not shown) which, after a preset time for air expulsion, initiates the closure of the discharge valve 22.

A temperature is now built up under the steam pressure in the closed retort and, when this has reached a predetermined figure (for example 260° F.), the timing of the preboarding stage can commence. To this end use is made of a first process timer (hereinafter referred to as a preboarding timer) of which a prototype is diagrammatically illustrated in FIGURE 2. It consists of a synchronous electric motor, indicated at 52, geared to an indicating pointer 53 movable over the time scale of a dial 54. Associated with the zero figure on dial 54 are fixed electrical contacts 55 controlling the equipment to be operated by the timer (see below). Associated with the indicating pointer is a setting pointer 56 which can be set manually to a required time delay figure on the dial 54. When the timer has been brought into action, the pointer 53 moves away from the pointer 56 until it reaches, and closes, the contacts 55, thereby to initiate the next stage in the proceedings.

The preboarding timer is brought into operation by the temperature controller 19 diagrammatically illustrated in FIGURE 3. This comprises a casing 57 housing a Bourdon tube 58 connected through a capillary tube 59 with the bulb 20 in the base of the retort. The tube 59 is filled with vapour or mercury and increasing temperature sensed by bulb 20 causes the indicating pointer 60 associated with the end of the tube 58 to move away from a temperature setting pointer 61 by which the required starting-temperature for the preboarding operation has been selected on a dial (not shown) of the instrument 19.

When the indicating pointer 60 has fully run down, i.e. the preset temperature has been reached in the retort, it contacts and operates a pivoted baffle 62. This in turn closes an air discharge nozzle 63 in a compressed air supply line 64, causing the compressed air now to flow through a line 65 to a bellows 66 operating a microswitch 67 which sets into operation the preboarding process timer. At the same time the flow of compressed air closes valve 12 to interrupt the steam supply to the retort.

At the end of the period preset on this timer the indicator pointer 53 first of all stops the synchronous motor 52 and resets the setting pointer 56. At the same time the contacts 55 control the operation of solenoid valve 23 and cause the latter to open the discharge valve 22, as a result of which the steam exhausts from the retort and the pressure in the latter falls. When it has reached atmospheric level, a pressure switch 68, connected into the base 2 of the retort, triggers the solenoid valve 42 to commence the dyeing stage.

The dyeing is, in fact, to be performed by the re-cycling of a batch of dye liquor of predetermined volume over the stockings in the retort. This re-cycling is performed by the pump 17 which delivers the liquor through line 32 and pipe 33 to the shower head 36, from which the liquor is showered over the stockings, to collect at the base 2 and be drawn back through line 21 to the suction side of pump 17 and round the circuit again, this cycle being repeated so long as the pump is in operation and valve 22 closed.

Operation of solenoid valve 42 first brings about the opening of valve 41 in feed conduit 40, wherefore a supply of proportioned and preheated dye liquor passes from tank 24 to pump 17, and valve 41 is closed automatically when a predetermined volume of liquor has been discharged from tank 24. This is determined by probe 35 in the tank which serves as a switch which, when the liquor level in the tank 24 has dropped to a specific position, operates solenoid valve 42 to close the valve 41.

In addition the electrical connections of probe 35 control the starting up of pump 17 and the setting into operation of a second process timer controlling the dyeing period. This second and dyeing process timer is of the same form as the timer described in connection with FIG-

URE 2 of the drawings, and in this case closure of contacts 55 is effective to arrest the operation of pump 17 and open the discharge valve 22, thereby to discontinue the dyeing stage and to drain the dye liquor from the retort.

At the ultimate end of the dyeing stage, and with the valve 22 still open, the second process timer starts a third and similar timer which controls the postboarding stage. At the same time the closing of contacts 55 of the second process timer is arranged to operate and open steam admission valve 12, steam then flowing into the retort to scavenge the residual dye liquor from the same through still-open discharge valve 22. The second and dyeing process timer is also arranged, by closure of its contacts 55, to start a separate delay timing device (not shown) which will close valve 22 after a preselected scavenging period.

Pressure will then be built up in the retort for postboarding, and at the end of the postboarding period, set by the third process timer, steam-admission valve 12 is closed and steam allowed to evacuate from the retort by the opening of valve 22. When, as a result, pressure falls in the retort a further pressure switch (not shown) further similar to the switch 68, or even forming part of the latter, and brought into operation by the postboarding process timer, senses atmospheric pressure and brings into operation the fourth and drying process timer and starts up blower 44. This blows air heated by heat exchanger 46 and the battery of heat exchange tubes 49 into the retort, and the moisture-charged air, produced as a result of the drying of the stockings, passes out from the retort through the drain conduit 21, valve 22 still being open.

This stage continues for a time determined by the fourth and drying process timer, and at the end of this period the latter causes solenoid valve 6 to open and operate the devices 5 and unlock the retort. The locking devices 5, in returning to their release position, will operate a further microswitch (not shown) to operate valve 4 and so feed air into jacks 3, thereby raising the retort bell 1. As has already been indicated, when this bell reaches its upper position a new sequence of operations is initiated.

It will thus be seen that the four stages of preboarding, dyeing, postboarding, and drying can take place in automatic sequence, and that the duration of each stage is under the control of its individual process timer. These process timers, which can govern their subordinate agencies (e.g. valves, switches etc.) through relay circuits of standard design, can be preset to selected time periods as described above.

The operation of a preferred embodiment of the invention, which has been described in considerable detail above, will now be summarized with respect to FIGURE 4 for the purpose of clearly illustrating the operation of the invention. In FIGURE 4 there is shown, in addition to the elements shown in FIGURES 1 through 3, a set of four timers indicated as 54A through 54D and representing the timers for the preboarding stage, the dyeing stage, the postboarding stage and the drying stage, respectively. These timers have associated therewith motors 52A through 52D respectively, and contacts 55A through 55D, respectively. The pointers 53 and 56 are omitted for clarity. The remaining elements in FIGURE 4 correspond to FIGURE 1. In addition, there is provided electrical connections 10 through 84 and switches 91 through 94. Initially the closing of the bell 1 operates the solenoid 18 along line 70 to open the valve 12. Subsequently, temperature probe 20, operating through switch 57, starts the timer 54A. At the end of the set time the contacts 55A are closed and this causes a current to be transmitted along line 72 to the solenoid 23 to open the exhaust valve 22, and along line 73 to the solenoid 42 for opening the valve 41 to permit the flow of dye from the tank 24 to the pump 17. When the required amount of dye has left the tank 24, the probe 35, sensing this, causes a current

to be transmitted along line 74 to the solenoid 42 to close the valve 41, and also along line 75 to start the pump 17 and also along line 76 to start the second timer 54B. At the completion of the time set on 54B, the contacts 55B are closed. The lines along which current is passed upon the closing of contacts 55B are shown in dotted lines for purposes of clarity. Current is first transmitted along line 77 to shut off the pump 17 and also along line 78 to solenoid 23 to open the exhaust valve 22. Current is also transmitted along line 79 to start the third timer 54C. Additionally, current along line 80 to the solenoid 18 opens the valve 12 for postboarding steam and current along line 81 operates a delayed device which operates solenoid 23 at a later time to close the valve 22. Upon the completion of the time period set on 54C, the contacts 55C are closed causing current to be transmitted along line 82. Additional lines from line 82 would perhaps confuse more than clarify, and thus it has simply been indicated in FIGURE 4 that this current would pass to the solenoid 18 to close the valve 12, to the motor 52D of the fourth timer along line 83, to solenoid 23 to open the exhaust valve 22 and also to the blower 44 to commence the flow of hot drying air to the bell 1. However, as has been indicated above, the line 83 may be replaced by a pressure switch which starts the timer 54D when the pressure in the bell 1 has fallen to a predetermined level. Finally, at the completion of the period set on timer 54D, current is caused to flow through contacts 55D and line 84 to the solenoid 6 to operate the unlocking device 5 and to the solenoid 4 to raise the bell 1.

In practice the machine or plant can be equipped with a control panel which carries the four process timers 52-56 side by side, whereby an operator is given a ready facility for setting the durations of the various stages in the process. Moreover the system of electrical connections is such as to allow for switching over from one timer to another, so that any of the stages can be excluded from the automatic sequence. Thus, for example, the dyeing stage, and the postboarding stage, could be eliminated and the system operated for preboarding and drying only, or other variations are possible.

Such a switching arrangement is shown schematically in FIGURE 4. Each of the four timers have associated therewith conventional switches 91 through 94 including arms 91A and 94A respectively, contacts 91B through 94B, respectively leading to the motors 52A through 52D respectively. In a conventional manner, the switch 91 may be provided with a second lead 95 so that the arm 91A can either contact 91B to operate timer 54A or contact lead 95 to bypass timer 54A. Similarly, the arm 92A can either contact 92B or operate the timer 54B or it can contact a lead 96 to bypass the timer 54B. Similarly, the timer 54C may be bypassed by connecting the arm 93A with lead 97 and finally the timer 54D can be bypassed by connecting arm 94A with lead 98. Thus, by simply selecting the position of the arms 91A through 94A, it is possible to select for operation any combination of the four stages.

In particular, moreover, the control panel will be equipped with a push button or equivalent means which allows the automatic and pre-set process sequence to be terminated at any point during any one of the four stages, this action being arranged to override all the relays, effective to bring about the automatic sequence from that point onwards, by reversing the current in those relay circuits so that they will no longer function. An interruption of this character may take place for instance, when it is desired to inspect the characteristics of the stockings at a chosen phase in the process, or during an initial run-through of the process.

In any event, this interruption will need to be followed by a raising of the bell of the retort, and it is to be remembered that there may be a steam atmosphere in the retort at the time. Consequently, as a safety feature, actuation

of the interruption button or equivalent is also arranged to bring about the opening of exhaust valve 22, unlocking of the bell (still after an impeded delay), and the raising of the bell, these latter actions being performed through the controls which are used for this purpose in the normal process sequence (see above).

It is a feature of the system of this invention that provision is made for washing out the retort and the conduitry between changes of dye liquor, using water and detergent in tank 24.

Finally the control panel will conveniently be used to present other indicator and control elements which will group all the controls at a single point where they can be readily manipulated and observed by an operator. For instance the control panel may have a press button to operate the controls to effect a repetitive re-cycling of water and detergent from the tank 24 when washing out of the retort is required, and this button or equivalent will operate circuits which will render the other stages of the treatment inoperative, in other words this washing out cycle can be effected quite independently and with the remainder of the machine shut down.

The control panel further may be provided with indicator lamps signalling the particular process which is in operation in the closed retort at any time, a setting device which regulates the upper limit of the temperature control instruments 19 and 28, a pressure gauge indicating the pressure in the pump and retort during the steaming stages, start and stop buttons for the operation of the machine as a whole, and so on.

In the foregoing a general reference has been made to the use of solenoid valves in the arrangement described. In practice these solenoid valves will conveniently be of the two following main types.

In the first place, where the valve to be controlled is of a fluid flow type and conveniently of the spring-return diaphragm kind, a single solenoid three-way spring return valve will be used as the solenoid valve. In the particular system illustrated in the accompanying drawings, this type of solenoid valve will be used to control the valve 27 regulating the flow of steam to the heating coil 25 in tank 24, as the solenoid valve 51 which operates the valve 50 regulating the supply of heating steam to the battery of heat exchange tubes 49 for the air, and as the solenoid valve 18 which controls the steam admission valve 12.

Valves in the system performing a mechanical function will preferably be of the cylinder-operated type, and in this event the solenoid valves regulating the same may be of the single- or double-solenoid four-way type. This latter type may be used for the solenoid valve 23 controlling exhaust valve 22, as the solenoid valve 42 controlling the feed tank outlet valve 41, the solenoid valve 6 controlling the locking devices (e.g. cylinders) 5, and the valve 4 controlling the jacks 3.

I claim:

1. A system for controlling the operation of a dye-boarding apparatus, comprising a structure beginning a treatment zone, means for applying steam to said zone,

means for applying dye liquor to said zone, means for applying hot air to said zone, first, second, third and fourth adjustable timers which can be set to determine the duration of each of four potential stages of operation of the apparatus including the preboarding, dyeing, post-boarding and drying stages respectively, each said timer including means for operating subsequent stages upon the completion of the time period set on the adjustable timer, control means for carrying out said stages of operation automatically in sequence, comprising a first means automatically actuating said dye liquor applying means in response to the first timer completing its set period at the termination of the preboarding stage, a second means automatically actuating said steam applying means in response to the second timer completing its set period at the termination of the dyeing stage, and a third means automatically actuating said hot air applying means in response to the third timer completing its set period at the termination of the last-mentioned application of steam, and means for selecting at will any group of said preboarding, dyeing, postboarding and drying stages to be carried out automatically, in sequence, by said control means, such that one or more of said stages can be excluded from said automatic sequence.

2. A system as claimed in claim 1, in which the structure for defining the treatment zone is a retort which is adapted to be opened and closed and has therein a steam admission opening, a dye liquor dispensing device, and a drain out, means for opening and closing said retort, valve means respectively controlling said steam admission opening, said dye liquor dispensing device, said drain outlet, and said retort opening and closing means, solenoid valves for operating said valve means under the dictation of electrical circuits controlled by the process timers through electrical relays.

3. A system as claimed in claim 2, which includes press button means to override and eliminate a chosen process timer, and the functions controlled thereby, from the program sequence.

4. A system as claimed in claim 3, which includes means for interrupting the performance of any processing stage, and emergency means adapted simultaneously to operate the valve means controlling said drain so as to open the latter and vent steam from the retort in the event of such interruption.

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