Sept. 19, 1950 H. M. SCHMITT 2,522,900

CLOTH BLEACHING OPERATION

Filed June 16, 1945 3 Sheets-Sheet 1

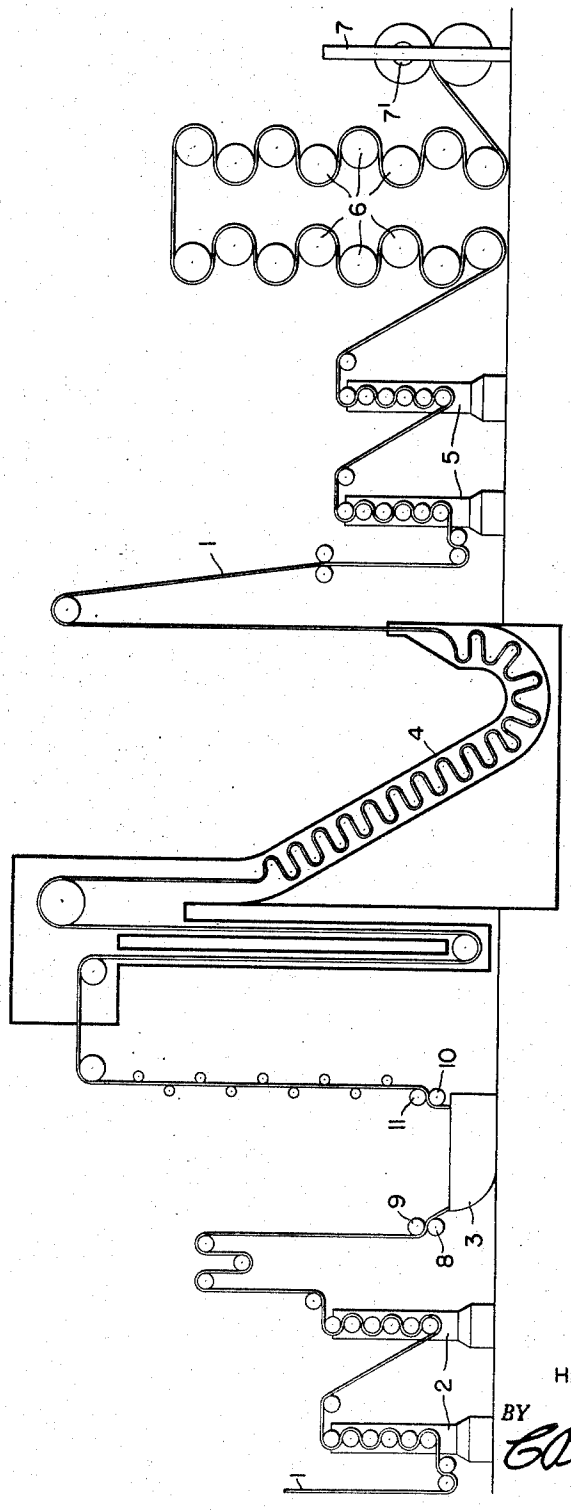


FIG. 1

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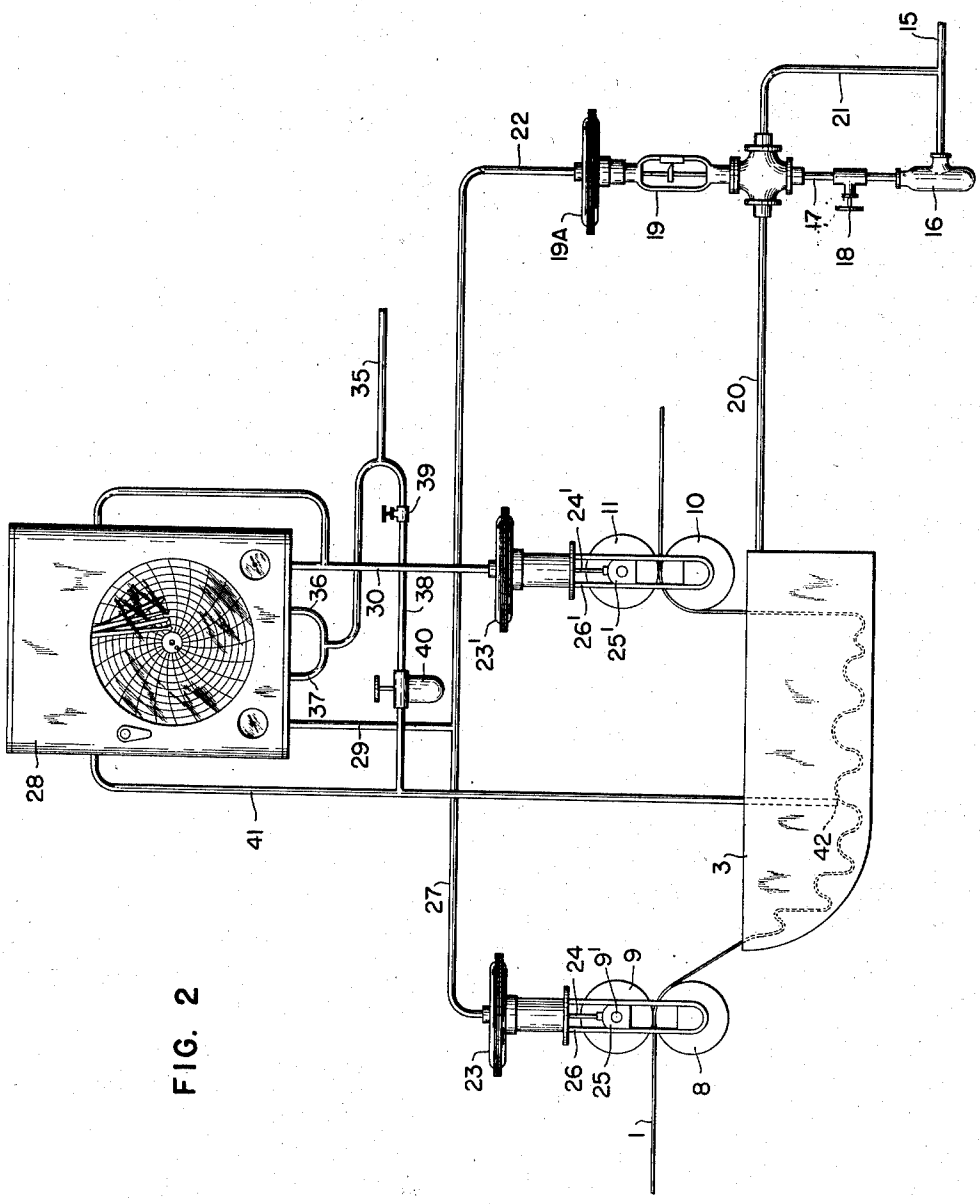


FIG. 2

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CLOTH BLEACHING OPERATION

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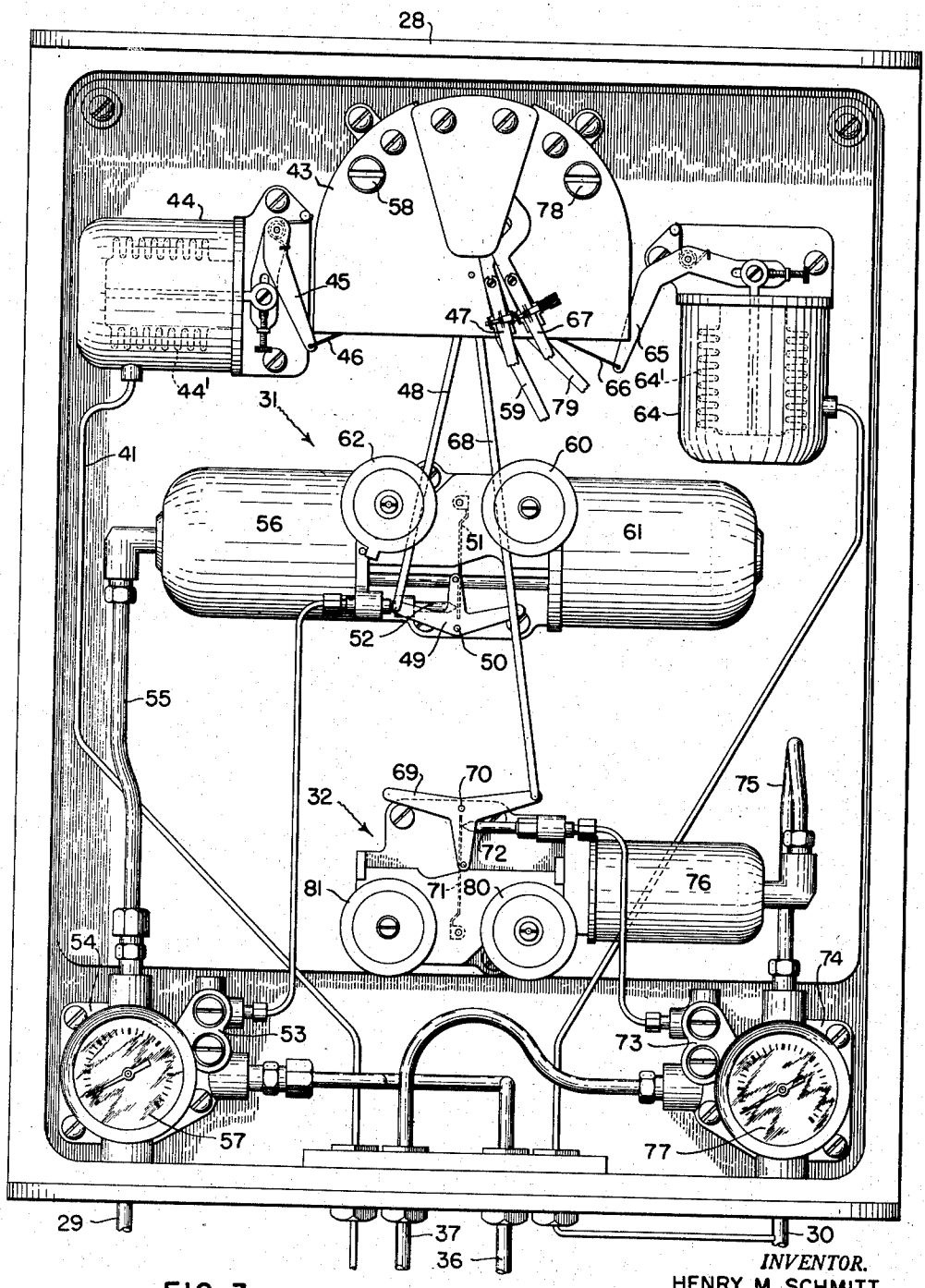


FIG. 3

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CLOTH BLEACHING OPERATION

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Application June 16, 1945, Serial No. 599,825

2 Claims. (Cl. 8—151)

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The present invention relates to a bleaching system of the known type in which cloth is bleached by subjecting it to a plurality of washing, chemical treating, steaming and drying operations, one after another in some definite order, and including at least one operation in which the cloth in a water wet or saturated condition is passed into and through a caustic bleaching liquor bath.

The general object of the present invention is to provide an improved method of, and improved apparatus for automatically controlling the water content, or degree of saturation of the cloth passing into said bath, and for controlling the rate of addition to the bath of concentrated bleaching liquid which unites with the water carried into the bath by the cloth to form a suitably dilute bath liquor. By suitably controlling the cloth water content and the addition of the concentrated bleaching liquid to the bath in accordance with the present invention, it is possible to maintain the desired volume and composition of the bath liquor.

A further object of the invention is to automatically control the bath liquor content, or degree of saturation, of the cloth leaving the said bath so as to insure uniform operation and the avoidance of bath liquor waste in the subsequent treatment of the cloth.

In the preferred form of the invention, I utilize air control apparatus which may be of well known commercial form, to maintain a controlling air pressure proportional to the volume of bath liquor in the bath, and utilize variations in that controlling pressure to regulate the compression or wringer action to which the cloth entering the bath is subjected by so-called "nip" rolls between which the cloth passes, and to regulate the feed of a chemical bleaching agent to the bath.

In the preferred form of the invention, the bath liquor content, or degree of saturation, of the cloth leaving the bleaching liquor bath is regulated by regulating the compression or wringer action of a pair of nip rolls between which the cloth is passed immediately after leaving the said bath. In the preferred form of the present invention, the last mentioned regulating action is obtained by the use of air control apparatus of known type combined in a so-called dual measuring and air control instrument with the first mentioned air control apparatus.

The various features of novelty which characterize my invention are pointed out with particularity in the claims annexed to and forming a part of this specification. For a better understanding of the invention, however, its advantages, and specific objects attained by its use, reference should be had to the accompanying drawings and descriptive matter in which I have illustrated and described preferred embodiments of the invention.

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Of the drawings:

Fig. 1 is a view diagrammatically illustrating a portion of a bleaching system;

Fig. 2 diagrammatically illustrates control apparatus associated with a saturator element shown in Fig. 1, and

Fig. 3 is an elevation on a larger scale of an instrument shown in Fig. 2.

In Fig. 1, I have diagrammatically illustrated the final portion of a cloth bleaching system of conventional type. The apparatus shown diagrammatically in Fig. 1 comprises means for moving a cloth web 1 successively through washing devices 2, a bleaching liquor bath held in a saturator tank or vessel 3, a so-called J-box 4, a pair of washing rolls 5, a multiplicity of drying cylinders or "cans" 6, and rolling apparatus 7 in which the bleached and dried fabric is wound about a suitable spool 7'. The cloth passes into the saturator immediately after passing between nip rolls 8 and 9, and passes between nip rolls 10 and 11 immediately after passing out of the saturator 3. In addition to the nip rolls 8, 9, 10 and 11, the apparatus shown in Fig. 1 comprises numerous rolls employed to effect the movement of the cloth, and to define its path of movement, through the apparatus shown in Fig. 1, but as such rolls are conventional and form no part of the present invention, they need not be further referred to herein.

A bleaching system of the conventional type illustrated includes apparatus, not shown herein, which acts on the cloth before it reaches the washers 2 shown in Fig. 1 and may comprise a sodium hydroxide bath, a J-box, and in many cases an acid bath as well as cloth washers.

In the operation of the apparatus shown in Fig. 1, the pressure or wringer action of the nip rolls 8 and 9 on the cloth passing between them, determines the water content, or degree of saturation, of the cloth passing into the bath in the saturator 3. In normal practice, the weight of the water carried by the cloth entering the bath is ordinarily between 65% and 80% of the weight of the cloth. Similarly, the pressure between the nip rolls 10 and 11 determines the bath liquor content or degree of saturation of the cloth passing away from the saturator 3. In normal practice, the weight of the bath liquor carried

out of the saturator by the cloth should be approximately equal to the weight of the cloth.

In the J-box 4, the cloth is allowed to fold as shown so as to suitably prolong the detention period during which each unit of length of the cloth is within the J-box 4. The cloth is subjected to a steaming action in the J-box 4 which acts on the bleaching liquor carried by the cloth and opens up the cloth fibres. The bath liquor in tank 3 is the final bleaching agent, and the bleaching operation will not be efficient if the cloth carries an inadequate amount of bath liquor in the J-box 4, but if the cloth carries more bath liquor into the J-box 4 than is required for efficient bleaching, bleaching liquor is wasted and the bleaching operation cost rises.

In the conventional bleaching system illustrated, the bleaching agent in the saturator 3 is usually sodium peroxide (Na_2O_2). As shown in Fig. 2, it is supplied in concentrated liquid form by feed pipe 15 to the inlet of a pump 16 which discharges through pipe 17, and a manually operable valve 18, to the inlet of a three way valve 19. The latter has one outlet discharging through pipe 20 to the saturator 3, and a second outlet connected to pipe 21 which returns the supply pipe 15 liquid passed by the pump 16 to the valve 19 when the adjustment of that valve prevents some or all of the liquid received from passing through pipe 20 to the saturator. As shown, the valve 19 includes an actuator of the fluid pressure motor type to the pressure or diaphragm chamber 19A, of which a controlling air pressure is transmitted by a pipe 22.

The pressure of the nip rolls 8 and 9 against the cloth passing to the saturator 3, is controlled by the pressure in the pressure or diaphragm chamber 23 of a pressure regulator of the fluid pressure motor type. Said regulator includes a strut or rod 24 which is longitudinally adjusted by variations in fluid pressure in the chamber 23 and has its lower end connected to bearing blocks 25. The latter are mounted for vertical movement in a guideway 26 in which the trunnion end portions 9' of the nip roll 9 are journalled. In the arrangement shown, the controlling air pressure transmitted through the pipe 22 to the pressure chamber 19A of the valve 19, is also transmitted through a pipe 27 to the pressure chamber 23 associated with the nip rolls 8 and 9.

The pressure between the nip rolls 10 and 11 is controlled by means comprising parts 23', 24', 25' and 26' similar to the previously mentioned parts 23, 24, 25 and 26, respectively, and associated with the nip roll 11, as said parts 23—26 are associated with the nip roll 9.

The controlling pressure transmitted to the pressure chambers 19A and 23 by the pipes 22 and 27, respectively, is established by a control instrument 28 and is transmitted from the latter through a pipe 29 to the pipes 22 and 27. The controlling pressure transmitted to the pressure chamber 23' is also established in the instrument and is transmitted therefrom to the chamber 23' by the pipe 30. As hereinafter explained, the instrument 28 includes separate instrumentalities for establishing the control pressures transmitted by the pipes 29 and 30.

As shown in Fig. 3, the instrument 28 is of the type known as a "dual" air controller and includes two air control units 31 and 32. The unit 31 includes follow-up and automatic compensating or reset provisions which may be, and are conventionally shown as, of a type and form disclosed in the Moore Patent 2,125,081. The control unit 32 is of the so-called "full throttler" type which includes follow-up provisions but no automatic compensating or reset provisions, and which may be, and as conventionally shown is, of a type disclosed in said Patent 2,125,081.

Air under suitable pressure is supplied to the instrument 28 for the operation of its air control mechanisms through branches 36 and 37 of an air supply pipe 35. Another branch 38 of the pipe 35 supplies air through a needle valve 39 and flow indicator 40 to a level measuring pipe 41. The latter extends down into the bath liquor in the tank 3 and has its lower end 42 open and well below the minimum working liquid level in the tank. The upper end of the pipe 41 extends into the casing of the instrument 28 and is therein connected to a bellows type pressure responsive element 44 of well known type. The slow flow of air into the pipe 41 from the pipe 35 permitted by the valve 39 maintains a pressure in the pipe 41 corresponding to the bath liquor head or hydraulic pressure at the level of the open lower end 42 of the pipe 41. The air pressure transmitted by the pipe 41 to the device 44, is thus proportional to, and is a measure of, the height of liquid level in the tank 3. The flow indicator 40 may be a so-called bubbler through which air is bubbled so that the rate of air flow is indicated by the number of air bubbles formed per unit of time.

The variations in the pressure transmitted by the pipe 41 to the responsive device 44 expand and contract the bellows 44' of element 44 and thereby oscillate a lever 45 which has one end connected to, and longitudinally adjusts, a link 46. The link 46 is the actuating element of a recording and control unit included in a mechanism assembly 43 and comprising a pen arm 47 which is angularly adjusted, and a control link 48 which is longitudinally adjusted, by the longitudinal adjustments of the link 46. The longitudinal adjustments of the link 48 turn a valve operating lever 49 about its pivot 50 and thereby cause a flapper valve 51 to approach or move away from the bleed orifice in the adjacent end of a bleed nozzle 52. The latter constitutes one end section of a pipe which has its other end connected to the air supply pipe branch 36 through a device 53. The latter includes a flow restricting orifice and usually includes an air filter. In consequence of the flow restriction in the device 53, the pressure in the bleed nozzle is varied by the movement of the flapper valve away from and toward said nozzle, between a minimum which may be a pound or so per square inch, and a maximum which is the full pressure in the supply pipe 35, and may be of the order of 17 pounds or so.

The varying control pressure in the nozzle 52 is transmitted through device 53 to a pilot valve 54. The latter also receives air through the device 53 from the branch 36 of the supply pipe 35 at the pressure in the latter. The air thus received is utilized in maintaining a pressure in a pipe 55 which is proportional to the pressure in the bleed nozzle 52. The pipe 55 is connected to, and thereby determines the pressure in the pipe 29 connected through branches 22 and 27 to the pressure motor chambers 19A and 23. The pipe 55 also transmits the pilot valve pressure to the follow-up mechanism 56 of the air controller unit 31. That follow-up mechanism operates, following each adjustment of the flapper valve 51 produced by a longitudinal movement of the link 48, to adjust the supporting pivot 50 of the lever 49 in the direction to eliminate a portion

of the said adjustment of the flapper valve preceding the operation of the follow-up mechanism. The unit 31 also includes a reset or compensating mechanism 61, which tends to eliminate, more or less slowly, each adjustment of the valve 51 effected by the follow-up mechanism 56. The rate at which the compensating or reset adjustment is effected may be regulated by adjustment of the rotatable adjustment device 62.

The overall effect of the adjustment in the pressure transmitted from the instrument 28 to each of the pressure motor chambers 19A and 23, is to increase or decrease the amount of bath liquor in the tank 3, following any decrease or increase, respectively, in the air pressure in the pipe 41. As shown, the instrument 28 includes a gauge 57 which may be calibrated to show either the pressure in the pipe 41, or the pressure in the pipes 29 and 55.

The adjustments of the flapper valve 51, effected as above described, tend to maintain a normally constant quantity of bath liquor in the tank 3. That constant quantity can be varied, or regulated, by the rotation of a control point adjustment element 58 included in the mechanism assemblage 43. The effect of that adjustment is to change the relation between the longitudinal adjustments of the links 46 and 48. An index or control point setting pointer 59 is adjusted by the adjustment of the device 58 and indicates on the record chart of the instrument 28, the amount of liquor which the apparatus tends to maintain in the tank 3. The thrattling range, or ratio between the longitudinal movements of the links 46 and 48 can be adjusted by rotating an adjustment device 60.

In respect to the above mentioned features through which the instrument 28 varies the pressure in the pipe 29 in response to a variation in the pressure transmitted to the element 44, the apparatus shown does not differ significantly from mechanism fully disclosed in the above mentioned Patent 2,125,081 and now in extensive use in this country.

The air controller unit 32 differs in essential principle from the unit 31 only in that it omits the automatic mechanism of the unit 31. As shown in Fig. 3, the mechanism associated with the unit 32 comprises parts 64 to 80 corresponding respectively to the previously mentioned parts 44 to 60. The unit 32 also includes manual reset means including a rotatable adjusting element 81. The unit 32 does not differ in principle and need not differ significantly in form from the so-called full throttler unit illustrated and described in prior Patent 2,125,081. The lever and linkage units mounted in the housing 43 and respectively associated with the air controller units 31 and 32 are similar to one another and the two pen arms 47 and 67 turn about adjacent axes.

The general mode of operation of the invention in the form disclosed may be summarized as follows. An increase or decrease in the height of liquid level in the saturator tank 3 results in an increase or decrease in the air pressure in pipe 41. An increase in that pressure results in an angular adjustment of the lever 45 which through the link 48 and lever 49 causes the flapper 51 to approach the nozzle 52 and increase the pressure in the nozzle 52. The pressure increase in the nozzle 52 causes a corresponding increase in the pressure in the pipes 55 and 29. An increase in the pressure in pipe 29 acts through the pressure chamber 23 to increase the pressure between the nip rolls 8 and 9. That increase in roll pressure wrings more water out of the cloth 1 passing to the said rolls with the result that the cloth carries less water into the saturator tank 3.

The pressure increase in the pipe 29 also acts through the pressure chamber 19A of the three-way valve 19 to adjust the latter so as to interrupt or reduce the passage of the concentrated bleaching agent through the pipe 20 to the tank 3, while correspondingly increasing the amount of bleaching agent returned from the valve 19 through the pipe 21 to the feed pipe 15. The reduction in the amount of water carried into the bath by the cloth and the amount of bleaching agent passed into the tank through the pipe 20 checks the rise in liquid level in the tank 3. Conversely, on a decrease in the liquid level in the tank 3, the resultant decrease in the pressure transmitted to the instrument 28 through the pipe 41, correspondingly decreases the pressure transmitted through pipe 29 and its branches 22 and 27 to the pressure chambers 19A and 23.

The effect of the pressure reduction in said chambers is to increase the amount of bath liquor passing to the saturator from the valve 19 through the pipe 20 and to increase the amount of water carried into the bath by the cloth 1. The instrument 28 thus operates in response to variations in the pressure in the pipe 41 to effect adjustments tending to hold that pressure constant and thereby maintain a predetermined height of liquid level in the tank 3. The height maintained depends upon the adjustment of the control point adjusting device 58.

The apparatus described, when properly calibrated with respect to the character of the cloth being bleached and other conditions of operation, will proportion the amounts of water and concentrated bleaching agent supplied to the tank 3 as required to maintain the composition of the bath liquor substantially constant. If the amounts of water and bleaching agent passing to the tank are not properly proportioned the bath liquor in the tank will more or less slowly increase or decrease in strength. Such variations in the strength of the bath liquor may be compensated by suitable manual calibrating adjustments of the apparatus. Such compensation may be effected, for example, by varying the operative length of the threaded connection 24 between the bearing blocks 9' for the nipper roll 9 and the diaphragm in the pressure chamber 23. Alternatively, a suitable corrective effect may be obtained by increasing the tension of the spring, not shown, but invariably provided in a fluid pressure motor of the character shown, to oppose and partially neutralize the tendency of the pressure in the chamber 23 to lower the roll 9.

The operative purpose and effect of the control action of the instrument 28 on the pressure in the chamber 23' is to maintain the pressure between the exit nip rolls 10 and 11 constant under any particular condition of operation, and to vary that pressure readily and accurately when operating conditions change. Such adjustment of the pressure transmitted to the pressure chamber 23 is effected by adjustment of the control point adjustment device 78 of the instrument 28. A definite adjustment of the pressure between the exit nipper rolls 10 and 11 is customarily required whenever the character of the cloth treated is changed. For example, the amounts of bath liquor which should be carried

into the J-box 4 by rayon velvet and canvas are quite different.

While in accordance with the provisions of the statutes, I have illustrated and described the best form of embodiment of my invention now known to me, it will be apparent to those skilled in the art that changes may be made in the form of the apparatus disclosed without departing from the spirit of my invention as set forth in the appended claims and that in some cases certain features of my invention may be used to advantage without a corresponding use of other features.

Having now described my invention, what I claim as new and desire to secure by Letters Patent, is:

1. In the cloth bleaching operation in which water wet cloth is passed continuously into and through a bath of bleaching liquor, the method of regulating the volume while maintaining the composition of the bath liquor substantially constant which consists in increasing and decreasing the rates at which water is carried into the bath by the cloth and at which a bleaching agent uniting with water to form bleaching liquor is passed into the bath in predetermined accordance with decreases and increases, respectively, in the height of bath level, and in squeezing the cloth passing away from the bath to reduce the reduction in the volume of the liquor bath produced by the movement of the cloth through and away from the bath.

2. A method as specified in claim 1, in which the amount of water carried into the bath by the cloth is varied by decreasing and increasing the pressure between a pair of nip rolls passing the cloth to said bath, in accordance with decreases and increases, respectively, in the bath level height.

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