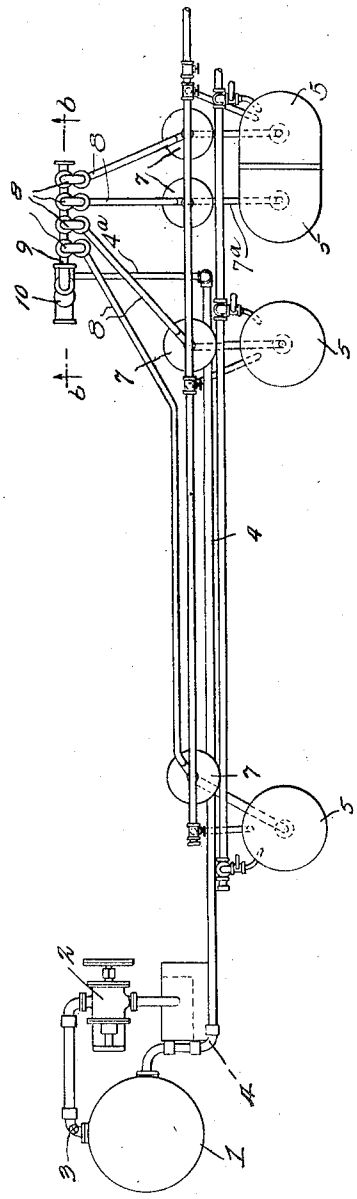
March 26, 1929. G. W. STEIGER 1,706,827

PROCESS OF AND APPARATUS FOR EFFECTING DYEING, BLEACHING, AND SIMILAR OPERATIONS UPON TEXTILE FABRICS

Filed Jan. 15, 1927 4 Sheets-Sheet 1

Fig. 1.



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Filed Jan. 15, 1927 4 Sheets-Sheet 2

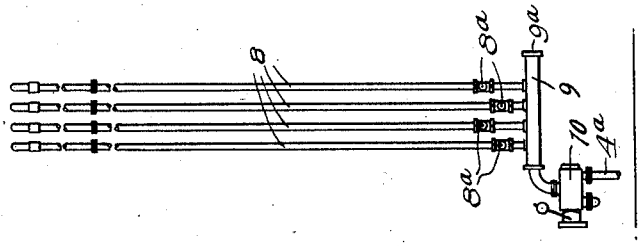

Fig. 3.

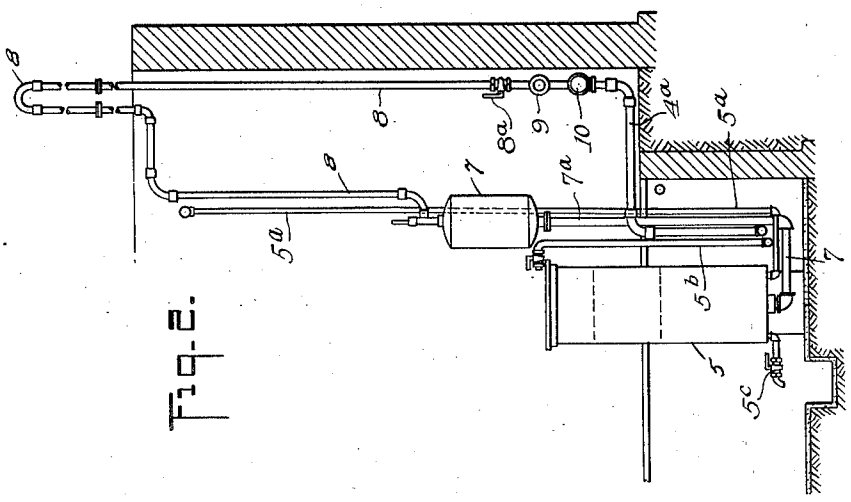

Fig. 2.

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Filed Jan. 15, 1927 4 Sheets-Sheet 3

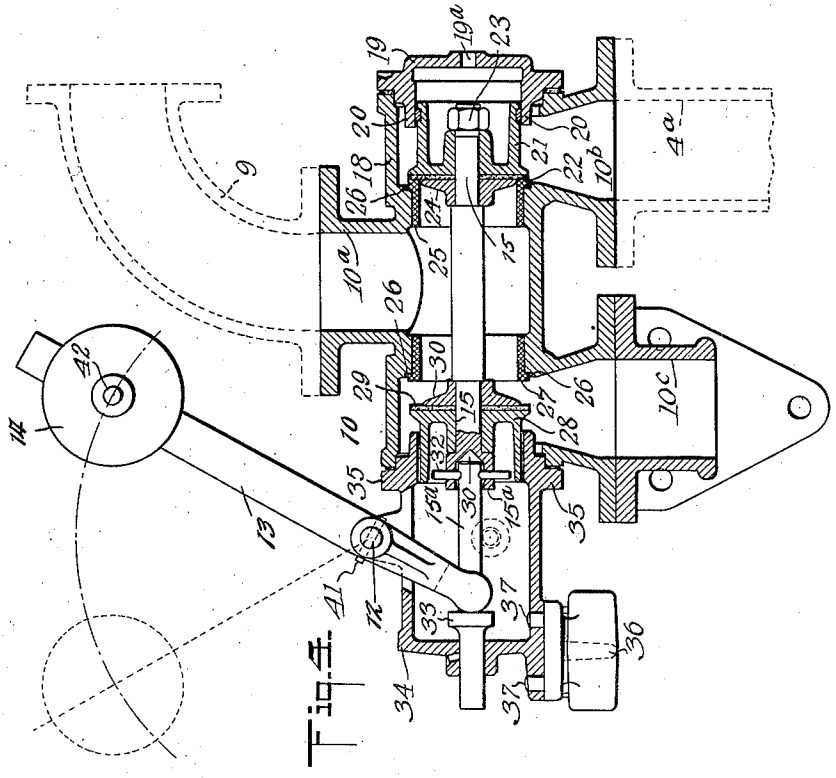

Fig. 4.

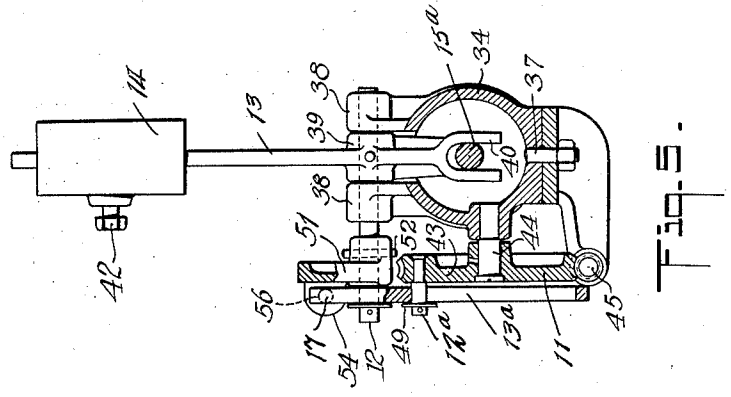

Fig. 5.

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Filed Jan. 15, 1927 4 Sheets-Sheet 4

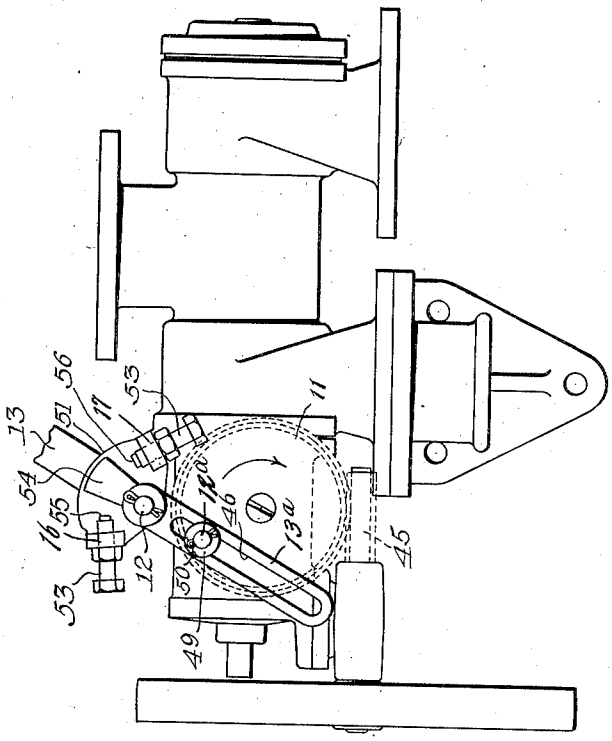

Fig. E.

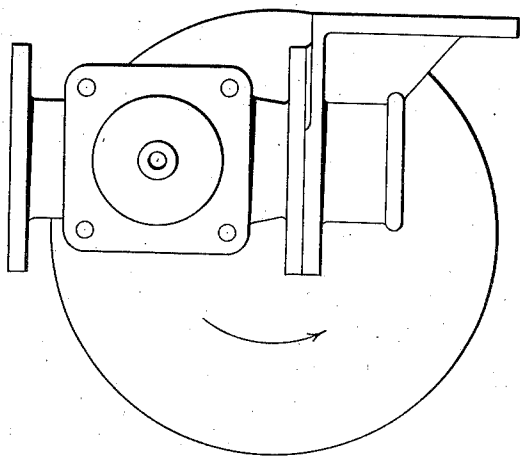

Fig. 7.

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PROCESS OF AND APPARATUS FOR EFFECTING DYEING, BLEACHING, AND SIMILAR OPERATIONS UPON TEXTILE FABRICS.

Application filed January 15, 1927. Serial No. 161,312.

This invention relates to improvements in methods of and apparatus for effecting the dyeing, rinsing, after treatment and extraction and similar operations carried out in the production of textile fabrics. The invention relates to the dyeing and bleaching of all kinds of textile yarns including rayon (artificial silk) and the like. More specifically the invention relates to a vacuum arrangement for automatically operating a plurality of apparatus comprising, say, boiling off apparatus, rinsing, after treatment, and extracting and drying apparatus, and it has for its object to provide means whereby the automatic operation of the various stages of treating textile materials may be effected simultaneously, consecutively, or separately, at will. The further object of the invention is to eliminate the necessity for the rotation or other handling of the textiles during treatment whilst effecting efficient dyeing or bleaching or similar operations thereon. In brief, the invention consists in the automatic movement of the various or separate liquors employed in the different stages of the production and treatment of textiles, by vacuum means, and in conjunction with this various improvements in the apparatus employed will be hereinafter fully described while other purposes and modifications of this invention will be obvious from a consideration of the following description and claims.

In order that the invention may be more clearly understood the same will be now described with reference to the accompanying drawings in which various parts of the apparatus are shown in more or less diagrammatic views and in which

Figure 1 shows a diagrammatic plan view of a plant forming one modification of the present invention, and

Figure 2 shows a section on line A—A.

Figure 3 shows a section on line B—B.

Figure 4 is an enlarged sectional elevation of a control valve for automatically operating the vacuum.

Figure 5 is a corresponding end elevation of Fig. 4.

Figure 6 is a plan view of the control valve shown in Figures 4 and 5, while

Figure 7 is an end elevation of Figure 6.

Referring to the drawings, a vacuum tank 1 usually housed in the basement of the textile shed, is connected by means of pipe 2^a with a vacuum pump 2 of the usual kind; on the pipe 2^a is situated a vacuum control or release valve 3 which carries a weight, not shown, which is removable on an operating shaft or rod, whereby the amount of vacuum created in tank 1 is varied at will. Thus, when this weight is pulled to the end of the rod, more resistance to the closing of pipe 2^a is experienced and a greater vacuum created in tank 1.

The vacuum tank 1 is in turn connected to a series of boiling-off, rinsing, after-treatment and dyeing tanks and like apparatus, by means of the common vacuum line 4 in the following manner. The vacuum pipe line 4 is connected by any suitable pipe 4^a, which might well be a mere continuation of pipe 4, to an automatic governor control valve 10 of special design. This control valve 10 will be fully described later, but for the present it is sufficient to understand that this automatic valve can be operated to release and to bring about a condition of vacuum at predetermined periods in one or more of a plurality of vacuum extension lines 8 connected in parallel to a common vacuum line 9 operated by the control valve 10.

These vacuum extension lines 8 are shown in clearer view in Figs. 2 and 3, and it will be seen that each line 8 extends upwards to a considerable height, while each line 8 is also provided with a cock or valve 8^a whereby the vacuum created or released in pipe 9 can be applied, at will, to each one or more of the several lines 8. It may be noted here that the end 9^a of pipe 9 is not open to the air; only four lines 8 are shown, but it will be understood that more or less of these can be provided according to the needs of the system.

Each pipe line 8 extends upwardly to a height of at least 33 feet and preferably to

a height of from 40 to 50 feet, and then returns downwardly to connect with one or more of the several vessels suitably arranged on the floor of the shed. Each pipe line 8 can, if desired, directly connect with the base of a rinsing, dyeing or other tank. On the other hand each pipe 8 may terminate at the upper part of an expansion tank 7 (Fig. 2) disposed away from and above the vessel to be operated by vacuum. Preferably the base of such an expansion tank 7 is higher than the top of the treating vessel 5. Referring to Fig. 2 is will be seen that the expansion tank 7 is provided with outlet pipe 7^a connecting with the base of tank 5. Pipes 5^a and 5^b denote steam and water lines respectively and a draw-off pipe 5^c is also provided.

Referring back to Fig. 1 it will now be seen that the vacuum tank 1 is connected through pipes 4, 4^a, control valve 10, pipe 9, pipes 8, to a series of treating tanks 5 through suitably disposed expansion tanks 7 and pipes 7^a.

Reference is now directed to Figs. 4 and 7 inclusive, which show in various views control valve 10 in detail. The control valve 10 comprises casing 18 having three openings, 10^a, 10^b and 10^c connected respectively to the vacuum line 9, vacuum line 4 or 4^a and to the atmosphere. The casing 18 has a cap 19 with air-port 19^a secured thereto and extending inwardly to form a sleeve 20, said sleeve 20 being adapted to receive a piston valve 21 having a packing ring 22 of any suitable material and carried on a piston 15. The piston valve 21 is secured to the piston 15 by any suitable means such as by the nut 23, and for this purpose the end of the piston 15 is screw-threaded to receive the nut 23. The piston valve 21, preferably hollow, slidably engages in the sleeve 20 as indicated in Fig. 4. The packing-ring 22 is preferably secured on its other side with a plate 24 attached to the piston 15, the plate 24 slidably engaging with the inner surface of an optional stationary cylinder or seating 25 secured in the casing 18 and carrying flanges 27 resting in suitable detents 26 in the casing 18. At the other end of the piston 15 is a second piston valve 28 similar to piston valve 21 carrying packing-ring 29 and plate 30. The other end of piston 15 terminates in a cup 31, adapted to receive piston 15^a secured therein by any suitable means such as with a pin 32. The piston 15^a carries a suitable shoulder or abutment 33 and the other end of the piston 15^a slidably engages in a casing 34 secured to the casing 18 and carrying a sleeve member 35 adapted to receive the cylinder 28 in a similar manner to the reception of the cylinder 21 by the end 19.

The casing 34 is secured to a base 36 by means of bolts 37 and abutments 38 are provided adapted to receive and to support a spindle or rod 12 rotatable therein.

An arm 13 formed with shoulders 39 is rotatably mounted upon the spindle 12, the abutments or shoulders 38 maintaining the shoulders 39 and the arm 13 in position on the spindle 12. The arm 13 extends inwardly into the chamber 34 and terminates into a U or forked-shaped member 40 adapted to slidably engage and to straddle the piston 15^a. The U-shaped end member 40 is preferably of circular formation, and it is adapted to contact with the shoulder 33 and with the end 15^b on the pistons 15^a and 15 respectively upon movement of the spindle 12. The arm 13 is secured to the spindle 12 by a suitable pin 41. The arm 13 also carries an adjustable weight 14 whose position on the arm 13 can be varied at will by release of the screw 42.

A grooved wheel 43 mounted on a shaft 44 secured in the casing 34 co-acts with a worm wheel 45 suitably positioned in the base 36. The worm wheel 45 is driven by a suitably disposed electric motor, not shown, and the rotation of the worm wheel 45 causes the grooved wheel 43 to rotate on the shaft 44. The wheel 43 carries an abutment 12^a engaging in a slot 46 of slotted arm 13^a slidably engaging the spindle or rod 12. A suitable washer 47 and pin 48 maintain the slotted arm 13^a in position on the spindle 12. Similarly a washer 49 and pin 50 maintain the slotted arm 13^a in position with respect to the pin 12^a.

On the spindle 12 a member 51 is secured by a pin 52, and carries abutments or lugs 16 and 17. The slotted arm 13 slidably engages with the spindle 12 and terminates in an integral plate 54. The lugs 16 and 17 carry adjustable set screws 53 having shoulders 55 and 56.

The pinion 12 therefore moves up and down the slotted arm 13^a which is free to rotate about the spindle 12. In Fig. 5 the arm 13 is shown in a position of equilibrium but a continued rotation of the worm wheel 45 rotating the wheel 43 brings the pin 12^a into contact with the upper extremity of the slot 46 in slotted arm 13^a, and hence to rotate arm 13^a about the axis 12, causing extension piece 54 to contact with one or other of the shoulders 55 and 56 of set screws 53 carried in lugs 16, 17, on member 51. The contact of member 54 with either shoulder 55 or 56 moves member 51 secured to spindle 12, and hence rotates spindle 12 and with it arm 13 carrying weight 14. When the arm 13 has been rotated sufficiently to place weight 14 is position of equilibrium any slight further movement will cause gravity to act on weight 14 to rotate the arm 13 sharply causing end 40 to contact with shoulder 33 or end 15^b, according to position of pin 12^a in respect to slotted arm 13^a.

When pin 12^a contacts with upper end of slotted arm 13^a, extension 54 contacts with shoulder 55, rotating member 51 and anti-clockwise direction when viewed as in Fig. 5. The arm 13 is slowly rotated in anti-clockwise direction until weight 14 passes the line of center of gravity when it falls abruptly to take up such a position as is shown in dotted lines in Fig. 4. The end 40 of arm 13 will, in this case, impact against end 15^b of piston 15, causing piston 15 to move laterally whereby piston valve 21 abandons seating 25 and piston valve 28 contacts with seating 25, establishing communication between air inlet 10^c and vacuum line 9 while closing vacuum line 4^a. Similarly a reverse movement is effected when pin 12^a engages with the bottom end of slot 46 in arm 13^a and connection is established between vacuum line 4^a and pipe 9.

It will be readily understood that by adjusting the screws 16 and 17 the period in which the movement of the arm 13 takes place can be varied at will. In other words the time interval for the movement of the arm 13 can be predetermined as desired. With each movement of the arm 13 the piston 15 (Fig. 4) is operated in one direction or the other, and hence the vacuum line 9 is alternately connected with the vacuum line 4^a and with the air inlet 10^c.

With each movement of the piston 15 vacuum is therefore released or brought into being in the vacuum line 9, and hence into one or more of the vacuum extension lines 8 according to whether or not the cocks or valves 8^a are open or closed.

Referring now once more to Fig. 2 and assuming that, say, dyed liquor is in the treating tank 5 and also any material to be dyed is already placed in that tank, the vacuum engine is put into operation, causing a vacuum to take place along pipes 4, 4^a, and through the control valve 10 into pipes 9 and 8, into expansion chamber 7 and from thence via pipes 7^a to the base of the treating tanks 5. Automatic operation of the control valve 10 causes this vacuum to be alternately released and brought into operation. When the vacuum is on the liquor in the treating tank 5 is drawn downwardly and up into the pipe 7^a to the expansion tank 7 and possibly also into some portion of the vacuum extension line 8. It will have been noted that this extension line 8 is preferably more than 33 feet in height, and this is to prevent any of the liquor being drawn over the top of the pipe 8 and into the control valve 10, since it is well known that 33 feet is about the limit to which water can be drawn upwardly by vacuum. The closing of the vacuum inlet 10^b in the control valve 10 by movement of the piston 15 admits air through the inlet 10^c and into the lines 9 and 8 respectively. Hence no vacuum exists above the level of the liquor in the expansion tank 7 of the extension line 8 and the liquor returns by gravity to its former position in the treating tank 5. In Fig. 2 two dotted lines indicate approximately the various heights which can easily be attained by the control and release of the vacuum in the pipe 8. Consequently the liquid is automatically moved up and down in the tank 5 and the material to be dyed or otherwise treated therewith is subjected to regular action without necessarily handling the material at all. In other words the liquor is agitated adequately without any human labor or guidance.

It will be obvious from the above brief description of the various parts comprising the apparatus employed in effecting the operation of the present invention, that the vacuum generated in the tank 1 can be applied at will to any or all of the various apparatus in connection therewith, and although in the present drawings only four such apparatus are shown, it will be understood that no limit is placed upon the number of such apparatus which may be used in accordance with this invention. The vacuum is automatically controlled by means of the governor valve 10 which alternately opens and closes the vacuum pipe line 4 and the provision of suitable cocks or the like on the series of extension pipe lines 8 enables the vacuum to be directed to one or more of the various apparatus in operation. The return flow of the liquors from the expansion tanks 7 is permitted by the provision in the top of each material carrier of a suitable valve device so that the liquid rises into each tank to regain initial depth as indicated by the upper dotted line in Fig. 2, whereas when the vacuum is in operation the liquid is withdrawn to a lower position such as that indicated by lower dotted line in Fig. 2.

It will be understood that the provision of an expansion tank as depicted in Fig. 2 may be made in any number or all of the various apparatus employed, so that the agitation of the liquid in each of the several baths may be operated at will. Various modifications will readily suggest themselves to those skilled in the art and it must not be taken that the above description is limiting in any sense save by the interpretation of the features defined in the appended claims.

I claim:

1. A process for effecting the dyeing, rinsing, after treatment, extraction and similar operations in the production of textile fabrics wherein the liquid in the several baths is caused to flow in alternately upward and downward direction by the action of intermittent vacuum.

2. A process for effecting the selective dyeing, rinsing, after treatment, extraction and similar operations in the production of

textile fabrics wherein the liquid in the several baths is selectively agitated by vacuum.

3. An apparatus for effecting the dyeing, rinsing, after treatment, extraction and similar operations carried out in the production of textile fabrics, comprising a vacuum tank, a pipe connecting said vacuum tank to each of the series of dyeing, rinsing, after treatment, extraction and similar baths, means for effecting the alternate operation and release of the vacuum and means for temporarily storing the liquid drawn from each of the several baths in the action of the vacuum, and means for effecting the return flow of said liquid under release of said vacuum into each of said several baths.

4. An apparatus for effecting the dyeing, rinsing, after treatment, extraction and similar operations in the production of textile fabrics according to claim 3, wherein the means for temporarily storing the withdrawn liquids comprises in each case an extended pipe line rising to a height of at least 33 ft. said pipe lines connecting with the pipe leading to said vacuum tank, and means for selectively operating one or more of the series of extended pipe lines.

5. An apparatus for effecting the dyeing, rinsing, after treatment, extraction and similar operations in the production of textile fabrics according to claim 3, in which means are provided for temporarily storing the withdrawn liquids comprising in each case a receiving tank and an extended pipe line rising to a height of at least 33 ft. said pipe lines connecting with the pipe leading to said vacuum tank, and means for selectively operating one or more of the series of extended pipe lines.

6. In an apparatus for effecting the dyeing, rinsing, after treatment, extraction and similar operations carried out in the production of textile fabrics of the kind described, the provision of a governor valve adapted to operate the release and closing of the vacuum pipe lines, means for operating said governor valve and means for adjusting the operation of said valve.

7. An apparatus for dyeing, rinsing, washing and bleaching textile fabrics which comprises a source of vacuum, connections between said source of vacuum and the bases of a plurality of treating tanks, and means disposed intermediate said treating tanks and said source of vacuum for intermittently releasing and closing the vacuum.

8. An apparatus for dyeing, rinsing, washing and bleaching textile fabrics which comprises a source of vacuum, a plurality of treating tanks having their bases in connection with said source of vacuum, and automatic valve mechanism for releasing and closing said vacuum during predetermined periods.

9. An apparatus for dyeing, rinsing, washing and bleaching textile fabrics which comprises a source of vacuum, treating tanks, expansion tanks exposed above said treating tanks, connections between said expansion tanks and the bottom of said treating tanks, connections between said expansion tanks and said source of vacuum, and means for intermittently releasing and closing said vacuum for predetermined periods.

10. An apparatus for dyeing, rinsing, washing and bleaching textile fabrics which comprises a source of vacuum, treating tanks, expansion tanks exposed above said treating tanks, connections between said expansion tanks and the bottom of said treating tanks, upwardly projecting vacuum extension lines from said expansion tanks to said source of vacuum, and means for automatically releasing and closing said vacuum for predetermined periods.

11. An apparatus for dyeing, rinsing, washing and bleaching textile fabrics which comprises a vacuum pump, a vacuum tank connected thereto, a vacuum pipe line, a control valve for automatically releasing and closing said vacuum pipe line, a plurality of vacuum extension lines from said control valve to a plurality of expansion tanks disposed above a plurality of treating tanks, and pipe connections between the bases of said expansion tanks and the bases of said treating tanks.

12. In an apparatus for the automatic movement of treating liquor in a plurality of treating tanks in the manufacture of textiles, the provision of a plurality of vacuum extension lines rising to a height of at least 33 feet and connecting a control valve with a plurality of expansion tanks connected to the bottom of and disposed above a plurality of treating tanks, and connection between said control valve and the source of vacuum.

13. In an apparatus of the kind claimed in claim 12, the provision of means for the selective action of the control valve on the expansion tanks.

14. An apparatus for treating textiles which comprises a source of vacuum, connections between said source of vacuum and the bases of a plurality of treating tanks, means for intermittently releasing and closing said vacuum, means for the reception and retention of the liquors from said treating tanks when vacuum is closed, said retaining means being adapted to release and return the said treating liquor to the treating tanks upon release of said vacuum.

15. An apparatus for the treatment of textile fabrics comprising a source of vacuum, a plurality of treating tanks in connection at their bases therewith, a governor control valve for intermittently releasing and closing said vacuum, a plurality of extension lines from said treating tanks and means for

selectively operating said vacuum on said treating tanks.

16. In an apparatus of the kind described, the provision of a control valve comprising a casing, a vacuum inlet, an air inlet, and a vacuum pipe connecting with a plurality of vacuum extension lines in connection with the bases of a plurality of treating tanks, a piston operating in said casing to alternately open and close said air inlet and said vacuum inlet, and means for automatically operating said piston.

In testimony whereof I affix my signature.

GEORGE W. STEIGER.