

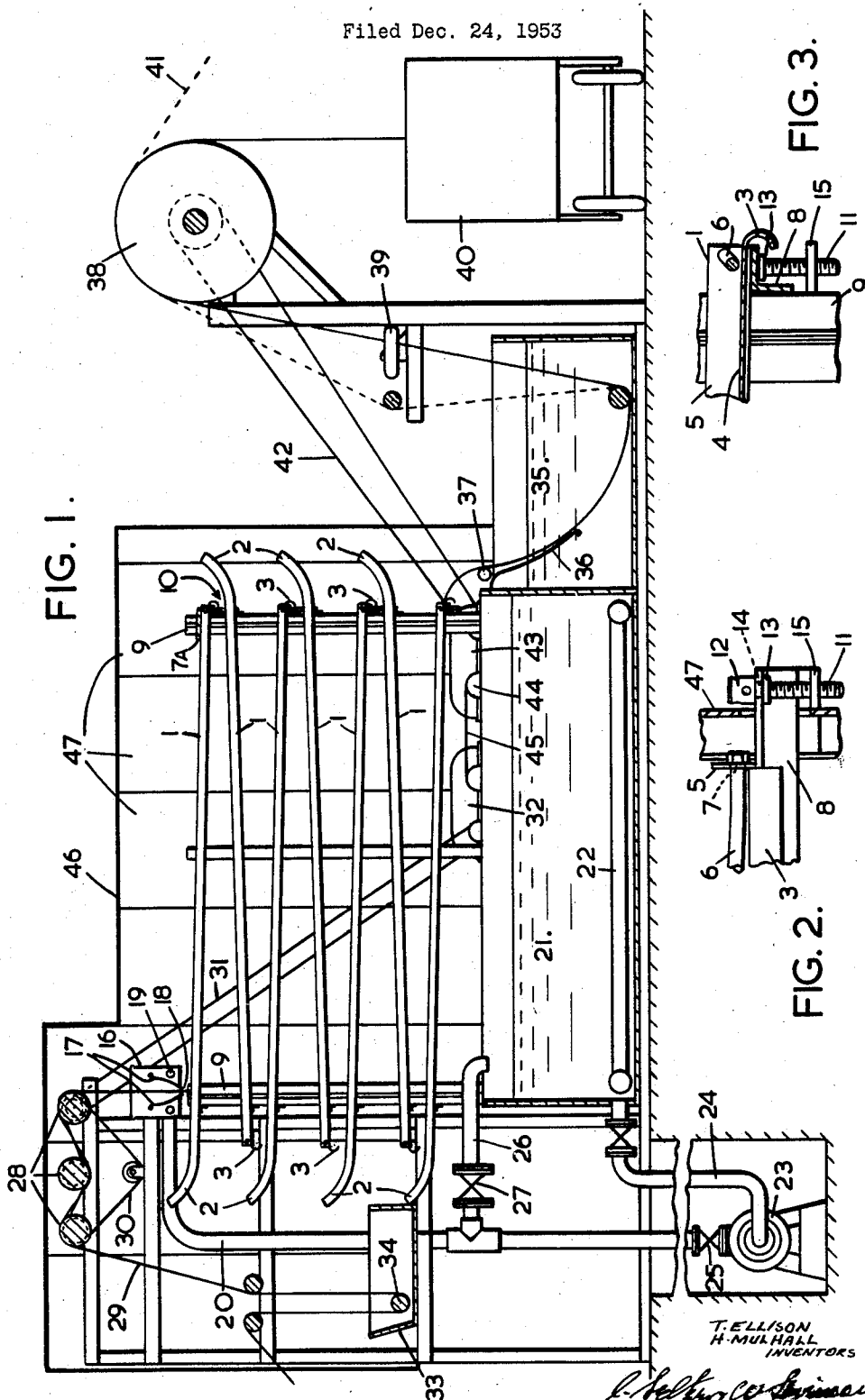
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# APPARATUS FOR TREATMENT OF TEXTILE MATERIALS

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## APPARATUS FOR TREATMENT OF TEXTILE MATERIALS

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4 Claims. (Cl. 26—1)

This invention relates to apparatus for the liquid treatment of textile fabrics.

It is well known that very many textile fabrics depend, for their finished appearance and other physical properties, upon changes brought about by the action of aqueous treatments applied to the fabrics in the form in which they leave the loom. These changes usually involve considerable rearrangement of the yarns of the fabric relative to one another and also shrinkage of the fabric either in the direction of the length of the fabric or in the direction of the width of the fabric, or both. This applies particularly in the case of crepes and other fabrics containing highly twisted yarns but is not restricted to such fabrics. These changes commence almost as soon as the fabric is wetted and it is important, if they are to take place to the desired extent, that the fabric is under a minimum of constraint at this stage. Further it is highly desirable that the fabric should not be permitted to develop creases at this stage, since it may be very difficult or even impossible subsequently to remove such creases, at least without modifying profoundly the character of the fabric. This latter applies particularly to textile fabrics consisting of or comprising yarns of thermoplastic fibres, for example fibres of cellulose acetate, in those cases where the first wetting treatment must be at relatively high temperature. The requirements of minimum constraint and absence of creasing are in large measure conflicting and the design of machines which are convenient in operation and permit aqueous treatment of textile fabrics in continuous manner under these conflicting conditions has been a matter of great difficulty. It is an object of the present invention to provide such a machine.

The machine of the present invention comprises a series of inclined trays down which the fabric to be treated is continuously carried by a current of the treatment liquid. Preferably the trays are disposed one below the other, each tray after the first being disposed so as to receive and forward the liquid and fabric from the preceding tray. The machine may have various other features which are capable of contributing to the convenient and effective operation of the machine. These include for instance the following: (1) A device for wetting the fabric a short time, e.g. a few seconds, before it is fed to the input end of the first or uppermost tray. (2) A device for feeding fabric and liquid to the first tray such that there is a body of liquid on each side of the fabric at the moment when the latter commences its movement along and down the first tray. (3) An expander bar disposed at the lower end of a tray to assist in maintaining the fabric in open width, said bar being slightly separated from the end of the tray so as to permit liquid to escape from beneath the fabric and fall towards the next lower tray. (4) Means permitting collection of the liquid leaving the lowermost tray and means for conducting the fabric away from the end of the lowermost tray and subjecting it immediately to a second treatment liquid, e.g.

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for washing or cooling purposes. (5) Means permitting adjustment of the angle of inclination of the trays.

A particularly useful form of apparatus in accordance with the invention comprises a series of superposed inclined metal trays carried on a suitable framework by means permitting adjustment of the angle of inclination. The upper end of each tray is provided with an upturned lip and the lower end with a down-turned lip, the trays being disposed so that liquid leaving the lower end of one tray is caught by the upper end of the next succeeding tray below. Below the series of trays is a tank for receiving liquid leaving the lowest tray and provided with a steam coil for heating purposes. A pump is provided for withdrawing liquid from the tank and delivering it to the upper end of the uppermost tray. Immediately above the upper end of the uppermost tray is a narrow trough (hereinafter referred to as the "feed-trough") extending across the width of the tray and provided with two partitions extending in the same direction. The upper ends of these partitions are below the level of the walls of the trough and are more widely separated than their lower ends which terminate at or a little below the edges of a narrow slot in the base of the trough. The partitions thus define sides of a passage way within the trough and extending generally downwards from a level below the top of the trough to a level at least as low as the bottom of the trough. Between each partition and the adjacent wall of the trough is a perforated or slotted horizontal pipe which can be supplied with liquid from the tank below the trays by means of the pump. When the latter is in action liquid flows over the tops of the partitions and down the passageway between the latter and so on to the upper end of the uppermost tray. A set of feed rollers is provided for feeding a fabric in open width down between the partitions so that it is carried away by the flow of liquid on to and down the uppermost tray and then in succession down the remaining trays. The lower end of each tray is provided with an expander bar, which may be simply a curved rod of circular cross-section, spaced slightly away from the lip of the tray and arranged so as to spread the fabric transversely and so counteract any tendency of the fabric to crease warp-wise, i.e. lengthwise; the space between the bar and the lip of the tray permits escape of liquid from beneath the fabric and on to the tray below. A bar, e.g. in the form of a plate, may extend across and more or less parallel with, and spaced slightly above, the lower end of the uppermost tray. Similar bars may be fitted to succeeding trays. Such bars are often useful to reduce ballooning of the fabric.

As already indicated the liquid falls away from the lower end of the lowest tray. The fabric may be carried away from this point by any suitable means. Thus it may be allowed to descend into a vat of washing, cooling, or other liquid from which it may be drawn out, beneath a freely rotatable submerged roller, by means of a winch or other suitable device for further treatment. Conveniently the fabric is plaited down on to a trolley by the winch and may then be dyed or further processed as requisite. When the fabric is subsequently to be processed in rope form, as for example dyed on a winch, it may be gathered into rope form by drawing it from the washing or cooling vat through a pot-eye.

Immediately beyond the lower end of the last tray a horizontal perforated pipe may be mounted for spraying washing or cooling liquid on to the underside of the fabric leaving the tray and may be followed by a chute to convey the fabric down into the vat.

The apparatus may be provided with a pre-wetting device for wetting a fabric prior to feeding it with the treatment liquor proper into the feed-trough above the uppermost tray. This may comprise a container for liquid

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provided with a submerged freely rotatable roll under which the fabric can be drawn from a suitable supply by the feed rolls and forwarded in the wet state to the feed-trough. The liquid container is provided with means for heating the liquid content, for example a steam heating coil or a steam injection device.

The system of inclined trays may be enclosed in a casing in order to conserve heat when hot treatment liquors are employed.

One form of apparatus in accordance with the invention will now be described in detail with reference to the accompanying drawing in which:

Fig. 1 shows the apparatus in sectional side elevation.

Fig. 2 shows in front elevation one of the adjustment means for varying the slope of a tray.

Fig. 3 is an enlargement of the end of the uppermost tray in side elevation.

The apparatus comprises a series of superimposed metal trays 1 inclined in the direction of their length. The upper end of each tray is provided with an up-turned portion 2 and the lower end with a down-turned lip 3. Each tray comprises a sheet metal base 4 fixed to angle steels 5 forming the sides of the trays. Both the sheet metal and angles are advantageously of stainless steel. The lower end of each tray is provided with an expander bar in the form of a slightly curved circular metal rod 6 carried in holes 7 drilled in the angle steels 5 forming the sides of the trays. An anti-ballooning bar 7a extends across, parallel with, and spaced slightly above, the lower portion of the uppermost tray. The trays 1 are supported by angle steels 8 in turn supported by a frame work generally indicated at 9. Means generally indicated at 10 and shown in greater detail in Fig. 2 are provided to permit adjustment of the angle of inclination of the trays. The adjustable means comprises a screw 11 provided with a head 12 and collar 13 and freely rotatable in a hole 14 in the angle steel 8. The lower end of the screw 11 screws into a projection 15 carried by the main frame 9. Immediately above the upper end of the uppermost tray is a feed trough 16 extending across the width of the tray and provided with two partitions 17 extending in the same direction. The upper ends of these partitions are below the level of the walls of the trough and are more widely separated than their lower ends which extend through the base of the trough and form a liquid-tight joint therewith. The lower end of the partitions form a narrow slot 18. Between each partition and the adjacent wall of the trough is a perforated horizontal pipe 19 through which treatment liquor can be supplied through the conduit 20. Below the lowermost tray is a tank 21 provided with a steam heating coil 22 and arranged to receive liquid falling from the lower end of the lowermost tray. A pump 23 and conduit 24 are provided for withdrawing treatment liquid from the tank and forwarding it to the feed trough 16 through the perforated pipes 19 so that it may flow over the partitions 17 and down between them and through the slot 18 on to the tray below. The conduit 20 is provided with a valve 25 and a by-pass conduit 26 and valve 27 permitting the pump to return the treatment liquor directly to the tank 21 instead of to the feed trough 16. The valve 25 and the by-pass conduit 26 and valve 27 permit fine control of the flow of liquid delivered by the pump to the feed trough. At a level above the feed trough 16 is a series of three feed rollers 28 adapted to draw a fabric 29 from a fabric supply (not shown) and to deliver it down between the partitions 17 and so on to the uppermost tray. The feed rollers 28 are interconnected by a sprocket-and-chain drive shown schematically and indicated generally by reference numeral 30, one of them being driven by a rope drive 31 from a positively, infinitely variable gear box 32. Between the feed rollers 28 and the fabric supply is a pre-wetting device comprising a trough 33 for containing liquid and having a submerged guide roller 34. The

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trough 33 and guide roller 34 permits fabric drawn from the supply to be wetted out prior to reaching the triple feed rollers 28. A vat 35 is provided for containing cooling or washing liquid and for receiving fabric descending from the lower end of the lowermost tray. A chute 36 is provided to guide the fabric into the vat. Immediately beyond the end of the lowermost tray is a spray pipe 37 for spraying the under-side of the fabric leaving the tray with cooling or washing liquid. A gap between the upper end of the chute 36 and the lower end of the lowermost tray permits the liquid flowing down the tray to fall into the tank 21. A winch 38 is provided for withdrawing the fabric from the vat 35. If the fabric is required in rope form for subsequent processing, it may be withdrawn from the vat through the pot-eye 39, and delivered by the winch into the trolley 40. Alternatively, the pot-eye 39 may be omitted and the fabric drawn in open width from the vat 35, and forwarded by the winch, in the direction generally indicated by the line 41, to a winding and batching device not shown. The winch is driven by the rope drive 42 from a positively infinitely variable gear box 43. The driving shaft 44 of this gear box is driven by a chain and electric motor not shown and serves also to drive the gear box 32 by the chain drive 45.

The trays, feed-box, feed rollers and wetting out trough are enclosed by a casing generally indicated at 46 so as to conserve heat and prevent escape of steam into the atmosphere. The casing may comprise a number of panels 47, e.g. panels of compressed asbestos cement sheets; some of the panels may be of glass to permit inspection of the material under-going processing.

The general method of operating the machine will be apparent from the foregoing description. The fabric to be treated is drawn by the set of feed rolls 28 from a suitable supply, through the pre-wetting device when desired, and fed into the feed-trough 16 from which it is carried by and together with liquid supplied by the pump on to the uppermost tray. It is carried down each of the trays in succession and at the lower end of the last tray most of the accompanying liquid flows downwards into the tank 21 while the fabric passes on past the washing or cooling spray 37 and into the washing or cooling vat 35 when these are employed.

The angle of inclination of the trays and the feed of treatment liquid should be such that the average depth of liquid on the trays and its linear velocity along the trays is sufficient to carry the fabric along at the rate at which it is fed to the uppermost tray. An angle of inclination of  $1\frac{1}{2}^\circ$  to the horizontal has been found useful in practice for fabric speeds of the order of 8 to 16 yards per minute. The total combined length of the trays depends on the fabric speed and the time of treatment desired. An assembly of seven trays of total length 36 to 60 feet (i.e. from about 5 to about 9 feet per tray) affords a time of treatment of  $1\frac{1}{2}$  to  $2\frac{1}{2}$  minutes when the fabric speed is 8 yards per minute.

Various liquid treatments of fabric may be effected on the new machine. The latter is however of particular value, as already indicated, in the case of those treatments which must be effected while the fabric is largely free from constraint if the desired results of the treatment are to be obtained. Such is the case for instance with hot aqueous treatments applied to develop crepe figure upon fabrics containing highly twisted crepe yarns. Again it is of great value in the case of aqueous treatments designed to thoroughly wet out and soften fabrics consisting of or containing thermoplastic fibres, particularly cellulose acetate, whether or not crepe effects or shrinkage is required, so that they may subsequently be dyed or otherwise processed in rope form without formation of permanent creases. The treatment liquids may be fed to the uppermost tray at temperatures up to 90 or 100° C. Due to heat losses the temperature of the liquid falls as the liquid descends the trays, the

extent of the fall depending on the magnitude of the heat losses. From the point of view of reducing heat losses and the consequent fall in temperature it is of great advantage to enclose the tray system in a suitable casing; this has the additional and important merit of preventing escape of steam into the atmosphere.

If desired the liquid used for pre-wetting the fabric in the pre-wetting device may be heated, e.g. to 80 or 90° C., for example so that the wetting of the fabric is accelerated and/or so that cooling of the treatment liquor, i.e. that supplied to the feed trough, by the pre-wetted fabric is reduced.

Referring again to the machine itself it will be appreciated that the arrangement of superposed trays constitutes a compact arrangement which may occupy only a small floor space having regard to the distance over which the running fabric may be subjected to the treatment liquid while in open width and under little constraint. The invention is not however limited to a machine having the superposed arrangement of trays but includes machines in which the trays are otherwise disposed so that the fabric and liquid leaving the lower end of one tray is caught by and flows along the next tray. Further, the invention includes a machine having but one or two inclined trays.

Having described our invention what we desire to secure by Letters Patent is:

1. Apparatus for the liquid treatment of textile fabrics in open width, said apparatus comprising an inclined tray open at its lower end, means for feeding to the upper end of the tray a fabric in open width and a treatment liquid therefor, whereby the fabric is carried down the tray by the liquid, both fabric and liquid falling freely downwards at the end of the tray, and an expander bar adapted to maintain the fabric in open width at the point at which the latter leaves the tray, said expander bar being near to but back from the end of the tray and spaced away from the tray sufficiently to permit escape of liquid from between the fabric and the end of the tray.

2. Apparatus for the liquid treatment of textile fabrics in open width, said apparatus comprising a series of superposed inclined trays, each tray being open at its lower end and each tray after the first and uppermost tray having its upper end disposed below the lower end of the preceding tray so as to receive fabric and liquid falling therefrom, means for feeding to the upper end of the uppermost tray a fabric in open width and a treatment liquid therefor, whereby the fabric is carried down

the series of trays by the liquid, both fabric and liquid falling freely downwards at the end of each tray, and an expander bar adapted to maintain the fabric in open width at the point at which the latter leaves at least one tray of the series, said expander bar being near to but back from the end of the tray and spaced away from the said tray sufficiently to permit escape of the liquid from between the fabric and the end of said tray.

3. Apparatus for the liquid treatment of textile fabrics in open width according to claim 2, said apparatus including a bar extending across, substantially parallel with, and slightly above the lower end of at least one tray carrying an expander bar, said first mentioned bar serving to reduce ballooning of a fabric travelling down said tray.

4. Apparatus for the liquid treatment of textile fabrics in open width, said apparatus comprising a series of superposed inclined trays, each tray being open at its lower end and each tray after the first and uppermost tray having its upper end disposed below the lower end of the preceding tray so as to receive fabric and liquid falling therefrom, means for feeding to the upper end of the uppermost tray a fabric in open width and a treatment liquid therefor, whereby the fabric is carried down the series of trays by the liquid, both fabric and liquid falling freely downwards at the end of each tray, an expander bar adapted to maintain the fabric in open width at the point at which the latter leaves at least one tray of the series, said expander bar being near to but back from the end of the tray and spaced away from the said tray sufficiently to permit escape of the liquid from between the fabric and the end of said tray, and a casing enclosing the series of superposed trays and adapted to restrict loss of heat from the treatment liquid.

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