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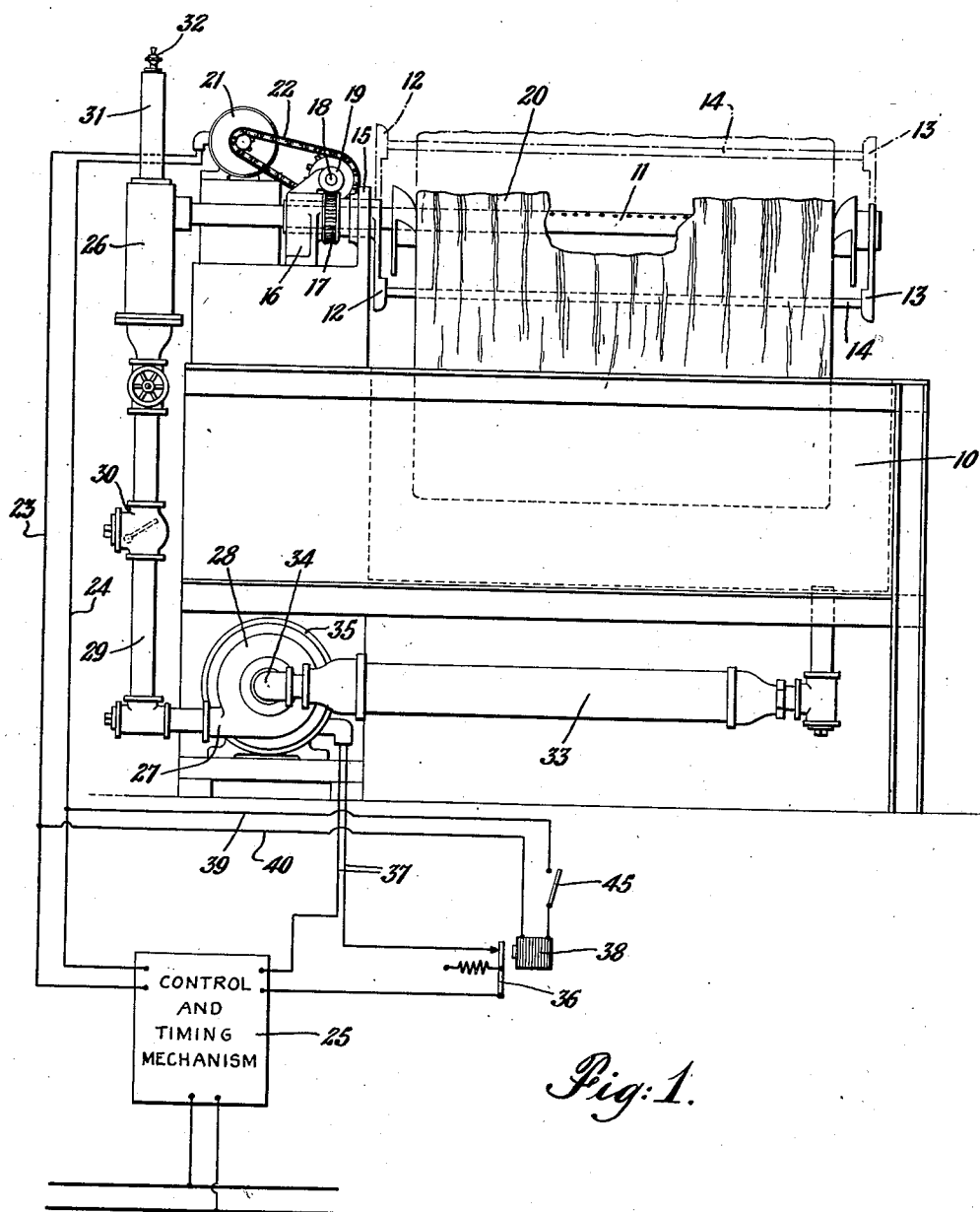
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MACHINE FOR TREATING YARN IN SKEIN FORM

Filed Feb. 12, 1936

2 Sheets-Sheet 1



INVENTOR

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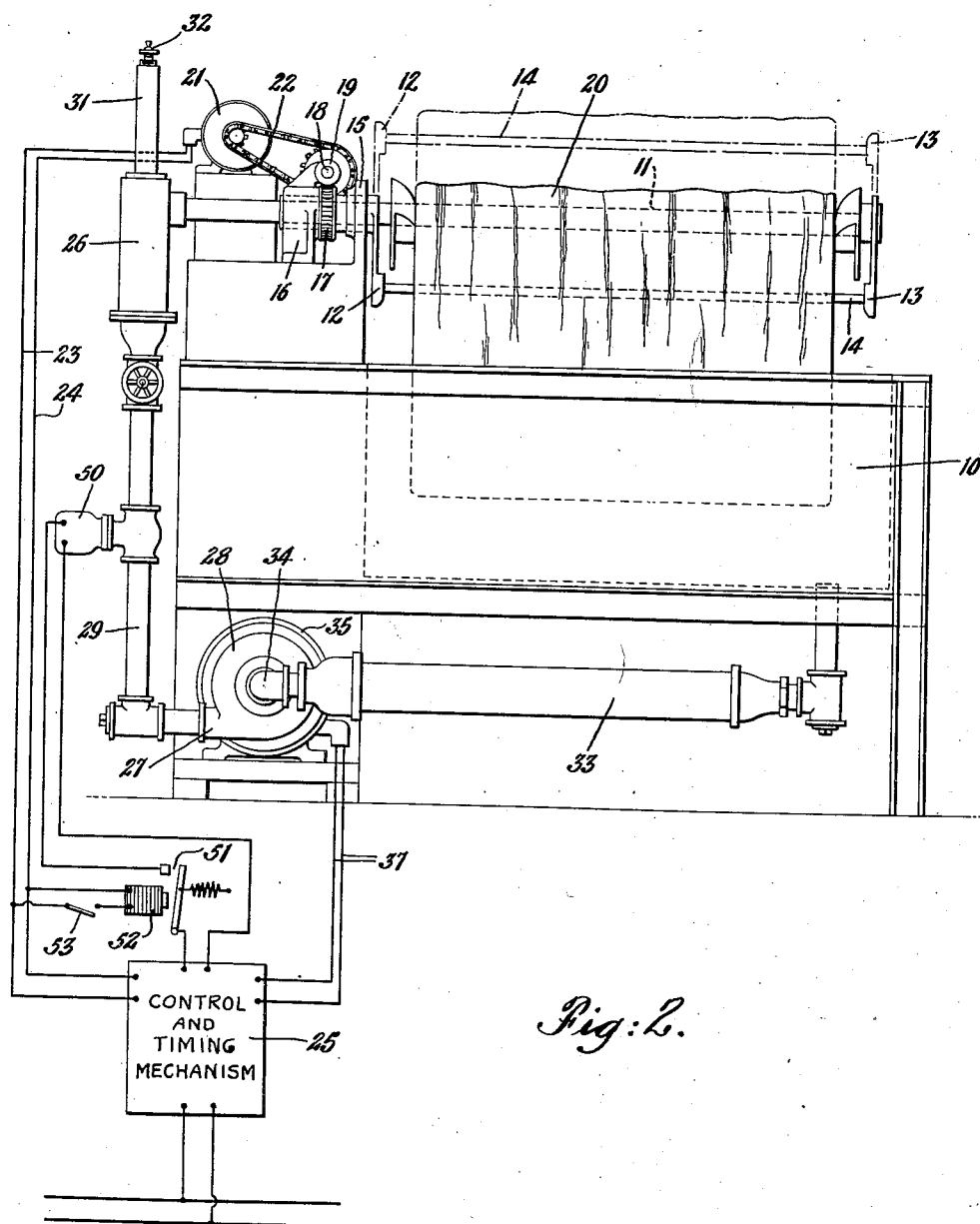
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UNITED STATES PATENT OFFICE

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MACHINE FOR TREATING YARN IN SKEIN FORM

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Application February 12, 1936, Serial No. 63,675

6 Claims. (Cl. 8—19)

This invention relates to that type or class of machines for treatment of rayon or other yarn in skein or hank form, and which employs the general principle of a great flow of liquid and a relatively slight movement of yarn, especially a periodic movement, which purpose may usually be accomplished by virtue of placing the hank or skein of yarn on a stationary hollow, perforated metallic tube, the perforations being preferably along the top of the tube only and hence in actual contact with the yarn, the whole being situated over a container for the solution with which the cellulose is to be treated and where the design of the perforated tube or yarn support is such that a large volume of liquid at low pressure is continuously forced upward and through the yarn, thus causing the skein to slightly rise from the tube, or at least, portions of the skein to rise, due to the pressure exerted by the liquid through the tube orifices.

In such a type of equipment wherein the skein form rests on the perforations of the pipe, liquids are pumped through the perforations against the yarn which covers them, but when the yarn is periodically raised from in contact with the tube perforations as is the condition when the yarn is being turned to ensure even distribution of solution through the material being treated, and therefore uniform penetration of solution, the yarn during the interval when it is raised from the surface of the tube ceases to act as a baffle to control the flow of solution thereby admitting of a greatly augmented flow of liquid through said perforations. This liquid, in order to escape, rushes out in a torrent, and forces its way through and to the bottom of the hank, mechanically injuring the individual filatures constituting the filament, opening up and rupturing the same.

This periodic, greatly augmented flow of liquid, especially when hot, due to its combined volume and weight, especially to the filaments which happen at that moment to be at or towards the bottom of the hank, often causes serious injury to the fibers as above indicated, especially when said fibers are of diminished tensile strength in the wet condition, as is usually the case with the hydrated cellulose fibers obtained from rayons, as by the viscose, copper-ammonia, and denitrated nitrocellulose methods of manufacture.

This disadvantage is especially apparent in dyeing operations, and where the filaments are artificial as the rayons, or where the filaments contain a notable proportion of rayon filatures, it is materially increased under the combined ac-

tion of heat and excess of dissolved reacting materials. As a class the rayons have less tensile strength in the wetted than in the dry condition.

If the pressure of the liquid passing through the tube perforations onto and in the yarn is reduced to the point where this disadvantage is substantially non-existent, when the hank is raised from the surface of the perforated tube, then it has been found that this diminished general pressure of liquids through the perforations results in inferior filament penetration, uneven action upon and in the cellulose, uneven and streaky dyeings being produced from improper and non-uniform penetration of liquid. Likewise the dyeing or other treatment to which the cellulose is subjected must be prolonged for a correspondingly longer period, and it is difficult otherwise to obtain satisfactory results.

The deterioration of the fiber by the sudden forceful increase in its weight and volume due to hot liquor being poured thereon, actually damages the fiber to a degree wherein an inspection of the dyed rayon is required at the completion of the operation, and a re-grading of the same as to quality, as based upon inspection. As a specific example, a 40's, 150 denier viscose rayon filament of 100% grade "A" as determined by inspection before dyeing, will, upon completion of the dyeing operation wherein the hot liquid is allowed to outpour undiminished onto the skein, be found to have the "A" portion reduced by from 10% to 30% and sometimes more, and this deterioration in quality represents the presence of frayed, opened-up and ruptured filatures or filaments, directly traceable to the action of the periodic flooding of the hank with excess of hot solution.

In bleaching, washing, desulfurizing, acidifying, dyeing, and analogous operations to which natural and synthetic silk, rayon and other fibers are subjected, corresponding losses in value are often obtained when working with types of machines as heretofore described.

In accordance with the present invention mechanism is provided to stop the flow of dyeing liquor through the perforated skein support before the skein is lifted from that support in the turning operation. This mechanism may be of several types, two of which are illustrated in the accompanying drawings; but in any event should be arranged to obtain a quick enough cut off of the liquor to avoid danger of it pouring out one or both sides of the skein when the latter is first lifted from the support, and should also be ar-

ranged to avoid a surge of the liquor when its flow is started which would tend to injure or disarrange the filaments in the skein. The present application is a continuation in part of my prior application Serial No. 759,229, filed December 26, 1934.

Referring to the drawings,

Fig. 1 is a side elevation of a dyeing machine embodying the invention, the control mechanism being in part shown diagrammatically; and

Fig. 2 is a similar view showing a modified construction.

The type of dyeing machine to which this invention is more particularly applicable comprises a tank 10 for holding the liquid supply, such as dye, finishing solution or other treating liquid, and suspension devices such as a perforated, liquid dispensing tube 11 upon which the material 20 to be treated is placed. For the purpose of changing the position of the material 20, such as skeins, hanks, cakes, etc., of silk, rayon or other suitable material, there is rotatably mounted on the perforated tube 11 a pair of arms 12 and 13 and a connecting rod 14 in the form of a roller Arm 12 is journaled in a frame member 15 and a bracket 16 between which is a worm wheel 17, keyed to the hub of the arm 12.

Shaft 18, which is carried by lugs upon brackets 16, carries a worm 19 to mesh with and drive the worm wheel 17, and thereby rotate roller rod 14 about the tube 11 and thus admit of changing the position of the skeins or hanks of material 20 suspended upon the tube. Shaft 18 is driven by motor 21 through a chain and sprocket drive 22. Motor 21 is energized through a circuit 23, 24 at timed intervals in the usual manner through an appropriate control and timing mechanism indicated at 25.

The perforated tube 11 passes through the center of the skein or other material changing mechanism, and is connected to a manifold chamber 26 to which other similar tubes are connected if the machine is a multi-tubular one. The manifold chamber 26 is connected to the outlet 27 of a centrifugal pump 28 by a pipe line 29. Carried in the pipe line 29 is a check valve 30, so arranged as to prevent return of liquid to the pump when the latter is stopped. Thus the column of liquid above the valve 30 acts as a dampener against the surge of liquid created when the pump is restarted. An air chamber 31, and its air cock 32, is mounted on and communicates with the manifold 26 for the purpose of further dampening the surge of liquid due to the restarting of the pump.

A feedline 33 from the bottom of the tank 10 to the inlet 34 of the pump 28 completes the fundamental liquid circuit. The pump 28 is driven by a motor 35 through a direct connection (not shown). It is to be understood that the illustrated form described herewith is diagrammatic only, and a number of additional pipe lines, valves, control levers, etc., are omitted for the sake of clarity, and as not being related directly to the invention.

As the machine operates to change the position of the skein 20 on the perforated tube 11, it is desirable, as pointed out above, to stop the flow of liquid through the tube so as to avoid possible injury to the lower loop of the skein because of the increased volume of liquid discharged due to the lifting of the skein from its contact with tube 11.

In the form shown in Fig. 1 this is accomplished by inserting a relay switch 36 (normally closed) in the circuit 37 of the pump motor 35. The

magnet 38 of switch 36 is energized through wires 39, 40 which are in shunt to the circuit 23, 24 leading to the skein moving motor 21. Thus the instant motor 21 is energized to turn the skeins 20 the relay 38 is also energized and opens switch 36 in the pump motor circuit 37, thus stopping the pump.

When the skein-turning motor 21 has completed its work and is de-energized by the timing mechanism 25, relay 38 is also de-energized and allows switch 36 to close and thus start pump 28. This arrangement is such that irrespective of the timing or speed of the skein-moving mechanism, the pump is automatically stopped and started at precisely the proper instant.

A manual switch 45 in relay circuit 39, 40, when it is thrown open, allows the machine to be operated in the ordinary manner.

In Fig. 2, the flow of liquid through perforated tube 11 during the skein-turning operation is stopped by replacing the check valve 30 in pump line 29 with a solenoid valve 50. This valve is closed when its solenoid is energized by the closing of a relay switch 51, the magnet 52 of which is in a shunt circuit taken off the skein-turning motor circuit 23, 24. Thus, when skein motor 21 is energized, magnet 52 is also energized to close switch 51. Solenoid 50, thus energized, closes its valve and interrupts the liquid flow into tube 11, the pump merely "churning" without circulating the liquid during this period. Manual switch 53 in the circuit of the magnet 52, when opened allows the machine to be operated without the automatic liquid shut-off.

I claim:

1. An apparatus for dyeing yarn in skein form which comprises a skein supporting tube having perforations along its upper surface, means for raising the skein from the tube and shifting its circumferential position thereupon, means for controlling the discharge of dyeing liquor from the perforations in the tube, and mechanism coordinating the operation of the means for controlling the discharge of dyeing liquor and of the skein shifting means in such a manner that the discharge of dyeing liquor from the perforations in the tube is automatically arrested before the shifting means has raised the skein from the tube and remains arrested until the skein is again deposited on the tube.

2. An apparatus for dyeing yarn in skein form which comprises a skein supporting tube having perforations along its upper surface, means for raising the skein from the tube and shifting its circumferential position thereupon, means for controlling the discharge of dyeing liquor from the perforations in the tube, mechanism coordinating the operation of the means for controlling the discharge of the dyeing liquor and of the skein shifting means in such a manner that the discharge of dyeing liquor from the perforations in the tube is automatically arrested before the shifting means has raised the skein from the tube and remains arrested until the skein is again deposited on the tube, and means for preventing surging of the dyeing liquor when its discharge through the perforations in the tube is resumed.

3. An apparatus for treating yarn in skein form which comprises a skein supporting tube having perforations along its upper surface, means for raising the skein from the tube and shifting its circumferential position upon it, an electric motor for operating said skein raising means, means for forcing dyeing liquor through

the tube and the perforations therein, means for activating said electric motor at intervals, a relay connected to the motor circuit for activation simultaneously therewith, and mechanism controlled by said relay for permitting flow of dyeing liquor through said tube only when said motor is inactive and the skein raising means is in its inactive position.

4. An apparatus for treating yarn in skein form which comprises a skein supporting tube having perforations along its upper surface, means for raising the skein from the tube and shifting its circumferential position upon it, an electric motor for operating said skein raising means, pumping means for forcing dyeing liquor through the tube and the perforations therein, means for activating said electric motor at intervals, a relay connected to the motor circuit for activation simultaneously therewith, an electric motor driving said pumping means, and connections between the relay and the last-named electric motor whereby said last-named electric motor will be stopped throughout the activation of the first-named electric motor for causing the skein raising means to raise the skein from the tube and shift it thereon.

5. An apparatus for treating yarn in skein form which comprises a skein supporting tube having perforations along its upper surface, means for raising the skein from the tube and shifting its circumferential position upon it, an electric motor for operating said skein raising means, means for activating said electric motor at intervals, a relay connected to the motor

circuit for activation simultaneously therewith, centrifugal pumping means for forcing dyeing liquor through the tube and the perforations therein, an electric motor driving the pumping means, connections between the relay and the last-named electric motor whereby said last-named electric motor will be stopped throughout the activation of the first-named electric motor for causing the skein raising means to raise the skein from the tube and shift it thereon and a check valve interposed between the pumping means and the tube in position to preserve a column of liquid beyond the delivery of the pump and thus to prevent surging of the liquid through the tube when the pump motor is started.

6. An apparatus for treating yarn in skein form which comprises a skein supporting tube having perforations along its upper surface, means for raising the skein from the tube and shifting its circumferential position upon it, an electric motor for operating said skein raising means, pumping means for forcing dyeing liquor through the tube and the perforations therein, means for activating said electric motor at intervals, a relay connected to the motor circuit for activation simultaneously therewith, and a valve controlled by said relay for stopping the flow of liquor between the pumping means and said tube throughout the activation of the skein raising motor for causing the skein raising means to raise the skein from the tube and shift it thereon.

WILLIAM FRANCIS GUINAN.