

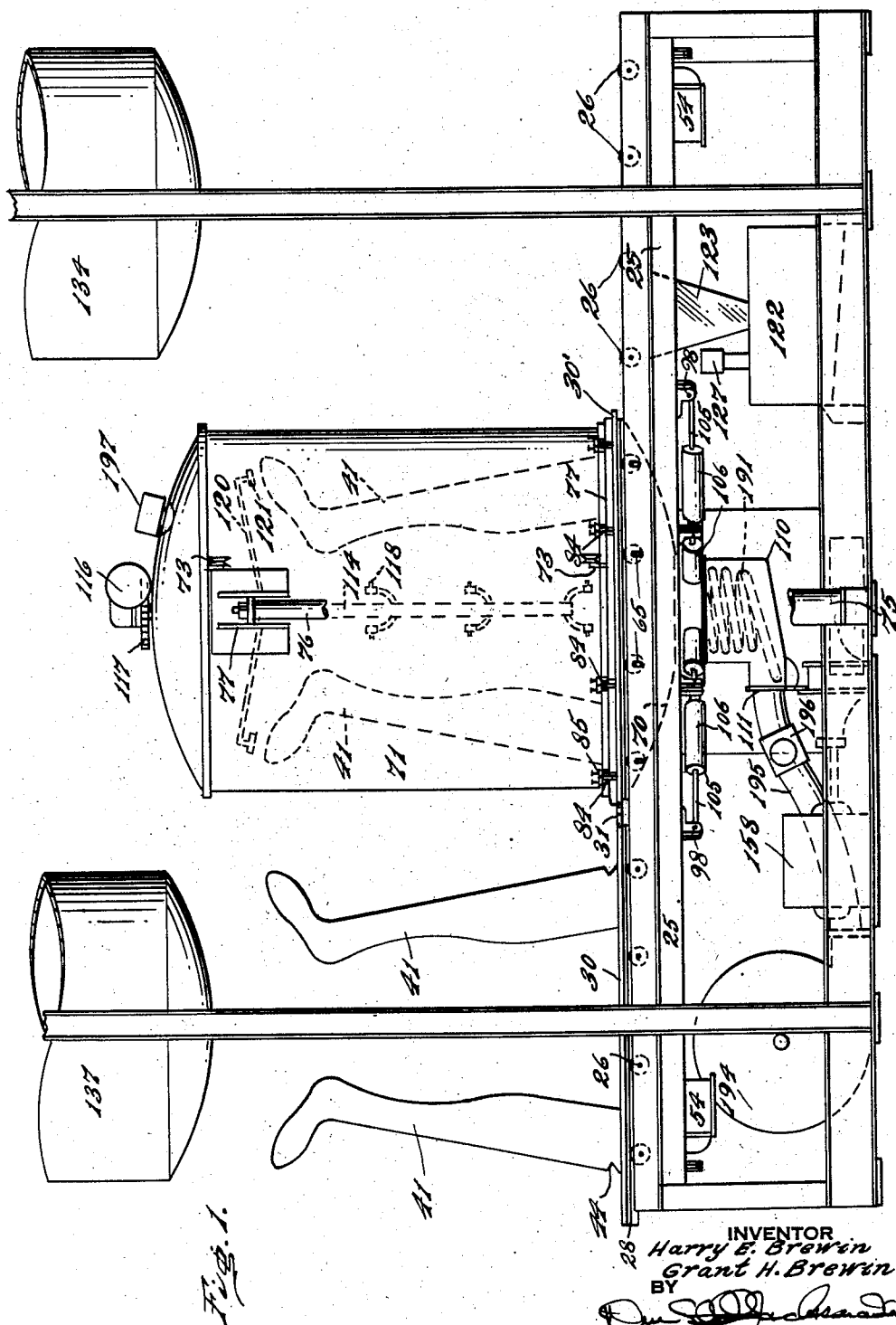
Dec. 1, 1959

H. E. BREWIN ET AL
TEXTILE TREATING APPARATUS

2,915,230

Filed April 5, 1955

9 Sheets-Sheet 1



INVENTOR
Harry E. Brewin
Grant H. Brewin
BY
Attorneys.

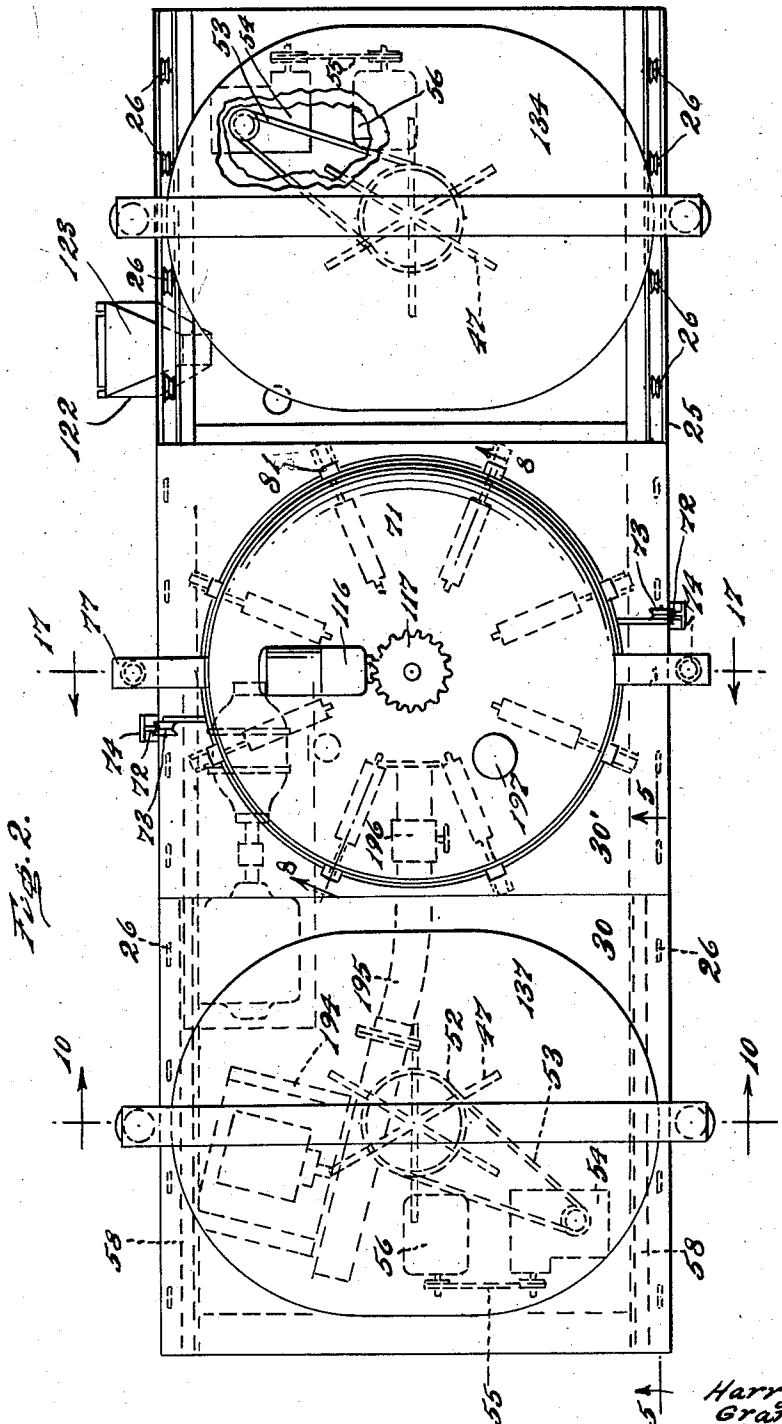
Dec. 1, 1959

H. E. BREWIN ET AL
TEXTILE TREATING APPARATUS

2,915,230

Filed April 5, 1955

9 Sheets-Sheet 2



INVENTOR
Harry E. Brewin
Grant H. Brewin
BY
[Signature]
ATTORNEYS.

Dec. 1, 1959

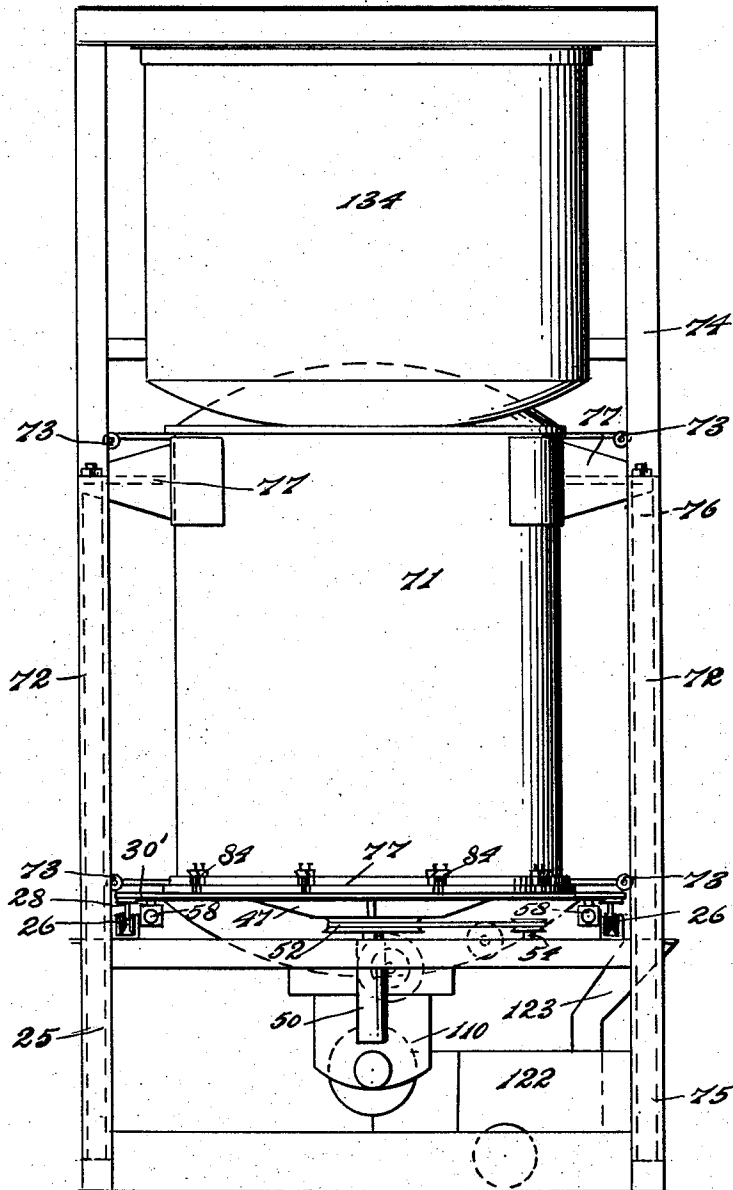
H. E. BREWIN ET AL
TEXTILE TREATING APPARATUS

2,915,230

Filed April 5, 1955

9 Sheets-Sheet 3

Fig. 3.



INVENTOR
Harry E. Brewin
By *Grant H. Brewin*
ATTORNEYS.

Dec. 1, 1959

H. E. BREWIN ET AL
TEXTILE TREATING APPARATUS

2,915,230

Filed April 5, 1955

9 Sheets-Sheet 4

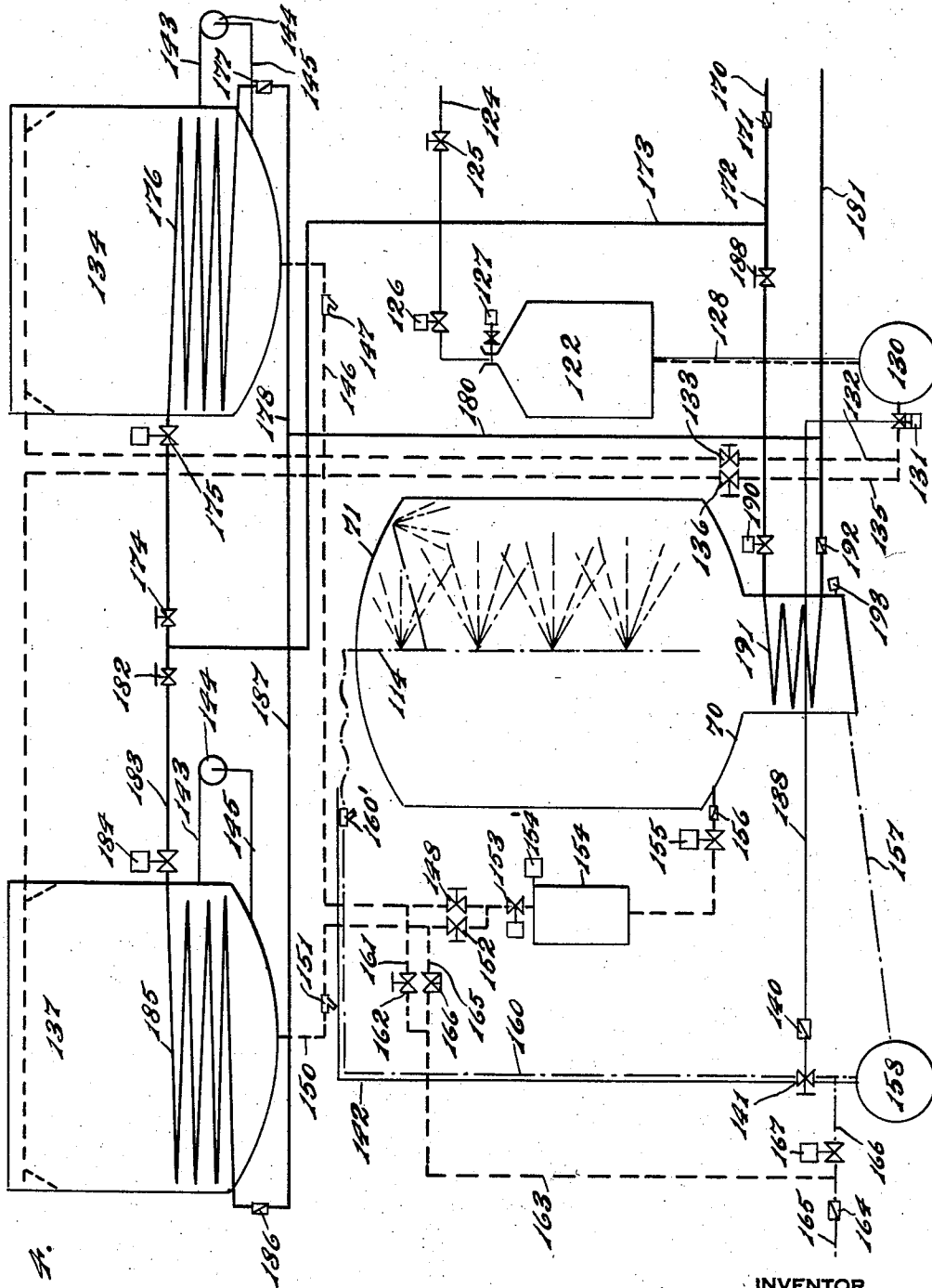


Fig. 4.

INVENTOR
Harry E. Brewin
Grant H. Brewin
BY
[Signature]
ATTORNEYS

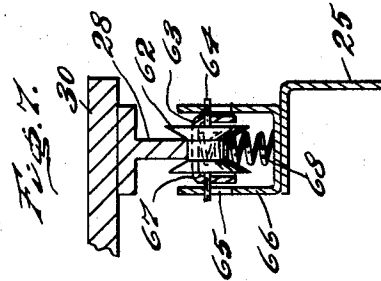
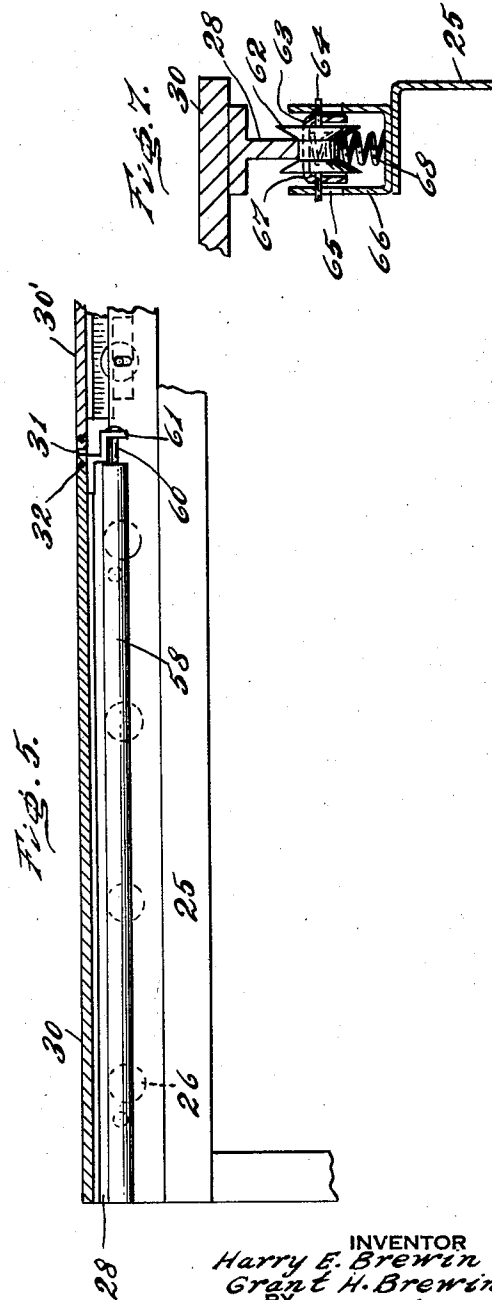
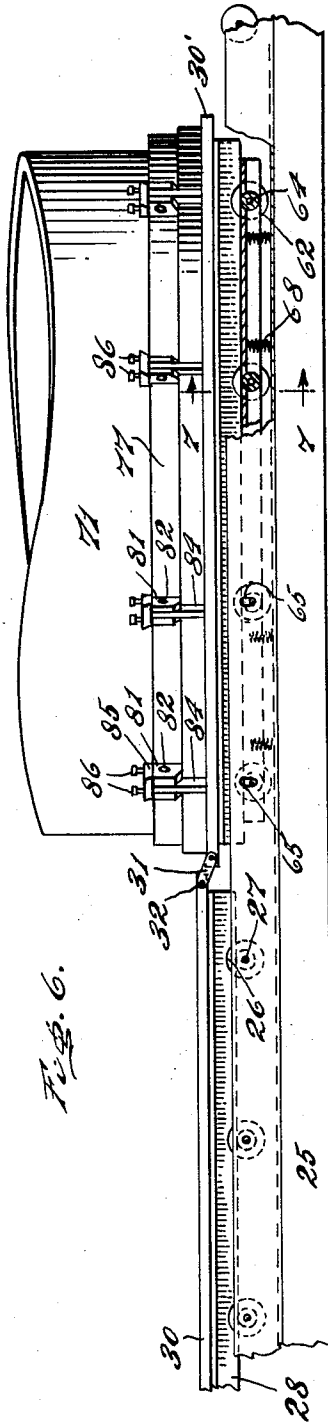
Dec. 1, 1959

H. E. BREWIN ET AL
TEXTILE TREATING APPARATUS

2,915,230

Filed April 5, 1955

9 Sheets-Sheet 5



INVENTOR
Harry E. Brewin
Grant H. Brewin
BY
[Signature]
ATTORNEYS.

Dec. 1, 1959

H. E. BREWIN ET AL
TEXTILE TREATING APPARATUS

2,915,230

Filed April 5, 1955

9 Sheets-Sheet 6

Fig. 10.

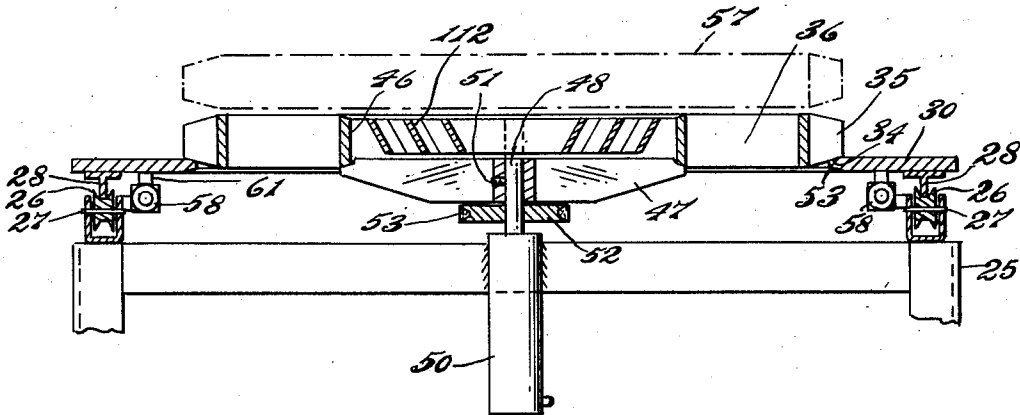
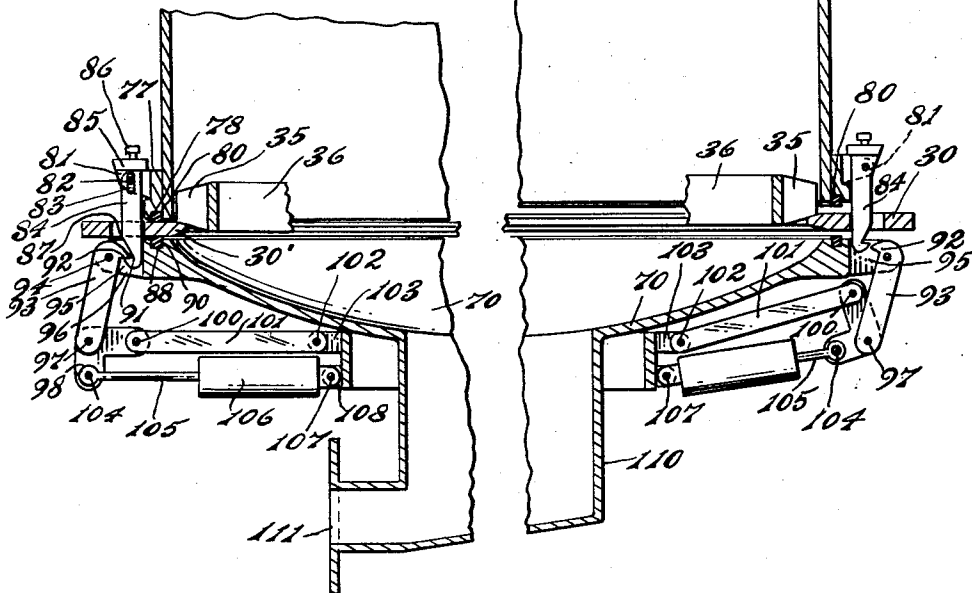
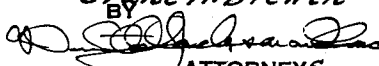


Fig. 9

Fig. 8.



INVENTOR
Harry E. Brewin
Grant H. Brewin
BY 
ATTORNEYS.

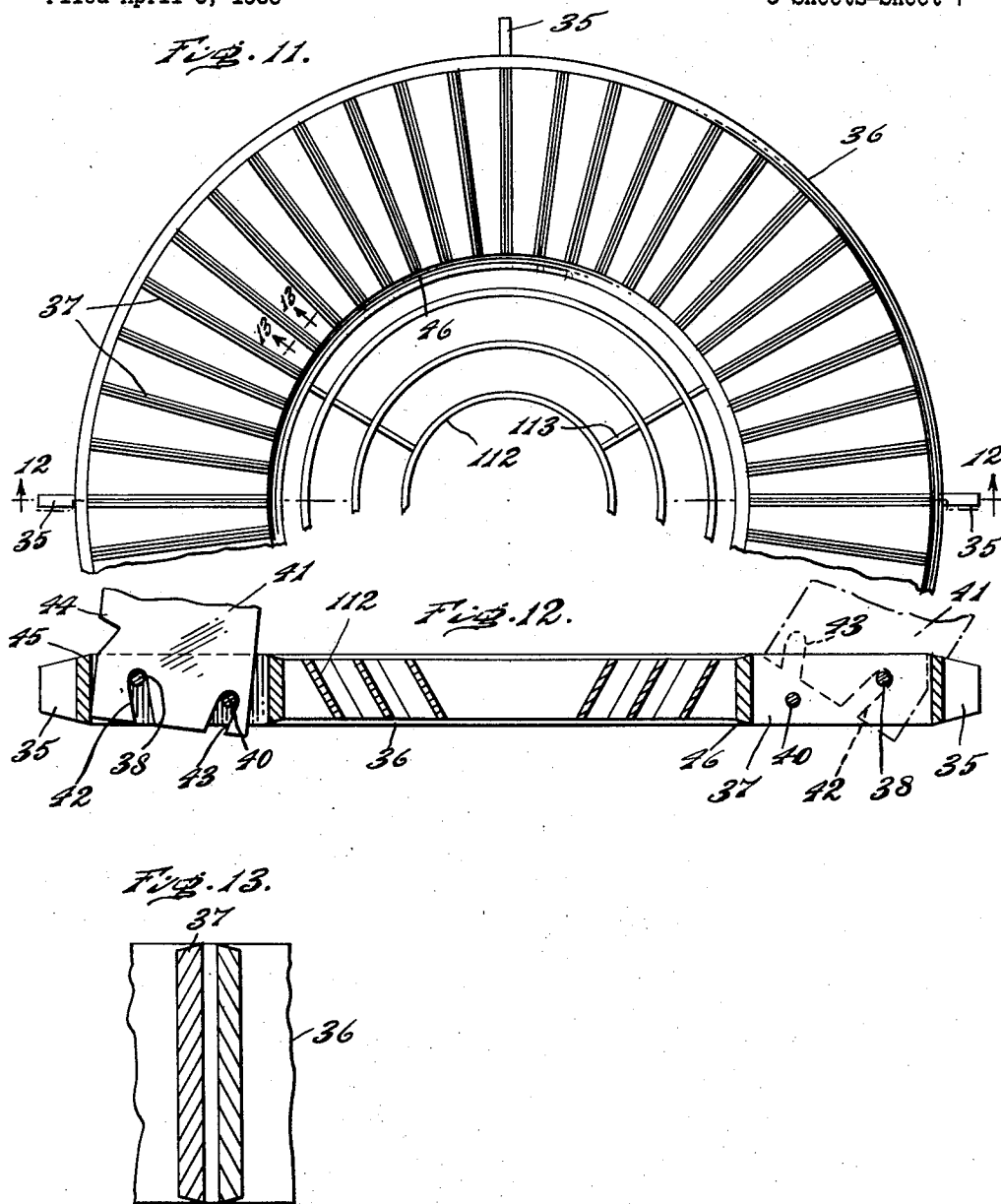
Dec. 1, 1959

H. E. BREWIN ET AL
TEXTILE TREATING APPARATUS

2,915,230

Filed April 5, 1955

9 Sheets-Sheet 7



INVENTOR
Harry E. Brewin
Grant H. Brewin
BY *[Signature]*
ATTORNEYS.

Dec. 1, 1959

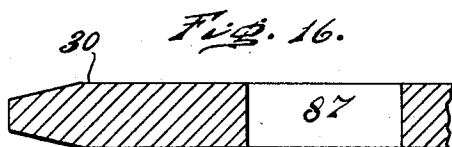
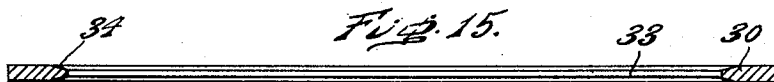
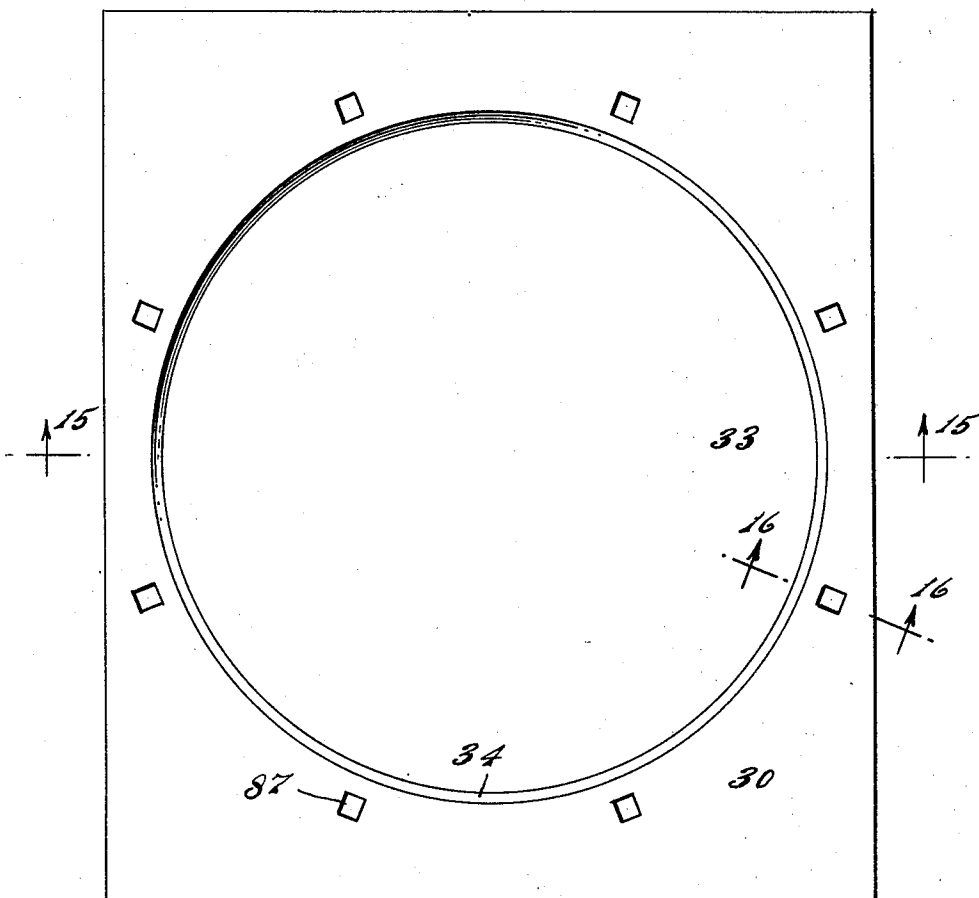
H. E. BREWIN ET AL
TEXTILE TREATING APPARATUS

2,915,230

Filed April 5, 1955

9 Sheets-Sheet 8

Fig. 14.



INVENTOR
Harry E. Brewin
Grant H. Brewin
BY *[Signature]*
ATTORNEY

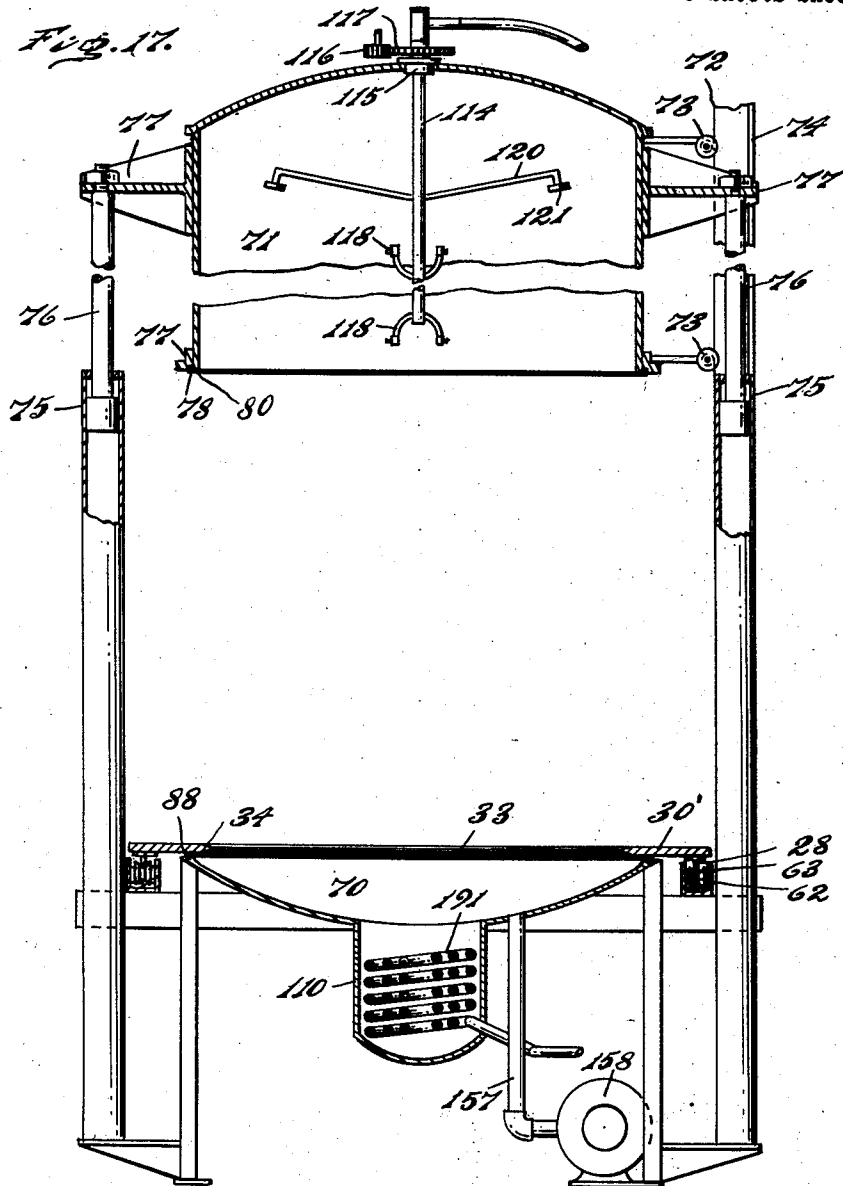
Dec. 1, 1959

H. E. BREWIN ET AL
TEXTILE TREATING APPARATUS

2,915,230

Filed April 5, 1955

9 Sheets-Sheet 9



INVENTOR
Harry E. Brewin
Grant H. Brewin
BY *[Signature]*
ATTORNEYS.

1

2,915,230

TEXTILE TREATING APPARATUS

Harry E. Brewin and Grant H. Brewin, Pleasantville, N.J.,
assignors to Dyotherm Corporation, Clementon, N.J.,
a corporation of New Jersey

Application April 5, 1955, Serial No. 499,382

8 Claims. (Cl. 223—76)

The present invention relates to preboarding (heatsetting), scouring, dyeing, finishing and postboarding (drying) of textiles, particularly hosiery.

The claims relating to the method formerly in this case have been divided and appear in our copending application Serial No. 616,534, filed June 17, 1956 for Textile Treating Method and Composition.

A purpose of the invention is to accomplish preboarding (heat setting), scouring, dyeing, finishing and postboarding (drying) of hosiery or similar textiles in a single step, avoiding need for repeated manipulation of the textile as in prior practice.

A further purpose is to place the textiles on forms in a closed space, to introduce a predetermined amount of treating solution, suitably a scour, dye and finish in water, to collect at the bottom of the space, to heat the treating solution, to recirculate the treating solution and spray it into the space against the textiles on the forms, so that the textiles are repeatedly sprayed with the same recirculated solution which is collected at the bottom of the space, to drain the solution, to subject the textiles to a gas at high temperature for a relatively short time, while the space is open to the atmosphere and to remove the textiles, thus completing the preboarding, scouring, dyeing, finishing and postboarding or any desired group of such operations, in a single procedure.

A further purpose is to accomplish the drying of the textiles by opening the space at the top and blowing in air or superheated steam at the bottom of the space, and in the case of air heating the air as it enters the bottom of the space.

A further purpose is to relatively rotate the textile material and the spray during the treating operation, desirably placing the forms in a ring, spraying from inside the ring, and rotating the spray.

A further purpose is to discharge the spray both downwardly and radially outwardly during the treatment.

A further purpose is to provide a dish having a cavity adapted to hold the textile treating solution, to employ a bell to seal with respect to the dish, the bell being raised and lowered as required, to mount the forms on a carrier movable horizontally and having a position outside the bell and inside the bell, to heat the treating solution in the dish, to pump the heated solution from the dish through spray nozzles and when the treating solution has drained to introduce hot gas against the textiles on the forms.

A further purpose is to provide a table which carries the textile forms into the space between the dish and the bell and to seal the dish and the bell both against the table at opposite sides.

A further purpose is to support the table in a resilient floating relation so that the table is free to adjust in sealing.

A further purpose is to pivot the forms on the carrier and desirably replaceably mount the forms on the carrier.

A further purpose is to incline the forms inwardly with respect to the vertical through the ring of forms.

2

A further purpose is to interconnect a second carrier and table combination with the first carrier and table combination and to move these table and carrier combinations back and forth in unison.

A further purpose is to raise the carrier from the table and permit it to rotate and desirably permit the forms to rock outwardly for placing textiles on the forms and taking textiles off the forms.

A further purpose is to provide a mixing tank, a storage tank, means for pumping the treating solution from the mixing tank to the storage tank, the mixing tank providing measurements of increments for filling of the storage tank, and to provide a measuring tank for measuring the discharge of the content from the storage tank, the measuring tank containing one charge for the textile treating apparatus.

In the drawings we have chosen to illustrate one only of the numerous embodiments in which the invention may appear, selecting the form shown from the standpoints of convenience in illustration, satisfactory operation, and clear demonstration of the principles involved.

Figure 1 is a front elevation of the textile treating machine of the invention, breaking away the upper portion of the storage tanks and the front of the panel.

Figure 2 is a top plan view of the machine of Figure 1.

Figure 3 is a right end elevation of Figure 1.

Figure 4 is a schematic view showing the piping system employed in the textile treating machine of the invention.

Figure 5 is an enlarged vertical section on the line 5—5 of Figure 2.

Figure 6 is an enlarged fragmentary front elevation breaking away a portion of the structure adjoining the track.

Figure 7 is an enlarged vertical transverse section on the line 7—7 of Figure 6.

Figure 8 is an enlarged fragmentary vertical radial section on the line 8—8 of Figure 2, showing the bell locked against the dish.

Figure 9 is a view corresponding to Figure 8, but showing the opposite side, and illustrating the bell and dish in open position, unlatched.

Figure 10 is an enlarged vertical transverse section of Figure 2 on the line 10—10.

Figure 11 is an enlarged fragmentary top plan view of one of the form wheels or carriers.

Figure 12 is a vertical central section of the form wheel or carrier on the line 12—12 of Figure 11.

Figure 13 is an enlarged fragmentary section transverse to the radius of the form wheel or carrier taken on the line 13—13 of Figure 11.

Figure 14 is an enlarged top plan view of one of the tables, omitting the form wheel or carrier and related structure.

Figure 15 is a section on the line 15—15 of Figure 14.

Figure 16 is an enlarged fragmentary vertical diametral section through the table, the section being taken on the line 16—16 of Figure 14.

Figure 17 is a vertical axial section on the line 17—17 of Figure 2, showing the bell in raised position and partially broken away.

Describing in illustration but not in limitation and referring to the drawings.

In the prior art the boarding, scouring, dyeing and finishing of hosiery has been a complicated, tedious and involved procedure. When reference is made herein to hosiery, it will be understood that the principles of the invention apply also to other analogous textile materials. Examples of textiles which may be processed according to the invention include ladies' stockings, men's stockings, men's half hose, sweaters, jackets, underwear, gloves and the like.

In the present practice as applied to ladies' hosiery, 18 or 24 stockings are boarded on metal forms and the forms are then placed in a preboarding (heatsetting) machine and subjected to steam pressure after which the stockings are removed by hand from the forms and handled in groups, usually 12 stockings to a group, and inserted in dye bags. The dye bags containing the stockings are then placed in a dyeing machine and then agitated and rotated.

In the dyeing machine the hosiery is scoured for approximately one half hour after which it is dyed for an hour and a half or more. Then the hosiery is rinsed twice, after which a finish bath is introduced. The hosiery ordinarily remains in the finish bath about 20 minutes, after which the hosiery is removed and extracted to remove as much of the finishing solution as possible. The bags containing the hosiery are then sorted for size, opened and the hosiery removed. The stockings are then placed on metal forms similar to those used in preboarding, and introduced into a dryer where postboarding is accomplished.

All of this is very time consuming and expensive in labor and equipment.

In accordance with the present invention, it is possible to accomplish all of the operations of preboarding (heat-setting), scouring, dyeing, finishing and postboarding (drying) in a single machine and a single procedure which is completed in a matter of a few minutes rather than several hours. If preferred the machine need not accomplish all of these steps, any desired number being accomplished in the single procedure.

Not only is the result accomplished more easily, but superior results are obtained. Since the dyeing is accomplished under control, the levelling is superior. The presence of the scouring agent aids in promoting levelling.

Since the operating temperature is of the order of about 235° F., well above the ordinary boiling temperature of water, the chemical effect of the dye on the fabric is accelerated and fast dyeing is obtained. The superatmospheric pressure makes it possible to maintain the high temperature without boiling. There is no danger of diluting or contaminating the treating solution since no steam is introduced from the outside during the dyeing and setting operation.

Furthermore, as the dye is accurately measured for each charge, very superior control of dyeing, scouring and finishing concentrations are obtained.

The relative movement of the spray with respect to the textile material by rotation of the spray, and desirably the relatively high pressure of the spray (preferably of the order of 100 to 125 p.s.i.), assures excellent penetration and great uniformity.

In accordance with the invention, the textiles are placed on the forms in a closed space, the textile treating solution which desirably includes the scour, the dye and the finish is introduced in a predetermined amount to collect in the bottom of the space, the treating solution is heated, the heated treated solution is recirculated and sprayed against the textiles on the forms, so that the textiles are repeatedly sprayed with the same recirculated solution, the excess solution is drained, the textiles are subjected to a gas at high temperature for a relatively short time to dry them, and then the space is opened and the textiles are removed. The heated gas may be superheated steam or air forced into the space and suitably heated as it enters.

In order to assure best distribution of the spray, it is desirably discharged both downwardly and radially outwardly.

The mechanism employed preferably comprises a dish having an upwardly open cavity adapted to hold the textile treating solution, a bell sealing with respect to the dish, a carrier movable horizontally and having a position inside and a position outside the bell, textile supporting forms on the carrier and mechanism for rais-

ing and lowering the bell, a heating coil in the dish for heating part of the solution, a pump for withdrawing solution from the dish, a spray for distributing the solution withdrawn from the dish over the textiles on the forms. The forms are preferably arranged in a ring and the rotating spray is placed inside the ring.

The carrier is preferably supported on a table which brings the carrier into the space between the dish and the bell and the dish and bell both seal against the table. In the preferred form the table is resiliently urged into floating position to aid in sealing.

The ring of forms is desirably arranged with the forms inclined inwardly from the vertical, preferably at an angle of about 5° so that the feet of the hosiery will receive maximum application of treating solution and so that the outwardly directed toes of the forms will not strike against the bell.

The carrier in a position outside the bell for loading and unloading desirably permits pivoting of the forms. The forms are also to advantage replaceably mounted on the carrier. For best results the carrier is raised from the table and permitted to rotate and the forms pivot outwardly as the carrier rotates.

The treating solution is made up in a mixing tank, and repeated fillings of the mixing tank are pumped to a storage tank. From the storage tank measured quantities of treating solution are withdrawn by a measuring tank which measures a charge for one set of hosiery or other textiles.

Considering now the drawings in detail, a frame 25 supports at opposite ends a series of track rollers 26, pivoted on axles 27 in the frame, which engage downwardly directed traveling rails 28 on the bottom of tables 30 and 30'. The tables are connected together by links 31 pivotally secured at 32 to the respective tables.

Each table has a central opening 33 and is desirably chamfered at 34 around the upper and preferably also the lower inner edge of the opening to receive a series of tapered lugs 35 extending out from a form wheel or carrier 36 which rests normally in the chamfered edge of the table.

The form wheel or carrier has a series of radially extending closely spaced pairs of spokes 37 which mount transverse pins 38 and 40 which secure stocking forms 41. The stocking forms desirably have diagonally upwardly and oppositely inclined slots 42 and 43 (Figure 12) engaging the respective pins, and the pin 38 serves as a pivot for the form allowing the form to pivot outwardly and the slot 43 to leave pin 40, the limit of outward movement of the stocking form being provided by engagement of the wall of a notch 44 on the stocking form on a circumferential rim 45 of the form wheel. The slot 42 by extending diagonally outwardly in upright position locks the form against leaving the form wheel when pivoted outwardly (right of Figure 12). The slot 43 by extending diagonally inwardly in upright position leaves pin 40 when the stocking form pivots around pin 38. To remove the form it is pivoted outward (right of Figure 12) and then pulled up and pivoted inward to release slot 42 from pin 38. In normal position the stocking form leans toward the inside of the circle, preferably about 5° to the vertical so that the foot is moved inward (Figure 1).

At the inner edge the form wheel or carrier has a rim 46 which in the loading and discharge position is engaged from below by a spider 47 (there is one at each end of the machine) which is held on a plunger 48 of a spring retracted hydraulic ram 50 by a suitable set screw 51. The hydraulic ram carries a pulley 52 which is turned by a belt 53 driven from a speed reducer 54 which is driven through a belt-pulley combination 55 from an electric motor 56. Thus the form wheel or carrier and the forms are turned slowly but if any opposition is encountered the drive stops by slippage of the spider with respect to the rim 46.

The form wheel or carrier does not rotate until the form wheel is raised slightly from the table to its normal raised position. The form wheel also has an abnormal raised position indicated by dot-and-dash lines at 57 in Figure 10 which is intended to facilitate removal and replacement of the form wheel by a lift truck.

The combination of tables is projected from one end to the other end of the machine by a pair of hydraulic cylinders 58 (Figure 5) at the respective sides anchored on the frame, which carry cooperating pistons and rams 60 which engage brackets 61 extending downwardly from one of the tables near to the connecting link between the tables.

At the center position track rollers 62 (Figure 7) are mounted differently from the track rollers at the end position. The track rollers 62 are pivoted in slots in a channel shaped holder 63 by pivotal axles 64 which extend through openings in the holder 63 and also through vertical slots 65 at the opposite sides in a channel 66 mounted horizontally on the frame 25. The holder 63 has slots 67 through which the rollers extend and at intervals along its length helical compression springs 68 operate between the holder and the bottom of the channel 66 to urge the carrier and the rollers upwardly. At the ends of the machine the rollers are pivoted rigidly in the channel 66.

At the center position the main dyeing container consists of a dish 70 upwardly open and rigidly positioned on the frame, and a cooperating bell 71. The bell carries rollers 73 which move up and down in guides 72. The guides are secured to a stationary frame 74. Vertical hydraulic cylinders 75 at the opposite sides mounted on the frame carry cooperating pistons and rod combinations 76 which connect to brackets 77 extending out at diametrically opposite positions from the bell. At the lower end of the bell a ring 77 is affixed thereto and it has an annular downwardly directed gasket recess 78 that contains an elastomer gasket 80 which in locked position is capable of sealing against the top of the table in a complete annular seal.

At intervals around the circumference of the drum the ring 77 carries outwardly extending pivot brackets 81 which mount pivot pins 82 which make pivotal connection with slots 83 on locking hook elements 84, the locking hook elements having T-shaped upper head portions 85 above the brackets 81. At the two sides each T-shaped head 85 mounts an adjusting screw 86 which can be advanced in its engagement on the prongs of the pivotal bracket 81 so as to move the hooks up due to the slots 83.

The hooks extend through recesses 87 in the table. The dish at a position cooperating with the gasket recess 78 has an upwardly directed annular recess 88 which receives an elastomer gasket 90. The elastomer gaskets are suitably formed of rubber, synthetic rubber or an elastomer plastic which is capable of sealing on the bottom of the table in the locking position.

At each one of the hook positions, the hook 84 has a downwardly directed latching end 91 having an outwardly extending latching notch, which in inactive position passes clear of the latching mechanism as shown in Figure 9, but which is capable of being engaged and pulled down by an inwardly extending latching dog 92 which is mounted on a latching lever 93 pivoted on a pin 94 which extends across a slot 95 of an outwardly extending bracket 96 from the dish. The latching lever at its outer end pivotally connects at 97 to the intermediate pivot of a free bell-crank 98. The bell-crank at one end pivotally connects at 100 with a link 101, the opposite end of which pivotally connects at 102 with a pivot bracket 103 which is located at the corresponding circumferential position on the lower part of the dish.

The other bell-crank arm pivotally connects at 104 with the outer end of a hydraulic ram and piston combination 105 which operates in a double acting cylinder

106 which is pivotally connected at its inner end at 107 on a bracket 108 secured to the lower part of the dish. The dish at the bottom has a sump 110 provided with a flange 111 for connection to the blower as later explained. At the center of the form wheel or carrier there will desirably be a series of outwardly and upwardly coned diffusing rings 112 supported by radially inwardly extending ribs 113.

In the top of the bell a central spray pipe 114 is rotatably mounted and supported on a bearing 115, and turned by a motor drive 116 operating on a gear 117 carried by the spray pipe at the top above the drum. The spray pipe has at suitably radially directed positions located at different locations along the axis and also at different peripheral positions, a series of spray heads 118 which are directed from the interior outwardly against the hosiery or other work which is mounted on the forms. Also mounted at a position above the toes of the stockings on the forms there are a plurality of spray pipes 120 extending radially from the center spray pipe and having downwardly directed spray heads 121.

A chemical mixing tank 122 is provided at an accessible point with a pouring chute 123 for introducing an initial charge of dye. As shown in the piping diagram of Figure 4, a service water connection 124 communicates through a normally open manual valve 125 and a system controlling solenoid valve 126 which is normally closed, and is operated by a probe 127 which shuts the water off when it reaches a predetermined higher level. The charge from mixing tank 122 is withdrawn through pipe 128 to pump 130 which is controlled by probe 131 to maintain pump 130 in operation until no liquid reaches the probe at which time the pump is shut off. The treating solution then passes either through pipe 132 and manually opened valve 133 to storage tank 134, or in the alternative through pipe 135 and manually opened valve 136 to storage tank 137.

There is also an auxiliary rinsing water line 138 from the high pressure side of pump 130 which passes through check valve 140 which opens in the direction of forward flow and through manually operated valve 141 and pipe 142 to the spray nozzles, to be used for washing out the spray nozzles when required in connection with cleaning of the equipment. Each of the storage tanks 134 and 137 has a discharge pipe 143, a pump 144 and an inlet pipe 145 for continuous circulation in order to agitate the content of the storage tanks.

The respective storage tanks 134 and 137 discharge respectively through pipes 146, strainer 147 and manual valve 148, or pipe 150, strainer 151 and manual valve 152 to a solenoid valve 153 to a measuring tank 154 which discharges through solenoid valve 155 and check valve 156 (opening in the direction of forward flow) to the bottom of the dish. An air vent is provided at 154 in the measuring tank.

From the sump at the bottom of the dish the high pressure treating solution is withdrawn through pipe 157 and pump 158 to manual three-way valve 141, to pipe 160 which discharges through strainer 160' into the vertical spray nozzle pipe 114 as already described.

Provision is made to drain storage tank 134 through pipe 161, manual valve 162, pipe 163, and check valve 164 (opening in the direction of forward flow) to drain 165, and likewise provision is made to drain storage tank 137 through pipe 165, manual valve 166, and pipe 163, and check valve to drain 165. There is likewise a drain connection from the outlet side of pump 158 through pipe 166 and solenoid valve 167.

Steam is introduced into the heater coil through pipe 170 and check valve 171 to pipe 172 which connects at a T to pipe 173 which extends through valve 174 and solenoid operated valve 175 to heater coil 176 of storage tank 134 discharging through steam trap 177 and pipe 178 connecting at a T with pipe 180 to drain 181. Likewise there is connection at the T from pipe 173 through

valve 182, pipe 183 and solenoid valve 184 to heater coil 185, steam trap 186 and pipe 187 which connects at the T to drain pipe 180.

From the inlet there is also a steam connection through manual valve 188 and solenoid valve 190 to heater coil 191 in the sump at the bottom of the dish, and the condensate discharges through steam trap 192 to drain 181. Temperature controller 193 controls solenoid valve 190 to maintain a predetermined temperature inside the bell.

A blower 194 (Figure 1) is connected to the flange at one side of the sump and during the drying phase the blower discharges air through a pipe 195 to the sump which is closed by a hydraulic valve 196 at other times during the operation. A solenoid valve 197 opens to discharge the heated air to the atmosphere.

Operation

In operation let us assume that one of the form wheels or carriers is at one end of the machine in a loading and discharging position, the hosiery from the previous treating step being discharged and gray goods being boarded on the form. The form wheel or carrier is raised on the spider and turning and the forms are being pivoted outwardly by the operator. The second form wheel or carrier is in position under the bell, its table resting on the rollers, and the roller holders having depressed the helical compression springs. The bell is in raised position.

The operator now being ready to start the next cycle, pushes the start button for the sequence timer of any well known character. This causes the form wheel or carrier at that end of the machine to be lowered onto its table by lowering piston and rod combination 48 in cylinder 50. Cylinders 58 on each side are then automatically energized, shifting the tables endwise in unison and placing the newly loaded form wheel or carrier and its forms into position under the bell. The end of the stroke being reached, the tables come to rest, the newly inserted table resting on the rollers beneath the bell.

The form wheel which has just been removed to discharge and reloading position is now raised off its table by raising ram 48, and is rotated by the action of pulley 52, so that the operator can readily remove the dyed hosiery by rocking the forms out to the dot-dash position shown in Figure 12, where the forms are more accessible. The measuring tank 154 discharges one tank full of treating solution by opening valve 155 while valve 153 is closed. Then the latching mechanism engages the locking hook elements 84 and pulls down on the bell so that the table which is beneath the bell is locked between the lower and upper gaskets to make a tight seal of the bell with the dish.

As soon as the bell is sealed tightly against the dish, the pump 158 starts withdrawing treating solution from the sump and pumping it through the spray nozzles which are rotating under the action of the spray nozzle drives. In the meantime heat transfer from the steam coil 191 has heated the watery treating solution to a temperature above the normal boiling temperature, but boiling has been prevented by the superatmospheric pressure. The thermal control element 193 maintains a predetermined temperature in the treating solution, which is desirably set at about 230° F. for best results under one particular set of conditions, it being understood, of course, that the temperature will vary with the particular operating conditions and with the character of the work and with the treating chemicals.

The recirculation of the treating solution through the spray nozzles continues for a predetermined time which will vary with the particular conditions, but which under a particular set of conditions has been found to be advantageously of the approximate order of 4½ minutes, it being understood that this time will vary widely with the character of the chemicals and the work and other conditions.

It is important from the standpoint of quality of the

dyeing to have a pressure and a temperature above ordinary atmospheric boiling temperature of water inside the closed container. This is particularly important in order to accomplish the preboarding (heatsetting) of the hosiery which takes place at the same time as the dyeing.

At the end of the dyeing cycle, pump 158 stops, and drain valve 167 opens to discharge the expended treating solution to the drain. The drainage time is suitably allowed for, after which the blower or other source of air (or superheated steam or other suitable gas) forces air upwardly from the sump through the steam coil, thus heating the air to a temperature adequate to dry the hosiery on the forms. The air is suitably discharged at the top of the bell by valve 197 either to the atmosphere or to a suitable duct. The drying time will vary with the requirements, but in a particular installation may be of the order of 2 minutes.

At the end of the drying time, the latches disengage under the action of cylinders 106 moving in the direction indicated by the position shown in Figure 9, after which cylinders 75 act to raise the bell above the top of the hosiery forms. This completes the cycle as far as the scouring, dyeing, finishing, preboarding (heatsetting) and postboarding (drying) are concerned.

During the period that the dyeing and preboarding (heatsetting) are taking place as to the work which is on the forms of one form wheel, the operator or operators are discharging the work from the forms of the other form wheel and positioning new work on these forms for the next cycle.

Also during the time that the dyeing of the hosiery for one cycle is taking place, the measuring tank 154 is filling again with a charge of dye dispersion by closing solenoid valve 155 and opening solenoid valve 153. It will be noted that there is an air vent at 154' so that air cannot bind in the tank and prevent filling or discharge.

The operation from the standpoint of solution preparation takes place as follows:

The mixing tank is first filled with water. As soon as it is filled completely, its probe acts automatically to start pump 130, which pumps the charge up to the storage tank which has been connected to the mixing tank by manually opening either valve 133 or valve 136, the other valve, of course, being kept closed.

When the mixing tank is empty, the entire charge of scour, dye and finish concentrate is introduced through chute 123 into mixing tank 122. This will suitably be an adequate quantity of concentrate for the scouring, dyeing and finishing required on one shift of operation of the machine. The rest of the mixing tank is then filled with water, and when the water comes up to the predetermined level for filling the mixing tank, probe 127 automatically starts the action of pump 130 to pump the charge of concentrate and water into the storage tank. As the concentrate and water enters the storage tank they are continuously agitated by being pumped off through an agitating pump 144 and brought back into the storage tank suitably through an orifice, and in this way uniformity of the content of the particular storage tank is maintained at all times.

The cycle selector control mechanism as well known is set for the desired number of charges of the mixing tank and this will automatically put in the desired number of mixing tank charges to create the predetermined charge in the storage tank.

As soon as the treating charge in the storage tank has been adequately mixed by its storage tank mixing equipment, the charge of scour, dye and finish is ready for the first operation. It will be evident that the solution in the mixing tank is maintained at a predetermined temperature suitably of the order of 110° F., although varying with particular conditions, by the action of steam coil 176.

The first charge is desirably put into the measuring

tank manually by opening measuring tank valve 153 while valve 155 is closed, thus filling the measuring tank by gravity. Subsequent operation will take place automatically as required in response to the action of a program control.

It will be evident that each time that the dish is draining the measuring tank is filling with the next charge of dye.

It will be evident that there is an important cooperative advantage in accomplishing not only the dyeing, but also the preboarding (heatsetting) and preferably also the finishing of the hosiery all at one time under the action of the solution in accordance with the present invention.

This is particularly true because in the case of nylon hosiery or analogous synthetic fabrics, the effect of the preboarding (heatsetting) under the elevated temperature is to provide a molecular rearrangement, and actually a swelling of the yarn ends, which is most favorable for the absorption of a very finely divided particle size of dye and also of finish.

It is also very important to accomplish the scouring at the same time. The detergent used is a very efficient dye leveller, and therefore improved levelling of the dye is accomplished by the action of the detergent.

It is no longer necessary according to the invention to utilize an individual dye which would be different in complete composition for each different shade, but instead the dye can be produced by varying compositions of three basic dye ingredients according to the tri-stimulus value of the particular wave length desired in the final shade to be dyed. Thus it is very simple and efficient to stock the three basic dye stuffs and simply use varying compositions for the various shades which are to be produced.

The quantity of dye stuff is likely to be of the order of 25 to 500 parts per million and frequently of the order of about 50 parts per million in the water dispersion.

Very desirable fundamental colors are blue, scarlet and yellow.

It will be evident that the principle of the invention can be applied using a wide variety of different chemical agents for scouring, dyeing and finishing hosiery and other similar textiles. The following example illustrates one desirable combination, suitable particularly for nylon hosiery, and having the very desirable feature that it dyes spun stable fiber and monofilament which may be present in the same stocking at the same rate and to produce results which are exactly comparable.

Example

A desirable scouring agent is the condensation product of ethylene oxide with a vegetable oil, such as olive oil. This product is neutral and salt free, and is available in a 94 percent concentration with 6 percent water by weight, known on the market as Energetic S (Armour Products, Chicago). This detergent is soluble in petroleum solvents and polar solvents, has very low tendency to foam, can readily be dispersed in the watery medium, has excellent soil suspension properties, forming a stable emulsion over a wide temperature range, and does not tend to deposit out soil in the drain and related systems.

The scouring agent is desirably dissolved in an aliphatic hydrocarbon of the character of Stoddard solvent, a suitable solvent of this character being sold on the market as Varsol No. 1 (Esso Standard Oil, Philadelphia). It is preferable to mix one part of the scouring agent by volume with three parts of the solvent, although the composition range can be varied considerably.

In the preferred embodiment about 0.1 percent by volume of the scouring agent above referred to is employed in the final treating solution, it being understood, however, that the proportions can be increased or diminished as desired, and the composition may vary between 0.01 and 1.0 percent although the higher concentrations are not recommended.

The dye employed is desirably an acetate type dyestuff, which is introduced in suitable proportions to obtain the desired color combination. As well known in the art, fundamental dye ingredients such as blue, scarlet and yellow can be combined in proportions to give the tri-stimulus value for the final shade desired.

As an example of the dyestuff combination to obtain suntone, the following ingredients may be used in the following proportions to make up 60 gallons of treating solution:

- 3 grams du Pont Celanthrene Blue F.R.
- 3 grams du Pont Acetamine Scarlet B.
- 5 grams American Aniline Products Amacel Yellow G.

The dyestuff is made up in a paste with a small amount of the solution containing the scouring agent and then gradually emulsified by stirring into a larger volume.

As to the finishing agent, it is preferable to use a resin, a suitable example being melamine-formaldehyde condensation product, a liquid, desirably in a concentration range of 0.1 to 0.6 percent by volume in the final treating solution, preferably in the range of 0.1 to 0.2 percent by volume.

It is preferable to maintain a pH slightly on the alkaline side, desirably in the range of 7.5 to 8. A suitable agent for adjusting the pH is trisodium phosphate.

It will in some cases be desirable to employ a lubricant which may for example be a sorbitol ester, a material of this character being available on the market as Avcosol 104 (Atlas Products, Wilmington). The lubricant is a wax with strong self-emulsifying properties and is preferably used in the proportions of 0.1 to 0.4 percent by weight, preferably about 0.2 percent by weight of the final treating solution.

It will be evident that the above ingredients may be replaced by other suitable ingredients to accomplish the purpose intended. One very desirable feature of the combination of ingredients suggested is that they impart scouring, dyeing and finishing action without any interference one with the other, and in fact the ingredients mutually assist because the scouring agent aids in uniformly levelling the dye and also dispersing the dye. The lubricant aids in dispersing the dye. The resin, which is water soluble contributes toward dispersing the dye and aids greatly in holding the dye in intimate association with the fabric.

It will furthermore be evident that the lubricant aids greatly in stripping the stockings from the stocking forms.

It will be evident that when the treating solution is drained a substantial amount of treating solution ingredients remain chemically combined with the fabric and this has the effect of creating a stabilized condition of the fabric, which will hold the stocking during subsequent service in the contour established by the boarding much more effectively than when prior art bulk finishing techniques are used.

In view of our invention and disclosure variations and modifications to meet individual whim or particular need will doubtless become evident to others skilled in the art, to obtain all or part of the benefits of our invention without copying the structure and method shown, and we, therefore, claim all such insofar as they fall within the reasonable spirit and scope of our claims.

Having thus described our invention what we claim as new and desire to secure by Letters Patent is:

1. A textile treating apparatus for setting, scouring, dyeing, finishing and drying textiles on forms, comprising a receptacle of dish form having a cavity adapted to hold a textile treating solution, spray means above the receptacle for distributing solution withdrawn from the receptacle, said spray means including outwardly distributing spray means, pump means for continuously withdrawing solution from the receptacle and introducing it into the spray means, heating mechanism in the system for heating the treating solution free from addition of any

11

outside ingredient to the solution and located in the system between the receptacle and the spray means, a carrier having forms thereon, movable horizontally and having a position surrounding the spray means and a position remote from the spray means, means forming a closed chamber surrounding the carrier and the forms thereon in one position and surrounding the spray means, said means forming a closed chamber comprising a bell sealing with respect to the receptacle, and means for introducing hot gas against the textiles on the forms and thereby drying the same, the heating mechanism establishing superatmospheric pressure in the closed chamber from the vapor of the treating solution alone.

2. A textile treating apparatus of claim 1, in combination with a table supporting the carrier and extending between the dish and the bell, mechanism for sealing both the dish and the bell against the table by pressure applied uniformly around the circumference, and resilient mechanism for urging the table upwardly in floating relation.

3. A textile treating apparatus of claim 1, in combination is a table supporting the carrier and extending between the dish and the bell, a second carrier having forms thereon, a second table supporting the second carrier and operatively connected to the first table, and mechanism reciprocating both carriers and tables in unison to bring one carrier and table into the chamber and to move the other carrier and table outside the chamber.

4. A textile treating apparatus for setting, scouring, dyeing, finishing and drying textiles on forms, comprising a receptacle having a cavity adapted to hold a textile treating solution, spray means above the receptacle for distributing solution withdrawn from the receptacle, said spray means including outwardly distributing spray means, pump means for continuously withdrawing solution from the receptacle and introducing it into the spray means, a mixing tank, a storage tank interconnected with the mixing tank, means for pumping treating solution from the mixing tank to the storage tank, the mixing tank providing a measurement of increments of filling of the storage tank, a measuring tank for measuring the discharge of the content from the storage tank, the measuring tank containing a single charge for the textile treating apparatus and discharging into the receptacle, heating mechanism in the system for heating the treating solution free from addition of any outside ingredient to the solution and located in the system between the receptacle and the spray means, a carrier having forms thereon, movable horizontally and having a position surrounding the spray means and a position remote from the spray means, means forming a closed chamber surrounding the carrier and the forms thereon in one position and surrounding the spray means, and means for introducing hot gas against the textiles on the forms and thereby drying the same, the heating mechanism establishing superatmospheric pressure in the closed chamber from the vapor of the treating solution alone.

5. A textile treating apparatus for setting, scouring, dyeing, finishing and drying textiles on forms, comprising a receptacle having a cavity adapted to hold a textile treating solution, spray means above the receptacle for distributing solution withdrawn from the receptacle, a carrier having forms thereon, movable horizontally and

12

having a position above the receptacle in which the forms are in spray receiving position with respect to the spray means, and also having a position remote from the spray means, pump means operating free from introduction of outside fluid for withdrawing solution from the receptacle and introducing it into the spray means, means forming a closed chamber surrounding the carrier and the forms thereon in one position, surrounding the spray means and sealing to produce an atmosphere tight seal with respect to the receptacle, heating mechanism in the system for heating the treating solution free from addition of any outside ingredient to the solution and located in the system between the receptacle and the spray means, said heating mechanism establishing superatmospheric pressure in the closed chamber from the vapor of the treating solution alone, and means operative after completion of the operation of the spray means for introducing hot gas against the textiles on the forms and thereby drying the same.

6. A textile treating apparatus for setting, scouring, dyeing and finishing textiles on forms, comprising a receptacle having a cavity adapted to hold a textile treating solution, spray means above the receptacle for distributing the solution withdrawn from the receptacle, pump means operating without introduction of additional fluid for continuously withdrawing solution from the receptacle and introducing it into the spray means, a carrier having textile forms, the carrier being movable horizontally and having a position adjacent the spray means and a position remote from the spray means, the carrier and the spray means in the adjacent position being located relatively one inward of the other, and being mounted relatively rotatably with respect to one another, means for relatively rotating the spray means and the forms during the operation of the spray means, heating means free from addition of any outside ingredient to the solution, operative to establish superatmospheric pressure by forming vapor from the treating solution alone, and means forming a closed chamber surrounding the carrier and the forms thereon in the one position and surrounding the spray means.

7. A textile treating apparatus of claim 6, in which the forms are arranged in a ring, and the spray means is located inside the ring.

8. A textile treating apparatus of claim 7, in which the spray means projects the spray downwardly on the forms.

References Cited in the file of this patent

UNITED STATES PATENTS

1,738,946	Chapin et al.	Dec. 10, 1929
1,907,429	Masland	May 9, 1933
1,948,568	Faber et al.	Feb. 27, 1934
2,299,040	Schwartz	Oct. 13, 1942
2,484,668	Backhus	Oct. 11, 1949
2,492,285	Heliot	Dec. 27, 1949
2,519,981	Richter	Aug. 22, 1950
2,520,062	Richter	Aug. 22, 1950

FOREIGN PATENTS

862,165	France	Feb. 28, 1941
702,434	Great Britain	Jan. 13, 1954