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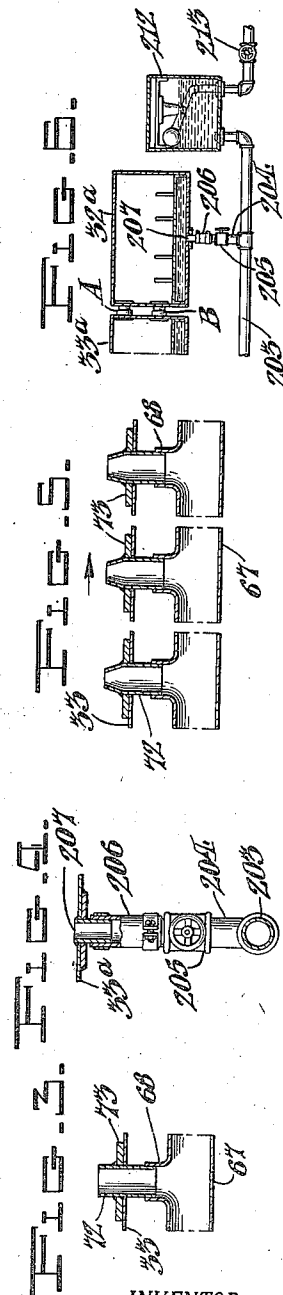
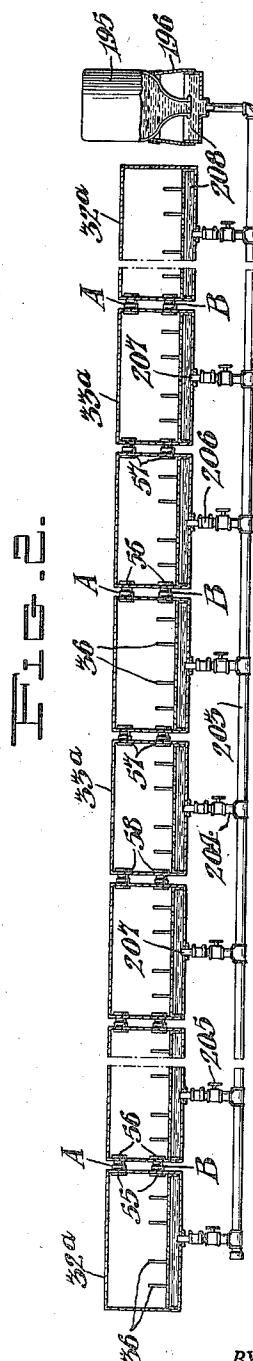
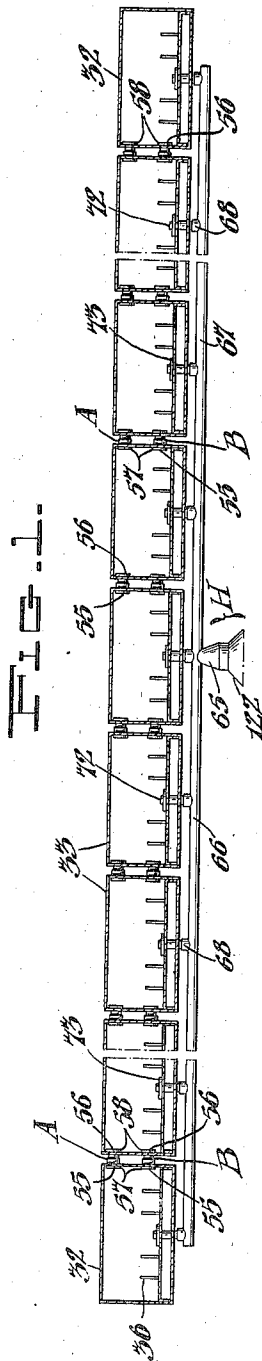
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2,108,404

MEANS FOR EFFECTING VAPOR TREATMENT OF YARN IN A STRAIGHT KNITTING MACHINE

Filed Oct. 9, 1935

7 Sheets-Sheet 1



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FIG. 7.

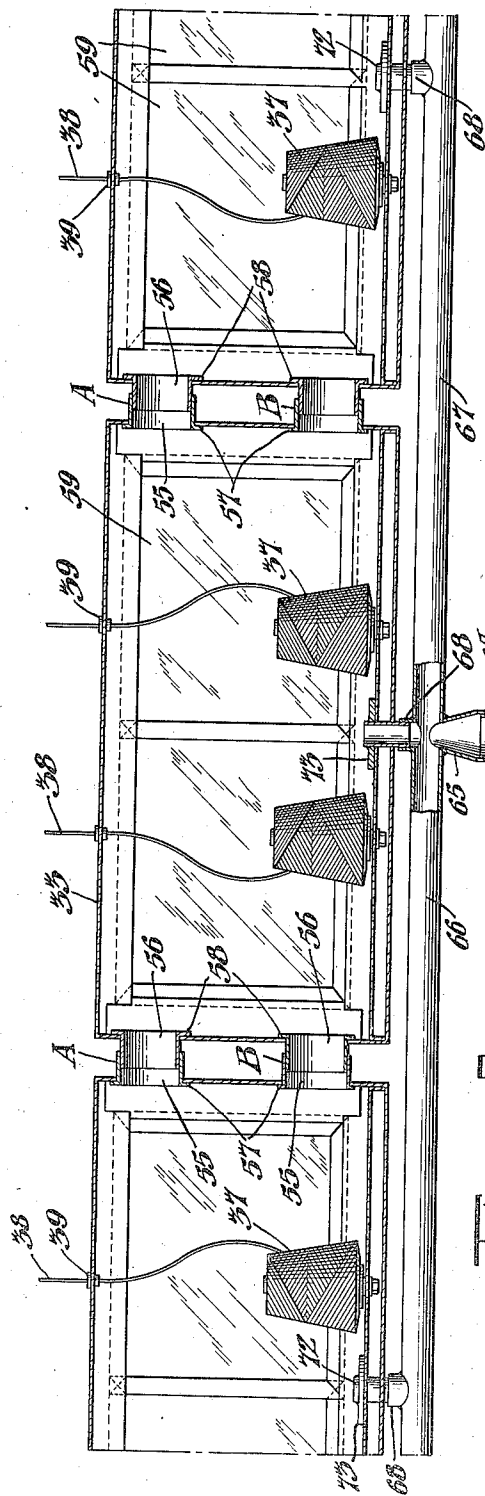


FIG. 8.

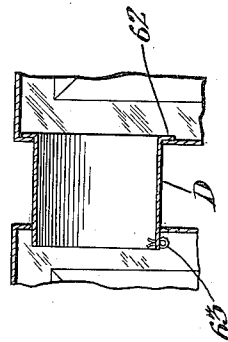
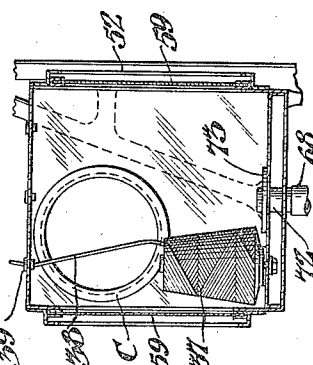


FIG. 9.

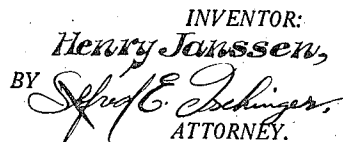


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MEANS FOR EFFECTING VAPOR TREATMENT OF YARN IN A STRAIGHT KNITTING MACHINE

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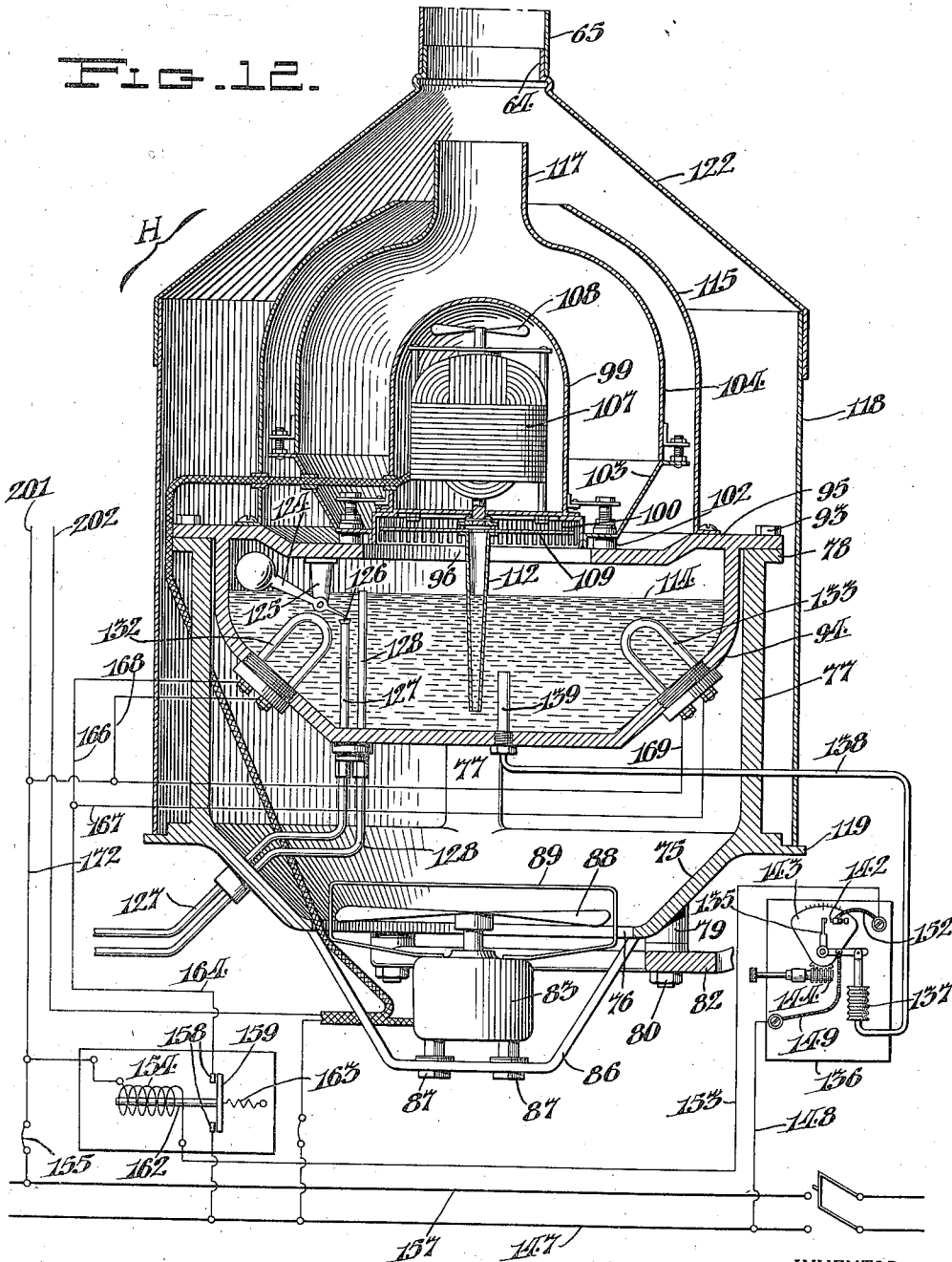
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FIG. 12.



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MEANS FOR EFFECTING VAPOR TREATMENT OF YARN IN A STRAIGHT KNITTING MACHINE

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FIG. 13.

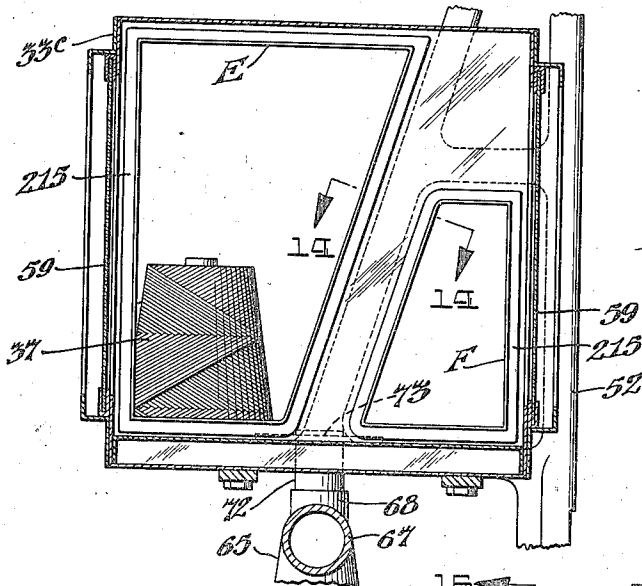


FIG. 14.

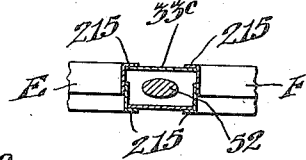


FIG. 15.

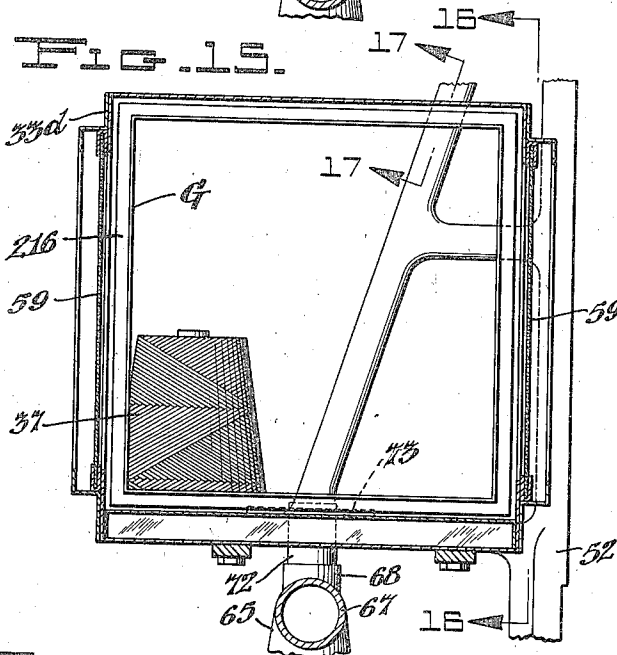


FIG. 16.

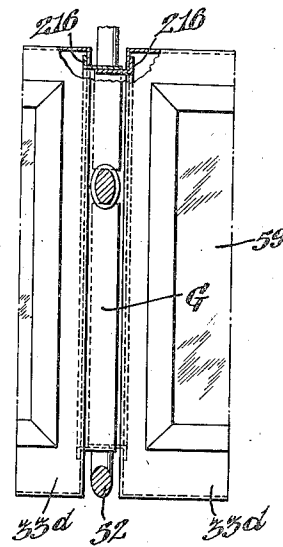
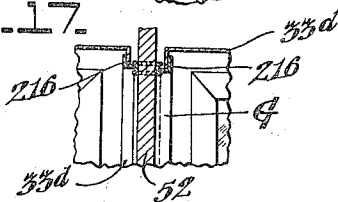


FIG. 17.



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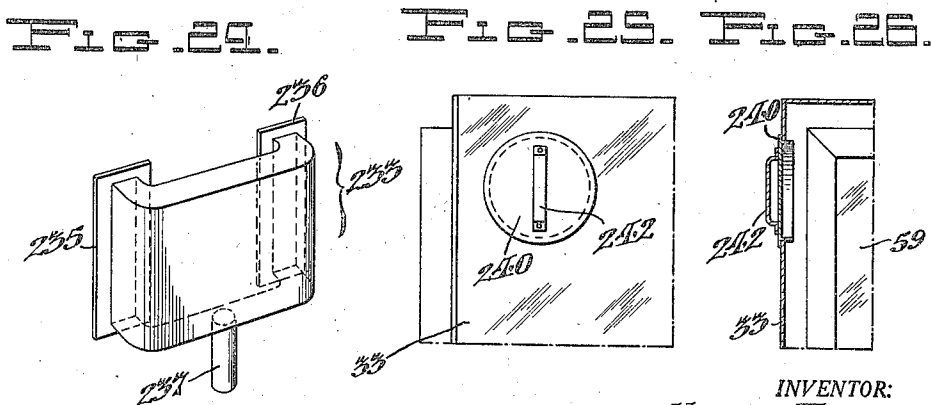
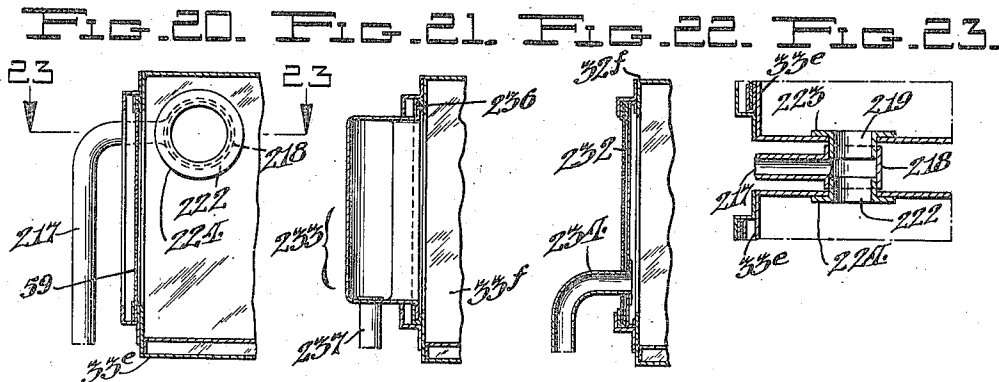
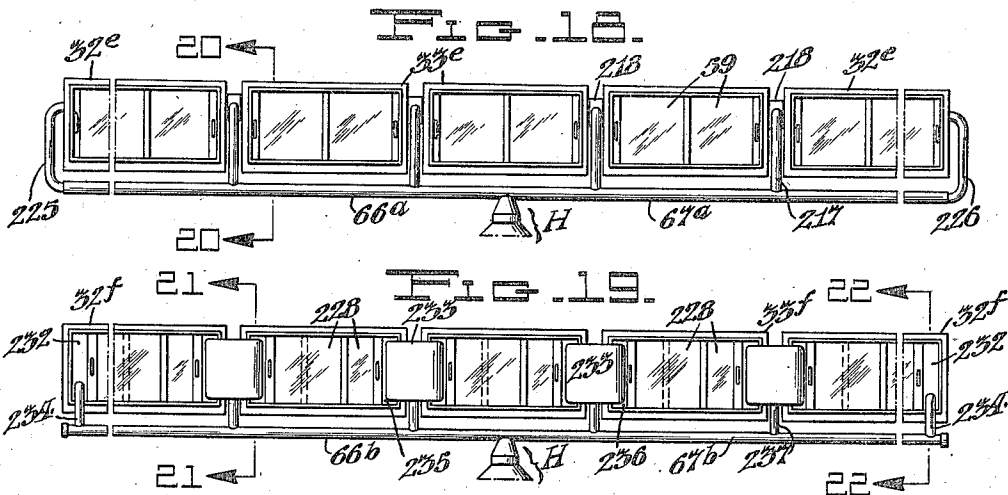
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MEANS FOR EFFECTING VAPOR TREATMENT OF YARN IN A STRAIGHT KNITTING MACHINE

Filed Oct. 9, 1935

7 Sheets-Sheet 6



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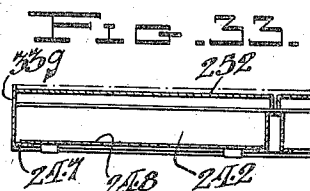
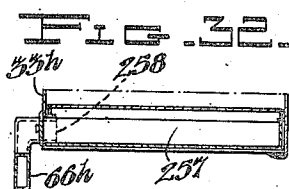
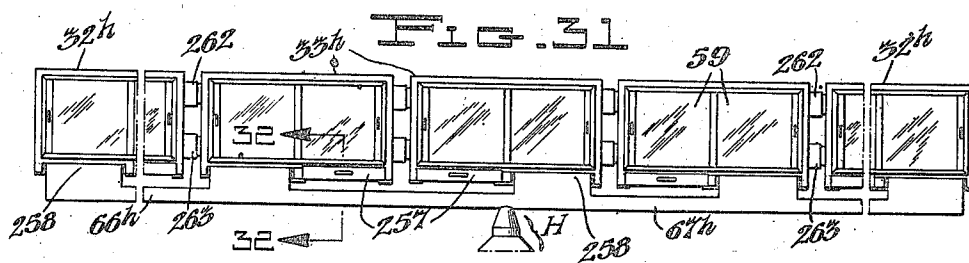
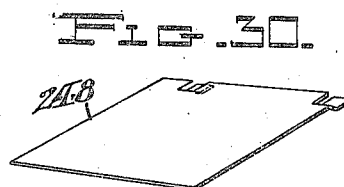
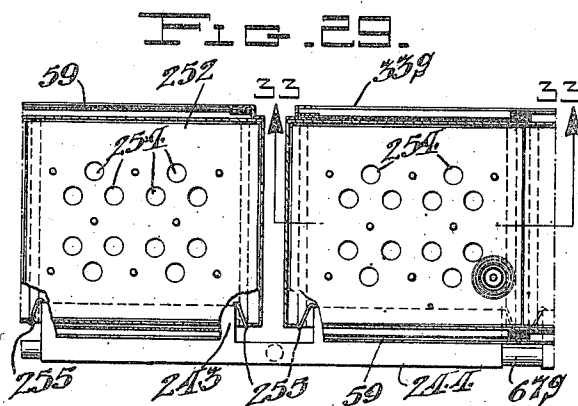
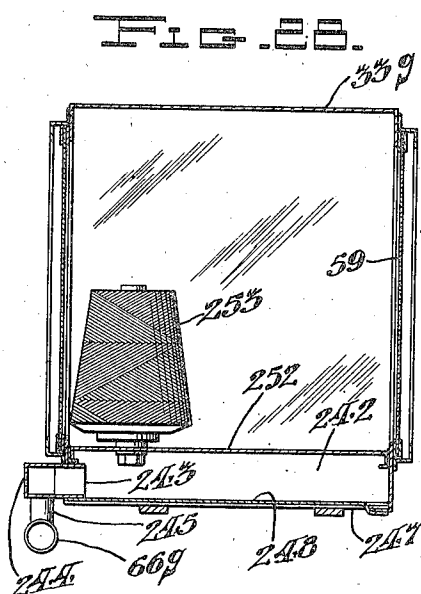
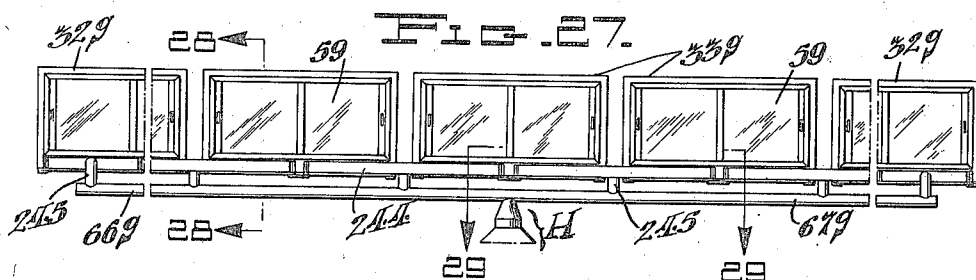
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Filed Oct. 9, 1935

7 Sheets-Sheet 7



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UNITED STATES PATENT OFFICE

2,108,404

MEANS FOR EFFECTING VAPOR TREATMENT OF YARN IN A STRAIGHT KNITTING MACHINE

Henry Janssen, Wyomissing, Pa., assignor to Textile Machine Works, Wyomissing, Pa., a corporation of Pennsylvania

Application October 9, 1935, Serial No. 44,133

9 Claims. (Cl. 66—125)

My invention relates to means for conditioning, or effecting vapor treatment of, the yarn in a yarn-fabricating machine, and particularly to means for subjecting all the yarns of a multi-section straight, or full-fashioned, knitting machine to the same uniform treatment.

Fine yarns, particularly of silk, are difficult to lay evenly, or on a straight line, to the needles of a knitting machine, because of an inherent tendency of the yarn to crinkle. To avoid this objection, the yarns have been moistened to prevent the formation of the irregular areas otherwise formed in the fabric, and to overcome other disadvantages, such as tangles, interruptions and delays.

In knitting full-fashioned stockings, it is usual to employ machines including a plurality of sections for simultaneously knitting a relatively large number of stocking blanks, and to provide a number of separate moistening boxes in proportion to the number of machine sections for enclosing, and humidifying, the yarn packages.

These boxes have been provided with means, either in the form of integral parts, or of slidably removable drawer-like pans, for supporting pools of water, which have been deficient in various ways, such as not supplying the humidity in either the quantity, or the constancy, of the supply needed, in requiring more frequent and individual attention, and causing unequal yarn-conditioning effects in the several cabinets.

In my Patent No. 2,066,781, issued January 5, 1937, on a Method of, and means for, effecting vapor treatment of yarn in a yarn fabricating machine, the invention thereof is shown in various forms for overcoming objections to the above-mentioned separate moistening-box structures, including the structure by which a unit receptacle or cabinet replaces the several former individual boxes. The invention of the above-mentioned patent is very effective, and highly successful, in operation, and has many applications, particularly in connection with new machines. However, there are many machines in existence having the pool or separate receptacle means, the structures of certain of which are in good condition for substantial further service.

With an object of saving a substantial amount of the cost of installation of these former entirely-independent boxes, the invention hereof so adapts these boxes to operate like the unit receptacle of the invention of the above-mentioned patent as to obtain substantially the same effect at a minimum cost of installation, in a shorter time, and with less material.

Another aim is to provide the structure in attractive and effective form whereby it may have advantages, in certain applications, in connection with new machines.

In the feature, in which certain of the structure and material, of the several individual boxes existing before the application of the invention, are retained, and identifiable in, the new structure for the above-mentioned purpose, the device is adapted to both the draft vapor, and the liquid-pool, principles of humidification, to obtain improved results. The device operates, in the draft or impelled-vapor form, to more effectively distribute the drafts, and to equalize and increase the humidity in the several receptacles. It operates, in the pool form, to enable the individual receptacles to assist one another by interchange of moist air, in furtherance of which, another novel element of the invention comprises means for automatically maintaining a pool or pools at predetermined level.

In the device shown in the above-mentioned patent, a gallows of new form is required between adjacent machine sections for supporting the moistening cabinet and yarn guide rods, because a unit cabinet is substituted for the spaced end-to-end moistening boxes, between which the old gallows partially extend. In the invention hereof, the gallows of former construction may be retained, and, in certain forms, conduit means are connected between adjacent cabinets, and so constructed and so placed in position, as permitted by the old gallows, as to render the conduit means of substantially maximum cross-sectional area.

It is another object of the invention to provide draft-connecting means, between the former separate moistening boxes, of substantially maximum transverse-sectional area, consistent with the presence of the former gallows. This result is effected, in one form, by introducing conduit means of cross-sectional contour in accordance with the shape of the gallows to give maximum draft, and to maintain the gallows outside the box. In another form, a single conduit is provided, which is constructed as though no gallows were present, by building around the gallows, and having portions of the gallows inside the conduit.

Also, in the device of the above-mentioned patent, and in certain forms of the invention hereof, the moist air is introduced into the yarn-enclosure structure, at points spaced along the machine, by inserting a nozzle or nozzles through the bottom of the structure. Although of highly desirable form, this structure requires alteration

of the structure at the bottom for reception of the nozzles, requiring time to produce at the place of installation, and rendering it necessary to discontinue operation of the machine.

5 It is another object of the invention to reduce the time required for installing the device by substituting for such bottom nozzle openings, other nozzle openings, which are similar to those employed in the bottom-nozzle structure, but
10 which are provided in conduits connected between adjacent receptacles.

A further object is to convert the several moistening boxes into a unitary structure, without shutting down the machine, by introducing one
15 or both of the box-connecting conduits, and the vapor-injecting pipe structures through the door openings of adjacent boxes; this result being effected by partially opening the box doors, inserting the device, and closing the doors against the device, whereby the doors continue their former
20 function of closing the boxes, and admitting yarn packages to the boxes when opened.

A similar result, without interfering with the usual operation of the doors, is obtained, in a
25 prior device including removable pans, by removing the pans, and leading the conduits into the spaces vacated by the pans. Another form contemplates the removal of only one of two pans of each box, leading a conduit for moist air to the
30 vacated pan space, interconnecting the spaces by conduits to facilitate the flow of vapor, and other combinations of vapor-introducing and circulation pipes and conduits.

It has also been suggested heretofore, in a device intended to moisten the yarn, to provide a
35 spraying source, and means for circulating spray from one side of this source, through the moistening boxes, and back to the other side of the source of spray. Such device produces a spotty
40 effect on the yarn, because of the impingement, at irregular positions against the yarn, of drops of various sizes, and involves the use of a great excess of water. This amount of water would be
45 difficult, or impossible, to control in the boxes, which have sliding doors of ordinary fit, and eyelets for the egress of the yarn from bobbins in the boxes to the carrier fingers. This prior device is unduly expensive, and difficult to install, and to operate, if feasible at all, and has other
50 features against its practical embodiment.

It is among the objects of the invention heretofore, to avoid the disadvantages of a spray device of such character, to reduce the number of parts, and amount of material relative thereto, and to
55 provide a more economical and effective device, in general, which, in accomplishing its purpose, has, as one feature, an automatically-controlled unidirectional feed of a vapor, or volatile fluid, at a controlled temperature, to substantially only
60 the amount required by the yarn, thus reducing the amount of condensation, or other excess fluid, and effecting a precision yarn treatment, not believed heretofore approached by any device, other than that of the above-mentioned patent.

65 Other objects are to provide features of construction for effectively and economically obtaining the major objects, such as novel arrangements of conduits between the receptacles, each with its advantages, as will appear.

70 With these and other objects in view, which will become apparent from the following detailed description of the illustrative embodiments of the invention shown in the accompanying drawings, my invention resides in the novel elements, features
75 of construction and arrangement of parts

in cooperative relation, as hereinafter more particularly pointed out in the claims.

In the drawings, only those parts of a "Reading" full-fashioned knitting machine necessary to an understanding of the invention are illustrated, the other parts and the operation thereof being well known in the art, as shown and described in the "Reading" Full Fashioned Knitting Machine Catalogue, copyright 1929, published by the Textile Machine Works, Reading, Pennsylvania.

In the drawings:

Figure 1 is an outline, or diagrammatic view of a receptacle or cabinet and humidifier unit structure embodied in the invention, parts being
15 shown in section, and others omitted, for clearness;

Fig. 2 is a view, similar to Fig. 1, of a modified form of the invention in which, instead of a forced-draft humidifier system, as in Fig. 1, the structure is of the pool type, and embodies an automatic liquid leveler;

Fig. 3 is an enlarged detail view of a nozzle embodied in the invention illustrated in Fig. 1;

Fig. 4 is an enlarged detail view of one of several inlet structures shown at the bottom of
25 Fig. 2;

Fig. 5 is a view of a modified nozzle structure wherein the nozzles have outlet openings of various sizes;

Fig. 6 is a view, similar to a portion of Fig. 2, showing a liquid leveling device of modified form;

Fig. 7 is a greatly enlarged detail of a portion of the structure as indicated at the center of Fig. 1, parts being shown in section, and yarn
35 packages being added;

Fig. 8 is a view corresponding to a cross section of Fig. 7, but of a modified form of the structure of Fig. 7;

Fig. 9 is an enlarged detail view of a conduit of modified form, included in the invention;

Fig. 10 is a view, in transverse section, of a full-fashioned knitting machine, showing parts of the device of Fig. 7 on a reduced scale, certain of the parts of the knitting machine in full lines, and others in broken lines, and an electrical circuit diagram;

Fig. 11 is an enlarged detail view of a humidistat embodied in the invention, and as seen in Fig. 10;

Fig. 12 is a greatly enlarged detail view partially in section, and partially in elevation, of a humidifier unit indicated at the center of Figs. 1 and 7, and at the lower left of Fig. 10, together with an electrical circuit diagram therefor;

Fig. 13 is a view, similar to Fig. 8, of a cabinet or receptacle of modified form;

Fig. 14 is a view, taken substantially along the line 14—14 of Fig. 13;

Fig. 15 is a view, similar to Fig. 13, of a further modification of the structure thereof;

Fig. 16 is a view, taken substantially along the line 16—16 of Fig. 15;

Fig. 17 is a view, taken substantially along the line 17—17 of Fig. 15;

Fig. 18 is a view similar to Fig. 1 of another modified form of the invention;

Fig. 19 is a view, similar to Fig. 1, of the invention in a further modified form;

Fig. 20 is an enlarged detail view, taken substantially along the line 20—20 of Fig. 18;

Fig. 21 is a view, taken substantially along the line 21—21 of Fig. 19;

Fig. 22 is a view, taken substantially along the line 22—22 of Fig. 19;

Fig. 23 is a view, taken substantially along the line 23—23 of Fig. 20;

Fig. 24 is a detail perspective view of a conduit structure shown in Figs. 19 and 21;

Fig. 25 is an end view of one of the moistening boxes or cabinets, as indicated in Figs. 8 or 20, showing an element for closing the cabinet, when the conduits are removed to permit removal of one of the cabinets from the machine;

Fig. 26 is a sectional view, taken at right angles to Fig. 25;

Fig. 27 is a view, from the rear of the machine, of a receptacle and conduit structure of modified form;

Fig. 28 is an enlarged view, taken substantially along the line 28—28 of Fig. 27;

Fig. 29 is a view, larger than Fig. 27 and smaller than Fig. 28, taken substantially along the line 29—29 of Fig. 27;

Fig. 30 is a detail perspective view of a wall or plate element shown at the bottom of Fig. 28;

Fig. 31 is a view, similar to Fig. 27, of a receptacle and conduit structure of further modified form;

Fig. 32 is a view, taken substantially along the line 32—32 of Fig. 31; and

Fig. 33 is a view, taken substantially along the line 33—33 of Fig. 29.

Referring to Fig. 10, in the example indicated, a multi-section, full-fashioned, stocking-knitting machine comprises a cam shaft 12 for supporting usual cams (not shown) for actuating the various machine mechanisms, and which is journaled in bearings on end and center frames 14. The latter, which are disposed in parallel-plane spaced relation, front-to-back of the machine, are held by tie members extending transversely thereto, including a front rail 15, a back rail 16, a front bed 17 and a center bed 18.

Each bank of needles 22, of a pair of such banks between each pair of the frames 14, is held to a needle bar 23 by clamps 24, and cooperates, in a usual manner, with the sinkers, dividers and knockover bits of a sinker-head assembly S on the center bed 18.

Each of carrier rods 1 to 8, inclusive, longitudinally reciprocally mounted on brackets 28, on the center bed 18, supports a yarn-carrier finger 29 for laying yarn to the needles 22 of each bank.

Receptacles or cabinets 32 and 33, see Fig. 1, are disposed in spaced end-to-end series relation along the rear of the machine; this series including the end cabinets 32 and the intermediate cabinets 33, which comprise right and left end cabinets, and intermediate cabinets differing only slightly in construction, in that each intermediate receptacle, a duplicate of each other intermediate receptacle, is provided with apertures at each end, and the end receptacles, although like each other in having corresponding apertures, each at only one end, have these apertures at opposite ends, respectively, next to the intermediate receptacle 33.

Although these receptacles may be originally constructed as shown, it is one of the primary features of the invention that they may be reconstructed, at slight cost and with slight or no change, from the usual and well-known moistening boxes of former practice, which are merely boxes with pools of water therein.

The former boxes, as mentioned, are all substantially duplicates of each other, are all entirely closed and self contained, and none cooperates with any other in any interchange of humidified air, or in other manner, except as

to structural relation to the machine. They thereby, are subject to widely different humidifying conditions, do not supply enough moisture to the yarns, do not have a fixed liquid level, and require individual attention and manipulation in supplying the several pools therein; these pools easily attaining different levels, by being installed in different amounts, by different rates of evaporation, and by other causes.

In the structure, shown in Figs. 1 and 10, the cabinets are provided with pins 36 for supporting bobbins or packages 37 of yarn 38, which is led from each package, through an eyelet 39, over one of a set of guide bars 42, through a usual moistening trough 43, through a tension ring device 44, through a snapper 47, and across one of another set of guide bars 48 to one of the yarn carrier fingers 29, by which it is laid to the corresponding needles 22 across the knitting field.

Gallows or brackets 52, mounted on the machine frame, and which support the guide rods, the trough, the tensioning ring device and the snapper, above set forth, also support the cabinets 32 and 33.

In the form shown in Figs. 1, 7 and 10, the intermediate cabinets 33 are joined to each other, and to the end cabinets 32, by conduits A and B disposed adjacent to diagonally-opposite corners of the cross-sectional area of the cabinets, as seen in Fig. 10. This arrangement, in consideration of space factor, and of the positions of the gallows and other parts, provides room permitting the conduits to be of substantially maximum diameter, and locates the conduits in relatively widely-separated vertical relation, conducive to good circulation of the air in the receptacles. Each conduit A and B, is preferably constructed of telescopically-interfitted longitudinal sections 55 and 56, disposed in oppositely-registered apertures in the adjacent end walls of adjacent cabinets, and provided with end flanges 57 and 58, respectively, at the inner sides of the cabinet end walls. These walls, and the conduits, are preferably constructed of thin sheet metal. The cabinets are also provided with sliding glass-panel doors 59 for placing the packages 37, and which permit the ready placing, and separation, of the conduit sections 55 and 56 through the openings in the end walls, and into interfitted relation to each other. This structure, in which the longitudinal sections 55 and 56 have substantial overlap, permits a conduit of one size to connect cabinets of different distances apart, and to compensate for expansion or other slight relative movement or discrepancies of spacing between the cabinets. The arrangement also permits a cabinet or cabinets to be removed for renewal or repair thereof, or for renewal or repair of parts of the machine.

As shown in Fig. 8, a single conduit C is of substantially larger diameter than either of, and is substituted for, the conduits A and B. It is otherwise similar to these conduits, and similarly placed in, and withdrawn from, position.

In the form shown in Fig. 9, a unitary, or one-piece, conduit D may take the place of any of the conduits A, B or C, and have a flange 62 at one end, and be provided with a cotter pin 63 or other means for holding the conduit in place.

Referring particularly to Figs. 1 and 7, a humidifier unit H, disposed at or near the longitudinal central rear part of the machine, has a top outlet pipe 64 telescopically fitting a pipe 65 from which extend, in opposite directions therefrom, along the machine, a pair of branch pipes 66 and 67. From these branches, lateral exten-

sions 68 may be provided for the reception of short nozzles 72, as viewed in Fig. 3, which project through the bottom walls of the cabinets 32-33, for a short distance, and are surrounded by washers 73 fixed thereto, as by solder.

All of the nozzles may be of one diameter as in Figs. 3 and 7, or, as in Fig. 5 be, in the direction of the arrow, of progressively larger outlet-end diameter from, and including, the nozzle nearest the humidifier unit H to, and including, the farthestmost nozzle on each of the branch pipes 66 and 67. This arrangement compensates for fluid-pressure drop along the pipes to more nearly equalize the amount of vapor introduced into the cabinets.

As better seen in Fig. 12, the humidifier unit H comprises a support 75, of hollow substantially frusto-conical form, having an opening 76 in the bottom thereof, uprights 77 spaced about the upper edge thereof, laterally outwardly projecting top portions 78 and bottom lugs 79. The latter are for attachment, as by bolts 80, to a bracket 82 secured to the back rail 16 of the machine frame. A fan motor 83 is mounted on the support 75, below the opening 76 by a bracket 86 and standards 87, and supports a fan 88, and a fan guard 89, in the opening 76.

A tank, secured to the top portions 78 of the uprights 77, as by screws 93, has a body portion 94 depending into the space surrounded by the uprights 77, and a top wall 95 embodying a depending portion having an aperture 96 therein. The aperture 96 is closed by a motor cover structure 99, except for a grid 100 of short vertical slots and bars around the aperture. The structure 99 is mounted by bushings 102, which also support a basin rim 103, and a basin cover 104 on the rim 103.

A motor 107, supported in the cover structure 99, carries a cooling fan 108 therefor at the upper end, and a disc 109 at the lower end of the shaft thereof opposite the grid 100, from which disc, a cone or tapered tube 112 depends into a body of liquid 114 in the tank body 94. A dome-like element 115 is supported on the top wall 95 of the tank, surrounding the basin rim and the cover members 103 and 104, and extends to a position below a top outlet neck 117 of the basin cover 104. An outer cover 118, mounted on a ledge 119 of the support 75, embodies a substantially frusto-conical upper wall 122 on which the pipe 65 is disposed.

In operation, an air draft drawn by the fan 88 into the device of Fig. 12 from the bottom, through the aperture 76, is directed upwardly and laterally through the spaces between the uprights 77, and upwardly, in the space between the dome 115 and the outer cover 118, to atomize liquid at the basin outlet 117. This liquid is drawn upwardly in the cone 112, is precipitated laterally by the disc 109 through the grid 100 for breaking up into minute particles, and is impelled outwardly through the pipes 64, 65, 66 and 67 in the form of a very fine cloud-like vapor.

To maintain a nearly constant supply of the liquid 114 at substantially a given level in the tank body portion 94, a float lever 124, pivotally mounted on a bracket 125 on the wall 95, maintains a valve 126 closed in an inlet pipe 127 until the level falls slightly, when the valve 126 opens to again raise the level; an overflow pipe 128 also being provided.

Electrical heaters, or resistors 132 and 133, provided in the humidifier tank, as diagrammatically indicated in Fig. 12, are controlled to main-

tain the temperature of the liquid 114 substantially constant. For the control of these resistors, a contact arm 135, in the form of a bell crank, is pivotally mounted on an insulating panel 136, and connected to a bellows 137, which is connected, by a pipe 138, to a bulb 139 in the tank body 94.

The bellows 137, the pipe 138, and the bulb 139 are filled by a liquid, which when subject to temperature rise or drop in the liquid 114, relative to the temperature desired, causes the bellows 137 to expand or contract to move the contact arm 135 out of, or into, engagement with a normally stationary contact member 142. The latter may be in the form of a screw adjustably mounted in an insulating sector 143, which is also pivotally mounted on the panel 136 about the pivot of the arm 135. A manually operable worm screw device 144, journaled in a bearing on the sector 143, engages a worm wheel sector on the insulating sector 143 for adjusting the latter about the pivot of the arm 135. By turning the worm screw 144, the normally stationary contact member 142 may be moved bodily relative to the arm 135, and the position of the screw 142 may also be adjusted relative to the sector 143.

A circuit extends from a main conductor 147, through a conductor 148, a flexible conductor 149, the crank arm 135, the screw 142, a flexible lead 152, a conductor 153, a relay coil 154, and a fuse 155, back to a main conductor 157. This circuit controls the opening and closing of another circuit, between the main circuit conductors 147 and 157, through stationary relay contact members 158, and a movable contact member 159 that is moved to closed position by a core 162 against the action of a spring 163. The latter circuit extends from the main conductor 147 through relay contact members 158 and 159, to a conductor 164, which has branches 166 and 167 leading, respectively, to one terminal each of the heaters 132 and 133 in the tank body 94 below the level of the liquid 114. From the heaters 132 and 133, conductors 168 and 169, respectively, join a conductor 172 leading back to the other main conductor 157.

The worm screw 144 is turned to place the stationary contact member 142 at a selected position representing the temperature at which it is desired to maintain the liquid in the tank. If, at this time, the temperature of the liquid is lower or higher than the selected temperature, since the bell crank 135 will be at a position representing the actual temperature of the liquid, it will engage or disengage the screw 142 until the liquid temperature rises or falls to the selected value. Cooling of the liquid 114 affects the bulb 139 to contact the bellows 137 to engage the arm 135 to the screw 142. Heating of the liquid 114 has reverse effect, and this reciprocal action is repeated upon small temperature changes to maintain the liquid 114 at a substantially constant temperature, which, in this instance, is preferably such as to maintain the temperature of the vapor in the cabinets substantially below the temperature of steam. The temperature selected is such as to avoid the adverse effects on the yarns of temperature at or near the temperature of steam. It is selected to accelerate the penetrating action of the vapor into the yarns at its point of substantially maximum efficiency depending somewhat on the diameter and structure of the yarn, and the nature of the liquid from which the vapor is derived.

The degree of humidity in the cabinets 32 and 75

33 is controlled by a humidistat V, Figs. 10 and 11, in one of the cabinets, or by a plurality of humidistats placed at distributed positions throughout the cabinet system, and electrically connected to the motors 83 and 107.

The humidistat V comprises a panel 175, a pendulum pointer 176 and a mark 177 for determining the position of the humidistat, a main actuating arm 178 pivoted on a pin 179, an auxiliary arm 182 pivoted to the main arm 178 by a pin 183, a spring 184, a spring 185, an adjusting sector 186, a moisture-extension filament device 187, a terminal 188 for adjusting the filaments of the device 187, an arm 192 pivotally connected to the auxiliary arm 182 by a pin 193 and carrying a mercury-switch tube 194, and flexible leads 197 and 198 between terminals 199 and 200, respectively, and the terminals of the mercury-switch tube 194. Conductors 201 and 202 connect the terminals 199 and 200 to the main-circuit supply-line conductors 157 and 147, respectively.

The moisture extension device 187 comprises a plurality of filaments, such as horse hairs, whereby to move the main arm 178 about the pivot pin 179 against the action of the spring 185, when the hairs shorten, or to allow the spring to move the arm when the hairs lengthen. The main and auxiliary arms 178 and 182 act in unison about the pin 179 to tilt the tube 194 about the pivot pin 193 in making and breaking the circuit of the tube. The pin 183 and the spring 184 provide a yielding connection between the arms 182 and 178 to compensate for a certain continued movement of the arm 178 in one direction after movement of the upper end of the arm 182 is stopped upon movement of the tube 194 to a certain limiting position. The spring 185 biases the arm 178 counterclockwise about its pivot pin 179, as viewed in Fig. 11, to open the mercury tube circuit when the device 187 becomes wet according to the approximate degree of humidity desired to be maintained. By adjusting the sector 186 about the pin 179, the device may be caused to open and close the circuit of the tube 194 at any desired degree of humidity.

By the invention, as so far described, moistening-box structures of old and standard design, each comprising several separate boxes operating independently of each other, may be converted at low cost, and in a comparatively short time, to operate substantially as a unit, whereby all the yarns are humidified by a greater, and by a like, amount, to cause the loops of the many simultaneously-knitted stockings to be uniformly alike. The time element of converting the device from the old to its new form is important in preventing the loss of output of the product of the machine.

In Fig. 2, is shown how, by a feature of the invention in its above-described form, even an ordinary pool device, without the humidifier unit H, may be caused to better perform its function. This feature includes the conduits A and B, or the equivalents thereof as above described, and to be hereinafter set forth, which connect end and intermediate boxes 32a and 33a, respectively. By this feature, should any discrepancy tend to occur in the humidifying effect of the respective boxes, it will be compensated for by moist air from the other boxes. Thus, one box might become totally ineffective to contribute any moisture to its yarn, and the yarn be still maintained at substantially its proper humidity.

As an aid to the latter purpose, a further feature is provided, which is also of advantage, even though the conduits A and B are omitted. This feature resides in providing a renewable water-supply bottle or vessel 195, supported by a structure 196, which is connected to the several boxes by a pipe 203, and through branch conduits 204, see also Fig. 4. The conduits 204 are connected, through valves 205 and flexible connections, such as rubber tubing 206, to inlet jets 207 in the respective boxes 32a and 33a.

The bottle 195, in inverted position, has its mouth slightly submerged in the water, or other liquid, 208 at the level of the water in the boxes. As evaporation occurs, sufficiently to admit air to the bottle, the latter discharges enough water to again level the water sufficiently to close the bottle, and stop further displacement of water from it. This bottle, although it might be constructed to do so, is not employed to supply all of the water in the pools in the several boxes, but merely to keep up the levels of the pools. In other words, the pools are first separately supplied, by placing water in the cabinets independently of the bottle, and the latter then provided merely to maintain the water level. The flexible tubing 206, or equivalent means, are provided to compensate for slight relative movements of parts, or discrepancies of position of these parts, and to permit ready detachment of individual boxes for working on the boxes, or on parts of the knitting machine adjacent thereto. When a box is detached, the corresponding valve 205 is closed, so that the remaining boxes operate with the bottle as before.

In Fig. 6, instead of the bottle 195 of Fig. 2, a float chamber structure 212 is provided in the place thereof, and connected to a water-supply tap 213. With this device, not only is the level of the several boxes maintained constant, but also, the boxes may receive their entire supply from the tap 213, without separately filling the pools, as in the device of Fig. 2.

Referring to Figs. 13 and 14, instead of the cylindrical conduits A, B, C or D, above set forth, conduits E and F are provided to have cross-sectional contours in accordance with, or as permitted by, parts of the gallows 52 positioned between adjacent boxes 33c. With these conduits, which are otherwise constructed like the conduits A, B, C, or D, substantially greater draft area, transversely of the boxes, may be provided for interchange of moist air along, and between, the boxes. The conduits E and F, as seen more clearly in Fig. 14, may have end flanges 215, like the flanges 57, 58 or 62, and be constructed in telescopic parts, as are the conduits A, B and C.

In the form of the invention, illustrated in Figs. 15, 16 and 17, instead of having the box-connecting conduit or conduits constructed relative to the gallows 52, so that the latter is, in effect, outside the moist air zone, as in each of the previously-described figures, a single conduit G has cross-sectional contour corresponding to the cross-sectional contour of the boxes 33d, irrespective of the presence of the gallows parts, and is sealed relative to these parts, which are thus, in effect, inside the boxes or moisture zone. By this feature, substantially maximum air-duct capacity is provided between the boxes; the conduit G, in this form, also permissibly having telescopic parts, and end flanges 216 inside the adjacent box end walls, somewhat as in the structure of Fig. 7.

In the form of the invention of Figs. 18, 20 and 23, instead of introducing the volatile fluid or

vapor through openings in the bottom of the receptacles, as in Figs. 1 and 7, a reduction in the time and cost of installation operations at the location of an old machine, to which it is to be applied, is effected by tapping inlet tubes 217 from the main branch pipes 66a and 67a into conduits between the intermediate and end cabinets 32e and 33e, as shown more clearly in Fig. 23. As here shown, the tubes 217 each have a tubular T-head portion 218 into which are oppositely telescoped tube sections 219 and 222 having flanges 223 and 224, respectively, as in the corresponding conduits of Fig. 7. Tubes 225 and 226 are connected between the main pipes 66a and 67a, respectively, and the outer ends of the corresponding end boxes 32e.

The device of Figs. 18, 20 and 23 has the advantage of permitting more of the parts to be fitted, or assembled, at the factory, and reducing the amount of work, time and expense at the location of the knitting machine for installing the device, in addition to producing a different circulation of the vapor at the end boxes from the end tubes 225 and 226.

In the form of the invention of Figs. 19, 21, 22 and 24, all changes in the old boxes at the side of the machine are rendered unnecessary, and the invention may be installed without stopping the machine, by merely opening the sliding doors 228 slightly, inserting elements 232 and 233 in the doorways, and closing the doors against these elements.

The elements 232, at the left end of the left-end box 32f, and at the right end of the right-end box 32f, respectively, are of narrow panel-like sheet form fitting parts of the doorways, and have tubular elements 234 for passing vapor therethrough from the pipes 66b and 67b.

The elements 233, provided one between each adjacent pair of end and center boxes 32f and 33f, each comprises similar panel-like members 235 and 236 for fitting portions of adjacent doorways, and connected by a conduit 237, to one of the pipes 66b and 67b.

Figs. 25 and 26 show an element 240, on the order of a receptacle lid having a handle 242. Two elements like this are employed to close the circular openings in the adjacent ends of alternate boxes, from between which another box is removed for repair of the box or the machine. This device, although adapted for the circular openings in the box ends occupied by cylindrical conduits, such as the conduits A and B, may also be constructed to fit the openings in the ends of the boxes in which the conduits F and G are disposed.

Fig. 27 illustrates the invention in another form, as applied to a structure previously including a pair of removable pans, each in a space 242, as indicated in Fig. 28, at the bottom of the corresponding cabinet 32g or 33g, but not here shown. In their stead, are provided conduit portions 243, projecting into the entrances to the spaces 242 vacated by the pans, and constituting side taps of conduits 244 that are connected by short conduits 245 to main conduits 66g and 67g from the humidifier unit H. Since the pans which are replaced, were supported merely by lugs, or strips 247, and the pan bottoms therefore in effect, constituted the bottoms of the cabinets, the space 242 is closed and rendered of conduit character adapting it to the invention, by the employment of a plate 248, as better seen in Figs. 28, 30 and 33. A wall or plate 252 above the space 242, supports

yarn packages 253, and has apertures 254 through which the air rises to the yarn-enclosing chamber.

As indicated more clearly in Fig. 29, the inner end of each upright side wall of each conduit 243 is provided with an outwardly return-bent extension or wing 255, originally disposed at a given angle to the main side wall portion of which it is an extension. With this construction, when the conduit, which is narrower than the vacated pan space 242, is inserted into the entrance to such space, if the fit is not symmetrical, or exact, one or both of the wings 255 may be bent to effect a seal between the conduit and the receptacle. This arrangement compensates for discrepancies, between the spacing of the conduit portions 243 along the conduit 244, and the locations of the spaces 242 along the machine.

As indicated in Figs. 31 and 32, the structure is similar to that of Figs. 27-30, and 33, except that, at each receptacle 32h and 33h, only one of two pans 257 is removed for the reception of a conduit portion 258, similar to one of the conduit portions 243 of the previous figures. The conduit portions 258 are connected to main conduits 66h and 67h, which extend along the machine and are connected to the humidifier unit H. Also, in this form, conduits 262 and 263, similar to the conduits A and B of Fig. 7, are connected between the receptacles 32h and 33h. Thus, in the device of Figs. 31 and 32, the yarns are not only subject to the vapor conditioning of the humidifier and conduit systems, but also to the humid air from the pools in the pans. This system, which may be installed, without modifying or stopping an existing machine, provides greater flexibility in the choice of yarn treatment, in that the vapor system of the humidifier unit H may be stopped, and the device still provide humidified air from the pans, as during extended periods, such as holidays or week ends, when the yarn does not require as much moisture, as when the machine is in regular operation.

Of course, the improvements specifically shown and described, by which the above-mentioned results are obtained, may be changed in various ways without departing from the invention as set forth and claimed.

I claim:

1. In a multi-section machine for producing knitted fabrics, yarn-receptacle elements disposed a distance from each other, and means for uniting said elements into a single housing structure and for maintaining a yarn-treating medium uniformly distributed and homogeneous throughout the length of said housing structure, including a conduit element constituting passageway means for the medium between the receptacle elements, certain of said elements being arranged for movement relative to each other to compensate for differences in the spacing of the receptacle elements from each other and to effect free distribution and homogenization of the medium throughout the length of said single housing structure.

2. In a multi-section machine for producing knitted fabrics, yarn-receptacle elements disposed a distance from each other, and means for uniting said elements into a single housing structure and for maintaining a yarn-treating medium uniformly distributed and homogeneous throughout the length of said housing structure, comprising conduit elements constituting passageway means for the medium between the receptacle elements, certain of said elements being arranged for telescopic movement relative to each other to compensate

for discrepancies in the spacing of the receptacle elements from each other and to effect free distribution and homogenization of the medium throughout the length of said single housing structure.

3. In a multi-section machine for producing knitted fabrics, yarn-receptacle units disposed a distance from each other, and means for uniting said units into a single housing structure and for maintaining a yarn-treating medium uniformly distributed and homogeneous throughout the length of said housing structure, comprising conduit means including telescopically interfitted sections movable relative to each other to compensate for discrepancies in the spacing of the units from each other and to effect free distribution and homogenization of the medium throughout the length of said single housing structure.

4. In a multi-section straight knitting machine, means for enclosing and humidifying yarn packages including a series of cabinets disposed in spaced end-to-end relation along the machine, and means for substantially equalizing the yarn-humidifying effects in the cabinets and causing the same to operate in effect as one cabinet including one or more conduits disposed in the space between each adjacent pair of the cabinets around registering apertures in adjacent end walls of said adjacent pairs, said conduits each including a pair of telescoped longitudinal component sections each having a perimetral flange at one end of the composite conduit disposed inside the adjacent cabinet.

5. In a multi-section machine for producing knitted fabrics, yarn receptacle units disposed a distance from each other and having side walls which, if extended through said distance, would render the walls symmetrical continuations of each other, an element of the machine in the space between said units defined by such extension, and means for uniting said units into a single housing structure and for maintaining a yarn-treating medium uniformly distributed and homogeneous throughout the length of said housing structure, comprising conduit means positioned in said space in accordance with the position of said machine element constituting passageway means for the medium between the units and arranged relative to the units to effect free distribution and homogenization of the medium throughout the length of said single housing structure.

6. In a multi-section machine for producing knitted fabrics, yarn receptacle units disposed a distance from each other and having side walls which, if extended through said distance, would render the walls symmetrical continuations of each other, an element of the machine in the space between said units defined by such extension, and means for uniting said units into a

single housing structure and for maintaining a yarn-treating medium uniformly distributed and homogeneous throughout the length of said housing structure, comprising conduit means positioned in said space having cross-sectional area partially defined by said machine element constituting passageway means for the medium between the units and arranged relative to the units to effect free distribution and homogenization of the medium throughout the length of said single housing structure.

7. In a multi-section machine for producing knitted fabrics, yarn receptacle units disposed a distance from each other and having side walls which, if extended through said distance, would render the walls symmetrical continuations of each other, an element of the machine in the space between said units defined by such extension, and means for uniting said units into a single housing structure and for maintaining a yarn-treating medium uniformly distributed and homogeneous throughout the length of said housing structure, comprising conduit means positioned in said space having cross-sectional area of substantially the cross-sectional area of the units minus the cross-sectional area of said machine element constituting passageway means for the medium between the units and arranged relative to the units to effect free distribution and homogenization of the medium throughout the length of said single housing structure.

8. In a multi-section straight knitting machine, means for enclosing yarns including a plurality of receptacles disposed in spaced series relation along the machine, means for supporting a plurality of pools provided one for each of the receptacles for humidifying the air therein and means for substantially equalizing the yarn-humidifying effects in the receptacles including conduit means interconnecting the several pools, means for automatically maintaining the levels of the pools substantially equal and constant, and means whereby one or more of the receptacles may be removed from the series and the remainder operated as in the complete series.

9. In a multi-section straight knitting machine, a plurality of moistening boxes disposed along the machine and having sliding doors, elements for insertion at adjacent ends of each pair of adjacent boxes in the places of portions of adjacent sliding doors of said adjacent boxes, said elements being insertable by sliding the doors open and cooperating with the doors when the doors are closed against them to close the boxes, conduits provided at least one for connecting the adjacent boxes of each pair through said elements, a source of humid air, and pipes connected between the source of humid air and said conduits.

HENRY JANSSEN. 60

CERTIFICATE OF CORRECTION.

Patent No. 2,108,404.

February 15, 1938.

HENRY JANSSEN.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 4, second column, line 58, for the word "contact" read contract; line 70, for "penetrating" read penetrating; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 5th day of April, A. D. 1938.

(Seal)

Henry Van Arsdale,
Acting Commissioner of Patents.