July 18, 1939. H. JANSSEN 2,166,548

TEXTILE MACHINE YARN CONDITIONER

Filed Oct. 28, 1936 4 Sheets-Sheet 1

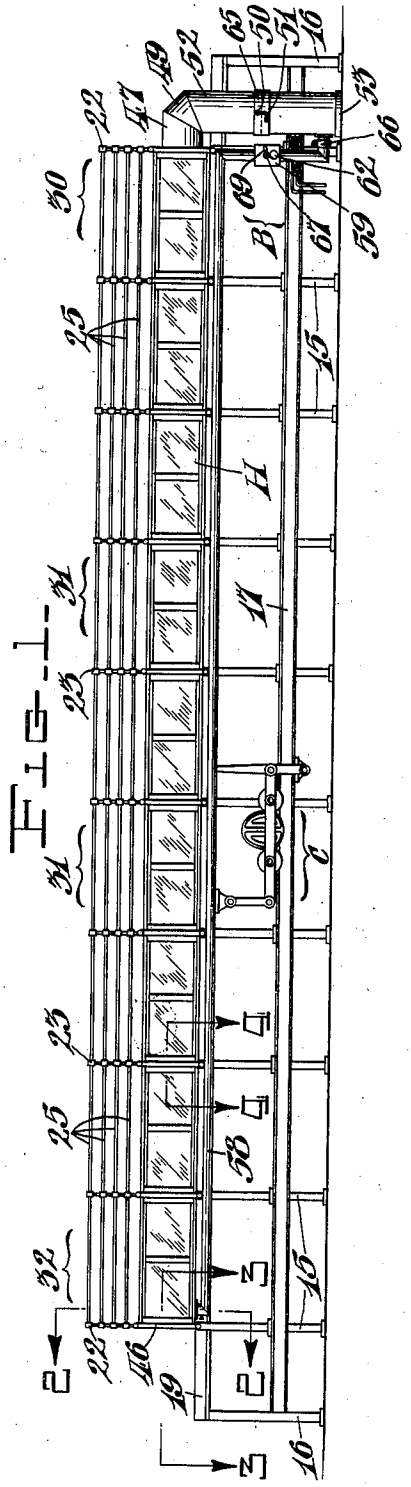

Fig. 1.

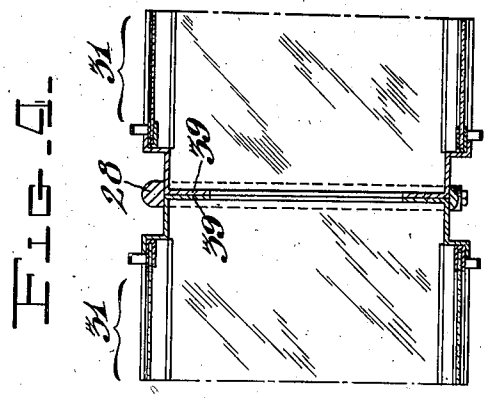

Fig. 5.

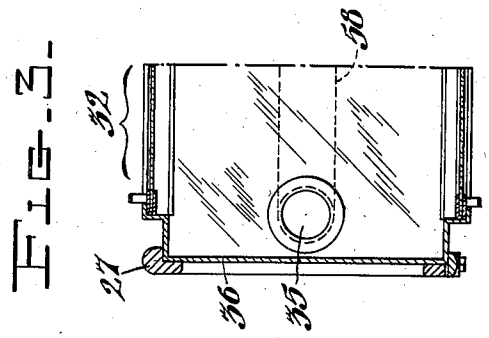

Fig. 3.

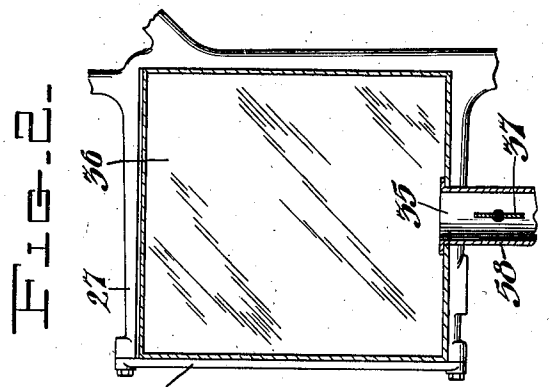

Fig. 2.

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TEXTILE MACHINE YARN CONDITIONER

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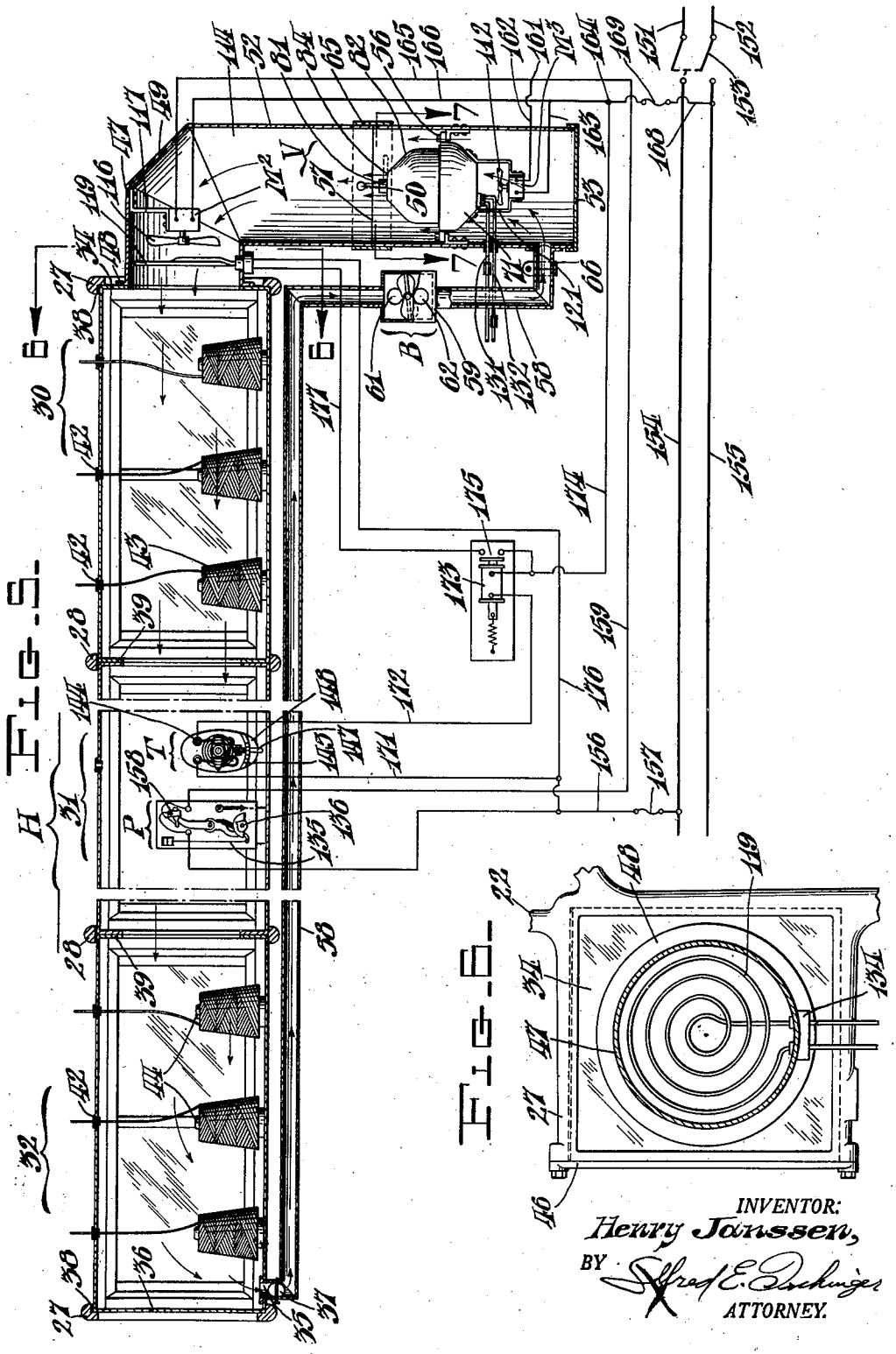

FIG. 5.

FIG. 6.

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TEXTILE MACHINE YARN CONDITIONER

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FIG. 9.

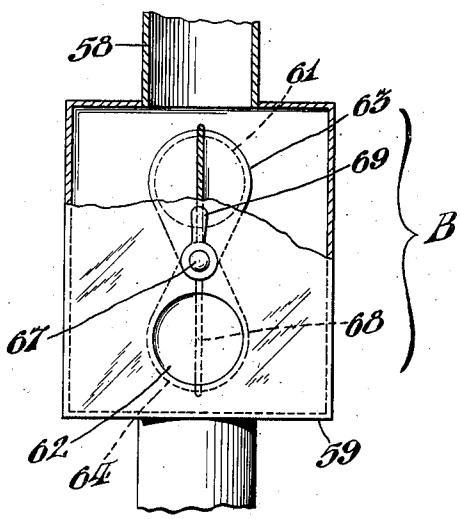


FIG. 10.

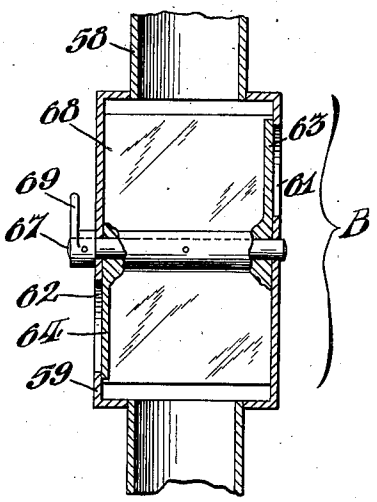


FIG. 8.

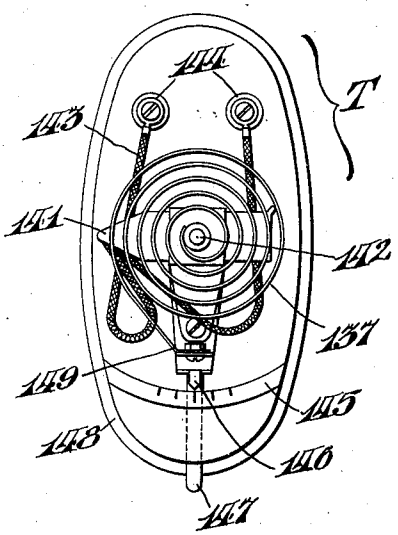
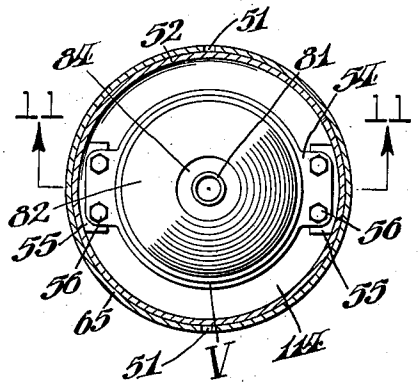


FIG. 7.



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TEXTILE MACHINE YARN CONDITIONER

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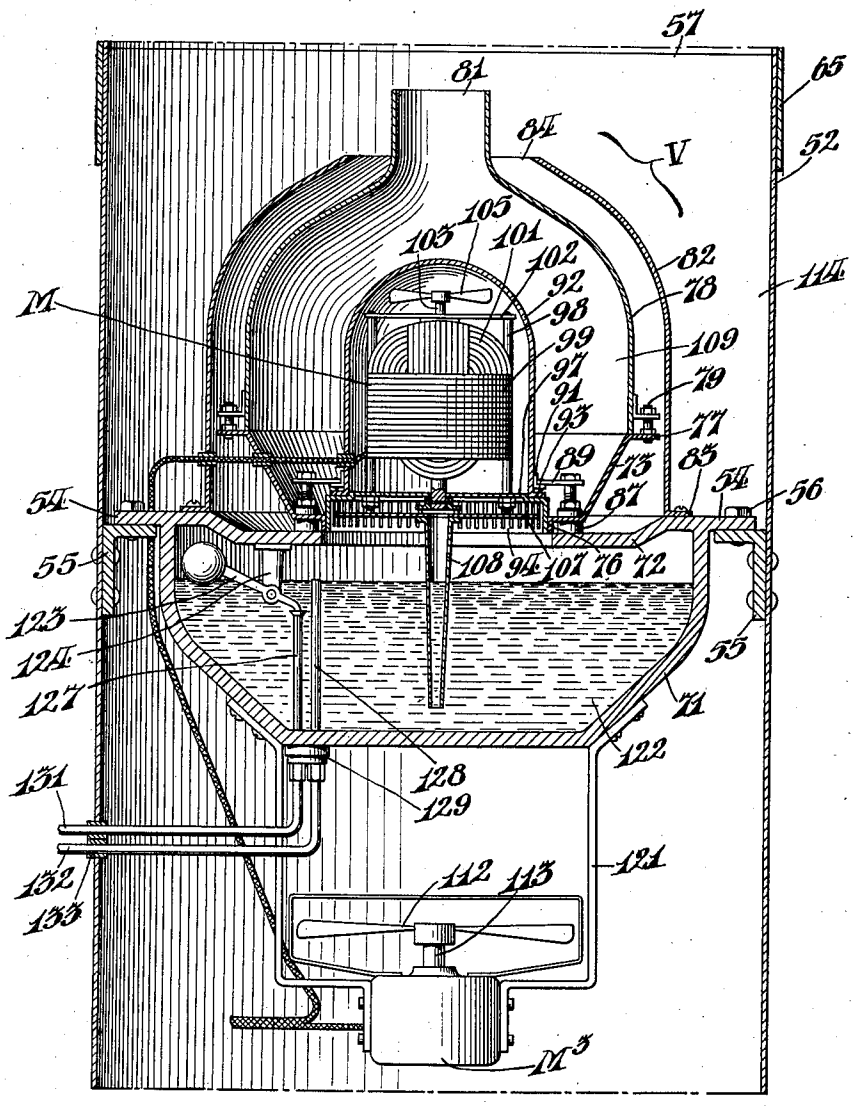
Fig. 11.



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Patented July 18, 1939 2,166,548

UNITED STATES PATENT OFFICE

2,166,548

TEXTILE MACHINE YARN CONDITIONER

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Application October 28, 1936, Serial No. 107,922

7 Claims. (Cl. 66—125)

My invention relates to knitting-machine yarn conditioners, and particularly to means for humidifying the air in the yarn-enclosing housings of multi-section straight knitting machines.

Heretofore, it has been usual to condition the yarn, particularly fine silk yarns for muti-section full-fashioned stocking knitting machines, by having it on cones in so-called moistening boxes for feeding through openings in the top walls of the boxes to the knitting-mechanisms; the boxes containing pools of water to render the air in the boxes humid.

It has also been suggested, in my copending application, Serial No. 13,858, filed March 30, 1935, issued January 5, 1937, as Patent No. 2,066,781, for the "Method of and means for effecting vapor treatment of yarn in a yarn fabricating machine", to vapor-treat the yarn by power-operated units, and to have all the yarns of a multi-section straight knitting machine in a unit housing made up of separable longitudinal sections, to operate with the vapor-producing units and/or the water pools.

The unit housing structure may comprise either what may be more properly termed a unit housing made up of component sections, or what may appear more like individual housings joined by conduits, in either case subjecting all the yarns to more nearly equal treatment than with the separate individual box structure.

However, the problem, of uniformly distributing the vapor from a power-operated unit in either of such multi-section housings, so that all of the yarns will be treated alike, with none receiving too much moisture, and none too little, has not been free from difficulty; certain of the trouble probably resulting from dead-air spaces, obstructions to the flow of vapor causing eddy currents, leakage of the air, differences in operation caused by housings of different design, back pressure, and other causes.

Also, the control of the vapor temperature, the relative freshness or staleness of the air in the housings, the manufacture, assembly, location, repair and other factors associated with the unit housing, have caused problems of one kind or another.

It is an object of this invention to overcome certain of the above-mentioned disadvantages, and to thereby provide a more effective device, as by boosting, at a position removed from a power-operated vapor-producing unit, the impulses given to the circulating vapor-carrying air by the vapor-producing unit.

Another object is to heat the vapor, rather than the water body from which the vapor is produced, and to effect this heating closer to the yarn than by heating the water body, to thereby compensate for the loss of heat which may be caused by vaporizing the water after heating the water body and conducting it a substantial distance away from the heating source.

Another object is to better control the temperature of the vapor by means more directly responsive to temperature changes in the housing than in devices herebefore constructed.

Another object is to reduce dead air spaces and eddy currents and to cause more uniform filling of the housing with vapor in better condition.

Another object is to effectively and definitely control the discharge of stale air from, and the injection of fresh air into, a housing, as against letting this feature take care of itself, as irregularly, or in any other way that it might occur.

A further object is to promote the more effective flow of vapor, by reducing or preventing back pressure, by providing a return-vapor or air current to the vapor-producing unit, by compensating for pressure drop along an elongated housing, by compensating for bends or turns in the vapor path, and in other ways.

With these and other objects in view, my invention resides in the elements of novel structure, combination and operation, exemplified by the drawings, and described in the specification and claims.

In the drawings:

Figure 1 is a view, in rear elevation, of a multi-section straight knitting machine, showing a multi-section yarn-treating housing of the invention;

Fig. 2 is an enlarged view, taken substantially along the line 2—2 of Fig. 1;

Fig. 3 is an enlarged view, taken along the line 3—3 of Fig. 1;

Fig. 4 is an enlarged view, taken along the line 4—4 of Fig. 1;

Fig. 5 is an enlarged view of certain of the apparatus, as viewed in Fig. 1, parts being in elevation and parts being in vertical-plane section, distance cut-outs also being employed to show end and intermediate sections, without unnecessary repetition;

Fig. 6 is an enlarged view, taken along the line 6—6 of Fig. 5;

Fig. 7 is an enlarged view, taken along the line 7—7 of Fig. 5;

Fig. 8 is an enlarged detail front elevational

view of a thermostat employed in the invention, as viewed in Fig. 5;

Fig. 9 is a slightly enlarged detail view partially in vertical-plane section, of a device, seen near the lower right hand portion of Fig. 5, for regulating the egress of stale air and the ingress of fresh air to the conduit system according to the invention;

Fig. 10 is a vertical-plane sectional view of the device of Fig. 9, taken at right angles thereto; and

Fig. 11 is an enlarged view, taken along the line 11—11 of Fig. 7, together with a diagram of an electric circuit associated with the device.

For clearness, only those elements of a usual knitting machine for which the invention is adapted, are shown; other elements of the machine, and the operation thereof, being shown and described in the "Reading" Full Fashioned Knitting Machine Catalogues, copyrighted 1929 and 1935, and published by the Textile Machine Works, Reading, Pennsylvania.

In practicing the invention, an entire housing and associated vapor-conducting system therefor, are constructed and related, as a continuous, or closed-loop, conduit circuit, having a vapor-producing unit in one part or section thereof, a vapor heater, a vapor-impulse boosting and redirecting fan or blower, temperature and humidity responsive means, a constricted return conduit or section from the housing to the vapor-producing unit, and an air controller.

To conserve space, one portion of the conduit section containing the vapor-producing unit may vertically depend from a horizontal portion of this section which will thereby be disposed at right angles thereto and enter one end of the housing; this conduit section being relatively large in cross-sectional area, and the portions thus being at right angles to each other having a bend or turn therebetween for the passage of vapor from the unit to the housing.

In the horizontal large conduit section, directly associated with the housing, a heater is disposed; this heater, in the example given, taking the form of an armored electrical resistor extending spirally in a cross-sectional plane of the conduit to have widely and uniformly distributed surface contact with the vapor-carrying air passing therethrough. Screens, cell structures and other devices of electrical, hot water or other heaters could be employed and otherwise located.

At the bend, between the right-angularly related portions of the unit-containing conduit section, adjacent to the housing, an impeller or fan is disposed to pick-up and boost, or reimpel, the vapor-laden air which has already been impelled toward the bend by the vapor-producing unit; this reimpulse being directed through, or past, the heater along the elongated housing conduit section, or series of separable sections, whereby not only to compensate for drop in the pressure of the vapor, but also to prevent air swirls or eddy currents from the bend or turn between the right-angularly related patterns of the conduit section containing the vapor-producing unit. Thus, instead of whirling, concentrating or hesitating at the entrance end of the housing conduit section, the vapor-carrying air is given an impulse at this entrance whereby to more uniformly carry the vapor along the housing to the other end thereof. A booster impeller or impellers may be placed at other positions about the vapor circuit.

Also, where, as in the past, there has been no vent or exit for air at a position, such as the end of the housing spaced some distance from the air entrance, there has been a tendency to form a dead air space, and to build up back pressure reducing the amount of vapor received by the dead-air space and other parts of the housing. In my device, an exit port has been provided near the extreme opposite end of the housing from the end at which the vapor is introduced; this port being of a diameter to prevent undue back pressure, and to utilize back pressure to avoid free escape of the air whereby the vapor pressure would be sharply reduced from the entrance toward the exit.

A constricted conduit of approximately the diameter, or cross section of the exit port, returns the spent air to the vapor-producing unit, or is partially or fully discharged from the system, and fresh air taken in its place for circulation around the closed-loop path which the conduit system constitutes.

A hydrostat and a thermostat, disposed directly in the housing, and thereby more immediately affected in accordance with the humidity and temperature conditions at the place where close control of these conditions is desired, control the operation of the vapor-producing unit and the vapor heater, respectively, which, in the example given, are located some distance from certain parts of the housing. Thus, several factors bearing on the operation of the device, and the effective treatment of the yarn, have been improved, and a device provided which is generally of advantage in the art.

Referring to Fig. 1, a multi-section full-fashioned knitting machine comprises a support, and various working parts on the support, such as a Coulier motion mechanism C and others (not shown). The support includes center frames 15, end frames 16, a back beam 17, and a center bed 19. Gallows 22, secured to the machine frame at the ends of the machine, and gallows 23, secured to the machine frame intermediate the end brackets 22, support yarn guide rods 25.

Brackets 27, secured to, or integral with, the end gallows 22, and brackets 28, similarly related to the intermediate gallows 23, support, as viewed in Figs. 1 and 5, a right end section 30, a plurality of intermediate sections 31, and a left-end section 32, of a multi-section yarn-conditioning housing H, which sections are separable, and communicate with one another from a vapor-entrance right-end wall 34 of the right-end section 30 to a constricted outlet port 35 near a left-end wall 36 of the left-end sections 32, see also Fig. 3. The port 35 has a butterfly valve 37 therein, whereby the port opening may be regulated to adjust the back pressure in the housing, and the rate of return of spent air to the unit V.

The housings, constructed of sheet metal and glass, fit rabbet groove portions 38 in the end brackets 27 and have abutting end flanges 39 between sections near the central vertical planes of the intermediate brackets 28, (Fig. 4) providing large connecting openings between adjacent boxes. Eyelets 42, of porcelain or the like, constitute wall-aperture means providing for the feeding of yarn from supply cones 43 supported on bobbin pins 44.

As better seen in Figs. 2 and 6, the brackets 27 and 28 are of substantially C-shape disposed in vertical planes and facing rearwardly of the machine for the reception, between the arms of the C-shaped portions, of the housing sections, which are positioned as indicated, and held in

place by clamps 46 secured to the brackets 27 and 28.

A horizontal conduit section 47 of relatively large diameter has an end flange 48 sealed about a correspondingly large opening in the entrance end wall 34, and is connected by a bend portion 49 to a vertical conduit section 52 having a removable bottom wall 53.

A power-operated vapor-producing unit V, Figs. 7 and 11, is supported in position in the conduit section 52 by projecting lug portions 54 thereof held on brackets 55 by screws 56; the brackets 55 being riveted to the conduit.

A conduit 58, of constricted diameter relative to the diameter of the conduit portions 47, 49 and 52, and to the cross-sectional area of the housing H, provides communication between the port 35 and the conduit section 52 at a position on the latter below the vapor-producing unit V; the spent vapor-carrying air traversing the conduit 58 through a control valve device B. The conduit section 52 is transversely divided along a line 57 surrounded by a longitudinally slidable sleeve 65, and detachably connected to the conduit 58 by a clamp 66 to provide for the lateral removal of the unit from under the upper part of the conduit 52 for inspection and repair. Pins 50, fixed to the conduit 52 above the line 57, cooperate with slots 51 in the sleeve 65; the slots each having angularly related portions whereby the sleeve may be raised above the line 57 and turned to be held by the pins 50, when the lower portion of the conduit 52 containing the unit V is to be removed.

The device B, Figs. 9 and 10, comprises a flat-sided box-like casing 59 having opposite side wall vents or apertures 61 and 62, respectively, to be opened and closed simultaneously by doors 63 and 64, respectively, which are fixed to a shaft 67 in the casing 59, journaled in side walls of the casing. A butterfly vane 68, on the shaft 67, operates when a handle 69 on the shaft 67 is operated in one direction to turn the shaft, to close the butterfly vane 68 across the path of air through the control valve device B, and to withdraw the vanes 63 and 64 from over the apertures 61 and 62.

When the butterfly vane is in fully closed position, obstructing passage of all air through the control depice B from the port 35 to the conduit 52, the apertures 61 and 62 are fully open. In this position of parts, the spent air from the port 35, if it be unduly stale, is diverted from the conduit and housing system through the opening 61, and fresh air taken into the opening 62. The handle 69 may be operated to regulate the parts in any way discharging more or less of the spent air from the system, and accordingly receiving less or more fresh air into the system, with a proportionate amount of the spent air mingling with the fresh air for return to the vapor-producing unit. Thus, if, under certain conditions, the so-called spent air, or air that has circulated past the bobbins, reaches the control device B sufficiently fresh, or with sufficient fresh vapor still in it, the butterfly valve 68 will be kept in position to allow all of the internal air of the system to recirculate through it, and conversely the valve 68 will be kept fully or partially open according to the condition of the exhaust air from the port 35.

As best shown in Fig. 11, the vapor-producing unit further comprises a tank 71 having the lugs 54, and constituting a source of water or other liquid. An apertured depending top wall 72 of the tank 71 constitutes a base ring or support for a basin rim 73 having a bottom perimeter 76 sealed about the perimeter of the opening in the ring 72; the rim 73 being of inverted substantially frusto-conical shape having a top flange 77 to which a basin cover 78 is secured in sealed relation thereto, as by bolts 79.

The basin cover 78 is in the form of an inverted funnel having a reduced open top 81. A dome 82 conforming generally to, but substantially larger than, the basin cover 78, is disposed over and around the cover on the base ring 72 to which a bottom flange 83 of the dome is sealingly secured; the top 84 of the dome 82 being disposed somewhat below the uppermost portion of the open top 81.

Rubber bushings 87, on the base ring 72, project upwardly through apertures in the basin rim 73 in sealed relation thereto, and enclose bolts or supports on which clips 89 are supported. Angle elements 91, secured to the clips 89, are also secured to the lower portion of a dome-like cover 92 for a motor M near the bottom of the cover, which has an annular bottom flange 93 sealingly seated on a grid element 94 in the form of an inverted pan having peripherally-spaced vertical side wall slots, a bottom perimeter sealingly fitted in the bottom perimeter 76 of the basin rim 73, and a slightly elevated closed top wall 97 about which the cover 92 fits. Relatively long bolts 98 are secured to the grid top 97, and support the stator of the motor M, which stator comprises an electromagnet field iron portion 99 and coils 101.

A top bridge 102, between the bolts 98, supports the shaft 103 of the armature of the motor M; the lower end of the shaft 103 being positioned by the top wall 97 of the grid 94. A fan 105 is provided on the shaft 103 for cooling the motor M.

A disc 107, and a cone 108 in the form of a downwardly-converging tapered tube, are supported at the lower end of the shaft 103 such that, upon high speed rotation of the shaft, water from the tank 71 is drawn upwardly in the cone 108 and whirled by the disc 107 through the slots of the grid 94, being broken up into fine particles as it is impelled into the space 109 formed in the basin rim 73, and the basin cover 78.

The air draft, from a fan 112 travels upwardly through a space 114, between the dome 82 and the conduit section 52, past the basin top 81, tending to create a vacuum in the basin whereby to atomize the water particles into a fine vapor, which is impelled upwardly toward the conduit bend 49, and around this bend to a fan 116 operated by a motor M2 supported by the conduit 47 through a bracket 117. The fan 116 boosts the impulse given to the vapor laden air by the unit V and redirects it through or past a heater 119 longitudinally through the housing H and its series of sections 30, 31 and 32. The fan 112 is mounted on the shaft 113 of a motor M3 supported by brackets 121 to lower portions of the tank 71, the sloping sides of which assist in directing air drafts from the fan 112 upwardly and around the tank into the space 114.

A body of water, or other liquid 122, in the tank 71, is maintained at a substantially constant level, irrespective of its rate of consumption by the unit, by a float lever 123 pivotally mounted on a bracket 124 depending from the base ring 72, and having a ball float at one end and a valve seat at the upper end of a water inlet supply pipe

127. The latter, and an overflow pipe 128 closely adjacent thereto, which determines the level of the liquid 122, extend through the bottom wall of the tank 71 to which they are sealed by a bushing 129, and communicate, respectively, with a supply line pipe 131 and a discharge line pipe 132, which extend through the wall of the conduit 52 through bushings 133. Conduits 131 and 132 are also detachably connected, adjacent to the unit V, to outside supply and outlet pipes therefor.

The heater 119, as better seen in Fig. 6, comprises an armored resistor, of a known type, of spiral shape having convolutions spaced from each other to allow the free passage of vapor therethrough from the unit V, and as reimpelled and directed by the fan 116, which, like the spiral heater 119, is disposed in a vertical plane and directs the vapor-carrying air horizontally through the housing H. The ends of the spiral are supported by a bushing 134 mounted in an opening extending through a side wall portion of the conduit portion 47.

In its passage along the housing, the vapor affects a thermostat T and a hydrostat P to control the heater 119 and the vapor-producing unit V, respectively.

The hydrostat, which is of usual character, and described in my above-mentioned copending application, comprises a moisture sensitive element, such as a horse hair 135, which, when too dry, affects an electric circuit, to be hereinafter described, to start the vapor-producing unit V and the fan 116, and when, too wet, operates to stop the vapor-producing unit; these starts and stops being regulated to closely control the humidity in the atmosphere of the housing H, by a regulating device 136 of the hydrostat P.

The thermostat T is also of a usual type, comprising a spiral bimetallic temperature responsive element 137, as better seen in Fig. 8, a mercury tube switch 141, pivotally mounted on a pin 142, flexible conductors 143 from binding posts 144 to the switch 141, a scale 145 over which a pointer 146 is adjusted by a handle 147, and a base or panel 148 on which the working parts are mounted. The bimetallic spiral 137 is fixed at one end 149 to a stationary part of the device, and, at the other end is secured to the pivotally mounted mercury switch 141, whereby, upon expansion and contraction of the spiral, the switch 141 is opened or closed, as the case may be.

As indicated in Fig. 5, the system derives its electrical energy from supply-line conductors 151 and 152, through a master switch 153, to load-circuit conductors 154 and 155, respectively.

The circuit of the hydrostat P and the vapor-producing unit V, extends from the load circuit conductor 154, through a conductor 156, having a fuse 157 therein, to a mercury tube switch 158 controlled by the hydrostat P, through a conductor 159 to a point 161. From the point 161, current is carried, by a conductor 162, to the motor M3, and from the motor M3, through a conductor 163 to a point 164. From the point 161, current is also carried through a conductor 165 to the motor M2 and from the motor M2, through a conductor 166 to the point 164, which is connected through a conductor 168, including a fuse 169 to the opposite load circuit conductor 155.

The circuit of the thermostat T extends from the conductor 156, through a conductor 171, through the mercury tube switch 141, a conductor 172 to a relay coil 173, and back to the load circuit conductor 155 through a conductor 174 and the conductor 168.

The relay coil 173 controls a switch 175 which opens the circuit of the heater 119 and closes it through a conductor 176 from the load circuit conductor 154 through the conductor 156 to the heater 119, and through a conductor 177, through the switch 175, the conductor 174 and the conductor 168 to the load-circuit conductor 155.

In operation, assuming the machine to have been idle, and the master switch 153 open, the electrical parts will, of course, have been deenergized, with neither the vapor-producing unit V capable of operation, nor the heater 119 capable of heating.

When the master switch 153 is closed, assuming the humidity or vapor conditions in the housing H to be as desired, the mercury tube switch 158 of the hydrostat P will be open, thus retaining the unit V idle, and, since the circuit of the fan 116, also depends on energization of the circuit of the unit V, this device will also be idle. If the temperature in housing H is, at the same time, as high as desired, thermostat T will be in position to hold switch 141 open and thereby hold relay 173 and heater 119 inoperative.

However, if at the time of closing the master switch 153, or later, the humidity and temperature in the housing H should be, or become, sufficiently low, the switch 158 of the humidostat P and the switch 141 of thermostat T will be closed, or operate to become closed, thereby energizing the vapor-producing unit V, the motor M2 of the fan 116, and the circuits of the thermostat T and the heater 119. Thus there are provided sensitive systems, side-by-side, for operating the humidity and the temperature controlling devices simultaneously and independently of each other, so that irrespective of ambient temperature and humidity conditions, the corresponding conditions in the housing are maintained substantially constant at all times.

The fan 116, in its capacity of boosting the impulses of the fan 112, also functions to redirect the vapor draft at the conduit bend 49 differently from the effect of merely allowing this draft to hit the bend and take its own horizontal and other component directions. The fan 116 thus prevents eddies at and near the bend, and gives the vapor draft a direct longitudinal impulse better adapted to carry it to the far end of the housing.

The fan 116 also serves to build up a pressure in the housing to prevent ingress of untreated air and to assist in the absorption of moisture by the yarn.

By manipulation of the butterfly valve 37, in the constricted port 35, the degree of relief to the vapor pressure, or the degree of opposition to it, can be regulated to suit different conditions, such as slight variations in the characteristics of different housings, or different locations.

Likewise, the device B may be controlled to vary the air, as to freshness, according to various needs and surrounding conditions.

The invention contemplates the above-described features for the first time so far as I am aware, and by its solution to the problems presented is a distinct improvement in the art to which it relates.

The improvements specifically shown and described, by which the results are obtained, may be modified in various ways without departing from the spirit and scope of the invention as set forth and claimed.

I claim:

1. An air-conditioning device for a knitting machine, comprising conduit means including a housing, yarn-supply supporting means in the housing, means providing for the feeding of yarn from the supply through wall-aperture means in the housing to the knitting mechanism of the machine, a unit for providing a vapor for the conduit, and impelling it along the conduit, and means spaced along the conduit for the unit for boosting the impelling force of the vapor.

2. An air-conditioning device for a knitting machine, comprising conduit means providing a closed circuit including a housing, yarn-supply supporting means in the housing, means providing for the feeding of yarn from the supply through wall-aperture means in the housing to the knitting mechanism of the machine, a unit in the conduit for producing vapor and impelling it along the conduit and longitudinally the length of said housing, and means in the conduit spaced from the unit for boosting the impulsion of the vapor by the unit.

3. An air-conditioning device for a multi-section knitting machine, comprising conduit means including a horizontally elongated housing portion and another portion approaching the housing portion at an angle thereto, yarn-supply supporting means in said housing conduit portion, means providing for the feeding of yarn from the supply through wall-aperture means in said housing conduit portion to the knitting mechanism, a vapor-producing unit for impelling vapor along said other conduit portion toward the housing portion, and means adjacent to the intersection of said housing and said other portion of the conduit for boosting the impulsion of the vapor and directing it longitudinally through the housing conduit portion.

4. An air-conditioning device for a multi-section straight knitting machine, comprising an elongated housing made up of separable longitudinal sections extending in horizontal series relation along the machine, yarn-supply supporting means in each of said housing sections, means providing for feeding the yarn from the supporting means through top wall-aperture means in the housing sections to the knitting mechanism, the housing having a large opening adjacent to one end and a small opening adjacent to the other end, a conduit of large diameter having a horizontal portion sealed to said one end around said large aperture and a vertical portion depending from said horizontal portion, a vapor-producing unit in said vertical conduit portion for directing vapor upwardly into the housing through said large opening, a conduit of constricted diameter communicating between said small opening and said vertical conduit portion below said unit, a vapor heater in said horizontal large conduit portion, a fan in said horizontal large conduit portion for impelling the vapor past the heater longitudinally through the housing, a humidostat in the housing for controlling the operation of the unit, a thermostat in the housing for controlling the operation of the heater, and means associated with said constricted conduit providing for expelling stale air from, and introducing fresh air into, the housing in definitely related quantities.

5. An air-conditioning device for a multi-section straight knitting machine, comprising an elongated housing made up of separable longitudinal sections extending in horizontal series relation to each other along the machine, yarn supply supporting means in each of said housing sections, means providing for feeding the yarn from the supporting means through wall-aperture means in the housing sections to the knitting mechanism. the housing having openings disposed one adjacent to each end, a conduit sealed to one of said ends around the corresponding opening, a vapor-producing unit in said conduit for directing vapor into the housing through said corresponding opening, a conduit communicating between the other of said openings and said first conduit, heating means in one of said conduits means in the same conduit as said heating means for impelling the vapor through the housing, means in the housing for governing the operation of the unit, means in the housing for controlling said heating means, and means providing for expelling used air from, and introducing fresh air into the housing.

6. The combination of a multi-section knitting machine, a box structure for holding yarn to be knitted by said sections, means for creating an air current through a plurality of said boxes in series, means for adding moisture to said current prior to its entrance to said structure, optionally operable means for retarding the outflow of the air current from said structure, and means to accelerate said current near its point of entrance to said structure.

7. An air conditioning device for a multi-section knitting machine, comprising a horizontally elongated housing of substantially uniform cross-section throughout a large portion of its length extending along all the sections of the machine, supporting means in the housing arranged to hold packages of yarn to be knitted tranversely of the length of the housing and in spaced relation therein, a humidifier unit, and means for flowing a moistening current lengthwise through said housing which in volume at all times substantially equals the volume of the housing, including a conduit of substantially the same effective cross-sectional area as said housing for delivering current from said unit to one end of the housing and a conduit for returning the current to said unit.

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