

Oct. 22, 1935.

R. N. APPRICH

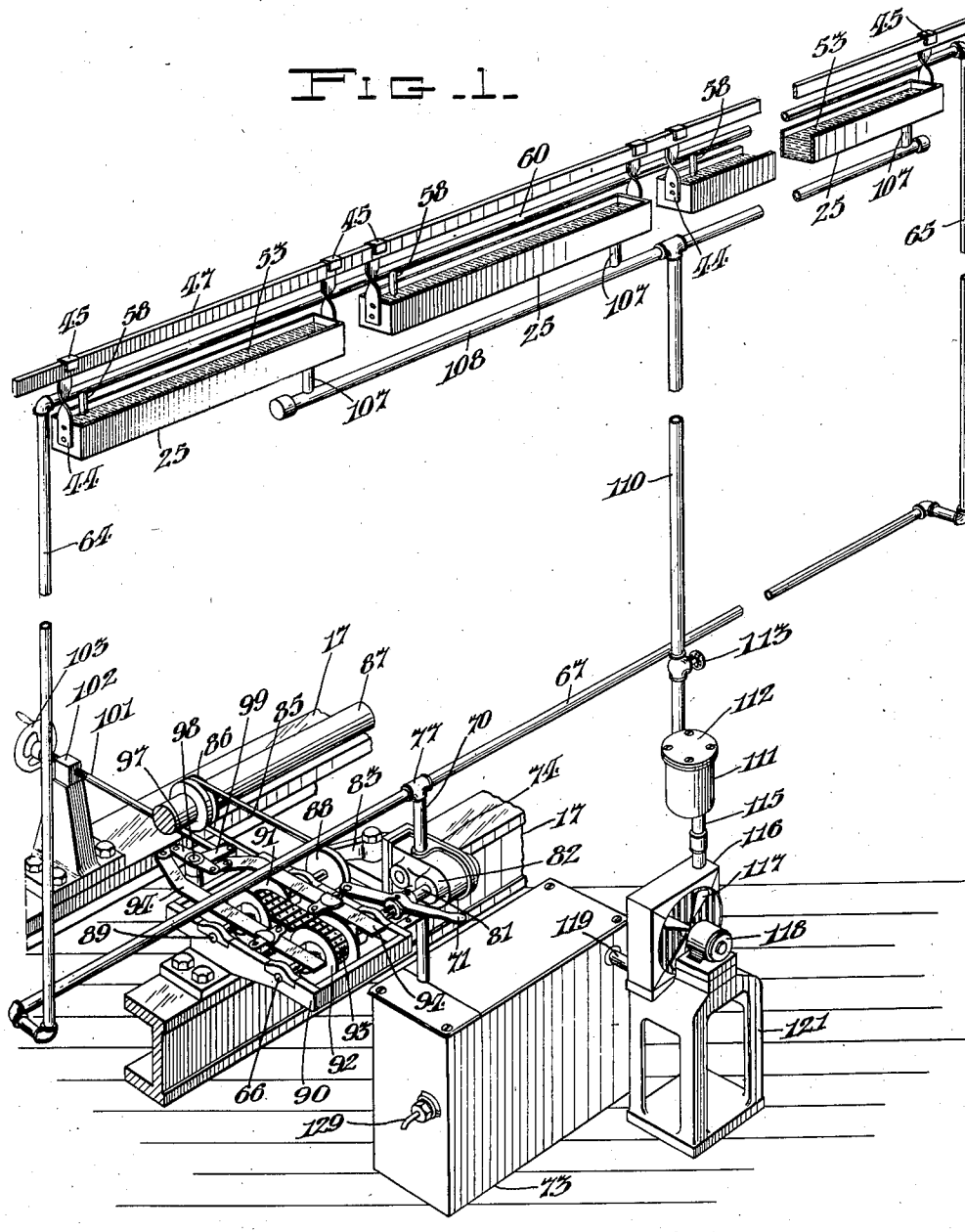
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MEANS FOR CONDITIONING YARNS IN KNITTING MACHINES

Filed Sept. 19, 1934

5 Sheets-Sheet 1

FIG. 1.



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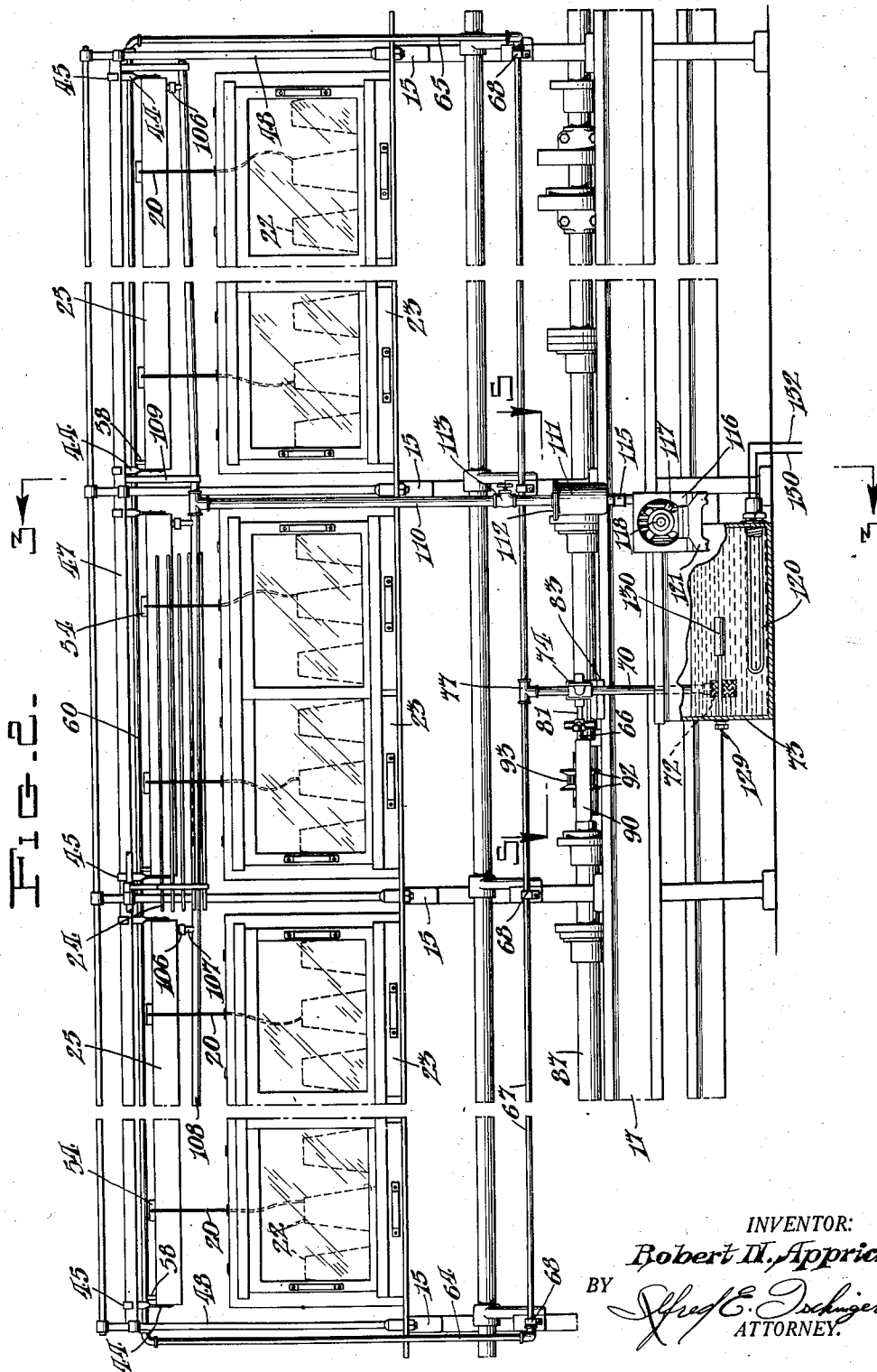
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MEANS FOR CONDITIONING YARNS IN KNITTING MACHINES

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5 Sheets-Sheet 2



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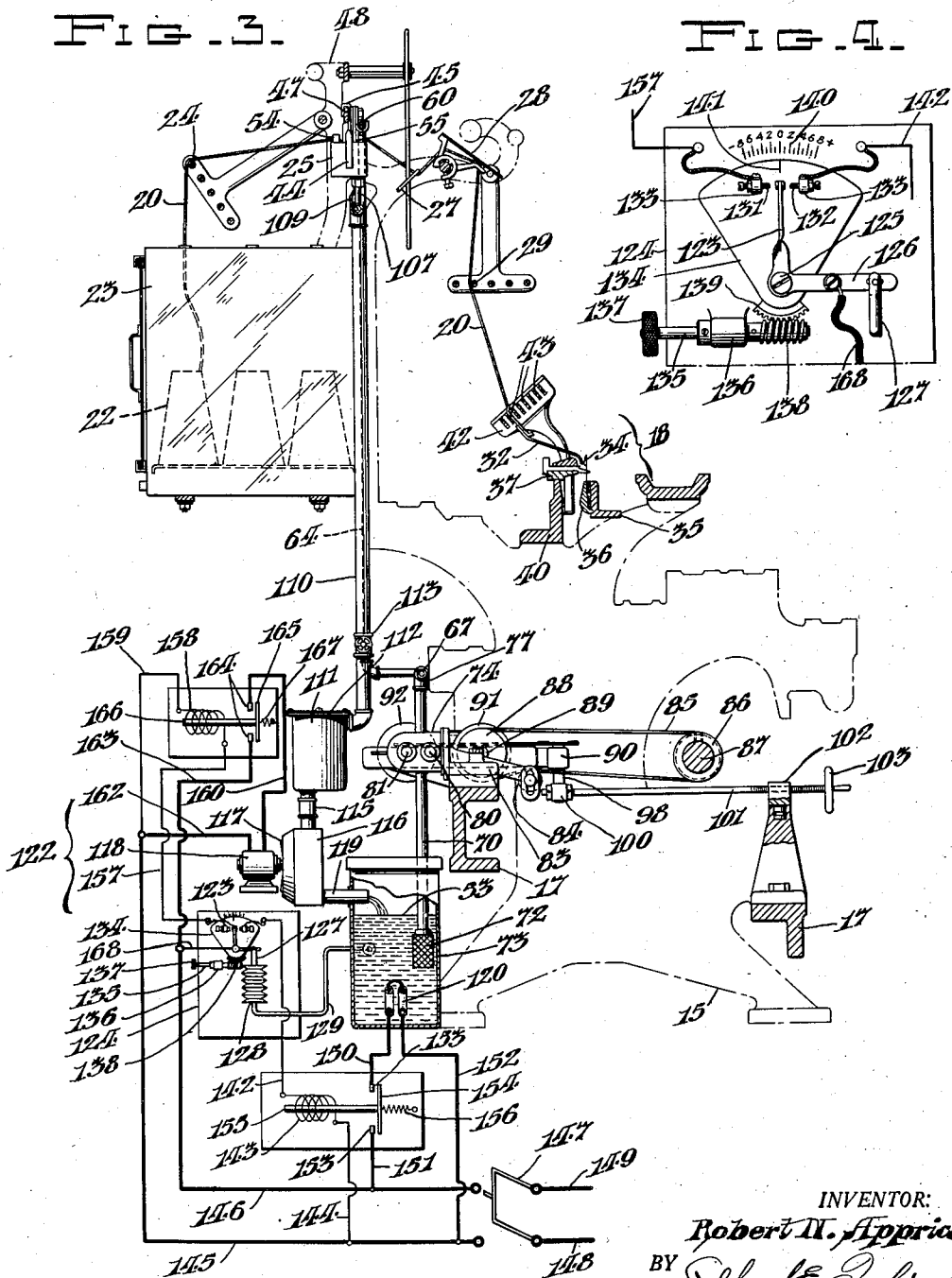
MEANS FOR CONDITIONING YARNS IN KNITTING MACHINES

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5 Sheets-Sheet 3

FIG. 3.

FIG. 4.



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MEANS FOR CONDITIONING YARNS IN KNITTING MACHINES

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5 Sheets-Sheet 5

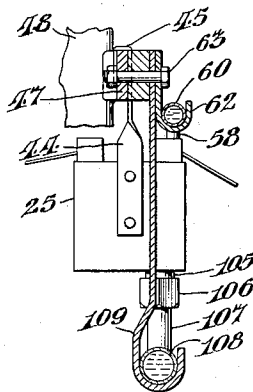
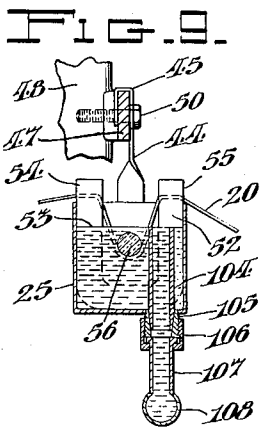
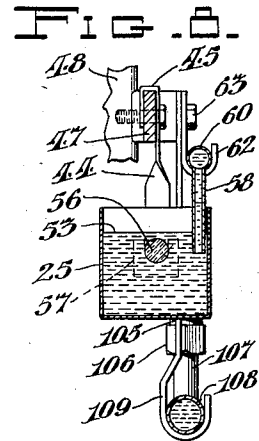
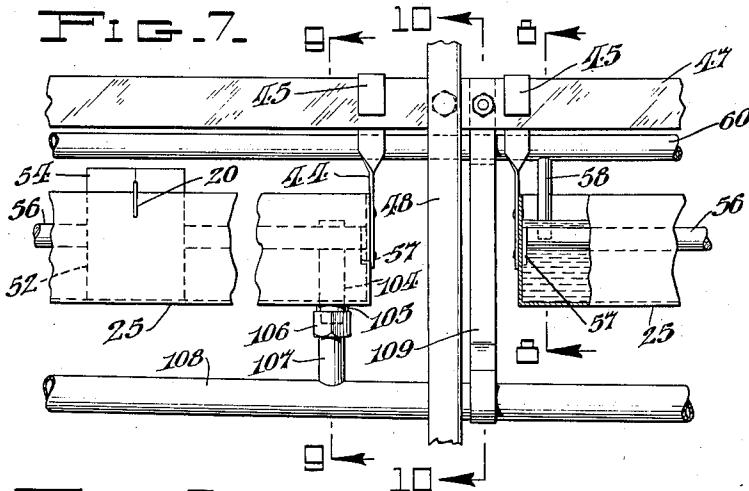
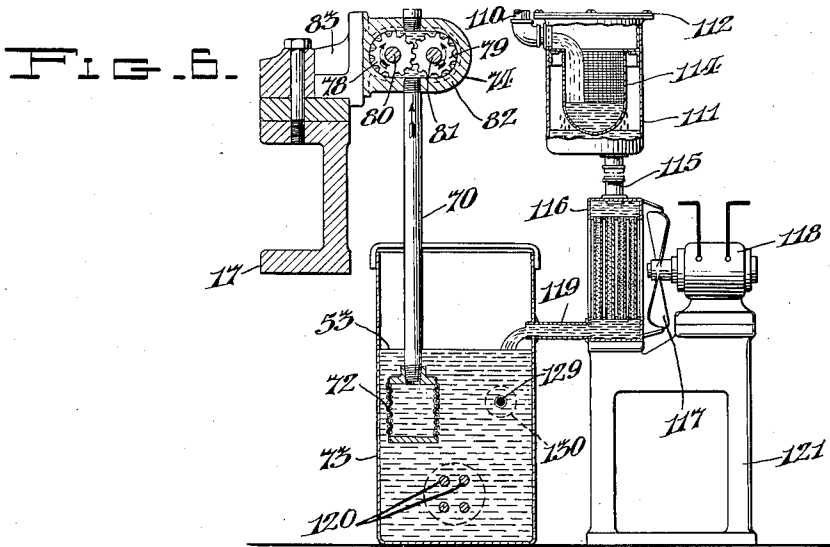


FIG. 10.

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UNITED STATES PATENT OFFICE

2,018,627

MEANS FOR CONDITIONING YARNS IN
KNITTING MACHINES

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Application September 19, 1934, Serial No. 744,631

11 Claims. (Cl. 66—125)

My invention relates to means for condition-
ing yarn, and particularly to a device for con-
trolling the temperature and other conditions of
a liquid for moistening, or otherwise treating, the
yarn employed in a knitting machine.

In the production of knitted fabrics, on
straight or full fashioned knitting machines, it is
customary to lead the thread or yarn from cones
or supply packages, through the so-called mois-
tening troughs, at which "felts" are disposed, be-
tween, or over, which the yarns pass on their way
to the thread carriers which feed the yarns to
the needles; the felts having portions immersed
in static bodies of liquid for supplying the liquid,
as by capillary or wick action, to felt portions
outside the main liquid body, which portions are
engaged by the yarns. In other instances, the
yarns are led directly into the liquid bodies in
the troughs by means of rolls or like guides
whereby the yarn may be more thoroughly mois-
tened; these methods being selected in accord-
ance with the requirements of particular yarns.

Such ordinary moistening-trough structure is
limited according to the nature and rate of feed
of the yarn, and the nature of the liquid, in the
degree of saturation it can effect in any given
yarn, because, the temperature is that of the
room in which the machine is disposed.

In other cases, it has been found desirable to
more thoroughly or rapidly wet the yarn, and, in
an effort to effect this result in a more facile
and effective manner than could be obtained with
the ordinary trough and felt arrangement at
room temperature, it has been suggested to force
steam against the yarn at the position of yarn
contact with the felts. This arrangement is,
however, unsatisfactory because the yarn or
strands, employed in the knitting machine, vary
widely as to texture, gauge and other character-
istics, such that a constant high temperature, at
or near the temperature of steam, or any tem-
perature which cannot be varied or controlled, is
not best suited to yarns of all kinds, or to all
conditions of knitting. Also, the felts are ad-
versely affected by contact with steam, or with
liquid at high temperature, particularly that at
or near the temperature of steam, such that they
require more or less frequent replacement.

Other arrangements have been employed, such
as leading a plurality of the yarns, of one or
two sections of a flat knitting machine, through
a static body of liquid in a single moistening de-
vice, which structure is relatively expensive, re-
quires rearrangement of the yarns from standard
practice, and has other disadvantages.

A further device heretofore used is one in
which the temperature of static liquid bodies in
the several moistening troughs of a multi-yarn
machine is determined by electrical heating units
disposed one in each trough, and adjusted by a
control mechanism common to all of the troughs.
This device, when employed in a machine during
the knitting of silk yarns, causes the accumula-
tion of gum in the troughs, and at the sinkers and
dividers.

Dust, lint and other foreign bodies also, ac-
cumulate in the above-mentioned devices such as
to adversely affect both the knitting operation
and the product, as well as to require frequent
cleaning, with the consequent expense and inter-
ruption of service.

Among the objects of my invention are to
overcome the disadvantages of the above-men-
tioned prior practice; to provide a novel device
whereby any desired temperature over a wide
range may be selected for operation and auto-
matically maintained constant within close lim-
its; to remove gum, dust, lint and other foreign
matter from the yarn conditioning liquid by a
liquid-circuit means; to condition any particular
yarn, irrespective of its texture, gauge, rate of
feed or other requirement of knitting closely in
accordance with any exact requirements as to
moisture and temperature relating to that par-
ticular yarn; to permit ready adjustment of the
same machine to different yarns; to provide a
device of the indicated character of simple and
durable construction, economical manufacture,
and effective operation; to construct the device
for application to existing machines, and ma-
chines of various sizes and types, with practically
no change in the standard or customary arrange-
ment and manipulation of yarns, except as to the
moistening troughs and provision for parts of
the new device; and to render the device an im-
provement generally in its field.

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, fea-
tures of construction and arrangement of parts
in cooperative relationship, as hereinafter more
particularly pointed out in the claims.

In the drawings:—

Figure 1 is a perspective view of portions of a
full-fashioned knitting machine, and of the
structure of my invention as related thereto,

Fig. 2 is a view, in rear elevation, of a full-
fashioned knitting machine embodying the in-

vention, certain parts being broken away and others in section,

Fig. 3 is a view, taken substantially along the line 3—3 of Fig. 2, slightly enlarged with respect thereto, certain parts being indicated in full lines, and others in broken lines; a control system and elements being indicated diagrammatically,

Fig. 4 is an enlarged detail view, in front elevation, of an adjustable control device employed in the invention,

Fig. 5 is an enlarged view, taken substantially along the line 5—5 of Fig. 2,

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

Fig. 7 is an enlarged fragmentary detail view of a moistening trough and its support structure, as viewed near the upper left central portion of Fig. 2, and

Figs. 8, 9, and 10 are views taken substantially along the lines 8—8, 9—9, and 10—10, respectively, of Fig. 7.

In practicing the invention, adjustment of the temperature at which the moistening liquid is to be maintained, is attained by a structure, preferably including an electrical relay, in which a balancing contact member is arranged in an air gap between two normally relatively stationary contact members, and actuated in accordance with slight temperature fluctuations of the moistening liquid; the normally stationary contact members being adjustable, relative to each other and to the balancing contact member, to determine the distance of the above-mentioned gap which represents the range of temperature over which the liquid may be allowed to fluctuate, or at which the system works best. The normally stationary contact members, being connected, respectively, to a cooling device, such as a fan-cooled radiator, and to a heating device, such as a resistor, associated with the yarn-conditioning liquid, and the balancing contact member being actuated in accordance with the temperature of the liquid, slight rises and falls of temperature actuate the balancing contact member, one way or the other, to periodically operate the fan and the resistor such that the temperature of the liquid is maintained substantially constant. To adjust the device to thus operate at any particular temperature, the gap is shifted by moving the normally stationary contact members simultaneously, and equally in the same direction to a new position, where the balancing contact member resumes its back and forth operation to maintain the newly selected temperature.

The liquid is provided in quantity sufficient to keep one or a series of moistening troughs to full level, and to have a reserve supply in a reservoir, and is directed, through a substantially closed or continuous circuit, from the reservoir to each trough and back. Although the circuit is continuous, or endless, in the circuit sense, its enclosing structure is open at the troughs for contact of the liquid with the yarns, where it receives lint, dust and other foreign matter, as mentioned above. In the ordinary moistening troughs, this matter accumulates at the stationary body of the liquid. Where these static bodies are sufficiently heated, silk thread gives off some of its gum, and the liquid receiving an undue quantity, passes it along the yarn to the sinkers and dividers. In the invention, these matters are carried by the circulating liquid away from the troughs to a filter which prevents the return thereof to the troughs, the means for effecting this result operating to remove certain of the

matter during the operation of the machine, and for periodic accelerated or intensified cleaning action, as will appear.

The circulation of the liquid may be obtained by convection, or preferably by the assistance of a pump whereby its rate of flow may be faster and capable of adjustment. In either case, the device, by such circulation, effects not only the improvement of removing foreign matter, as above set forth, but also ensures uniform and like heating in the several moistening devices, in which aspect, the invention contemplates the use of such circulation of a fluid separate from the yarn-conditioning liquid, which may circulate or remain static.

Referring to the drawings, in which a knitting machine is illustrated by way of example as a preferred device for which my invention is particularly adapted, only the parts of such machine necessary to a full and complete understanding of the invention are therein shown, the various other parts and mechanisms, and the manner of operation thereof, being well known in the art, as shown and described in the "Reading" Full Fashioned Knitting Machine Catalogue, copyright 1929, and published by the Textile Machine Works, Reading, Pennsylvania.

Referring particularly to Figs. 2 and 3, among the parts of a full-fashioned hosiery-knitting machine therein shown, sufficient for an understanding of the invention, is a base or support having end contour, indicated generally by broken lines in Fig. 3, and including usual end and intermediate frames 15, and beams 17 common to the units of a multiple-unit machine. A knitting mechanism 18 is represented generally in Fig. 3, and it is to such mechanism of each unit or section of the machine that a yarn 20, to be conditioned by my invention, is fed from one of several usual cones 22 or sources of supply, in a yarn box 23, over a thread guide rod 24 to a yarn-moistening trough 25, constituting one of the primary elements of my invention, and from the trough 25, through a ring tensioning device 27 and a snapper 28, and past another thread guide rod 29 to a yarn carrier 32. The latter traverses a bank of needles 34 held on a needle bar 35 by a clamp 36, and cooperating in a usual manner with a sinkerhead assembly 37 that is supported on a center bed 40. Brackets 42, only one of which is shown, support carrier rods 43 for supporting the carrier 32.

Referring particularly to Figs. 1, 7, 8, 9, and 10, each trough 25 is provided at its ends with metal strap-like brackets or hangers 44 including hook-like portions 45 having opposite parallel inner flat hook faces for snugly fitting a support bar 47 of rectangular cross section whereby the trough, altho readily removable from the bar, is relatively rigidly supported thereby; the bar 47 being secured to a poriton 48 of the machine frame, as by bolts 50. Felts 52 of substantially U-shape have lower portions immersed in the yarn conditioning liquid 53, and portions 54 and 55, above the level of the liquid. The yarn 20 passes through the portion 54 in entering the trough, and then passes downwardly into the liquid about a preferably glass roller or bar 56 that is supported in bearings or brackets 57 in the trough, see Fig. 8. Moving upwardly from the bar 56, the yarn 20, then passes through the felt portion 55.

An upright inlet conduit element 58 depends from an upper horizontal supply conduit 60 into the trough 25 to a position below the level of the

liquid 53 to prevent splash and the resultant damage to surrounding parts by rust. The conduit 60, supported along the upper portion of the machine, as by clips 62 secured to the bar 47 by bolts 63, communicates at its ends, near the ends of the machine, with the upper ends of upright conduit sections 64 and 65, which communicate, at the lower ends, with a horizontal pipe section 67 secured to the end and intermediate frames 15 of the machine, as by brackets 68. An upright conduit 70, at the lower end of which a filter 72, Figs. 2 and 3, is disposed in a reservoir 73, is provided with a pump 74, and communicates with the pipe section 67 at a T connector 77.

The pump 74 draws the liquid 53 from its reserve supply in the tank or reservoir 73, through the filter or strainer 72, and forces it toward the T connector 77, where it divides to pursue opposite courses along the conduit 67 to the riser conduits 64 and 65, and to the upper conduit 60, from which it descends through the conduits 58 into the troughs 25. The pump 74, as indicated more clearly in Fig. 6, is of the gear type having gear wheels 78 and 79 on shafts 80 and 81, respectively, in a casing 82. The casing 82 is carried by a bracket 83 that is bolted to the rear beam 17, and carries an idler pulley wheel 84 for tensioning a belt 85 that extends between a pulley wheel 86 on the cam shaft 87 and a pulley wheel 88 on a shaft 89 that is journaled in a frame 90 on the beam 17. The pump shaft 81 projects from the gear wheel 79 through a wall of the pump casing 82 and has an extension 86 journaled outside the casing in the frame 90 parallel to the shaft 89 and connected to the shaft 81 through a clutch 89 having a handle 71. Pairs of conically-shaped wheels 91 and 92, Fig. 5, are keyed to the shafts 89 and 66, respectively, the wheels of each pair being relatively movable along the shaft thereof, and a chain 93 extending between the respective pairs of wheels 91 and 92.

Levers 94, pivotally mounted on pins 95 carried by the frame 90, are connected by links 96 to a beam 97 that is journaled on a shaft 98 supported by the frame 90. The shaft 98 is fixed to a lever arm 99 that is loosely connected, by a connector 100, to a shaft 101 which extends to, and is journaled in, a bearing 102 on the front beam 17. The shaft 101 has a hand wheel 103 at the front side of the machine.

By reason of the pivotal mounting of the levers 94 on the pins 95 between the wheels 91 and 92, when the hand wheel 103 is turned one way or the other, the conical wheels of one of the pairs 91 and 92 are moved closer together, while the wheels of the other pair are moved farther apart, or vice versa, this action causing the chain 93 to increase or decrease its turning radius about one pair of the wheels while decreasing or increasing its turning radius about the other pair of wheels, whereby the rate of rotation of the pump shaft 81 relative to that of its actuating shaft 87 may be varied.

Outlet or overflow conduits 104, Figs. 7 and 9, which are disposed upright in the troughs 25 and determine the level of the liquid 53, have tapered lower ends for removable telescopic seating in short conduit portions 105 at the bottoms of the troughs in sealed relation to the troughs, and connected, as by sealed joints 106, and through upright conduit sections 107, to a return pipe section 108 that is secured to the machine frame, as by hangers 109, and extends gen-

erally horizontally along the upper part of the machine to an upright return conduit 110 including a shut-off valve 113. Adjacent to the reservoir 73, the conduit 110 leads to a trap or filter device 111, preferably of the renewable cartridge type, including a movable cover or lid 112 for removing and replacing a filter cartridge 114 in the trap 111, Fig. 6. The liquid path continues from the trap 111 through a conduit 115 to a radiator 116 that is cooled by a fan 117 driven by a motor 118 mounted on a support 121. From the radiator 116, the liquid returns to the reservoir 73 through a conduit 119; the reservoir also enclosing a heater 120 in the form of an electrical resistor immersed in the liquid.

As shown diagrammatically in Fig. 3, a control system, indicated generally by the reference numeral 122, comprises a balancing contact member 123 pivotally mounted on an insulating panel 124 by a pivot pin 125 and provided with a crank arm 126, see also Fig. 4, secured, by a link 127, to a bellows 128, which is connected by a conduit 129 to a bulb 130 in the reservoir 73 below the level of the liquid 53. The bellows 128, the conduit 129 and the bulb 130 are filled by a substantially incompressible liquid which, when subject to temperature change of the liquid 53 in the reservoir 73, causes the bellows 128 to expand or contract whereby to move the contact member 123 in one direction or the other about its pivot pin 125.

Normally stationary contact members 131 and 132, in the form of axially aligned screws having adjacent contact ends spaced from each other at opposite sides of the balancing contact arm 123, are mounted in screw-threaded lugs 132 on an insulating plate or sector 134 which is also pivotally mounted on the panel 124 by the pin 125. An operating shaft 135, mounted on the panel 124 in a bearing 136 has a knurled handle 137 and a worm screw 138 which engages a worm-wheel sector 139 on the insulating sector 134 whereby to adjust the latter about the axis of the pivot pin 125. Thus, by turning the handle 137, the normally stationary contact members 131 and 132 may be moved bodily so that the air gap between the adjacent ends thereof may be shifted. The size of the gap itself may be adjusted by turning one or both of the screw contact members 131 and 132, each relative to its supporting lug 133. Thus, no matter to which position the air gap between the screws 131 and 132 is adjusted, the balancing contact member 123 will tend to assume a neutral position between the screws 131 and 132 representing a given temperature, as will hereinafter more clearly appear. This temperature may be any one within a selected range, indicated by a scale 140 on the panel 124, for cooperation with a pointer or index 141 on the sector 134.

The normally stationary contact member 132 is connected, by a conductor 142 through a coil 143 and a conductor 144 to a conductor 145 of a pair of main conductors 145 and 146 of a service circuit that is connected by a master switch 147 to a main supply circuit including conductors 148 and 149 for connection to the conductors 145 and 146, respectively. The heater 120 is connected across the conductors 145 and 146 by conductors 150, 151 and 152, stationary contact members 153 and a movable contact member 154 secured to a magnetizable core member 155 that is controlled by the coil 143 and a spring 156.

The normally stationary contact member 131 is connected by a conductor 157, through a coil 75

158 and a conductor 159 to the conductor 145. The fan motor 118 is connected across the conductors 145 and 146 by conductors 160, 162 and 163, stationary contact members 164 and a movable contact member 165 that is secured to a core member 166 controlled by the coil 158 and a spring 167.

The balancing contact member 123 is connected by a conductor 168 and the conductor 163 to the main conductor 146.

In operation, the handle 137 is manipulated to place the pointer 141 opposite a selected mark on the scale 140 representing the temperature at which it is desired that the liquid 53 should be maintained. If, at the time of so operating the handle 137, the temperature of the liquid in the reservoir is higher or lower than the selected value, since the balancing contact member 123 will be at a position representing the actual temperature of the liquid, such operation will engage the arm 123 to one or the other of the normally stationary contact members 131 and 132 to operate either the fan 177 or the heater 120. When the latter has brought the temperature of the liquid to the desired value, the balancing arm 123 will disengage the contact member 131 or 132 with which it has been in contact, thus removing further heating or cooling action, by the heater or the fan, respectively. Depending upon various conditions of operation and the ambient temperature, the selected temperature may be maintained by a succession of operations of the heater, by a succession of operations of the cooler, by alternate operations of the heater and cooler, or other combinations of such operations.

The fluid 53 in the reservoir 73, being thus maintained at a substantially constant temperature of any desired value, is drawn by the pump 74 through the strainer 72 and the conduit 70, and forced through the oppositely extending horizontal sections of the conduit 67, and the upright conduits 64 and 65, to upper horizontal conduit 60, where it is fed to the troughs 25 through the inlet conduits 58.

The yarn 20, feeding from its supply cone 22 to the knitting mechanism 18, passes over the guide rod 24, through the portion 54 of the felt 52, downwardly into the liquid 53 around the bar 56, upwardly to the felt portion 55 and through the latter toward the knitting mechanism. With the liquid in a static or quiescent state, as in prior art devices, accumulations of gum, dust, lint and other foreign matter occur to not only deleteriously affect the moistening or conditioning of the thread but to further cause loss and inconvenience by frequent stoppage of the machine for cleaning the troughs. Accumulated gum in the troughs also moves along the yarn to the sinkers and dividers to cause the consequent imperfect action, delays, expense and other troubles incident to such feature. It may be understood, particularly from Fig. 9, that by the circulating fluid and overflow-pipe arrangement, the surface of the liquid is maintained clear of floating particles, and that by the continued supply of fresh liquid, the conditioning of the thread is rendered and maintained more uniform and effective than could possibly be effected with a static or stationary liquid body. By periodically lifting the removable overflow conduit sections 104 off the seats thereof in the members 105, the troughs may be thoroughly flushed by the circulating liquid.

By providing for the circulation of the liquid,

the choice of its temperature over a given range, the automatic maintenance of the selected temperature, the control of its rate of flow, the automatic carrying of certain accumulations from, and the periodic flushing of, the troughs, the filtration of the liquid, the ready maintenance of an effective filter, the adaptation of the structure to existing machines of different sizes or kinds with substantially a minimum of change, and other features, a device is provided for more thoroughly and effectively conditioning yarns of a wide variety, and that is more flexible in its application, use and maintenance than any prior device of which I am aware.

Of course, the novel device and improvements shown and described can be changed and modified in various ways without departing from the invention herein disclosed and hereinafter claimed.

I claim:

1. A knitting machine comprising a source of yarn supply, a knitting mechanism, means for feeding the yarn from said source to said mechanism, means for conditioning the yarn for knitting comprising means for circulating a liquid with which the yarn cooperates for treatment thereby, and means for controlling the temperature of the yarn-treating liquid.

2. In a knitting machine, the combination with a source of yarn supply, a knitting mechanism, and means for feeding the yarn from said source to said mechanism, of means for conditioning the yarn for knitting comprising means for circulating a liquid with which the yarn cooperates for moistening thereby, and means for adjusting the temperature of said liquid to any one of a plurality of values within a predetermined range.

3. In a knitting machine, the combination with a source of yarn supply, a knitting mechanism, and means for feeding the yarn from said source to said mechanism, of means for conditioning the yarn for knitting comprising means for circulating a liquid with which the yarn cooperates for moistening thereby, means for adjusting the temperature of said liquid to a selected value within a predetermined range, and means for maintaining said selected temperature substantially constant.

4. In a knitting machine, the combination with a source of yarn supply, a knitting mechanism, and means for feeding the yarn from said source to said mechanism, of means for conditioning the yarn for knitting comprising a structure with which the yarn cooperates for moistening the yarn, a reservoir, conduit elements connecting said structure to the reservoir in a circuit for causing liquid to flow through said structure, and means for controlling the temperature of the liquid.

5. In a knitting machine, the combination with a source of yarn supply, a knitting mechanism, and means for feeding the yarn from said source to said mechanism, of means for conditioning the yarn for knitting comprising a structure including a trough for holding a liquid body with which the yarn cooperates for moistening the yarn, supply and overflow conduits for said trough, means for controlling the temperature of said liquid and conduit elements connecting said supply and overflow conduits and said trough in a continuous circuit.

6. In a knitting machine, the combination with a source of yarn supply, a knitting mechanism, and means for feeding the yarn from said source to said mechanism, of means for conditioning the

yarn for knitting comprising means for circulating a liquid with which the yarn cooperates for moistening thereby, and means for controlling the temperature of, and removing foreign matter from, the yarn-moistening liquid.

7. The combination with a plurality of knitting machine units each including a source of yarn supply, a knitting mechanism, and means for feeding the yarn from said source to said mechanism, of means for conditioning the yarns of said units for knitting comprising means for circulating a liquid with which the yarn of each unit cooperates for treatment thereby, and means for controlling the temperature of the yarn-treating liquid.

8. In a knitting machine, the combination with a source of yarn supply, a knitting mechanism, and means for feeding the yarn from said source to said mechanism, of means for conditioning the yarn for knitting comprising a trough-like receptacle for a yarn-moistening liquid, and means for controlling the temperature of said liquid including a reservoir and conduit elements connecting said reservoir and said receptacle in a continuous circuit for the liquid electro-responsive heating and cooling means for the liquid, and thermal responsive means for controlling the operation of said heating and cooling means to maintain the temperature of the liquid substantially constant.

9. In a knitting machine, the combination with a knitting mechanism, a source of yarn supply, and means for feeding yarn from said supply to said mechanism, of means for conditioning the yarn for knitting comprising a trough-like receptacle, an overflow pipe in said receptacle determining the level of a yarn-conditioning liquid therein, an inlet pipe for supplying said liquid to the receptacle, a reservoir for a reserve supply of said liquid, conduit elements connecting said trough and said pipes in a circuit with said reservoir, electro-responsive heating and cooling

means for the liquid of said circuit, a pump in said circuit, means for actuating the pump at a selected rate and thermal-responsive means for controlling the operation of said heating and cooling means to maintain the temperature of said liquid substantially constant.

10. In a knitting machine, the combination with a knitting mechanism, a source of yarn supply, and means for feeding yarn from said supply to said mechanism, of means for conditioning the yarn for knitting comprising a trough-like receptacle, a removable overflow pipe in said receptacle determining the level of a yarn-conditioning liquid therein, an inlet pipe depending to a position below said level for supplying said liquid to the receptacle, a reservoir for a reserve supply of said liquid, conduit elements connecting said trough and said pipes in a circuit with said reservoir, electro-responsive heating and cooling means for the liquid of said circuit, a pump in said circuit, means for controlling the operation of the pump to control the rate of flow of said liquid, thermal-responsive means for controlling the operation of said heating and cooling means to maintain the temperature of said liquid substantially constant, means for adjusting said temperature to any one of a plurality of values, and renewable filter means in said circuit for receiving foreign matter received into the circuit at the trough and preventing its return to the trough.

11. In a knitting machine, the combination with a source of yarn supply, knitting mechanism, and means for feeding yarn from said source to said mechanism, of means for conditioning the yarn for knitting comprising means for circulating a liquid with which the yarn cooperates for treatment thereby, means for controlling the temperature of the liquid, and means including a filter unit for removing foreign matter from the liquid.

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