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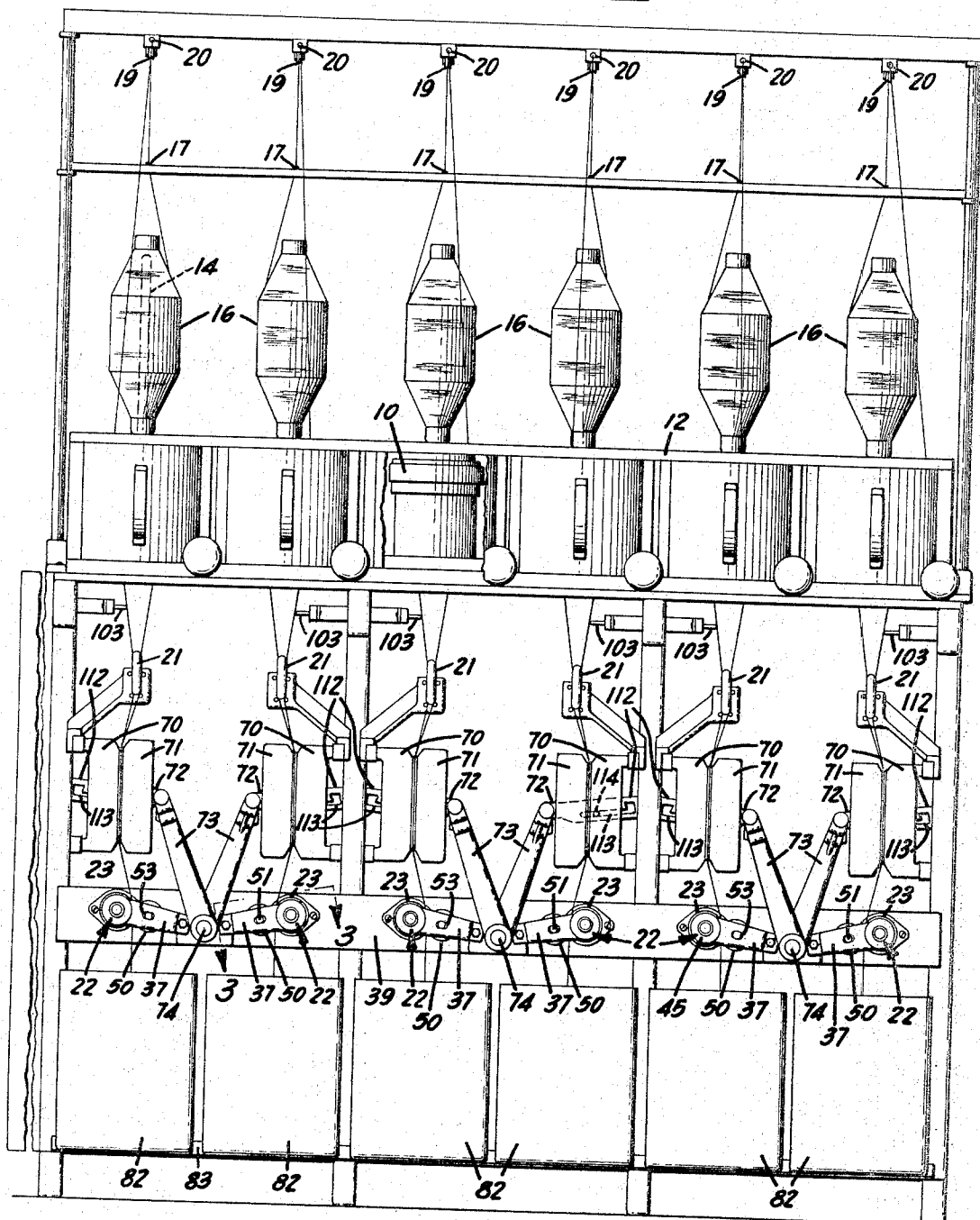
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APPARATUS FOR MAKING TEXTURED YARN

Filed March 29, 1965

3 Sheets-Sheet 1

FIG. 1



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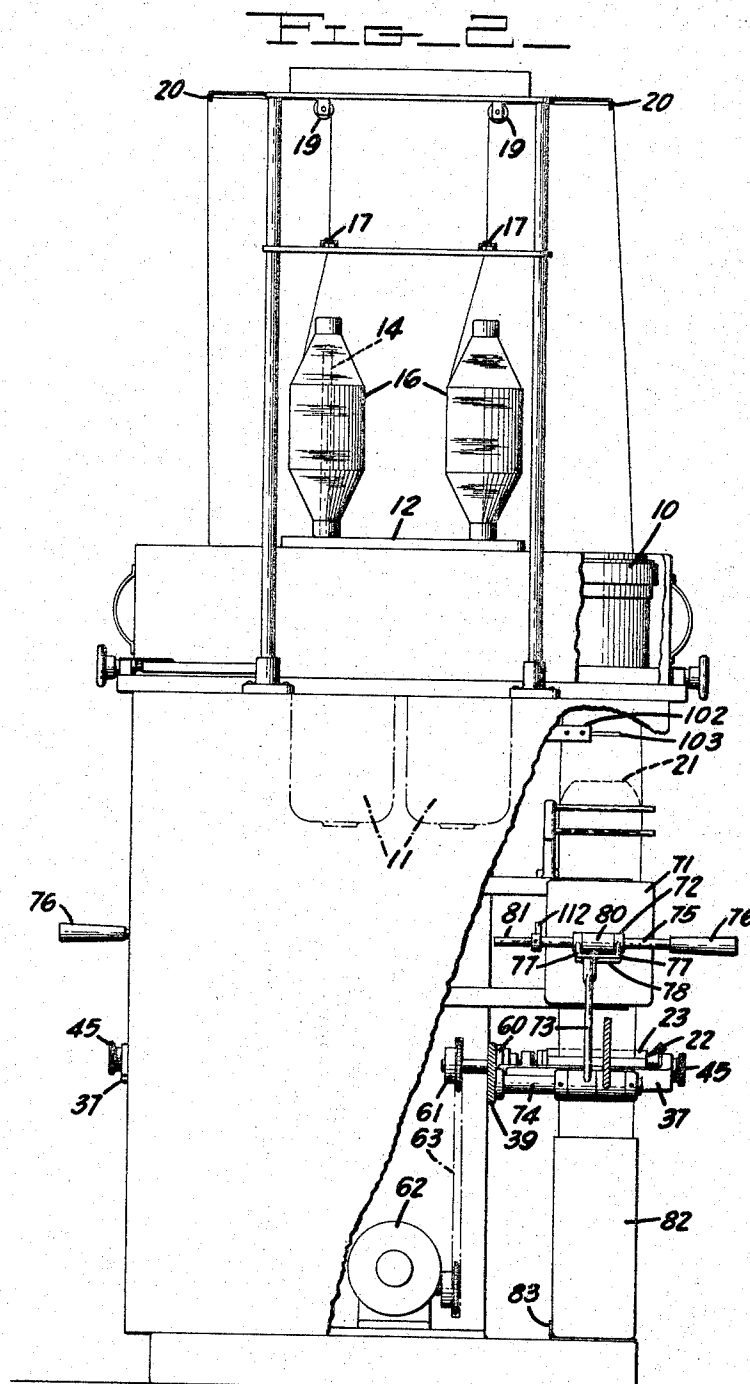
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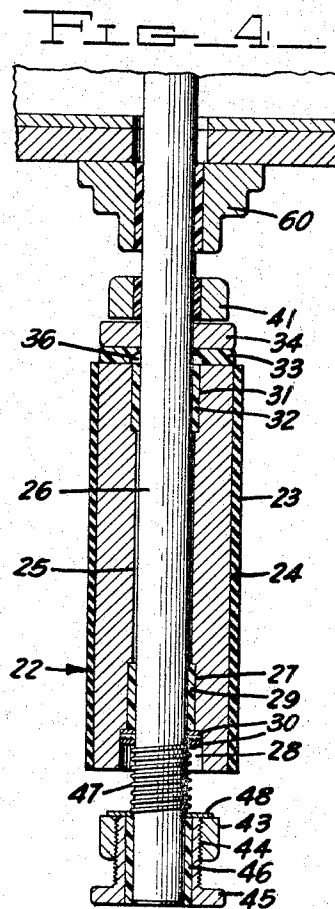
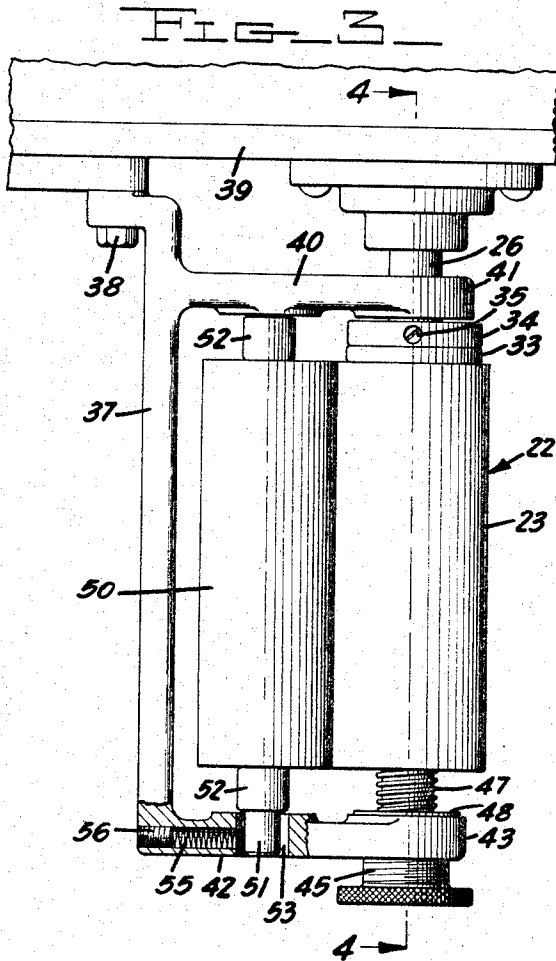
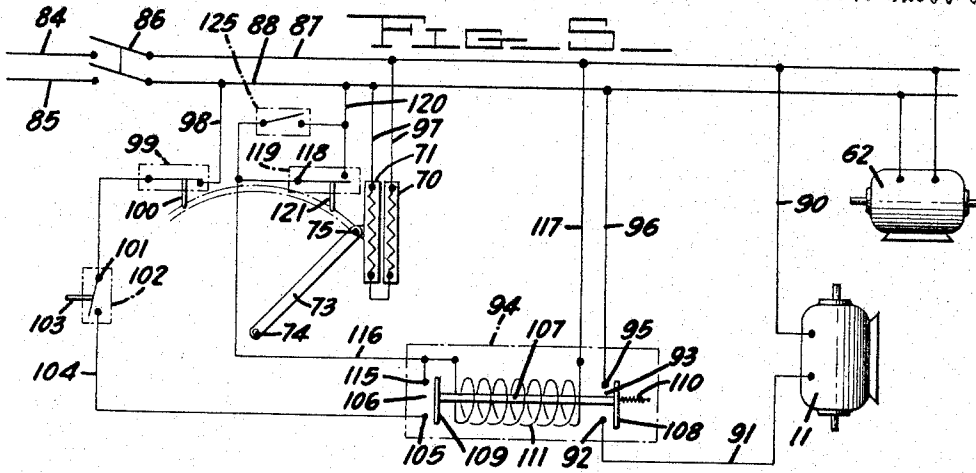
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3 Sheets-Sheet 3



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**APPARATUS FOR MAKING TEXTURED YARN**  
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5 Claims. (Cl. 66—147)

## ABSTRACT OF THE DISCLOSURE

This invention concerns apparatus for use in the "knit-heat set-deknit" process of producing crimped yarn and discloses such apparatus comprising a group of knitting heads with platen type heating means beneath each head through which the flattened fabric tube is drawn to heat set the yarn thereof continuously with the production of the tube, said apparatus further including a driven draw-off roller having slip clutch means for maintaining tension on said fabric tube and means whereby one of the heating platens may be moved to a remote position to free the fabric tube from contact with either, this movement of the one platen also opening the circuit to the driving motor of its associated knitting head.

The instant invention relates to methods and apparatus for modifying thermoplastic multifilament yarn and more particularly is directed to improvements in certain of the apparatus and method steps disclosed and claimed in our co-pending application Ser. No. 385,360, filed July 27, 1964, of which the present application is a continuation in part.

The prior application is directed to apparatus and processes for the production of textured multifilament yarns, such for example as polymedic yarn including nylon, Orlon and Dacron, synthetic yarns such as phenolic and acrylic resin yarns and yarns composed of organic derivatives of cellulose such as cellulose acetate, employing basically the so-called knit-deknit system. This system, as practiced prior to the improvements proposed in our said application, in its essentials required the knitting of a fabric tube from the yarn, subjecting the tube to a heat setting operation in an autoclave or the like and thereafter de-knitting or unraveling the yarn of the fabric tube. The unraveled yarn was then woven or knitted or otherwise converted into the final fabric. In our application identified above certain improvements in the prior knitting-deknitting process and the apparatus employed therein are disclosed including apparatus and methods for carrying out the knit-deknit system as a continuous operation. Also the prior application discloses additional means and methods whereby the deknitted yarn may be subjected to a bulking operation either continuously with the deknitting step or separately therefrom.

The instant invention is directed to and has for its principal object further improvements in the knit-deknit system and the apparatus employed therein and, more particularly, further improvements in the apparatus and method employed in the knitting of the fabric tube and the heat setting of the tube continuously with its production. Thus in accordance with the present invention a knitting head and a fabric draw-off means therefor are supported in substantially vertical alignment with a heating means interposed between the knitting head and the draw-off in the path of the fabric tube. Also in accordance with the invention the fabric draw-off means embodies a slip clutch mechanism whereby a controlled draw-off tension is maintained on the fabric tube.

A further object of the invention is the provision in

such apparatus of a motor drive for the knitting head and means for opening the circuit to the motor drive in the event of a discontinuance in the formation of the fabric tube.

A further object of the invention is the provision of a heating device for heat setting the knitted fabric tube continuously with its production, the device comprising fixed and movable platens the fixed platen being supported in a substantially vertical plane parallel to and spaced from the normal path of movement of the fabric between the knitting head and the draw-off means and the movable platen being mounted for movement between a position in which it is closely adjacent the first platen to confine the fabric between the two platens and a position spaced therefrom whereby, when the movable platen is moved to its spaced position, the path of the fabric will be remote from both platens. Also according to the instant invention means are provided to, upon the movement of the movable platen to its spaced position, open the circuit to the motor drive for the knitting head whereby production of the fabric is discontinued.

A still further object of the invention is the provision of a compact multihead machine with a heating device and draw-off means for each head in which all or only a portion of the heads may be operated.

The invention will be more fully understood and further objects and advantages thereof will become apparent when reference is made to the more detailed description to follow and to the accompanying drawings in which:

FIG. 1 is a front elevational view of a multihead machine for the processing of thermoplastic yarn in accordance with the instant invention;

FIG. 2 is a side elevational view, with parts broken away for purposes of illustration, of the machine of FIG. 1;

FIG. 3 is a sectional view on an enlarged scale taken on the line 3—3 of FIG. 1 looking in the direction indicated by the arrows;

FIG. 4 is a sectional view taken on the line 4—4 of FIG. 3 looking in the direction indicated by the arrows; and

FIG. 5 is a wiring diagram schematically illustrating the control circuits for the driving motors of the knitting heads.

Referring now to the drawings and particularly to FIGS. 1 and 2 there is disclosed a multihead machine incorporating the improvements of the instant invention for performing certain operations in the processing of multifilament thermoplastic yarn to the end that a textured or crinkled yarn may be produced. The yarn may be a linear polymede such as nylon but the invention is not limited thereto as other types of thermoplastic yarns including yarns of vinyl or acrylic resins, organic derivatives of cellulose or the like may be employed.

The machine in its preferred embodiment comprises a frame supporting a double row of knitting heads 10 the two rows of knitting heads being located in elevated positions at the two longitudinal sides of the machine. Each of the knitting heads 10 is constructed for high speed conversion of yarn into tubular fabric and may be of the type shown and described in our co-pending application Ser. No. 385,360 previously referred to or of other suitable construction. In any event each knitting head includes a stationary needle cylinder, needles mounted therein for reciprocation through a knitting wave, a cam cylinder mounted for rotation about the needle cylinder and carrying the cams required to cause the needles to move through their knitting motions, and appropriate feed means, none of such conventional parts being shown in detail. Each knitting head is preferably driven by an individual motor 11 (FIG. 2) through a suitable drive connection.

A yarn rack indicated generally at 12 is supported from the framework of the machine at an elevation above the knitting heads 10, yarn rack 12 having a double row of pirn holders 14 on which yarn pirns 16 are carried one or more for each knitting head. The yarn is supplied from each pirn to a yarn feed finger, not shown, of its associated knitting head the yarn being drawn through a guide 17 around a feed roll 19 and through a guide 20. The particular feed roll means forms no part of the instant invention but may be of any suitable construction to provide a positive yarn feed.

A fabric spreader 21 typified by those employed in circular cloth or body fabric knitting machines and which may be of any suitable specific construction is provided in the path of the fabric tube below each knitting head. The fabric spreader functions to spread the fabric into a flattened tube for reception by the heating devices hereinafter to be described.

A fabric draw-off means is mounted from the framework of the machine below and in substantially vertical alignment with each knitting head 10, each of the several draw-off means being generally indicated by the reference character 22. Referring particularly to FIGS. 3 and 4 each draw-off means includes a driven roller 23 having a surface layer 24 of rubber or other material adapted for frictional contact with the fabric. Roller 23 is bored as at 25 the bore having a diameter somewhat greater than the diameter of a shaft 26 on which the roller is mounted. Coaxial annular recesses 27 and 28 are formed in the outer end of roller 23. A bearing sleeve 29 is mounted in inner recess 27. The outer recess 28 contains washers 30 between which is inserted a thrust needle bearing of conventional type. The opposite or inner end of roller 23 is also provided with an internal recess 31 in which is mounted a bearing sleeve 32. An annular clutch plate 33 having a bore to freely receive the shaft 26 is mounted on the latter between the end of roller 23 and a collar 34 fixed to the shaft as by set screw 35. The inner corner of clutch plate 33 toward roll 23 is cut away as shown at 36. Bearings 29 and 32 and clutch plate 33 are suitably made of nylon or other wear resistant material.

A U-shaped bracket 37 is secured as by stud 38 to a machine frame member 39. An inner arm 40 of bracket 37 terminates in a bearing portion 41 rotatably receiving shaft 26. An outer arm 42 of the bracket terminates in a portion 43 having a threaded bore 44 receiving a correspondingly threaded sleeve 45. Sleeve 45 carries a bearing 46 for the outer end of shaft 26. A compression spring 47 is mounted on the shaft 26 between a washer 48 and the outer washer 30.

An idler roller 50 is rotatably mounted on a shaft 51 between collars 52. The ends of shaft 51 are carried in elongated bearing slots 53 in arms 40 and 42, one of said slots being illustrated in FIG. 3. The ends of shaft 51 are urged in a direction to maintain rollers 23 and 50 in adjacent relationship by compression springs 55 mounted in bores in arms 40 and 42 and projecting into bearing slots 53. The force at which the springs 55 bear against the shaft may be adjusted by means of set screws 56 threadably received in the bores and contacting the outer ends of the springs. Roller 50 suitably has surface characteristics of the same type as roll 23.

The inner end portion of shaft 26 for driven roller 23 is carried in a bearing 60 secured to frame member 39, the shaft projecting through an opening in the frame member. The inner end of the shaft has a sprocket 61 keyed thereto (FIG. 2).

Each of the draw-off rolls 23 may be driven by an individual motor if desired but preferably all are driven from a single motive source. As illustrated in FIG. 1 the successive sets of draw-off rolls at each side of the machine are so arranged that the relative positions of the driven and idler rolls alternate. Thus starting with the left-hand side of the machine the driven roller 23 of the first set is to the left of the idler roll, in the next set it is to the

right of the idler roll, etc. Where the rolls are to be driven from one source, the preferred arrangement as mentioned above, a chain 63 leading from the drive sprocket of a motor 62 is passed over sprockets 61 for the left-hand set, then under the sprocket 61 for the next set and so on to the end of the machine, the chain then being passed over an idler sprocket (not shown) and in its return run to the motor driving sprocket.

Referring again to FIGS. 1 and 2 the fabric heating device for each of the sections or heads comprises a fixed platen 70 supported in a vertical position from a frame member of the machine and a movable platen 71 rockably connected at 72 in a manner hereafter described to an arm 73 which in turn is rockably mounted on a shaft 74 projecting from a frame member and supported thereby. Referring particularly to FIG. 2 the rockable connection 72 comprises a pin 75 having an outwardly projecting hand grip 76, the pin extending through aligned apertures in the legs 77 of a U-shaped bracket 78 forming part of arm 73. Between the legs 77 of bracket 78 the pin is rotatably received in a bore formed in a lug 80 projecting from the rear side of the platen. Pin 75 has a projecting inner end portion 81 adapted to cooperate with the actuating arm of a switch as will hereinafter be explained. The projecting end of the pin also has a latch arm 112 secured thereto in fixed position thereon. Latch arm 112, shown in dotted lines for one of the heating devices in FIG. 1, has a bayonet slot 113 receiving a projecting end of a pin 114 carried by the fixed platen. As will be noted the movable platen may, by the mounting described above, be swung between a position in which it lies in parallel adjoining relationship to the fixed platen, or to the fabric confined between the platens, and a remote position in which it is held by the entry of pin 114 into the vertical portion or notch of bayonet slot 113.

As clearly illustrated in FIG. 1 fixed platen 70 is offset from the normal path of travel of a fabric tube from the knitting head to the draw-off means. As a consequence when the platen 71 is swung to its remote position away from platen 70, as by manual manipulation of grip 76, the fabric tube will be permitted to assume a normal path out of contact with platen 70. Inasmuch as the extent of movement of platen 71 is such that in its remote position it is also beyond the normal path of the fabric tube the latter will be out of contact with both platens. Hence overheating and injury to the fabric may be prevented by swinging the movable platen to its remote position in the event of any interruption in the production of the fabric.

Both platens of each heating device are heated to a controlled temperature preferably by electrical resistance means as indicated diagrammatically in FIG. 5. Alternatively an open flame or other heating means may be employed. The particular temperature to which the platens are heated will depend on the type and denier of the yarn of which the tube is composed and the effective heating length of the platens. In any event it is such as to heat set the yarn of the fabric in its passage therebetween.

As illustrated particularly in FIG. 1 the relative positions of the movable and fixed platens alternate for the several heads. Thus in the heating device for the first head, the head to the left in FIG. 1, the movable platen 71 is to the right of the fixed platen 70. In the next head the movable platen 71 is to the left of the fixed platen and so on. With this arrangement each shaft 74 supports arms 73 connected to the movable platens for two heads.

A container 82 may be supported on a platform 83 below each of the fabric draw-off means to collect the fabric as it is delivered thereby. Alternatively the drawn off fabric may be delivered directly to other equipment for the performance of further operations thereon as for example deknitting and yarn bulking operations.

Referring now particularly to FIG. 5 a wiring diagram is illustrated for controlling the drive of one of the motors 11 at one side of the machine. It will be understood that equivalent circuits are employed for each motor 11. Also

that motor 62, if individual motors are used for each take-off device, will be connected into the circuit. On the other hand if a single motor is employed to drive all of the take-off devices on a side of the machine, as is preferable, such motor may be connected into any one of the circuits or may be separately controlled. The main circuit includes power leads 84 and 85 connected to the terminals of a manually operated switch 86. The other terminals of the switch are connected through leads 87 and 88 to the terminals of motor 62 if it is to be included in the circuit. A lead 90 from main lead 87 is also connected to one terminal of the motor 11. The other terminal of the motor 11 is connected by a lead 91 to one terminal 92 of a switch 93 forming a part of a contactor 94 hereinafter to be described in detail. The other terminal 95 of switch 93 is connected by lead 96 to main lead 88. The heating elements of the platens 70 and 71 of the fabric heating device may also be connected to the main leads 87 and 88 as by leads 97.

Contactor 94 forms part of a control circuit for disconnecting the motor in the event the movable platen 71 of the heating device is moved to its remote position or there is a failure in the supply of the fabric due to exhaustion of the yarn supply to the knitting head or for other reasons. The control circuit includes a lead 98 connected to one terminal of a normally closed self-closing switch 99. Switch 99 has an actuating arm 100 positioned to be in the path of and to be moved momentarily to switch opening position by pin portion 81 as the movable platen is swung to its open position. Immediately upon the passage of portion 81 the switch again automatically closes. The other contact of switch 99 is connected to one contact 101 of a switch 102 which has an actuating arm 103 (see FIGS. 1 and 5) positioned to normally ride on the fabric as it leaves the knitting machine and to be held in switch closing position thereby. The other contact of switch 102 is connected by a lead 104 to a terminal 105 of second switch 106 forming part of contactor 94.

Contactor 94 includes a core 107 to which is affixed contacting elements 108 and 109 adapted to close switches 93 and 106 respectively when the core is moved to the left as viewed in FIG. 5. Core 107 is yieldably urged to its right-hand position in which members 108 and 109 are in their switch opening positions by a spring 110. A winding 111 surrounding core 107 when energized causes movement of the core to the left as viewed in FIG. 5 to close both switches 93 and 106. Switch 106 includes a second terminal 115 connected to a lead 116 which is also connected to one terminal of winding 111. The other end of winding 111 is connected by a lead 117 to main lead 87. Lead 116 is connected to one terminal 118 of a normally open self-opening switch 119 the other terminal of which is connected by a lead 120 to main lead 88. Switch 119 has an actuating arm 121 positioned to be momentarily moved to close the switch by the pin portion 81 when the movable platen is moved from its remote position to its position adjacent platen 70. Preferably a manually operated toggle switch 125 is connected by leads 120 and 116 in parallel with switch 119.

The operation of the machine as disclosed above will now be described. For the purpose of example it will be assumed that the yarn being processed is a 70 denier nylon yarn of thirty-four continuous filaments the yarn having substantially no twist, e.g. approximately one-half turn per inch. It will be understood however that the invention is in no way limited to the processing of such yarn and that yarns of other deniers and other filament counts and yarns of other thermoplastic compositions may be employed in lieu thereof. Also it will be understood that the temperatures of the platens 70 and 71 will be adjusted in accordance with the known heat setting characteristics of the yarns involved.

It will also be assumed that the machine is being started up with no preformed lengths of fabric in any portions of

the equipment. Under such condition a yarn is led from a pin 16 for each knitting head or machine section to be operated through the guide eyes over the feed roll and to the yarn feed finger of the knitting head. The main switch 86 for each such head is then closed. The movable platen 71 of the heating devices of each of such heads will suitably be rotated to its remote position with respect to the fixed platen 70. Under such circumstances switches 119 and 102 will both be open and hence winding 111 of contactor 94 will be de-energized and switch 93 will remain open and the knitting head inactive. However motor 62 for the draw-off device will be energized as well as will be the heating coils of the platens of the heating device.

If now the toggle switch 125 of each of such heads to be operated is closed winding 111 is energized through lead 116 causing core 107 to move to the left to close switch 93 and start motor 11 core 107 remaining in this position as long as switch 125 is closed. Upon the starting of the motor a fabric is formed by the knitting head, and as the operation continues the tube of fabric is allowed to hang loose, or if desired is weighted in some way as it issues below the knitting head, until a sufficient length is produced to be grasped by the rollers of the draw-off device. Before the introduction of the fabric between the rollers the spreader 21 is manually inserted in the tube through the lower end thereof.

As pointed out above upon the closing of the switch 86 the motor 62 driving the draw-off device, or devices as the case may be, is energized. The rotative speed of the motor is adjusted or predetermined so that roll 23, if rotated at the same r.p.m. as the shaft 26, would have a surface speed somewhat in excess of the rate of production of the fabric tube by the knitting head. However due to the slip clutch drive of the roll afforded by clutch plate 33 cooperating with collar 34 and the end of the roll, the surface speed of the roll will conform with that of the fabric but at the same time exert tension on the fabric. The tension thus exerted may be adjusted to the desired value by the turning of sleeve 45 which through spring 47 controls the force of engagement of clutch plate 33 with collar 34 and the surface of roller 23.

As soon as the knitted tube is of a length to be grasped by the draw-off device pin 75 is rotated through the hand grip 76 to release the latch arm 112 and the movable platen 71 is then brought into adjacent relationship to platen 70 to confine the fabric between the platens the fabric being heat set during its passage therebetween. Also when the fabric has been introduced between the draw-off rollers and tensioned thereby arm 103 of switch 102 is closed through contact with the fabric and the circuit to winding 111 is closed through lead 104 and switch 106 which was previously closed upon the manual closing of toggle switch 125. The toggle switch may now be opened to place the controls effected by switches 99, 102 and 119 into operation.

In the event that it is desired to stop the operation of one of the knitting heads grip 76 is manipulated to move the movable platen of the heating device, associated with that head, to its remote position away from fixed platen. During such movement the projecting end portion 81 of pin 75 momentarily opens normally closed switch 99 opening the circuit to winding 111 and de-energizing it, core 107 moving to the right as viewed in FIG. 5 under the influence of spring 110 and opening switch 93 whereby the circuit to the motor 11 is also opened and the operation of the knitting head stopped. When the knitting head is again to be placed in operation movable platen 71 is swung to its position adjacent to the fixed platen 70, portion 81 during such movement momentarily closing normally open switch 119. The momentary closing of switch 119 again energizes winding 111 which causes core 107 to move to the left as viewed in FIG. 5 and close switch 106. At the same time switch 93 is closed to start motor 11 whereupon the operation of the knitting head is re-

sumed and continues as winding 111 is then energized through lead 104 and closed switches 102 and 99. If at any time because of exhaustion of the yarn supply or otherwise, there is no fabric to maintain the actuating arm 103 of switch 102 in closed position the circuit including the lead 104 to winding 111 is again opened and the core 107 moved to the right under the influence of spring 110 to again open the switch 93 in the motor circuit.

A machine in accordance with the invention attains the several objects of invention heretofore set forth. It provides in its preferred embodiment a compact multihead construction in which all or any one or more of the heads may be operated as desired. The machine may of course be constructed as a single-head machine if that is preferred for any reason. In any event the fabric produced by the head or heads is; continually with its production and with a minimum path of travel, drawn off from the head, subjected to a heat setting operation and then delivered to a collecting device or, if desired, to other equipment for further processing. The operation of any head may be interrupted by the rotation of the movable platen of the heating device associated with that head to its remote position from the fixed platen, the fabric in such event automatically assuming a position spaced from both platens to avoid overheating and injury thereto. It is unnecessary in the event of such stoppage to interrupt the operation of the draw-off device as the shaft of the driven roller will turn inside the roller with slippage between the surfaces of clutch plate 33, collar 34 and the end of roller 23. In the event of discontinuance of fabric production the circuit to the driving motor for the head is automatically opened by the opening of switch 102.

Having thus described the invention in rather complete detail it will be understood that these details need not be strictly adhered to, and that various changes and modifications may be made all falling within the scope of the invention as defined by the following claims.

What is claimed is:

1. In an apparatus for processing thermoplastic yarn, a knitting head for converting yarn into a fabric tube, a fabric draw-off means below and in substantially vertical alignment with said head a fabric heating device supported in the path of travel of fabric from said knitting head to said draw-off means said heating device comprising a fixed platen and a movable platen, means supporting said movable platen for movement between a position in which it is closely adjacent and parallel to said fixed platen and a remote position, and releasable means for latching said movable platen in its remote position

2. In an apparatus for processing yarn a knitting head, a fabric draw-off means below said knitting head and a fabric heating device supported in the path of travel of the fabric, the improvement wherein said draw-off means

comprises a roller and a slip clutch means for driving said roller, and said slip clutch means comprises a shaft for said roller, a bore in said roller freely receiving said shaft, a clutch plate fixed to said shaft adjacent an end of said roller and adjustable means for urging said roller end into frictional contact with said clutch plate.

3. In an apparatus for processing thermoplastic yarn a knitting head, fabric draw-off means below and in substantial vertical alignment with said knitting head, and a fabric heating device supported in the path of travel of the fabric produced by said knitting head, a motor means for driving said knitting head, an electrical circuit for said motor, means including a normally open switch in said circuit and means under the control of said heating means for closing said switch.

4. In an apparatus for processing yarn said apparatus comprising means including a knitting head for converting yarn into a flattened fabric tube having a given path of travel, the improvement comprising a fabric heating device receiving said flattened tube and including a first platen in fixed position adjacent said path of travel, a second platen, means mounting said second platen for movement between a position in which the flattened tube is in contact with and confined between said platens and a remote position, means for individually heating both platens and means to cause said flattened tube to move out of contact with said fixed platen upon movement of said second platen to its remote position.

5. In an apparatus for processing yarn said apparatus comprising means including a knitting head for converting yarn into a flattened fabric tube having a given path of travel, a heating device in said path of travel, a motor for driving said knitting head and an electrical circuit for said motor, the improvement wherein said heating device comprises a first platen with means supporting said platen in a position adjacent to said path of travel, a second platen, means supporting said second platen for movement between a position in which the flattened tube is pressed and confined between said platens and a remote position, and means operable by movement of said second platen to its remote position to open said circuit.

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