Feb. 17, 1959 W. LARKIN 2,873,596

PNEUMATIC TAKE UP FOR CIRCULAR KNITTING MACHINES

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FIG. 1.

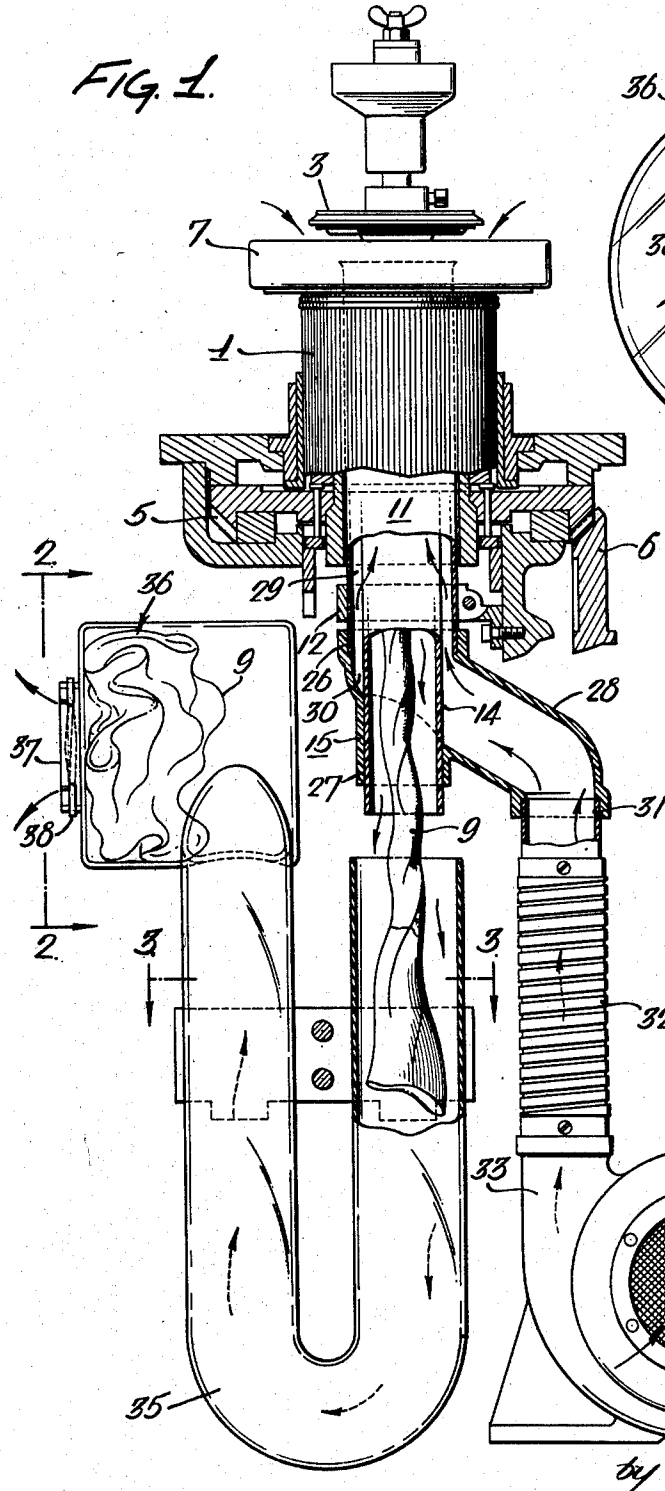


FIG. 2.

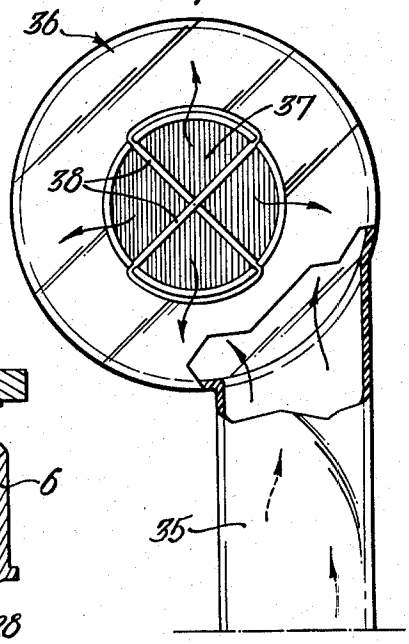
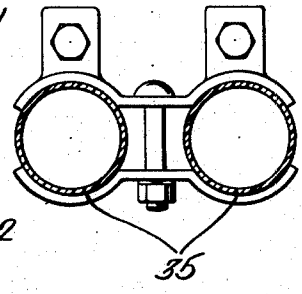


FIG. 3.



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FIG. 4.

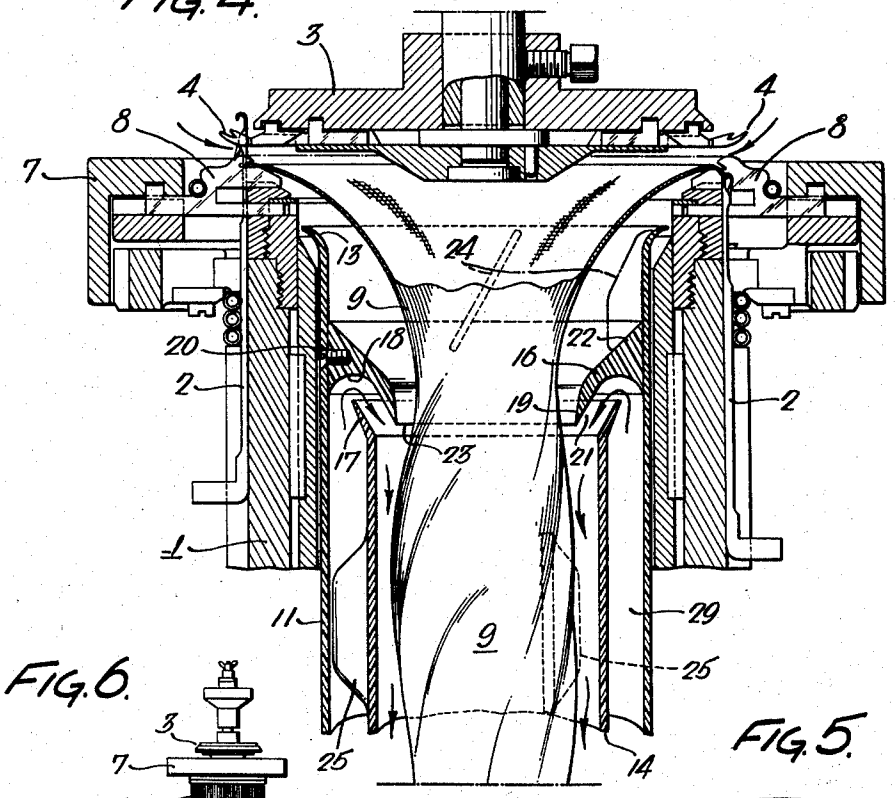


FIG. 6.

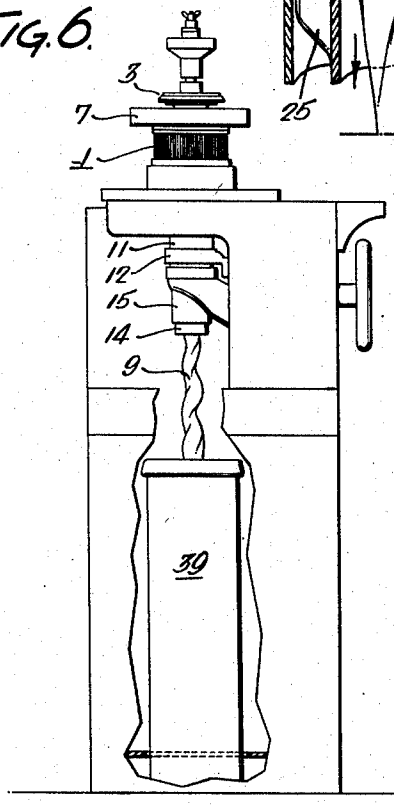
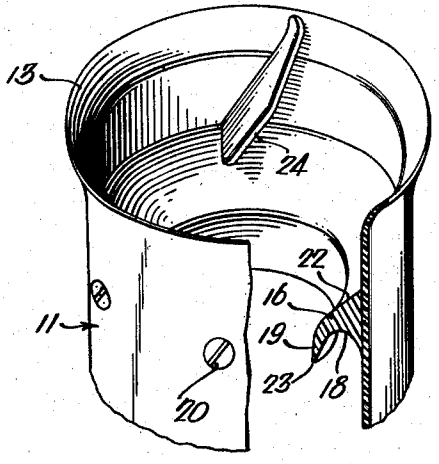


FIG. 5.



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PNEUMATIC TAKE UP FOR CIRCULAR KNITTING MACHINES

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15 Claims. (Cl. 66—149)

This invention relates to improvements in pneumatic take up devices for circular knitting machines, and a primary object of the invention is to provide a pneumatic device of this character that will function more consistently and uniformly in its stitch tensioning function than the prior devices of the same class.

Another object of the invention is to provide a take up device of the stated character wherein the primary pneumatic force is applied to the outer surface of the knitted tube and uniformly about the entire circumference thereof so that the resulting tensioning effect is substantially uniform around the entire needle circle.

Still another object of the invention is to provide a pneumatic device of the stated character wherein the component mechanical elements may be located entirely within and below the needle cylinder in positions offering no obstruction to the other machine functions and elements.

A further object of the invention is to provide a take up device of the stated character wherein adequate provision is made for inspection during production of the knitted fabrics.

A still further object of the invention is to provide a take up device which will function also as a medium for discharge of the knitted articles from the machine.

The invention contemplates also an improved means for collecting the individual knitted articles at stations readily available to the operators for periodic manual removal of the articles from the machine.

The invention resides further in certain novel structural features and details hereinafter described and illustrated in the attached drawings wherein:

Fig. 1 is a fragmentary vertical sectional view of the upper portion of a circular knitting machine equipped with a pneumatic take up device made in accordance with the invention;

Fig. 2 is an enlarged fragmentary elevational view on the line 2—2, Fig. 1, a portion of the structure being broken away and being shown in section;

Fig. 3 is a sectional view on the line 3—3, Fig. 1;

Fig. 4 is an enlarged fragmentary sectional view showing certain structural details of the take up device;

Fig. 5 is a sectional perspective view of an element of the structure shown in Fig. 4, and

Fig. 6 is a semi-diagrammatic elevational view, broken away in part to show details of the structure, illustrating a modification within the scope of the invention.

The knitting machine shown in the drawings, to which for purpose of illustration the device of applicant's present invention has been applied, is of a type adapted for production of women's hosiery including a turned welt at the upper end of the leg. The machine comprises a needle cylinder 1 which carries the circular series of cylinder needles 2, and a dial 3 which in the present instance carries an annular series of radially disposed transfer bits 4, said bits being cooperative with the needles in the formation of the turned welt in manner well known in the art. In the present instance, the cylinder 1 and

the dial 3 are rotated in unison about their common axis by mechanism which includes a bevel gear 5 at the lower end of the cylinder 1, said gear being connected to a suitable source of motive power by means of a bevel gear 6. The machine comprises also the usual sinker ring 7 which it attached to the upper end of the cylinder 1 and which carries cam actuated sinkers 8 cooperative with the needles 2 in known manner. Insofar as described, the machine may be considered conventional.

In operation, the tubular fabric 9 formed on the needles 2 passes inwardly and moves downwardly through the cylinder 1 as shown in Fig. 4. In accordance with the present invention, a tube 11 is mounted on the inside of the cylinder 1, said tube being supported on the fixed frame of the machine by means in the present instance of a bracket 12, see Fig. 1. The upper end of this tube, as shown in Figs. 1 and 4, extends to a point immediately below the plane defined by the under edges of the sinkers 8 and is flared outwardly as indicated at 13 so that the edge of the tube lies in proximity to the inner surface of the cylinder. Within the tube 11 is an inner coaxial tubular member 14, the lower end of which is secured in a fitting 15 attached to the lower end of the tube 11, see Fig. 1. The inner tube 14 extends upwardly in spaced relation to the inner surface of the tube 11, as best shown in Fig 4, to a point below the upper end of the latter, and the tube 11 has an inturned flange 16 which extends inwardly and downwardly over and into the upper flared end 17 of the said inner tube. As shown in Fig. 4, the underside 18 of the flange 16 which passes over the top of the tube 14 is smoothly curved and the depending inner end 19 of the flange extends downwardly into the upper flared end 17 of the latter tube and is uniformly spaced with respect to the latter so as to afford between the flange and the said flared upper end 17 an annular channel 21, the function of which will be hereinafter described. The upper surface 22 of the flange 16 extends downwardly at an angle of approximately 45° and curves toward its lower end to terminate in the sharp lower edge 23 of the flange. In the present instance, the flange 16 is formed as a separate annular element attached as shown to the wall of the tube 11 by screws 20. The form and structure of the upper end of the tube 11 is well illustrated in the perspective view of Fig. 5, and it will be noted that the upper end of the tube 11 comprises an inwardly projecting deflector plate 24 which lies at an angle to the axis of the tube and projects into the latter, the function of this element being also hereinafter described.

The upper end portion of the inner tube 14 may be maintained in the desired spaced relation with respect to the tube 11 by means of spacer elements 25, as illustrated in Fig. 4, so that the cylindrical space between the tubes and the annular space 21 between the upper flared end of the inner tube and the depending flange 19 of the outer tube may be constant, and so also that any tendency for the inner tube 14 to vibrate may be avoided.

The fitting 15, see Fig. 1, comprises an upper opening 26 which receives the lower end of the outer tube 11 and, in alignment with the opening 26, a second opening 27 in which is secured the lower end of the inner tube 14. The opening 26 is of greater diameter than the opening 27 in accordance with the different diameters of the outer tube 11 and inner tube 14, and this difference in diameter extends into the fitting 15 to an extent affording a continuation in the latter of the space 29 between the inner and outer tubes as indicated in Fig. 1 by the reference numeral 30. The fitting has a divergent branch 28 which connects with the space 30 and which in effect constitutes a continuation of the channel 29, this branch terminating at its lower end in a port 31. To

this port, in the present instance, is connected a flexible conductor 32 which extends to the discharge port 33 of a blower 34. The blower may be of conventional type and of adequate capacity to perform the functions hereinafter described and may be driven from any suitable source of power such, for example, as an electric motor (not shown). With the fitting 15 formed as described, air forced into the port 31 of the fitting will move upwardly through the space 29 between the outer and inner tubular elements 11 and 14 and will be deflected by the smoothly curved lower surface 18 of the flange 16 and by the depending lower end portion of the latter downwardly into the upper end of the inner tube 14. The stream of air thus projected downwardly through the tube 14 will impinge upon the outer surface of the tubular fabric 9 extending downwardly from the needles 2 and will tend to draw the fabric downwardly and through the inner tube 14. The stream of air projected into the upper end of the inner tube 14 as described is completely annular in form, and will, therefore, engage the tubular fabric uniformly around the entire circumference of the latter so that the take up or tensioning effect resulting from the friction of the air stream against the tube will be uniform as to the entire needle circle.

The flow of air described above will function additionally to induce a secondary flow of air inwardly through the throat between the upper end of the needle cylinder 1 and the peripheral portion of the dial 3, the inturned flange 16 functioning in the nature of an injector nozzle. This induced flow of air will maintain the fabric and particularly the welt portion of the fabric in extended condition and under uniform tension during formation even prior to initial passage of the tubular fabric into the upper end of the inner tube 14 and to the point of contact with the primary stream of air projected downwardly by the flange 16 into the tube 14. The induced flow of air between the cylinder and the dial is also characterized by the same high degree of uniformity over the entire circumference of the throat between the cylinder and dial so that the tensioning effect of this induced air on the forming stitches and its welt extending effect will also be substantially uniform. The flow of air in channel 29 has the effect also of cooling the tube 11 and also the needle cylinder. The needles and machine parts are thus kept from heating up and in free and clean condition.

The function of the deflector blade 24 is to give the fabric as it enters the upper end of the tube 11 a twist about the axis of the tube tending to compact the knitted tube and to direct it accurately to the center of the annular flange 16.

As shown in Fig. 1, the lower end of the inner tube 14 terminates immediately below the fitting 15. In axial alignment with the tube 14 and spaced somewhat below the lower edge of the latter is the upper end of a duct 35 of somewhat greater diameter than the tube 14. As shown in Fig. 1, this tube takes a 180° turn to extend upwardly to a cylindrical receiver 36, see also Fig. 2. The receiver 36 has at one end thereof an opening 37 which is obstructed in the present instance by crossed rubber or other resilient bands 38. In the automatic operation of the machine in the production of hosiery, the individual stockings when pressed off will be carried by the air stream through the tube 35 and into the receiver 36 from which they may be withdrawn through the opening 37 by deflection of the retaining bands 38. The receiver 36 will have a capacity adequate to retain a number of the articles and they may be removed periodically by the operator. The space between the lower end of the tube 14 and the proximate end of the tube 35 affords an opening for inspection of the tubular fabric by the operator, the space being adequate to permit the tubular fabric to be drawn outwardly for closer inspection. The duct 35 and receiver 36 may, suitably, be made of transparent plastic or other material.

As an alternative to the use of the receiver 36, the relatively simple device shown in Fig. 6 may be used. In this case, the lower end of the tube 14 overlies a bulk receptacle 39 which receives the knitted articles and from the accumulations may be periodically removed by the operator.

I claim:

1. In a circular knitting machine having an annular series of knitting needles and mechanism for actuating the needles to form the stitches of a circular knit fabric at a stitch-forming station, take up means for said fabric comprising devices operative during the knitting operation to set up a flow of air at the outside of and in contact with the fabric and in direction away from the needles so as to impose a longitudinal drawing and tensioning force on the web tending to withdraw it from the stitch-forming station, said air flow devices comprising a tubular duct for the fabric, a source of pressure air, and means for directing air from said source directly into the space between the inner wall surface of the duct and the fabric and in direction longitudinally of the duct.

2. A circular knitting machine according to claim 1 wherein the air directing means comprises an annular nozzle arranged to encircle the fabric passing through the duct.

3. A circular knitting machine according to claim 2 including an outer duct embracing the duct first named and forming with the latter a passage for flow of air from said source to the annular nozzle.

4. A circular knitting machine according to claim 3 wherein the said nozzle is formed by an annular air-deflecting flange projecting inwardly from the wall of the outer duct over the proximate end edge of the first named duct into the latter.

5. In a circular knitting machine having a needle cylinder and needles slidable in said cylinder and means for actuating the needles to form the stitches of a circular knit web at a station adjoining one end of the cylinder, and take up means for drawing the said web from the stitch forming station into and axially through the cylinder, said take up means comprising devices within said cylinder and operative during the knitting operation for directing a flow of air axially of the cylinder against the outside of and in frictional contact with the surface of the knitted web in direction away from said station, the said air flow means comprising an annular nozzle arranged to embrace the said web.

6. A circular knitting machine according to claim 5 including an inner fabric-receiving duct in the cylinder, and wherein the said nozzle is located at an end of said duct for discharge of air into the latter.

7. A circular knitting machine according to claim 6 including means providing an annular channel for the air flow to the nozzle at the outside of said duct in direction reverse to the movement of the fabric in the duct.

8. A circular knitting machine according to claim 7 wherein the nozzle comprises an air-deflecting flange at the terminal end of said channel extending over the proximate end edge of the inner duct and into the end of the latter.

9. A circular knitting machine according to claim 8 wherein the said channel and flange completely embrace the inner duct.

10. In a circular knitting machine having a needle cylinder, needles in said cylinder, means for actuating the needles to form the stitches of a circular knit fabric at a station at the upper end of the cylinder, take up means for drawing the fabric downwardly through the cylinder and for maintaining the fabric under constant tension at the said station, said take up means comprising devices for initiating a downward flow of air in the cylinder from

a point below the said upper end of the latter, and said air flow devices comprising inner and outer relatively spaced ducts extending axially in the needle cylinder, a source of pressure air connected to the lower end of the interspace between the ducts for projecting air upwardly in said space, and means at the upper end of said interspace for deflecting the air flow downwardly into the upper end of the inner duct, said inner duct providing passage for the fabric in the said downward movement thereof through the cylinder.

11. A circular knitting machine according to claim 10 wherein the lower end of the inner tube is open for discharge of the knitted fabric from the machine.

12. A circular knitting machine according to claim 11 including a receptacle for the knitted product operatively associated with the discharge end of the inner tube.

13. A circular knitting machine according to claim 11 including a receiving duct having an open end in alignment with and spaced from the discharge end of the inner duct, and a receptacle at the other end of said receiving duct.

14. A circular knitting machine having a needle cylinder, needles in said cylinder, means for actuating the needles to produce knitted fabric, and for feeding the fabric within the cylinder, said feeding means including an annular air nozzle in the interior of the cylinder embracing the fabric for producing a fabric-entraining and-tensioning stream of air in the cylinder, and a source of pressure air connected to said nozzle.

15. A circular knitting machine having a needle cylinder, needles in said cylinder, means for actuating the needles to produce knitted fabric, and for feeding the fabric within the cylinder, said feeding means including a tubular conduit for the fabric extending upwardly and terminating within the cylinder and spaced inwardly from the cylinder wall, a pressure air source, and means for directing air from said source upwardly around the conduit and into the upper end of and downwardly through the conduit to entrain the fabric in the latter.

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