Oct. 30, 1962 E. J. WICK ETAL 3,060,874

AUTOMATIC LOOPER OPERATOR

Filed Sept. 27, 1960 2 Sheets-Sheet 1

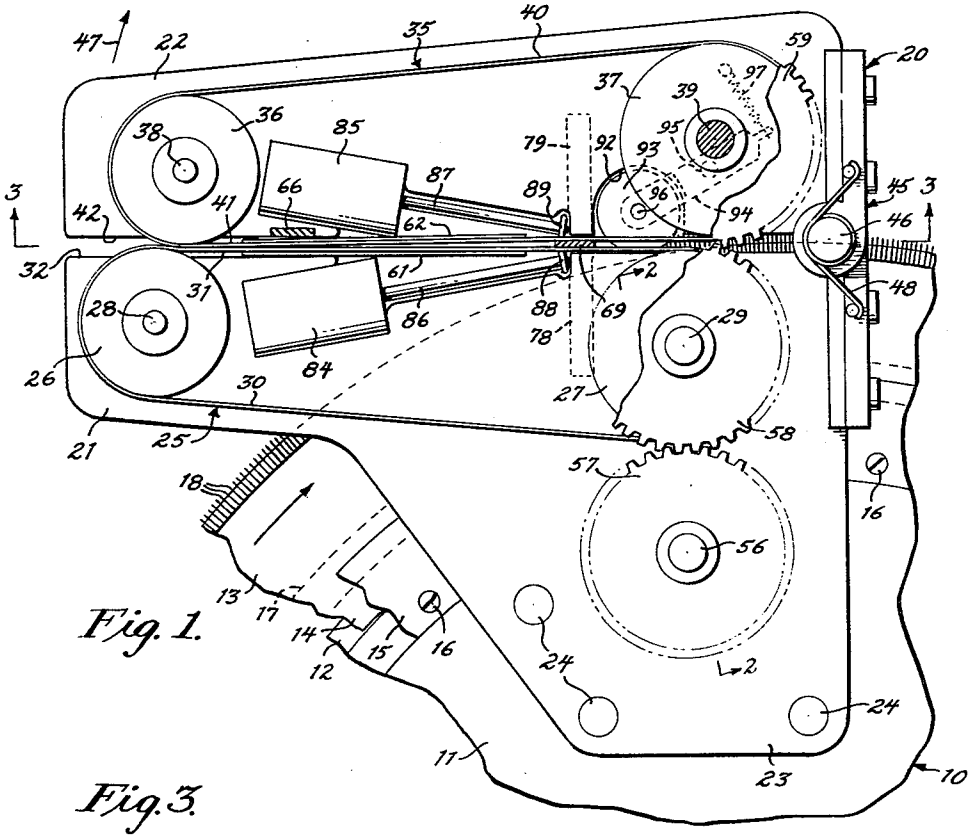


Fig. 1.

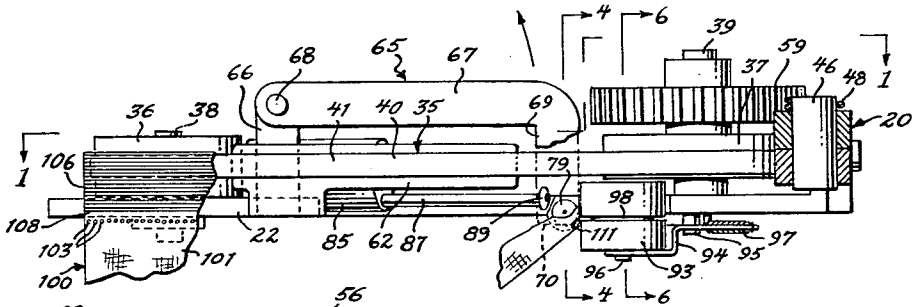


Fig. 3.

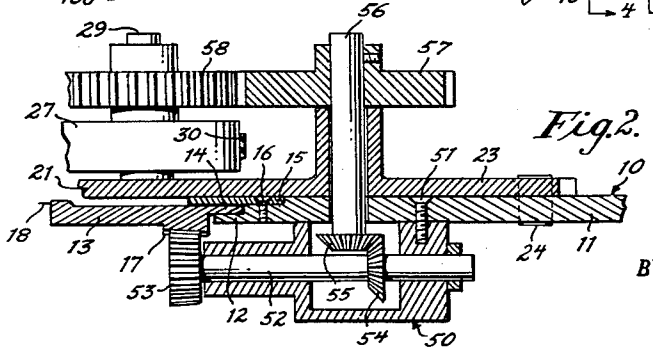


Fig. 2.

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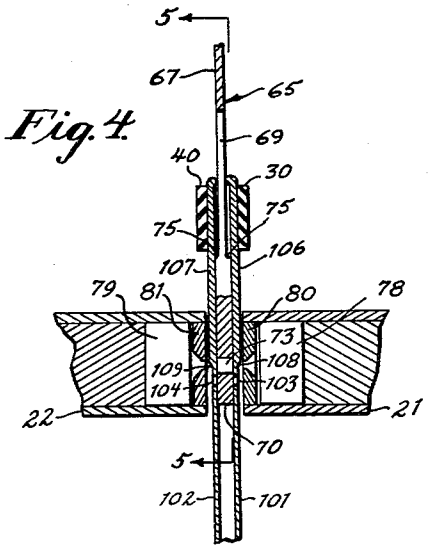


Fig. 4.

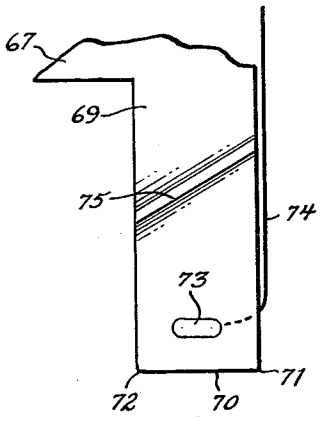


Fig. 5.

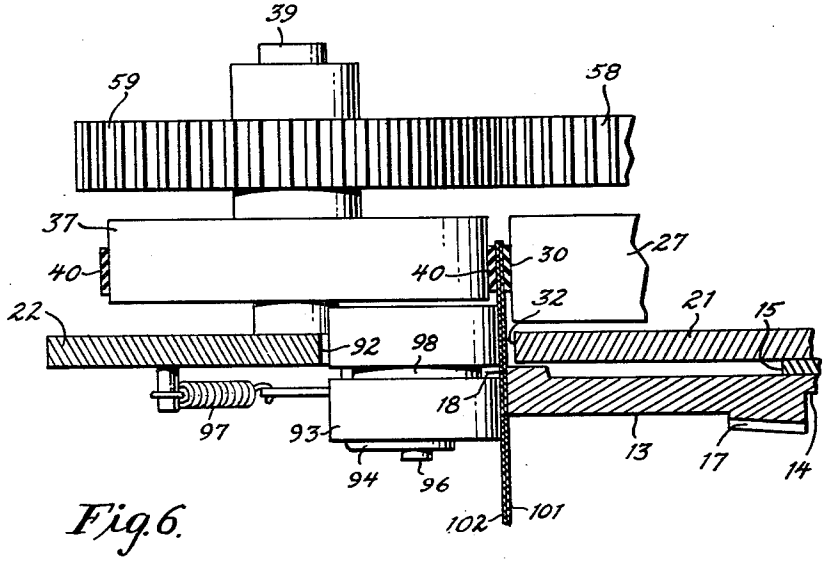


Fig. 6.

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AUTOMATIC LOOPER OPERATOR

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12 Claims. (Cl. 112—25)

This invention relates generally to improvements in methods and apparatus employed in textile manufacture. The instant invention is especially concerned with a unique attachment for a conventional looper machine, such as is employed in the hosiery industry, and includes a novel method of utilizing the looper machine.

While the method and apparatus of the present invention have been primarily developed and employed for use in the hosiery industry, and will be illustrated and described hereinafter with particular reference thereto, it is appreciated that the invention is capable of many varied applications, all of which are intended to be comprehended herein.

As is well-known to those versed in hosiery manufacture, conventional looping machines are employed for closing the toe opening of a seamless stocking, by trimming and looping the edges of the knit fabric. Of course, such operation is not limited to stockings, but may be employed for joining contiguous edges of any two facing layers of knit fabric and the like.

It is also well-known that the conventional looping procedure involves tedious and relatively expensive manual operations, particularly the application of the knit fabrics to the radially projecting support points on the rotary dial of a looper machine. In this operation each adjacent stitch of the fabric must receive a successive looper point; and in addition, both walls of the stocking fabric must be impaled in precise alignment on the same points, or an imperfect product will result.

While previous devices have attempted to simplify this operation, such proposals have been unacceptable to the industry for numerous reasons, so that application of the stocking to the looper pins continues to be laboriously performed by hand. Obviously, this operation is necessarily costly, and difficulty in obtaining skilled labor results in an abnormally high rate of defective products which must be mended or sold at reduced prices.

Accordingly, it is an object of the present invention to provide a highly improved apparatus and method which effectively overcome the above-mentioned difficulties to enable even unskilled persons to quickly, easily and with percision apply knit fabric, such as the facing layers or walls of a stocking to the pins of a looper machine.

It is a more particular object of the present invention to provide an entirely unique method and apparatus wherein both fabric layers or walls of a stocking or the like are simultaneously and entirely automatically positioned and applied to the looper-machine pins in perfect alignment.

It is a further object of the present invention to provide apparatus having the advantageous characteristics mentioned in the preceding paragraphs which is simple in construction, durable and entirely reliable throughout a long useful life, and which can be economically manufactured, installed and maintained to effect substantial savings to the textile industry.

Other objects of the present invention will become apparent upon reading the following specification and referring to the accompanying drawings, which form a material part of this disclosure.

The invention accordingly consists in the features of construction, and combinations and arrangements of elements and method steps, which will be exemplified in the

following description, and of which the scope will be indicated by the appended claims.

In the drawings:

FIGURE 1 is a top plan view partially illustrating a looper machine, and showing the attachment of the present invention in association with the looper machine, as taken along the section line 1—1 of FIGURE 3, with parts broken away for added clarity;

FIGURE 2 is a partial sectional elevational view taken substantially along the line 2—2 of FIGURE 1;

FIGURE 3 is a sectional elevational view taken substantially along the line 3—3 of FIGURE 1;

FIGURE 4 is a sectional elevational view taken substantially along the line 4—4 of FIGURE 3;

FIGURE 5 is a partial elevational view taken substantially along the line 5—5 of FIGURE 4; and

FIGURE 6 is an enlarged elevational view taken substantially along the line 6—6 of FIGURE 3.

Referring now more particularly to the drawings, and specifically to FIGURES 1 and 2 thereof, the conventional looper machine is there generally designated 10 and includes a generally horizontal fixed plate or table 11 of generally circular-outline configuration and having a peripheral ledge or upwardly facing shoulder 12 about its circumference. An annular member or circular dial 13 extends circumferentially about the periphery of the plate 11, being located outward therebeyond, and is provided with a radially inwardly extending flange 14 adapted to rest on the shoulder 12. An annular clamping ring 15 is secured fast to the plate 11, as by fastener 16, and extends spacedly over the shoulder 12, so as to overlie the flange 14 seated on the shoulder. In this manner, the dial 13 is mounted on the plate 11 for circular or rotary, concentric movement relative to the plate.

On the underside of the dial 13, extending downward therefrom, are gear teeth 17 combining to define an annular gear. Projecting radially outward from the outer periphery of the dial 13 are a multitude of support pins or points 18 for engagement through successive stitches of an article of hose. The construction thus-far described may be conventional.

Secured fast to the looper-machine plate 11 is the attachment or apparatus of the present invention, generally designated 20. The attachment 20 may include a pair of generally coplanar mounting plates 21 and 22 of an elongate configuration and arranged in side-by-side relation having their adjacent edges disposed generally tangential to the outer periphery of the dial 13. The mounting plate 21 is inward of the mounting plate 22, radially of the looper plate 11, and the inner mounting plate 21 includes a coplanar inward extension 23 overlying the looper plate 11 and secured fast to the latter, as by fasteners 24.

An elongate, endless conveyor 25 is arranged longitudinally of and mounted above the mounting plate 21 for rotation about generally vertical axes. In particular, the conveyor 25 includes a pair of wheels 26 and 27 disposed generally horizontally and spaced longitudinally of the plate 21, respectively mounted on the plate for rotation about the axes of generally vertically disposed shafts 28 and 29 carried by the mounting plate. The wheels 26 and 27 are preferably crowned in the conventional manner and an endless belt 30 extends about the wheels. The belt 30 may be of rubber or other suitable frictional material and has one run 31 extending generally tangential to the dial 13 along the outer edge 32 of the mounting plate 21.

A similar conveyor, generally designated 35, is provided on the mounting plate 22, having a pair of generally horizontally disposed rollers 36 and 37 spaced longitudinally of the mounting plate and carried thereby for rota-

tion about the axes of vertically disposed shafts 38 and 39. The rollers 36 and 37 may also be crowned in the conventional manner, and an endless belt 40 may extend about the rollers or wheels 36 and 37 having one run 41 extending along the inner edge 42 of the mounting plate generally tangential to the dial 13. Thus, the runs 31 and 41 of the conveyors 25 and 35 are disposed in proximate facing relation. The belt 40 of conveyor 35 may also be of rubber or other suitable frictional material; and, the belts 30 and 40 may be of the intermeshing or timed type to positively insure equal linear velocity thereof.

The outer plate 22 is mounted on the inner plate 21 by an appropriate hinge construction 45 having a generally vertical pintle 46 extending approximately normal to the facing conveyor runs 31 and 41. By this hinge 45, the outer mounting plate 22 may be swungaway from the inner mounting plate 21 in the direction of arrow 47 to space the conveyor runs 31 and 41 and afford access therebetween. Any suitable resilient means, such as spring 48 carried by pin 46 and connected to the elements of hinge 45 may be employed to resiliently urge the plate 22 toward its illustrated position with the runs 31 and 41 in facing engagement.

In operation of the looper machine 10, the dial 13 is driven in rotation by a looper drive mechanism (not shown). From the rotation of looper dial 13 is obtained power to positively drive the conveyors 25 and 35. In particular, a housing 50 is fixed to the underside of the stationary looper-machine plate 11, as by fasteners 51 and journals a generally horizontal, radially disposed shaft 52 which carries on one end a gear 53 in meshing engagement with the gear 17 of the dial 13. The shaft 52 is thus rotated by the dial 13 and through bevel gears 54 and 55 drives a generally vertically disposed shaft 56 journaled in and extending upward beyond the extension portion 23 of plate 21. On its its upper end the shaft 56 is provided with a spur gear 57 which meshes with a spur gear 58 on the upper end of shaft 29 over the conveyor roll 27. Thus, conventional rotation of the dial 13 drives the shaft 56 and its spur gear 57, which in turn drives the spur gear 58 and hence the conveyor 25. In addition, a spur gear 59 is carried by the shaft 39 over the roll 37 of conveyor 35, which gear is in meshing engagement with the gear 58 when the mounting plate 22 is swung toward the mounting plate 21. Thus, the gear 59 is driven from the gear 58 to drive the conveyor 35 in positive timed relation with the conveyor 25. As the dial 13 moves in the clockwise direction, as seen in FIGURE 1, it may be observed that the gear 57 is driven counterclockwise, and that the gears 58 and 59 are respectively driven clockwise and counterclockwise to effect movement of the conveyor runs 31 and 41 toward the right into substantially tangent relation with the dial 13, with the facing conveyor runs spaced over the looper pins 18 in the tangent region.

Fixed to each of the mounting plates 21 and 22, extending along their respective adjacent edges 32 and 42 are backing strips 61 and 62 serving respectively to back or firm up the runs 31 and 41.

Carried by one of the mounting plates 21 and 22, say the latter, is a locating finger generally designated 65. The finger 65 may be mounted on an upstanding bar or pedestal 66 fixedly secured to the mounting plate 22 along its inner edge 42 and upstanding therefrom beyond the run 41 and backing member 62. The journal pedestal 66 is preferably spaced considerably ahead of the tangent region of the conveyor runs 31 and 41. An arm 67 is pivoted at one end, as by pin 68, to the upper end of pedestal 66 and extends therefrom toward, but terminates short of the tangent region of the facing conveyor runs. At its end remote from the pivot 68, the arm 67 is provided with a depending extension or finger proper 69 entering between the facing runs 31 and 34 at a location just ahead of the tangent region of the runs. As best seen in FIGURES 3 and 4, the extension or finger proper 69 depends below the facing runs 31 and 41 to a point slightly below the mounting plates 21 and 22. The finger proper or extension 69 is relatively thin or flat, and preferably finished to a smooth surface, for a purpose appearing presently. However, the lower-end edge 70 of the extension 69 has its forward and rearward extremities or corners 71 and 72 preferably pointed, also for purposes appearing presently.

Provided interiorly of the depending extension 69 at a region below the conveyor runs 31 and 34 is a miniature lamp or light source 73 energized by any suitable means, say through conductors 74. At a location spaced above the light source or bulb 73, the extension 69 may be provided on each side or face with an upwardly facing ledge or shoulder 75 which extends obliquely upward, inclining in the direction of movement of the facing conveyor runs.

It will now be appreciated that the arm 67 of the locating finger 65 is swingable upward about the pivot 68 upon outward swinging movement of the mounting plate 22 to separate the facing runs 31 and 34, and is swingable downward to its illustrated operative position, preferably being releasably held in its operative position by suitable resilient-detent means (not shown).

Carried by each mounting plate 21 and 22, adjacent to respective edges 32 and 34 are suitable sensing means 78 and 79, respectively. The preferred form of sensing means is that of a photoelectric receiver or cell. The photoelectric cells 78 and 79 are located on opposite sides of the facing runs 31 and 34, in alignment with each other and with the light source 73 of the finger extension 69 to receive light therefrom. If desired, the photocells may be carried in the respective mounting plates 21 and 22, each being located behind an apertured disc, as at 80 and 81 in FIGURE 4. Thus, both sensing means 78 and 79 are located to receive light from the same light source 73.

A pair of servo-motors 84 and 85 are mounted in the mounting plates 21 and 22, respectively, being secured by any suitable means in conforming cutouts formed in the plates. The motors 84 and 85 may both lie in a horizontal plane, respectively adjacent to the conveyor rollers 26 and 36, each including a drive shaft extending obliquely toward and terminating short of the tangent region of the facing runs 31 and 41. That is, the motor 84 includes a shaft 86 extending obliquely toward and terminating proximate to the finger extension 69 beneath the adjacent run 31, while the motor 85 includes a drive shaft 87 extending obliquely toward and terminating short of the depending finger extension below its adjacent conveyor run 41. On the extending end of motor shaft 86 is provided a frictional roller 88, while a similar frictional roller 89 is provided on the extending end of the motor shaft 87. The servo-motors 84 and 85, their shafts 86 and 87, and rollers 88 and 89 serve as positioning means for accurately positioning fabric, as will appear more fully hereinafter. In order to operate the servo-motors 84 and 85, they are respectively electrically connected to the photocells 78 and 79, so that each positioning servo-motor is actuated by its adjacent photocell, independently of the other servo-motor and photocell. Of course, any suitable electrical circuitry may be employed, such as a phase-sensitive modulator, amplifier and motor-controller interposed between the photocells and motors for driving the latter. Also, reduction gearing may be incorporated between the servo-motors and their output shafts, if desired.

In FIGURE 3, it may be seen that the positioning roller 89 is located slightly ahead of and above its adjacent photocell 79.

Proximate to the tangent region of the facing runs 31 and 41 with respect to the dial 13, the mounting plate 22 is formed with a cutout 92 opening through the inner edge 42. Located in the cutout 92 is a peripherally grooved push-on roller 93 which is rotatably carried on one end of

a lever **94**. That is, the lever **94** is pivoted intermediate its ends on a stub shaft **95** depending from the underside of mounting plate **22**. On one end of the lever **94** proximate to the cutout **92**, the roller **93** is journaled on a generally vertical shaft or pin **96** carried by the lever **94**. The opposite end of the lever **94** is connected to a resilient member or spring **97** to resiliently bias the roller **93** toward and into rolling engagement with the peripheral edge of dial **13**. The roller **93** is provided with a circumferential groove **98** in alignment with and receiving the pins **18** of the dial **13**. Thus, as best seen in FIGURE 3, the photocell or electric eye **79** is located just forward of the push-on roller **93** and slightly above the pin-receiving groove **98** of the latter roller. The engagement of support pins **18** in the roller groove **19** is best seen in FIGURE 6.

In operation, it is only necessary to swing the mounting plate **22** outward and raise the finger arm **67**. The finger extension **69** may then be engaged between the fabric layers or walls of a stocking, and properly positioned therein by location of the finger-extension arm **71** in the forwardmost narrowing mark of the stocking. A stocking is generally designated **100**, including a pair of substantially identical facing layers or walls **101** and **102**, see FIGURE 4. Each of the walls **101** and **102** is conventionally formed with a row of open loops **103** and **104**, respectively, which open loops are to be aligned and placed in such alignment on the looper pins **18**. At a predetermined distance above each row of open stitches or loops, the fabric walls **101** and **102** are respectively provided with a relatively heavy ravel course, as at **106** and **107**, respectively. At the juncture of the cotton or ravel course with the fine denier, there is defined a definite guide line, as at **108** and **109** in the fabric walls or layers **101** and **102**, respectively. This guide line is a predetermined distance above the adjacent row of open loops; and, the cotton ravel course above the guide line is much less permeable to light than the fine denier below the guide line.

With the locating arm **67** raised, and the facing runs **31** and **34** away from each other, the locating finger is engaged between the walls **101** and **102** of the stocking **100** and the corner **71** of the locating finger is engaged in a conventional narrowing mark **111**. With the narrowing mark **111** receiving the finger corner **71**, and the finger swung downward to the position of FIGURE 3, the forward or leading region of the stocking is properly positioned with the open loops **103** at the same vertical height as the support pins **18** for engagement of the latter through the open loops. That is, the finger corner **71** is a predetermined distance below the looper pins **18**, which distance is equal to the distance between the narrowing mark **111** and line of open loops **103**.

The trailing region of the stocking is then stretched to the left, the condition shown in FIGURE 3, and the mounting plate **22** swung closed for frictional engagement of the runs **31** and **41** with respective stocking walls or fabric layers **101** and **102**. That is, the fabric layers are frictionally engaged and held between the facing runs **31** and **41**.

Swinging movement of the mounting plate **22** inward under the force of spring **48** also serves to engage the gears **58** and **59** to cause timed rotation of the conveyors **25** and **35**. If desired, electrical switch means may be associated with movement of the mounting plate **22** to deenergize the motors **84** and **85** upon opening or outward movement of the mounting plate **22** and energize the motors upon closing or inward movement of the latter mounting plate. If desired, the positioning motors **84** and **85** may be energized by switch means independent of movement of the mounting plate **22**.

In any event, with the positioning motors **84** and **85** energized and the conveyors **25** and **35** operating to convey the stocking **101** rightward toward the tangential region of the runs **31** and **41**, the photocells **78** and **79** are operative to receive illumination from the light source **73** through the apertured plates **80** and **81**. By the above-described initial positioning of a stocking **100** in the attachment, the guide lines **108** and **109** of the fabric layers are each in respective alignment with the apertures of plates **80** and **81** to pass a predetermined amount of light through the respective apertures. Should either of the fabric layers **101** or **102** be displaced vertically upward or downward, normal to the tangential direction of conveyor movement, a greater or lesser amount of light will be permitted to pass through the respective fabric layer and hence to the associated photocell. The signal produced by each of the photocells **78** and **79** is thus dependent upon the vertical positioning of the adjacent fabric layer **101** and **102**; and, the photocell signals are respectively fed to the positioning motors **84** and **85** to operate the latter. For example, should an increased quantity of light pass to the photocell **78**, by reason of the fabric layer **101** being displaced vertically upward from its proper position with the guide line **78** aligned with the light source **73**, the positioning motor **84** is energized to rotate the shaft **86** and its positioning wheel **88** which frictionally engages the fabric layer **101** to lower the latter until the guide line is properly positioned. Of course, should the guide line **108** be lower than required for alignment with the light source **71** and photocell **78**, the reverse operation of the positioning motor **84** is actuated by the photocell. Also, identical operation of the light-sensitive photocell **79** and its associated positioning motor **85** occurs with respect to the fabric layer **102**, but entirely independent of the positioning effected of the fabric layer **101**.

Thus, both fabric layers **101** and **102** are independently, but simultaneously precisely positioned in the vertical direction for engagement of successive looper pins **18** through adjacent open loops of both fabric layers. As the finger extension **69** is relatively smooth, the fabric layers slide easily over the finger extension and are moved readily both tangential to the looper dial **13** and in the direction normal to the tangential direction, as required for accurate positioning.

As the fabric layers pass the light source **73** and finger extension **69**, they are impaled on the dial pins **18** by the tangential relation between fabric movement and dial rotation. In order to insure that both layers of fabric are fully impaled on the pins, the push-on roller **93** engages with the outer fabric layer **102**, being frictionally rotated by the latter, and resiliently urges the fabric layers radially inward of the dial **13** while receiving the pins **18** in its peripheral groove **98**.

The above-described operation proceeds until the trailing region of the stocking **100** reaches the finger extension **69**, whereupon movement of the stocking by the conveyors **25** and **35** causes the locating arm **67** and extension **69** to be swung upward for continued movement of the stocking onto the looper pins. From this point, conventional looper operation occurs, and the mounting plate **22** may again be swung outward for insertion therein of another stocking in the same manner as described hereinbefore.

From the foregoing, it is seen that the present invention provides a method and apparatus for applying fabric layers to a looper machine, which fully accomplish their intended objects and are well-adapted to meet practical conditions of manufacture and use.

Although the present invention has been described in some detail by way of illustration and example for purposes of clarity of understanding, it is understood that certain changes and modifications may be made within the spirit of the invention and scope of the appended claims.

What is claimed is:

1. In a looper machine including a rotary dial having radial points, the improvement comprising a pair of elongate endless conveyors arranged in side-by-side relation and each having one run facing toward one run of the other with said facing run extending substantially tangential to the looper dial, said conveyors thereby being adapted to hold therebetween and convey a pair of facing

fabric layers in the direction tangential to said dial onto said points, sensing means on opposite sides of said facing runs for centering the positions of respective fabric layers in the direction normal to said tangential direction, and positioning means on opposite sides of said facing runs engageable with respective layers of fabric and responsive to said sensing means to move the fabric layers in said normal direction for proper positioning with respect to said points.

2. The combination with a looper machine including a rotary dial having radial points of apparatus for applying facing layers of fabric to a rotary-looper-machine dial having radial points, said apparatus comprising conveyor means for conveying a pair of facing fabric layers along a line tangential to said dial onto said points, sensing means on opposite sides of said tangential line for sensing the positions of respective fabric layers in the direction normal to said tangential line, and positioning means engageable with respective layers of fabric and responsive to said sensing means to move the fabric layers in said normal direction for proper positioning with respect to said points.

3. Apparatus according to claim 2, said positioning means comprising a relatively smooth element adapted to be interposed between the fabric layers, and engaging elements on opposite sides of and engageable with respective layers of the fabric and connected to said sensing means for engagement with and movement of the fabric layers in said normal direction.

4. Apparatus according to claim 3, said engaging means comprising rotary wheels operatively connected to said sensing means for actuation thereby to move said fabric layers.

5. Apparatus according to claim 3, said sensing means comprising a pair of photocells on opposite sides of said fabric layers, and light means interposed between said fabric layers for energizing said photocells.

6. In a looper machine including a rotary dial having radial points, the improvement comprising a pair of elongate endless conveyors arranged in side-by-side relation and each having one run facing toward one run of the other conveyor with said facing runs extending substantially tangential to the looper dial, said conveyors thereby being adapted to hold therebetween and convey a pair of facing fabric layers in the direction tangential to said dial onto said points, sensing means on opposite sides of said facing runs for sensing the position of respective fabric layers in the direction normal to said tangential direction, a relatively smooth finger adapted to be engaged between the layers of fabric during movement thereof in said tangential direction, and engaging elements on opposite sides of said facing runs engageable with respective layers of fabric and responsive to said sensing means to move the fabric layers in said normal direction for proper positioning with respect to said points.

7. In a looper machine including a rotary dial having radial points, the improvement comprising a pair of elongate endless conveyors arranged in proximate relation with each other each having one run facing toward one run of the other and with said facing runs facing substantially tangential to the looper dial, said conveyors thereby being adapted to hold therebetween and convey an article of hose in the direction tangential to said dial onto said points, means for moving said conveyors out of proximate relation for interposing an article of hose between said one runs, a locating finger movable into and out of position between said one runs and adapted to engage between the fabric walls of an article of hose to initially locate the latter between said one runs, light means carried by said finger adapted to radiate in opposite directions through respective fabric walls of an article of hose, light-sensitive means on opposite sides of said one runs for sensing the positions of respective fabric layers of the article of hose in the direction normal to said tangential direction, and engaging elements on opposite sides of said facing runs engageable with respective fabric walls of an article of hose and responsive to said light-sensitive means to move the fabric walls in said normal direction for proper positioning with respect to said points.

8. Apparatus according to claim 7, in combination with resilient means normally urging said conveyors toward said proximate relation.

9. Apparatus according to claim 7, is combination with guide means extending oblique to said tangential and normal directions for engagement with the ravel edge of an article of hose being conveyed to uncurl the latter.

10. In the method of applying fabric layers to a rotary-looper dial having radial points, the steps which comprise: conveying a pair of facing fabric layers in the direction generally tangentially toward said dial on opposite sides of a smooth locating member, separately sensing the positions of said pair of layers relative to a single point on said locating member in the direction normal to said tangential direction, independently engaging said layers responsive to said sensing to slide the layers relative to said locating member in the direction normal to said tangential direction into proper alignment with the points, and continuing tangential conveying of said fabric layers onto said points.

11. The method according to claim 10, further characterized by conveying said fabric layers between facing runs of endless conveyors to effect said conveying.

12. Apparatus for handling a pair of facing fabric layers, said apparatus comprising conveyor means extending along a path for conveying a pair of facing fabric layers edgewise along said path, a light source in said path having a light beam projecting oppositely outward from said path and adapted to be interposed between the layers of fabric for projecting light therethrough, a pair of photoelectric cells on opposite sides of the path located to be actuated by light projected from said source for sensing the positioning of respective fabric layers in the direction normal to said path, and positioning means on opposite sides of said path and respectively engageable with the fabric layers and each connected to a respective photoelectric cell for actuation thereby to move the fabric layers in said normal direction.

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