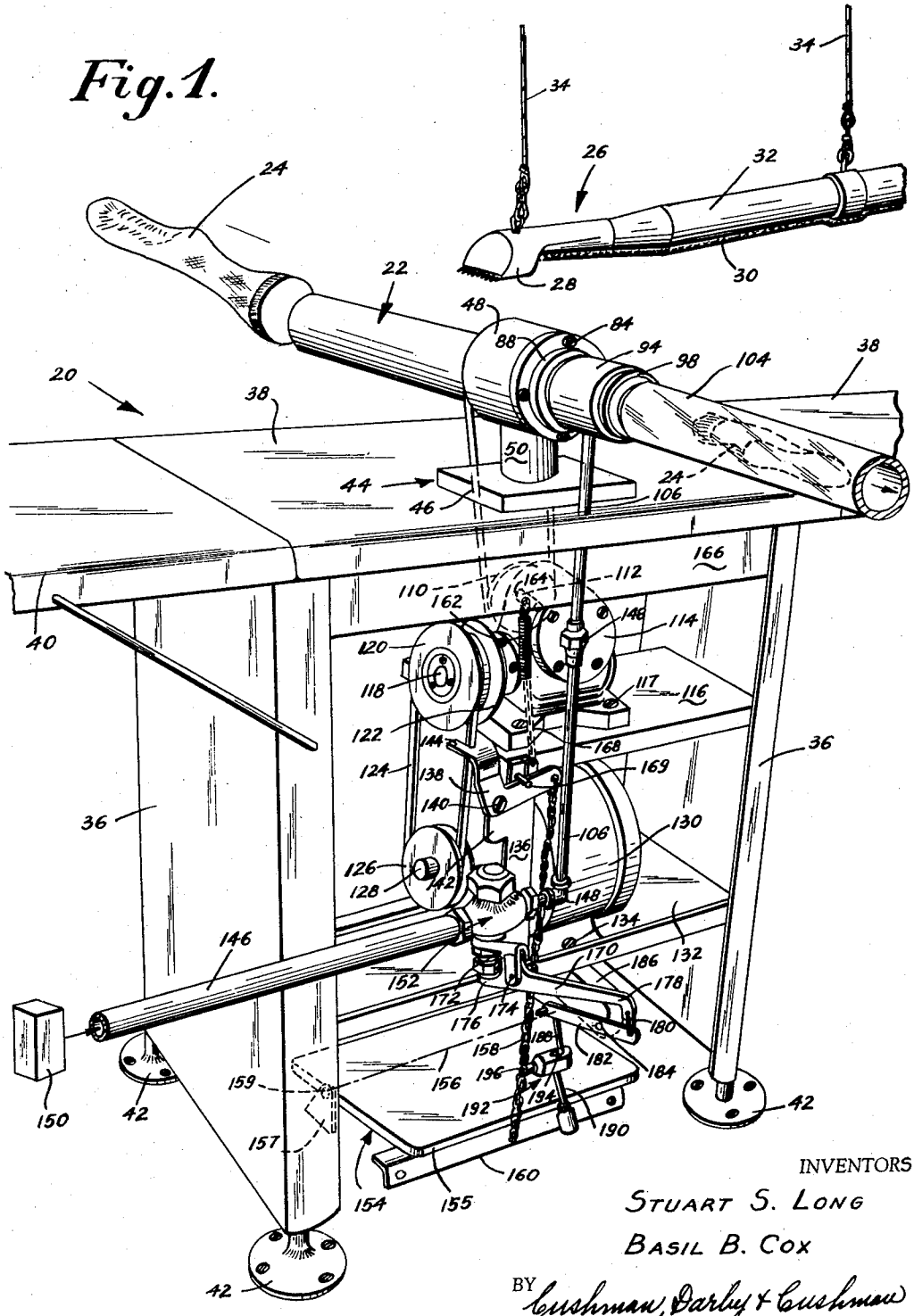
Aug. 11, 1959 S. S. LONG ET AL 2,899,116

HOSIERY CLIPPING AND EVERTING MACHINE

Filed May 7, 1958 2 Sheets-Sheet 1

Fig. 1.



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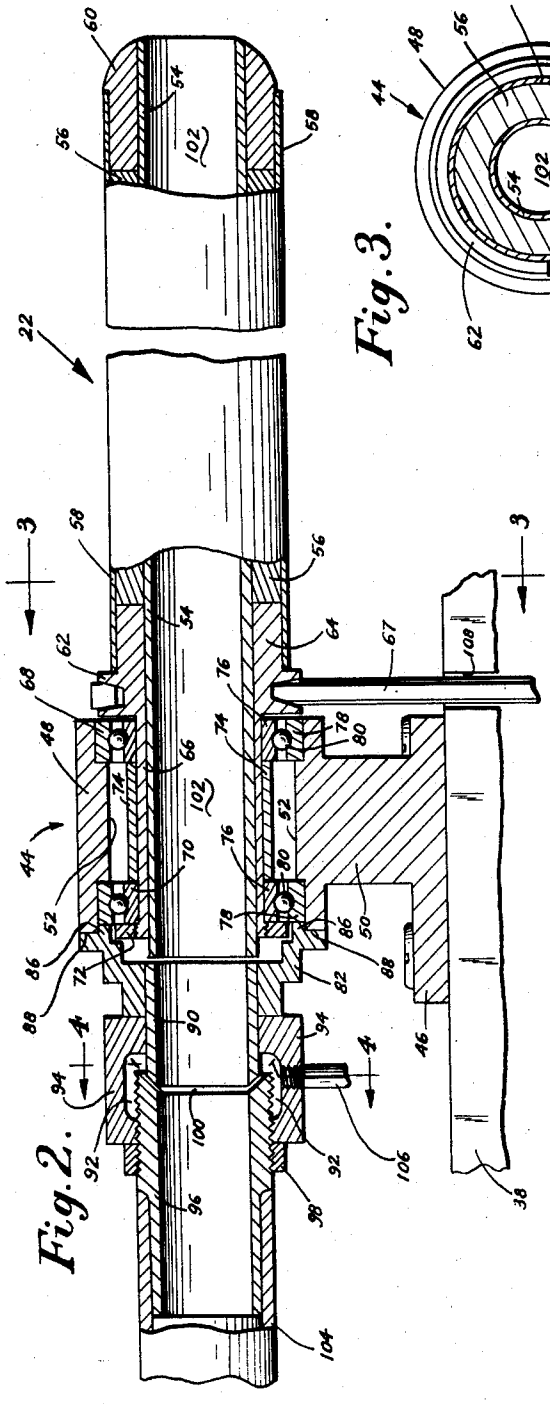

Fig. 2.

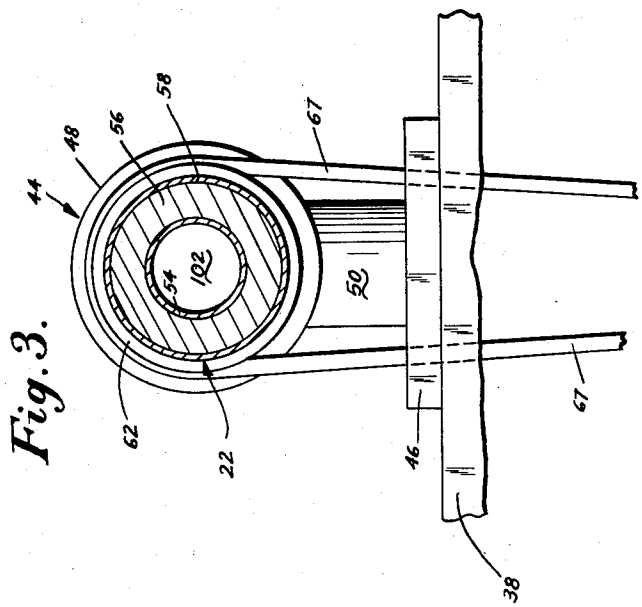

Fig. 3.

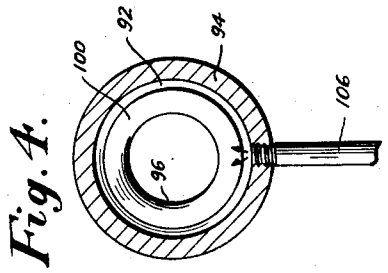

Fig. 4.

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HOSIERY CLIPPING AND EVERTING MACHINE

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Application May 7, 1958, Serial No. 733,700

9 Claims. (Cl. 223—43)

This invention relates to techniques and machinery used in the manufacture and handling of hosiery.

As is understood, when hosiery is removed from a knitting machine or the like, defects such as loose yarn ends or floated yarns normally are present on the inside of the stocking or sock. Machines have previously been proposed for inspecting the hose for such defects and for clipping and removing the undesirable yarn and yarn ends.

At present, the machines most commonly used include a flat metal board for holding the sock inside out and it is necessary during the processing for the operator to turn this board over by rotating it on a horizontal axis in order to clip both sides of the sock.

In some cases, machines have been proposed that included a mechanically rotated form for holding the sock inside out and rotating it while an external clipping means is applied. However, such machines require a preliminary cutting or slitting step by the operator on certain types of hose. This step is not only tedious but is also expensive. Furthermore, these machines involve high initial cost, are quite complicated in structure, and lack satisfactory flexibility of operation.

As far as is known, no satisfactory machinery has heretofore been devised where the hosiery form is rotated mechanically with automatic doffing means being provided for removal of the sock from the form after performing the trimming operation, and hence, it is a primary object of this invention to provide such a machine.

Another object resides in the provision of a novel, expedient and simplified method and apparatus for inspecting, trimming and handling hosiery.

A further and more specific object resides in the provision of a hosiery machine including a novel arrangement of a mechanically rotatable hosiery form and means for automatically everting the sock while removing it from the form.

Additional objects reside in the provision of novel structures, arrangements and combinations in hosiery machinery, of the type referred to, particularly adapted to facilitate hosiery trimming and everting operations.

The invention, in one aspect thereof, contemplates a novel arrangement of a tubular form to hold a sock in an inside-out position while it is being inspected and trimmed in combination with means for mechanically rotating this form and for thereafter applying a suction thereto to draw the sock from the exterior of the form into the latter, to turn the sock, and convey it to an appropriate collecting receptacle or the like.

In another aspect, the invention contemplates a novel control arrangement for convenient regulation of the operation of the means for rotating the hosiery form and the means for applying suction thereto.

Further objects and advantages of the invention will be in part obvious and in part pointed out hereinafter.

The novel features of the invention may be best made

clear from the following description and accompanying drawings in which:

Figure 1 is a fragmentary perspective view of a machine embodying the invention;

Figure 2 is a fragmentary and elevational view, partly in vertical section, of the hosiery form and related structure of Figure 1;

Figure 3 is a sectional view taken generally along line 3—3 of Figure 2; and

Figure 4 is a sectional view taken generally along line 4—4 of Figure 2.

Referring now to the drawings, a hosiery trimming and everting apparatus embodying the invention is illustrated in Figure 1 and is identified generally by numeral **20**. This apparatus includes a tubular hosiery form **22** adapted to have a stocking or sock **24** fitted thereover inside out, and a clipping means **26** adapted to clip loose yarn ends or floated yarns on the sock.

As previously indicated, means are provided for rotating the tubular form **22** at relatively high speeds to facilitate the clipping of the unwanted yarns by the clipping means **26**, as will be described in detail hereinbelow. And other means, also to be described in detail hereinbelow, are provided for sucking or drawing the sock inwardly into the form **22** to turn it right sideout and convey it, for example, to an appropriate collecting receptacle (not shown).

The clipping means **26** may be of any conventional construction, including, for example, a cutting head **28**, flexible driving cable **30** connected thereto, and a tube **32**. One such clipping means is disclosed in Patent No. 2,513,119, and as indicated therein, the cable **30** is driven by appropriate means and the tube **32** communicates with an appropriate suction device to draw the yarn ends clipped from the sock therethrough. Thus, the clipping means, per se, forms no part of the present invention. Cables **34** or the like may be connected at one end to the clipping means, as indicated, and at the other end to some other structure (not shown) whereby the clipping means may be suspended in the position shown or moved about by the operator, as desired.

Referring again to the illustrative embodiment, and in particular to Figures 1 and 2, the apparatus **20** is shown as comprising a table including side walls **36** and a top **38**, with dropleafs **40** at either end of the top. Foot portions **42** may be provided at the bottom of side walls **36** as indicated.

A support **44** is attached to the top **38** in any desirable manner to hold the form **22** in position. As best seen in Figure 2, the support **44** includes a base **46** and a horizontal cylindrical part **48** connected to the base by stem **50** and provided with a horizontal bore **52**. The inner or rear end of the form **22** is mounted for rotation in this bore as will be more fully explained hereinbelow.

As best shown in Figure 2, the form **22** includes an inner tubular liner **54**, enclosed by intermediate **56** and outer **58** tubular members, all of which preferably are circular in transverse section and suitably joined together. A contoured head **60** it fitted at the front end of the form, and includes an annular recess for receiving the outer end of tubular member **58** in the flush relation shown, presenting a smooth contour at this end so as not to damage a sock fitted thereover.

A pulley **62** is suitably drivingly connected to the inner liner **54**, in embracing relation therewth, and includes forwardly **64** and rearwardly **66** extending hubs. A driving belt **67** is trained around pulley **62** and is driven by a structure later to be described. The outer member **58** fits over the hub **64**, as shown, while the hub **66** and the rear end of the liner **54** are disposed within the bore **52**. The hub **66** and liner **54** preferably

are journalled in the bore 52 as by the two bearings 68, 70. Each of these bearings preferably is mounted in a counterbored portion of the bore 52, as shown, with the front bearing 68 being disposed adjacent the pulley 62 and the rear bearing 70 being positioned adjacent the inner end of the hub 66. A lock nut 72 is shown threaded onto the inner end of hub 66 engaging the bearing 70, and a cylindrical spacer sleeve 74 may be fitted around the hub 66 between the bearings 68, 70. Thus, these bearings and the form 22 will be held in the position shown whereby the form 22 will be rotatable relative to the support 44.

The bearings 68, 70 may be of the ball-bearing variety, including inner 76 and outer 78 rings with balls 80 fitted therebetween, as is conventional. Additionally, these bearings are so constructed as to be airtight, for a purpose to become apparent as the description proceeds.

A fitting 82 is connected to the rear of the support 44, as by bolts 84 (see Figure 1) and includes an annular boss 86 fitting into the space defined between the nut 72 and the rear end of the bore 52 of the support, as shown in Figure 2. This fitting 82 is engaged to the annular end surface 88 of support 44, as indicated in Figure 2, and appropriate sealing means (not shown), such as a conventional O ring, may be provided in the joint where this fitting engages the support.

A tubular sleeve 90 preferably having an internal diameter substantially equal to the internal diameter of the liner 54 is carried by fitting 82, in substantially flush relation to the liner, as shown. This sleeve extends into a chamber 92 in housing 94. Housing 94 carries a conduit section 96 mounted therein as by the threaded connection shown, with an adjustable locking nut 98 threaded onto the conduit section and engaging the housing, as shown. The inner end of the conduit section 96 and the adjacent end of the tubular sleeve 90 are spaced apart to define therebetween a fluid inlet 100. The surfaces defining this inlet may be complementarily flared, as shown, whereby the fluid inlet is of annular configuration, opening and converging in a rearward direction. If desired, sleeve 90 may be formed integrally with conduit section 96, with inlet openings arranged at circumferentially spaced points in the annular region defined by inlet 100 and likewise opening in a rearward direction.

Although not shown, appropriate sealing means may be provided between the engaged surfaces of the fitting 82, sleeve 90, housing 94 and conduit section 96, and also between the hub 66 and liner 54 to render these various joints airtight.

The internal diameter of the conduit section 96 preferably is of substantially the same internal diameter as the sleeve 90 and is mounted in substantially flush relation thereto, as shown, thus providing a passageway 102 of uniform cross-sectional area and uninterrupted in outline, extending between the front end of the form and the rear end of the section 96 for a purpose to become apparent as description proceeds.

A conveying tube 104 is engaged to the conduit section 96 and preferably extends to some suitable collecting receptacle or the like (not shown). This tube may be constructed of any desirable material and may be transparent, as indicated in Figure 1.

A pipe 106 opens into the annular chamber 92 of housing 94, as best seen in Figures 2 and 4 for introducing fluid under pressure into this chamber for discharge through the inlet 100, whereby it will flow rearwardly, or to the left as viewed in Figure 2, through the conduit section 96 and tube 104. This rearward flow of fluid under pressure will operate to draw a sock fitted over the form 22 into the passageway 102, thereby everting the sock and conveying it through the tube 104.

Referring again to the driving means for the form 22, the driving belt 67 extends through holes 108 in the table top 38 and is trained at its lower end around a pulley 110 carried by a shaft 112, as shown in dotted lines in Figure 1. Shaft 112 is carried by a conventional speed changing device 114 mounted, for example, on a shelf 116 as by bolts 117 and including an input shaft 118, shown extending at right angles to shaft 112 and having an idler pulley 120 and a drive pulley 122 disposed thereon. The idler pulley 120, as is understood, is mounted so as to be rotatable relative to shaft 118, while the drive pulley 122 is fixed to the shaft 118 to rotate therewith.

A belt 124 is trained around the idler pulley 120 and also around a pulley 126 drivingly connected to a take-off shaft 128 of prime mover 130. The pulleys 120, 122 are of any known construction and preferably are disposed adjacent each other whereby the belt 124 may be conveniently shifted from one of these pulleys to the other, as will be set out in more detail hereinbelow, thereby providing a clutch arrangement to rotate or not to rotate shaft 118 depending on which of the pulleys 120, 122 the belt 124 is engaged to.

The prime mover 130 may be mounted on a lower shelf 132 as by bolts 134, with a brace 136 engaged to and extending between the shelves, as shown. A clutch lever 138 in the form of a bell crank is pivoted as by bolt 140 to a support piece 142 extending from the brace 136. This clutch lever includes a bifurcated end 144 engaging the belt 124, and is pivotable about the horizontal axis of bolt 140 to move the belt 124 from the idler pulley 120 to the drive pulley 122 and vice versa.

Pipe 106 is shown extending downwardly through the table top 38 and communicates with the pipe 146. Conventional fittings 148 may be provided in the pipe 106, as shown, and pipe 146 communicates with an appropriate source of fluid under pressure indicated schematically at 150. The fluid preferably is air. A conventional quick-acting valve 152 is provided in line 146 to control the flow therethrough.

In the illustrative embodiment, a foot treadle 154 is provided for controlling the movement of the clutch lever 138 and the actuation of valve 152. This treadle 154 may be suitably mounted above the floor for pivotal movement about a horizontal axis, indicated by numeral 156, and toward or away from the floor. Any appropriate means may be used for pivotally mounting the treadle. For example, a bracket 157 may be provided on each side of the treadle, resting on the floor and pivotally supporting the treadle at 159. Because of the off-center or forward disposition of axis 156, the rear end 155 of the treadle will be continuously urged downwardly by its weight.

A chain 153 or other similar tension device is connected at one end to a bracket 160 on the rear end of the treadle and at the other end to the clutch lever 138, as shown. Lever 138 preferably is continuously urged to pivot in a counterclockwise direction, as viewed in Figure 1, by means of a compression spring 162 fitted at one end into a hole 164 in a depending wall 166 on the table, and connected at its other end to a chain 168 or other similar tension device, the latter being connected to the lever 138 adjacent chain 158, as shown. The action of spring 162 will be observed to operate through the chain 168, lever 138 and chain 158 to continuously urge the treadle 154 upwardly. A detent or stop 169 is fixed to brace 136 in the path of lever 138 to limit the counterclockwise swinging thereof under the action of spring 162.

An actuating lever 170 for the valve 152 is pivotally connected to a member 172 carried by the valve body for pivotal movement about an axis 174. The lever 170 is adapted to open the valve 152 when it is pivoted clockwise about axis 174, as viewed in Figure 1, the valve being normally closed. One end 176 of the lever 172

will be engaged to an actuating rod or other similar actuating device (not shown) in the valve **152**, while the other end **178** is connected by a chain link **180** to another lever **182**, this latter lever being pivoted at **184** to a member **186** carried by the lower shelf **132**. A rod **188** is engaged to the other end of the lever **182** and to a rod **190** attached to the foot treadle **154**, with an appropriate adjustable coupling device **192** connecting these rods. Coupling device **192** may include a central hole **194** for receiving the ends of rods **188**, **190**, with set screw **196** adapted to be tightened against the rods to hold them in adjusted position.

In the operation of the apparatus, the sock or stocking **24** is first fitted inside-out over the form **22**. At this time, the foot treadle **154** is in the position shown in Figure 1 wherein the belt **124** is engaged to the idler pulley **120**, the form **22** therefore being stationary, and the valve **152** is closed. The loose ends and floated yarns on the inside of the sock **24** are exposed and the operator now presses down on the rear end of the foot treadle **154** whereby the clutch lever **138** will be pivoted clockwise to move the belt **124** into driving engagement with the drive pulley **122**. The valve **152** will still be closed. The counterclockwise pivoting of lever **182** about axis **184** will not cause any significant movement of lever **170** due to the chain link connection therebetween.

Power will now be transmitted from the motor **130** through the speed changing device **114** and belt **67** to rotate the form **22**. This rotation preferably is at relatively high speed so tha loose yarns and yarn ends will stand out from the sock in a relatively taut position due to centrifugal force and to facilitate clipping. The clipping means **26** is then lowered into operative position to remove the undesirable portions of the yarn, sucking them through the tube **32** for discharge to a waste receptacle.

When the clipping and trimming step is completed, the operator tilts the treadle in the opposite direction so that the rear end **155** thereof will rise from its lower position to a position thereof above that shown in Figure 1 whereby lever **182** will be pivoted clockwise from its Figure 1 position, and whereby the clutch lever **138**, through the action of spring **162**, will return belt **124** to idler pulley **120**, thus stopping rotation of form **22**. This pivotal movement of lever **182** will cause lever **170** to be pivoted clockwise about axis **174** to open valve **152**. The treadle will be held in this position long enough for the pressurized fluid to flow through pipe **106**, chamber **92** and inlet **100** to create a suction in passageway **102** effective to draw the sock into this passageway and convey it through tube **104**.

The treadle **154** will then be returned to its Figure 1 position as by the weight of the rear end **155** acting about axis **156** and/or by a suitable compression spring means or the like (not shown) in the valve **152** urging lever **170** to its Figure 1 position. The valve **152** will thus be closed with the transmission of power to form **22** still discontinued. The apparatus is now ready for another cycle.

The single operation described above has the following advantages over methods currently in general use by hosiery mills manufacturing floated, wrapped, or striped patterns:

(1) Eliminates preliminary cutting or slitting of floated yarns or loose yarn ends now required to be done in a separate hand operation before socks can be placed on the clipping forms now in use. This is a tedious and expensive operation and is completely eliminated by the present invention.

(2) Methods currently used require the operator to move the clipper head a great number of times over a flat stationary form and also, to turn the form in the course of the operation so that both sides can be clipped. The present invention requires a minimum movement of the clipper head, and the turning of the form by hand is entirely eliminated.

(3) Methods currently used require the operator to use both hands to take the sock off the form after clipping, and in so doing turn the sock right side out manually. The present invention performs these functions automatically with a simple movement of the foot treadle.

(4) Methods currently used require the operator to retie the hosiery in bundles prior to further processing. The present invention eliminates this operation by depositing the hosiery in bags ready for further processing.

All of the above advantages result in increased production with fewer operators and with a great deal less effort on the part of the operators.

The present invention will thus be seen to completely and effectively accomplish the objects enumerated hereinabove. It will be realized, however, that various changes and substitutions may be made to the specific embodiments disclosed herein for the purpose of illustrating the principles of this invention, without departing from these principles. Therefore, this invention includes all modifications encompassed within the spirit and scope of the following claims.

We claim:

1. Apparatus for rotating and everting hosiery including, a tubular hosiery form having an open outer end, first means for mounting said form for rotation about its longitudinal axis, second means operatively connected to said form for mechanically rotating said form about its own longitudinal axis and relative to said first means, and means for inducing a flow of air inwardly into said form from the open outer end thereof whereby a sock fitted over said form will be drawn into said form and everted.

2. The apparatus defined in claim 1 wherein means are provided for selectively controlling the actuation of said rotating means and said means for inducing a flow of air.

3. The apparatus defined in claim 1 wherein said rotating means includes a prime mover and a pulley and belt drive arrangement operatively connected to said hosiery form and said prime mover.

4. Apparatus of the character described including a tubular hosiery form having an open outer end and adapted to have a sock or the like fitted thereover, first means journalled to and supporting said form inwardly of said outer end for rotation about its own longitudinal axis, second means for mechanically rotating said form about its own longitudinal axis and relative to said first means, and sock everting means including means for inducing a flow of air inwardly into said form from the open outer end thereof whereby a sock fitted over said form will be drawn into said form and everted.

5. The structure defined in claim 4 wherein said second means includes: a pulley drivingly connected to said form; a belt trained around said pulley; and a prime mover operatively connected to said belt; and further wherein said sock everting means includes: a fluid conduit means connected to said first means and in fluid communication with said tubular form; an inlet in said conduit means and opening in direction facing away from said form; and means for conveying fluid under pressure to said inlet.

6. The structure defined in claim 5 wherein clutch means are provided between said prime mover and said belt, and a valve being provided in said means for conveying fluid under pressure to said inlet.

7. The structure defined in claim 6 and further including a control means operatively connected to said clutch means and said valve for selective actuation thereof.

8. Apparatus of the character described comprising: a tubular hosiery form open at its front end, means for mounting said form in a horizontal position, said means including a base, a support attached to said base and journalled to the rear end of said form for supporting the latter above said base for rotation of said form about its own longitudinal axis; a prime mover, mechanical means including a clutch arrangement drivingly connecting said

prime mover to said form, a fluid conduit means connected to said support rearwardly of said form and in fluid communication therewith, valve controlled means operatively connected to said conduit means for directing a flow of fluid under pressure rearwardly therethrough to induce a flow of air rearwardly through said form, and means for selectively controlling the actuation of said clutch arrangement and said valve controlled means whereby said form may be rotated about its own longitudinal axis or a rearward flow of air induced therethrough.

9. In the manufacture of hosiery, the method comprising the steps of: arranging a sock inside-out on a tubular form; rotating the form at a sufficiently high speed so that any loose yarn ends or floated yarns on the inside of the sock will stand out due to centrifugal force; trimming said loose yarn ends and floated yarns of said sock; and thereafter drawing said sock into said form to evert said sock and convey it through said form.

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