# United States Patent [19]

**Haselgrove et al.**

[11] **3,908,874**

[45] **Sept. 30, 1975**


[54] **HOSIERY MANUFACTURE**


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Feb. 9, 1974 United Kingdom ..... 6003/74

[52] **U.S. Cl.** ..... **223/43**

[51] **Int. Cl.²** ..... **A41H 43/00**

[58] **Field of Search** ..... 66/149; 223/39–43



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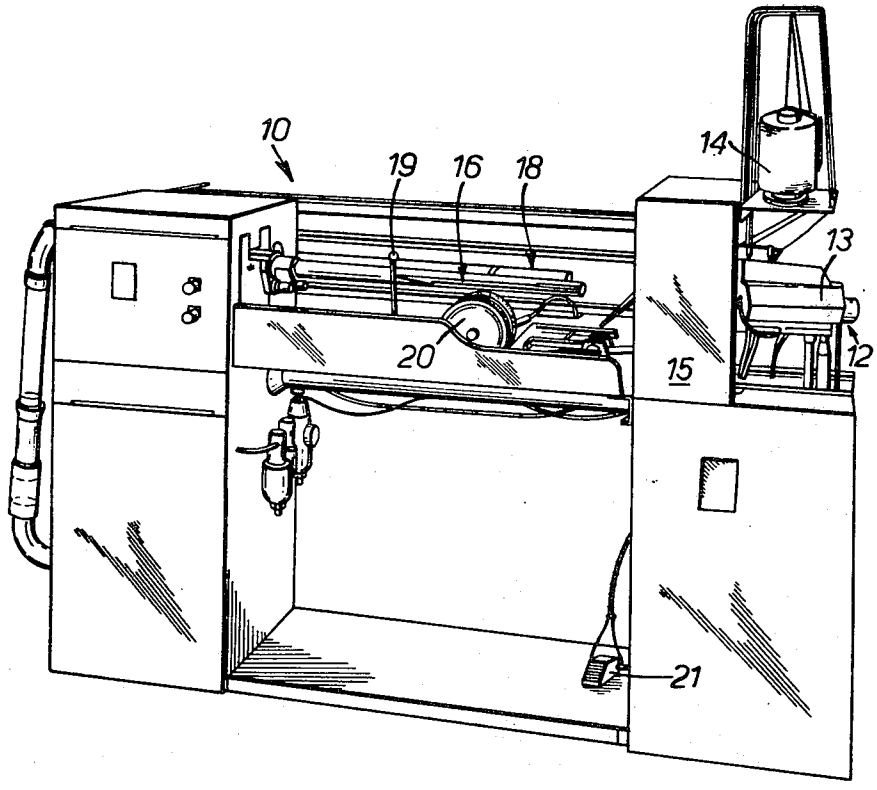
*Attorney, Agent, or Firm*—Flynn & Frishauf



[57] **ABSTRACT**

Hosiery everting apparatus has a suction tube over which hose is initially fully drawn and into which the hose is subsequently sucked to evert the hose, the apparatus having a movable clamp to draw the hose partly onto the tube and rotatably driven rollers which then grip the hose to the tube and pull the hose fully onto the tube, the rollers having an adjustable, slipping drive transmission enabling the driven rollers to continue rotating after a seamed toe end has engaged the end of the suction tube so that an adjustable tension can be exerted by the rollers on the hose before it is sucked into the tube.


**22 Claims, 5 Drawing Figures**



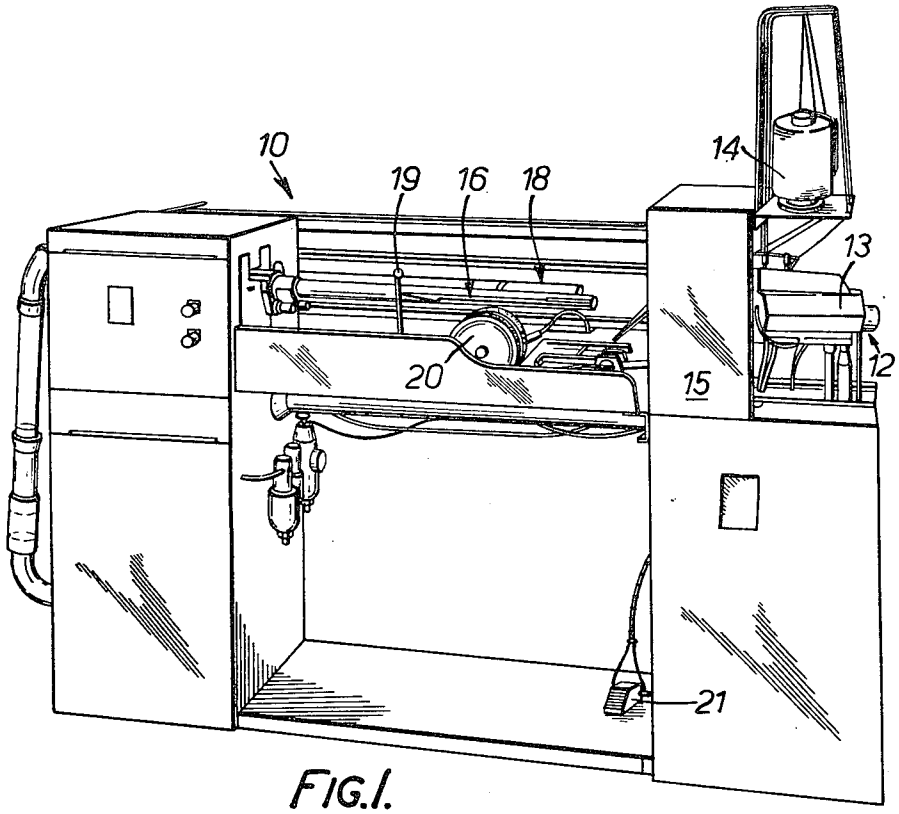



FIG.1.

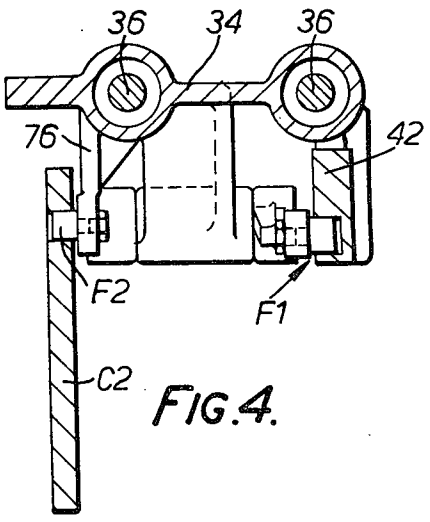



FIG.4.

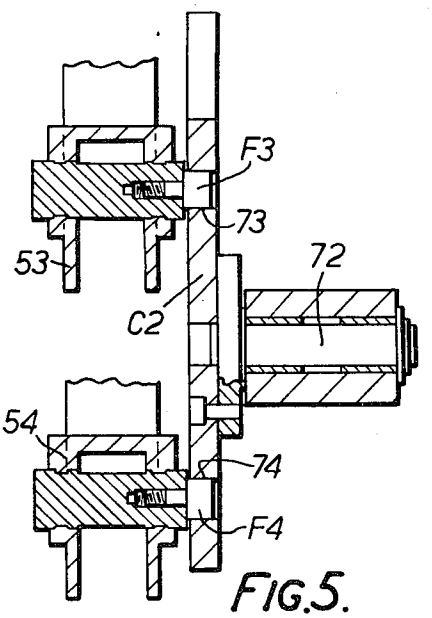
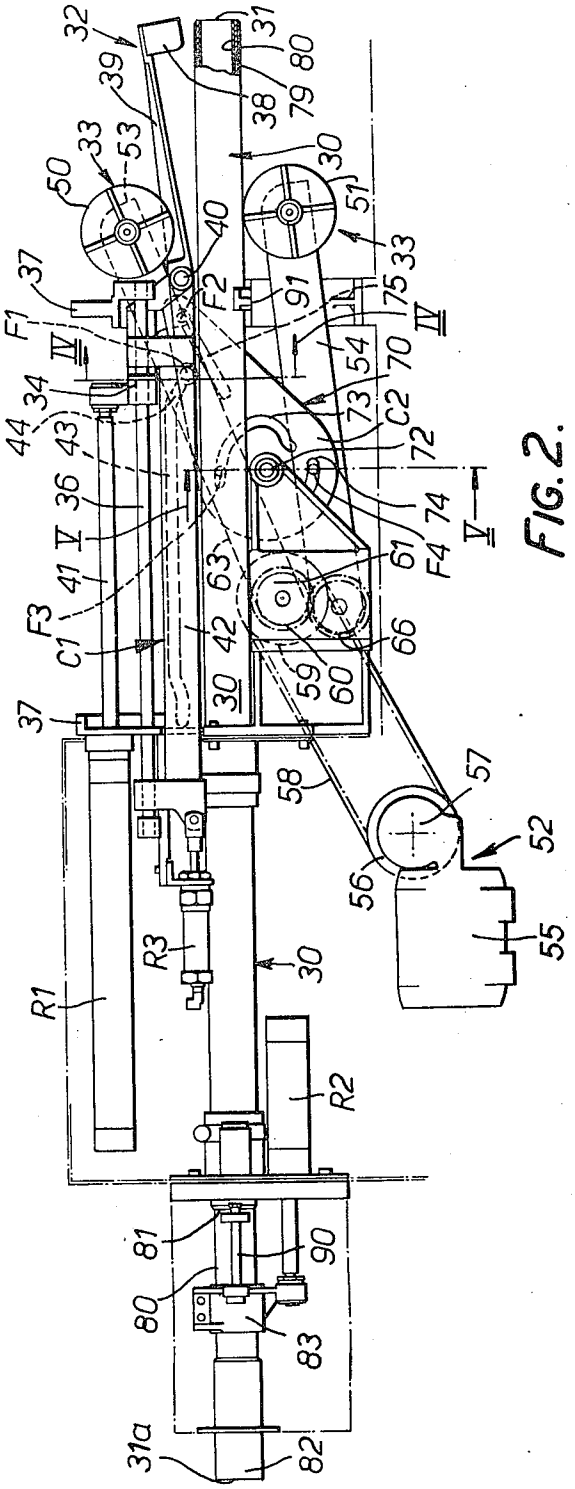



FIG.5.


32
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F1
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IV
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70
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44
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C2
72
36
74
V
V
41
63
61
F4
F3
C1
42
66
30
59
60
37
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57
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55
R3
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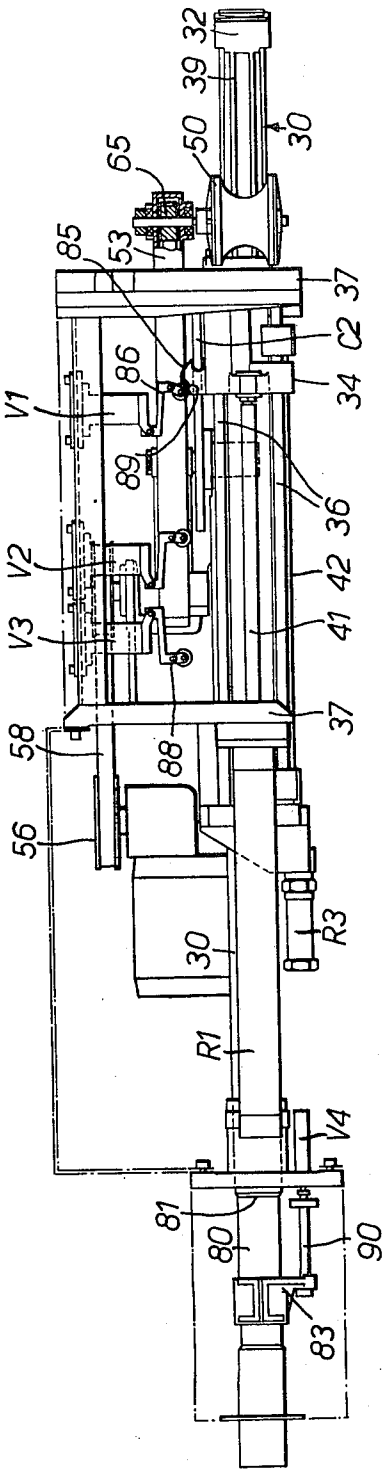
R1
R2
81
90
80
83
31a
82

FIG. 2.


32
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85
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C2
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V1
89
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V2
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V3
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88
56
R3
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R1
V4
81
80
90
83

FIG. 3.

# HOSIERY MANUFACTURE

Prior Application: Priority, Great Britain, 9th February, 1974, Application No. 6003/74.

The present invention concerns improvements relating to hosiery manufacture. More particularly, the invention relates to an improved everting or reversing apparatus.

During manufacture of stockings, tights and the like, some operations are customarily effected with the hose inside out. A typical example is the toe-closing operation. At a later stage in the manufacture, the hose are conveyed pneumatically to a collection station. It is desirable that the hose are delivered the right side out, and a turning or reversing apparatus is therefore desirable.

According to one aspect of the present invention, there is provided everting apparatus for hose-making plant, comprising a suction tube, roller means for drawing hose welt-first onto the tube until a toe portion of the hose engages the tube, the roller means thereupon being operable to exert and maintain a presettable tension on the hose, and means for applying suction to the tube and for relieving the tension exerted on the hose, thereby allowing the hose to be sucked toe-first into the tube and accordingly causing the hose to be turned or everted.

Advantageously, the everting apparatus includes flattening means for flattening a toe seam, the flattening means being operable while the tension is maintained on the hose. The flattening means can take the form of a punch seam straightener. This may comprise a reciprocal tubular member telescoped within the suction tube. In use, the tubular member is forcibly advanced so as to protrude from the toe end of the suction tube while the hose-drawing means tension is maintained on the hose.

It is preferred that roller drive means is provided including a presettable slipping clutch which governs the tension exerted by the roller means. The roller means can comprise at least one and desirably two gripper rollers.

In a preferred embodiment, the hose drawing means comprises, in combination, reciprocable and releasable clamp means movable lengthwise of the tube to draw the hose partly onto the tube, and a pair of rollers for drawing the remainder onto the tube and for tensioning the hose. Conveniently the rollers are mounted for movement between an idle position and an operative hose drawing position out of, and in engagement with the said tube and hose, respectively. Tension is then relieved by moving the rollers to the idle position. Alternatively, the or each roller could be fixedly mounted in continual light engagement with the tube, in which case the said roll should be capable of free-wheeling when suction is applied.

In the preferred embodiment, the pair of rollers are mounted individually on rocker arms, and the latter are rocked, via camming means actuated in timed response to movements of the clamp means, to engage and disengage the rolls with the suction tube.

Apparatus embodying the invention desirably is controlled by camming means and rams for simplicity and reliability.

The invention will now be described by way of example with reference to the accompanying drawings, in which:



FIG. 1 is a general perspective view of a toe closing machine,

FIG. 2 is a side elevational view of a hose reverser assembly embodying this invention,

FIG. 3 is a top plan view of the assembly shown in FIG. 2,

FIG. 4 is a sectional view of the reverser assembly taken along the line IV—IV of FIG. 2, and

FIG. 5 is another sectional view taken along the line V—V of FIG. 2.

The machine **10** shown generally in FIG. 1 is a semi-automatic toe-closing machine for use in hosiery manufacture. The machine may be used when making full-hose (stockings and tights) and half hose (socks). Control of the machine is generally via cams and switchable pneumatic operators.

The machine **10** includes a seaming device **12** for providing a toe-closing seam. The device **12** could be an adhesive applicator for adhesive seaming, but in this case is a sewing machine **13** fed with thread from a supply bobbin **14.** A clamp assembly, not visible behind a machine panel **15,** is located adjacent the sewing machine **13** for holding hose securely during the seaming operation. A carrier leg assembly **16** is provided to receive an unseamed hose and to present it to the clamp assembly. To one side of the carrier leg assembly **16** there is a reverser assembly **18.** The purpose of the reverser **18** is to turn a seamed hose "inside out," such that the seam is positioned within the toe of the finished or part-finished hose.

The machine **10** is used as follows. An operator is supplied with hose blanks to be toeseamed, which may arrive in a twisted state. A blank is presented toe end first to a suction tube associated with the carrier assembly **16.** The suction tube sucks in the blank up to its welt, which is firmly held by the operator. Then the operator threads the welt onto the carrier leg **16** and throws an actuating lever **19.** This causes a roller **20** to rotate and draw the hose blank onto the carrier leg **16** in a straightened condition. The operator now aligns the blank with an identification mark on the carrier leg **16** and thereafter depresses a foot pedal **21.** The carrier leg **16** is then operated to advance the hose blank towards the clamp so as to present the toe end of the blank to the clamp. The blank is then clamped thereby and the carrier leg is retracted. Next the toe end is sewn and the blank is thereafter transferred to the reverser assembly **18.** Conveniently, transfer mechanism which transports the now-sewn hose to the reverser assembly **18** is arranged to initiate operation of the latter. The reverser assembly **18** is adapted to discharge the hose neatly to a collecting station ready for subsequent operations to be performed thereon. Such operations can include, for example, the stitching together of companion legs to form tights.

Further details of the general construction and operation of the machine illustrated in FIG. 1 can be found in the Complete Specification filed on our co-pending applications numbered 26481/72 and 52911/72.

The improved reverser assembly embodying the present invention will now be described, and reference will be made to the remaining Figures of the drawings.

The reverser assembly includes a suction tube shown generally at **30** upon which a hose to be reversed is drawn initially. The suction tube **30** is open at its hose-receiving end **31** and has a connection **31***a* at its other end to a suction pump (not shown). When suction is

applied to the tube **30**, a hose mounted thereon can be sucked through its open end **31**, thereby drawing the hose off the tube **30**. In the process, the hose is reversed or turned "inside out."

Associated with the suction tube **30** is a clamping or holding means **32** and a wind-on or tensioning means **33**. The clamping means **32** is mounted for reciprocal movement lengthwise of the tube **30** on a carriage **34** which runs on a pair of rods **36**. The rods are fixedly held in a mounting frame **37** of the reverser assembly, the rods being disposed above the tube **30** and extending parallel thereto. The clamping means **32** includes an arcuate shoe **38** at one end of a leg **39** which is pivoted at **40** to the carriage **34**. It will be seen that the clamp shoe **38** can be moved towards and away from the tube **30** if the clamp leg **39** is rocked about its pivot **40**.

Drive means for reciprocating the carriage **34** and hence the clamping means **32** lengthwise relative to the tube **30** comprises a pneumatic ram **R1** having a piston rod **41** connected to the carriage **34**.

Clamping and releasing movements of the clamping means **32** are effected by camming means **C1, F1**. An elongated, slotted cam plate **42** is mounted alongside the carriage rods **36** for reciprocal movement parallel thereto. Movements of the cam plate **42** are effected by operation of a double-acting ram **R3**. The cam plate **42** has an elongated slot **43**, the major portion of which forms a straight dwell, and rise portions **44, 45** adjacent the slot ends. The follower **F1** rides in the cam slot **43** and is able to traverse substantially the whole length thereof. The follower is mounted on a free end of the clamp leg **39** located at the opposite side of the pivot **40** from the clamp shoe **38**. It will be appreciated that movement of the cam plate **42** to the right will, as seen in FIG. **2**, cause the follower end of leg **39** to rise. Accordingly, this movement will be accompanied by clamping movement of the shoe **38** towards the tube **30**.

The wind-on means **33** comprise a pair of rollers **50, 51** having associated drive means **52**. The rollers **50, 51** are mounted on a pair of arms **53, 54** which are pivotally mounted to allow their rollers to be swung towards and away from the tube **30**. When the upper roller **50** and its arm **53** are located away from the tube **30**, there is a space allowing the clamp arm **39** and clamp shoe **38** to move past the roller **50**.

The drive means **52** here comprises an electric motor **55** which drives a first pulley **56** through a slipping clutch **57**. A main drive belt **58** is trained around pulley **56** and a second pulley **59**, so as to drive a gear **60** and a third pulley **61**. A second drive belt **63** is trained around the pulley **61** and a fourth pulley **65** is fast with the upper roller **50**. The lower roller **51** is driven in a similar manner as the upper roller, its drive being obtained through a gear **66** in mesh with gear **60**. The rollers **50, 51** rotate in opposite senses so as to effect a wind-on action.

It is preferred that some or all of the pulleys and drive belts are toothed. Smooth pulleys/belts could be used, and if appropriate tension were employed, it might be feasible to dispense with the slipping clutch **57**.

Further camming means **70** are provided to move the rollers **50, 51** and their arms **53, 54** towards and away from the tube **30**. Additionally, the camming means **70** are arranged to move the arms in timed relation to the reciprocal movement of the clamping means **32**.

The camming means **70** comprise a cam lever **C2** which is journalled to a frame member at **72** for pivoting movement. The cam lever **C2** includes a pair of curved cam slots **73, 74**, receiving followers **F3, F4** which are mounted on the roller arms **53, 54** respectively. The cam slots are shaped to define relatively long dwells, when the arms **53, 54** and their rollers are spaced away from the tube **30**, and relatively abrupt cam drops for effecting sudden movement of the rollers towards the tube **30**.

A lost-motion connection is provided between the cam lever **C2** and the movable carriage **34**. The lost-motion connection serves to establish the timed operation of the rollers **50, 51** with respect to the clamping means **32**. The connection comprises an elongated slot **75** in the cam lever **C2** and a cam follower **F2**. The latter is mounted on a leg **76** on the carriage **34**. It will be appreciated that movement of carriage **34** along the rods **36** to the left, as seen in FIG. **2**, will cause the cam lever **C2** to swing anti-clockwise in the journal **72**. As this happens, the cam slots **73, 74** move relative to the followers **F3, F4**, and ultimately cause the rollers to shift inwardly towards the tube **30**. The arms **53, 54** are themselves journalled about the rotation axes of the associated drive gears and pulleys, e.g. **60, 61, 66**. Thus, as they rock, the tensions in their drive belts remain substantially unchanged.

The suction tube **30** comprises an outer tube **79** and a slideable inner punch tube **80** to the interior of which the suction is actually applied. Tube **80** is intended to serve as a seam-flattener. The suction tube **79** itself terminates at **81** clear of the suction inlet **82**, thereby exposing a portion of the punch tube **80**. The exposed portion carries a yoke **83** which is connected to an actuator in the form of a double acting pneumatic ram **R2**. Contraction of the ram here causes the punch tube **80** to move to the right so as to protrude from the outer tube **79** at end **31**.

With the exception of the electric motor **55**, drive elements of the reverser assembly comprise pneumatic actuators or rams. These are controlled by a set of valves including **V1** to **V4** in the illustrated embodiment. If the carriage **34** is moving to the right, a camming ramp **85** thereon engages a link **86** coupled to the valve **V1** as the carriage nears the end of its forward movement to the right. As illustrated in FIG. **2**, the valve **V1** has been actuated so as to retract ram **R3** and withdraw cam plate **42** to the left, thereby causing release of the clamping means **32** from the suction tube **30**.

Valve **V3** is located with an actuator link thereof disposed towards the left hand end of the path of travel of the carriage **34**. The link **88** is displaceable by a second camming ramp **89** on the moving carriage **34**. When displaced, the link **88** actuates the valve **V3** to allow pressure presently applied to ram **R1** to operate a pressure switch (not shown) controlling the motor **55** to switch the latter on. Actuation of **V3** may also set in train the starting of a timer. The timer creates a delay allowing a full hose to be wound fully onto the tube **30** before subsequent operations of the machine occur. The timer is arranged to actuate ram **R2** which drives the punch tube **80** to the right. Finally, valve **V3** actuates ram **R3** to withdraw the cam **C1** to the left, to lower the clamp shoe **38** onto the tube **30**, the clamp shoe **38** having previously been raised when follower **F1** rode along rise portion **45**.

Valve V4 is actuated by a push-rod 90 by the yoke 83 when the punch tube 80 has been fully extended, and serves to reverse the operation of ram R1 to return the clamping means 32 to the right. The changed pressure conditions in R1 concomitant with reversal of the operation thereof act, via the afore-mentioned pressure switch, to stop the motor 55. V4 also operates to actuate ram R2 for withdrawing the punch tube 80.

Then V2 is operated by the camming ramp 85 when the carriage 34 begins moving to the right. When operated, V2 admits air to the ram R3 whereby cam C1 is shifted to the right to maintain the clamp shoe against the tube 30. The camming ramp 85 then operates valve V1 to shift cam 42 to the left via ram R3 to raise the clamp shoe 38 away from the tube 30 for commencement of the next cycle of operation.

Whilst pneumatic actuators are presently preferred, hydraulic actuators could be substituted. Furthermore, it is feasible for electric solenoid actuators to be used.

The operation of the reverser assembly will now be described. A transfer mechanism of an associated machine or a human operator positions the hose to be reversed welt-first onto the end 31 of the suction tube assembly 30. The reverser is then started, manually or automatically, to actuate the ram R3 to advance cam C1 to the right. In response the follower F1 shifts the clamping means 32 from the illustrated position to a clamping position, thereby holding the welt of the hose on the end of tube 30.

Air is then applied to ram R1 to draw the carriage 34, the clamping means 32 and the hose to the left onto the tube 30. The arrangement is such that the moving clamping means 32 pulls the welt to the left beyond the rollers 50, 51. The movement permitted of the welt is limited by a stop 91. When the clamping means 32 has passed the rollers, its follower F1 enters the cam rise 45 and the clamp shoe 38 is released from the tube 30.

While the carriage 34 and clamping means 32 are moving leftwards, the cam C2 is being rotated anticlockwise. The roller arms 53, 54, are moved inwardly into engagement with the tube 30 by the time the clamping means is released therefrom.

As the carriage 34 commences its leftward movement, the motor 55 is switched on by the pressure switch actuated by pressure in the ram R1. As the carriage 34 nears the end of its leftward movement, it trips valve V3. This valve (i) starts the aforementioned timer provided, and (ii) actuates ram R3 to shift cam C1 to a clamp-applying position whereby the shoe 38 is brought once more into engagement with the tube 30. The motor 55 drives the rollers 53, 54 to pull the hose fully onto tube 30, until its seamed toe is disposed across suction tube end 31. The tension exerted by the rollers on the hose is governed by the setting of the slipping clutch 57 or the tension in roller drive belts if a slipping clutch is omitted.

When the ram R2 has extended the punch tube 80 fully to the right, thus stretching and flattening the hose toe seam, valve V4 is actuaged. V4 operates ram R2 to retract tube 80 and reverses ram R1 to bring about a return movement of the carriage 34 and clamping means 32 and to switch off motor 55 via the appropriate pressure switch. During its return to the right, the clamp shoe 38 rides along the tube 30 and as it does so the rollers 53, 54 are moved apart, their control cam C2 rocking clockwise in response to the moving carriage 34. While the clamping means is moving the suction applied to the tube 30 draws the hose toe-first into the tube 30. Motion of the hose into the tube 30 is assisted by the forwardly-moving clamping means 32.

During its forward movement, the carriage 34 trips the valve V2. Thereupon V2 actuates ram R3 and shifts the cam C1 forwardly to maintain the clamping means 32 in a clamping position until it reaches the end of its forward stroke. The carriage 34 then trips V1 to actuate cam C1, and thereby to raise the clamping means to the released position as in FIG. 2, ready for the next cycle of operation.

After passage through the equipment described and illustrated above, reversed hose are discharged to the left of FIGS. 2 and 3 in a straightened condition, right sides out and with well-flattened toe seams.

We claim:

1. Everting apparatus for hose-making plant, comprising a suction tube, roller means for drawing hose welt-first onto said tube to dispose a toe portion of the hose in engagement with the end of said tube, said roller means thereupon being operable to exert and maintain a presettable tension on the hose with the toe end thereof in engagement as aforesaid, and means for applying suction to said tube and for relieving said tension exerted on the hose, whereby the hose is sucked toe-first into said tube and accordingly is caused to be everted.

2. Everting apparatus according to claim 1, including flattening means operable to flatten a hose toe seam, said flattening means being operable while said tension is maintained on the hose.

3. Everting apparatus according to claim 2, wherein said flattening means comprises a reciprocal tubular member movable telescopically within said suction tube.

4. Everting apparatus according to claim 3, including ram means for forcing the tubular member to protrude from the said end of said suction tube to flatten a hose toe seam.

5. Everting apparatus according to claim 1, including roller drive means comprising a presettable slipping clutch to govern the tension exerted by said roller means.

6. Everting apparatus according to claim 1, wherein said roller means comprises a pair of contra-rotatable rollers disposed on diametrically opposite sides of said tube for gripping the hose to be everted to said tube.

7. Everting apparatus according to claim 6, wherein said rollers are mounted for movement between an idle position out of engagement with said tube, and an operative hose-drawing position in engagement with a hose disposed on said tube.

8. Everting apparatus according to claim 7, wherein the means for relieving said tension includes means to move the rollers to the idle position.

9. Everting apparatus according to claim 1, further including reciprocable and releasable clamp means movable lengthwise along said tube to draw hose to be everted partly onto said tube.

10. Everting apparatus according to claim 9, wherein said clamp means is adapted to push the hose along said tube whilst suction is applied to assist in transferring the hose into said tube.

11. Everting apparatus according to claim 9, wherein said clamp means comprises an arcuate shoe, a leg bearing said shoe at one end, and a carriage movable lengthwise with respect to said tube, said leg being piv-

otally mounted to said carriage to allow said shoe to be moved towards and away from a clamping position against the tube.

**12.** Everting apparatus according to claim **9**, including camming means to control the operation of said roller means in timed response to lengthwise movements of said clamp means.

**13.** Everting apparatus according to claim **12**, wherein said roller means comprises a pair of driven rollers journalled on rockably-mounted arms for rocking movement towards and away from said tube, and said clamp means comprises an arcuate shoe, a leg bearing said shoe at one end and a carriage movable reciprocally lengthwise with respect to said tube, said leg being pivoted to the carriage to allow said shoe to be moved towards and away from said tube, and the said camming means comprising a cam interconnection between said roller means and said clamp means to move said roller arms whereby the two rollers engage with a hose on said tube after operation of said clamp means to draw the hose partly onto the tube.

**14.** Everting apparatus according to claim **13**, wherein said cam interconnection comprises a pivoted cam, associated cam followers which are carried on the roller arms and a lost-motion connection between said cam and said carriage for pivoting said cam in response to carriage movement, said cam having dwells serving to establish timed movement of said rollers with respect to the operation of said clamp means thereby to allow said clamp means to draw the hose partly onto said tube before said pivoting cam moves said rollers into engagement with said tube.

**15.** Everting apparatus according to claim **13**, including a clamp cam to which said pivoted clamp leg is coupled for moving said clamp shoe between clamping and releasing positions, said clamp cam having an elongated dwell to maintain said shoe in its clamping position during a major part of the carriage movement and cam rises at the ends of said dwell to move said shoe between its clamping and releasing positions.

**16.** Everting apparatus according to claim **15** including a clamp ram to move the clamp cam longitudinally and a carriage ram to reciprocate said carriage, said rams being operable to effect the following sequence of events, namely:

i. the clamp ram is initially actuated, while said clamp shoe is in a released, ready position adjacent the said end of said tube, to shift said clamp cam and cause a first cam rise thereon to move the shoe to the clamping position.

ii. the carriage ram is actuated to move the carriage and the shoe through a hose-drawing stroke, a second cam rise of said clamp cam being operative at the end of the stroke to move said shoe to its releasing position,

iii. said clamp ram is operated a second time after hose-tensioning by said rollers to shift said clamp cam once again whereby said second cam rise is operable to return the shoe to its clamping position, and

iv. said carriage ram is operated a second time to return said carriage and said shoe to the said end of said tube.

**17.** Everting apparatus according to claim **16**, further including seam flattening means and a drive ram therefor, and the carriage is operable during a hose-drawing stroke thereof to actuate drive means for the rollers and to start a timer, said timer being operatively associated with said flattening ram to actuate the latter after a preset time has elapsed whilst tension on the hose is maintained by said rollers.

**18.** Everting apparatus according to claim **17**, including a valve, associated with said flattening means, which is switchable when said flattening means has been actuated to return the flattening ram and the flattening means to an idle position, to de-activate said roller drive means, and to actuate said carriage ram for returning said carriage.

**19.** Everting apparatus according to claim **16**, wherein said clamp ram is further operable

i. during the carriage return movement to shift said clamp cam to hold said shoe in its clamping position until the the end of said carriage return movement, and

ii. at the end of this movement to shift the clamp cam whereby the first cam rise moves the shoe to its released, ready position.

**20.** Everting apparatus according to claim **17**, including valving actuatable by said carriage during reciprocal movement thereof to control the said rams.

**21.** A method of everting hose during the manufacture thereof, comprising the steps of drawing hose to be everted welt-first onto a suction tube by engaging the hose with driven rollers and operating the rollers until a toe end of the hose engages a toe end of the suction tube, thereupon exerting and maintaining a given tension on the hose by continued operation of the rollers and thereafter relieving the tension and applying suction to the interior of the suction tube thereby causing the hose to be sucked toe-first into the tube and accordingly everted.

**22.** A method according to claim **21**, including the step of punch-flattening a toe seam of the hose whilst the hose is maintained under tension and prior to sucking the hose into the tube.

* * * * *