May 27, 1969 D. B. BOUNOUS 3,446,166

APPARATUS FOR INSPECTING AND SEWING STOCKINGS

Filed Oct. 5, 1966 Sheet 1 of 2

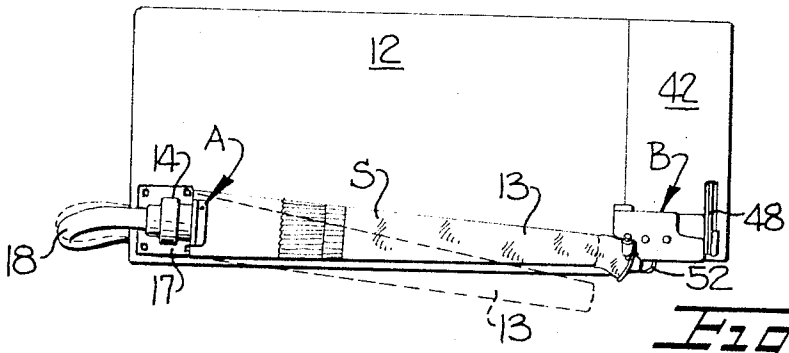


Fig-1

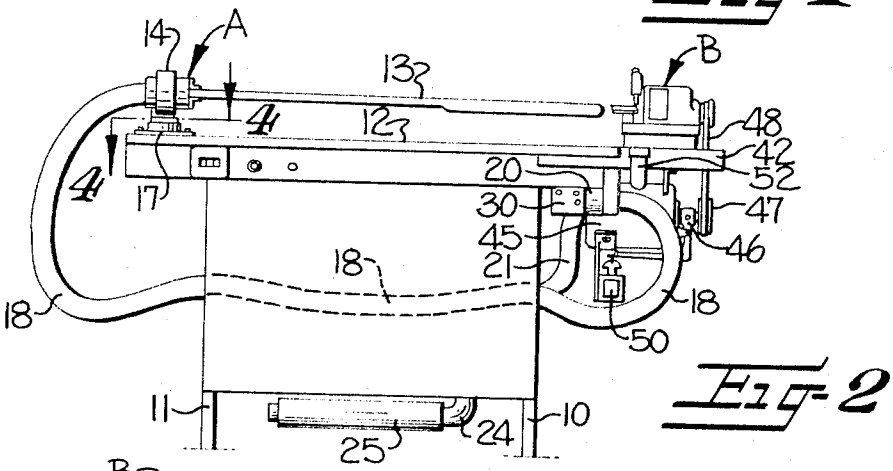


Fig-2

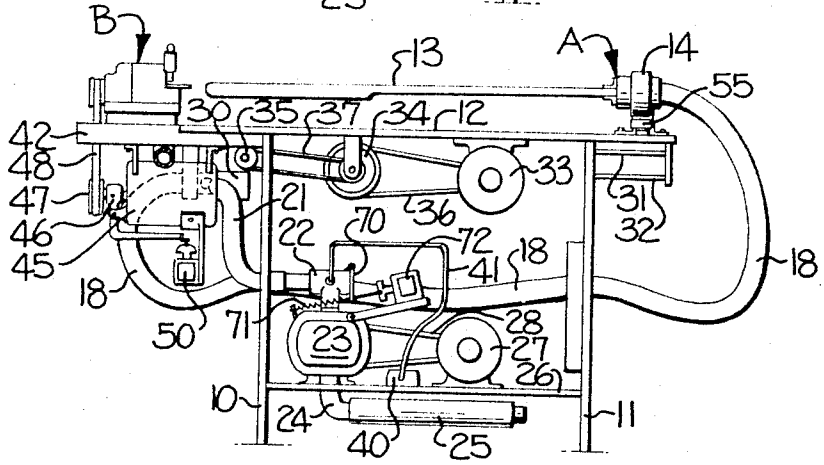


Fig-3

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Filed Oct. 5, 1966 Sheet 2 of 2

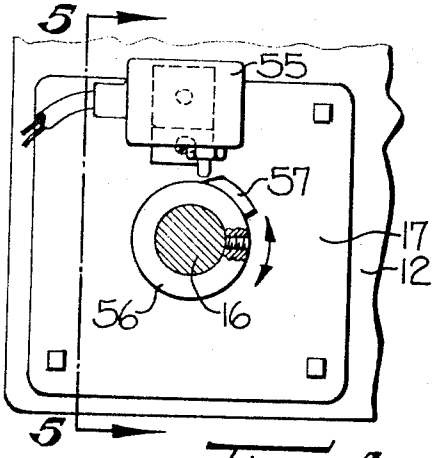


Fig-4

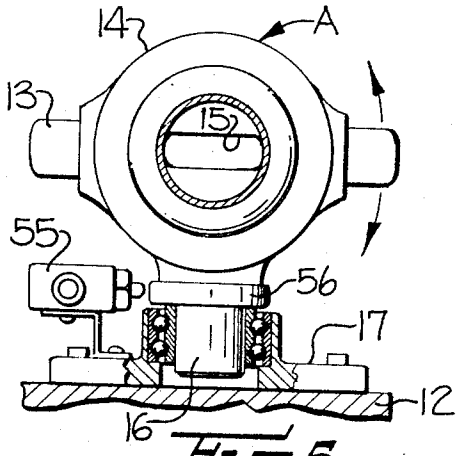


Fig-5

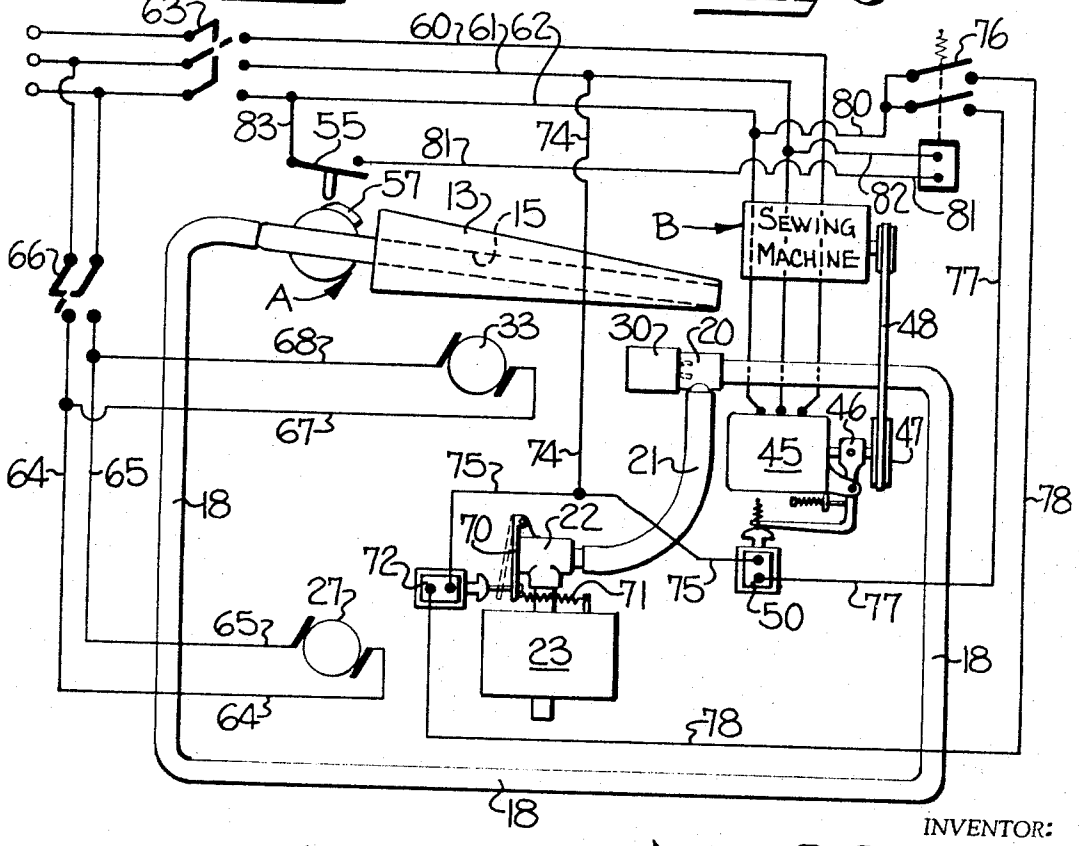


Fig-6

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APPARATUS FOR INSPECTING AND SEWING STOCKINGS

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U.S. Cl. 112—2
11 Claims

ABSTRACT OF THE DISCLOSURE

A stocking inspecting and toe closing apparatus including an elongated inspection form supported adjacent one end for pivotal movement between an inspection position and a sewing position. A sewing machine is mounted adjacent the other end of the form, when the form is at said sewing position, for sewing closed the open toe of a stocking supported on the form. Sewing machine controls responsive to movement of the inspection form are provided to actuate the machine when the form is in the sewing position and to deactuate the machine when the form is in the inspection position.

This invention relates generally to apparatus for inspecting and sewing the toes of seamless stockings and then everting and stacking the sewn stockings. More particularly, the apparatus of the present invention includes a stocking inspecting form which is combined with a sewing machine in such a manner that stockings can be inspected, sewn and then everted and stacked all in one continuous operation by a single machine operator.

For many years, it was the general practice to close the toe portion of seamless stockings by a looping operation and then inspect and turn the hosiery in a separate operation. In recent years, many mills have replaced the looping operation with a more economical sewing operation, but they have continued to inspect and sew in separate operations.

In an attempt to further reduce the cost of the sewing and inspection operations, machines have recently been introduced which permit the operators to continuously carry out both the sewing and inspection operations. While these devices have met with some success, they are expensive to purchase and, in some cases, they require two or more operators. Also, the seamers and inspectors must be retrained to operate the new machines, and the sewing machines and the inspection devices previously used by the hosiery mill must be discarded.

With the foregoing in mind, it is an object of this invention to provide a simple and relatively inexpensive apparatus which may be operated by a single operator to inspect, sew, evert and stack stockings in a continuous and rapid manner.

It is another object to provide a stocking inspection and sewing apparatus which may be inexpensively constructed by combining the stocking inspecting devices and the sewing machines presently in use in most hosiery mills.

It is a further object to provide a stocking inspecting, sewing, everting and stacking apparatus of the type discribed in which the hollow hosiery inspection form is supported for horizontal swinging movement relative to the sewing machine, and which includes means for activating and deactivating the sewing machine between sewing operations.

It is still another object to provide a stocking inspecting, sewing, everting and stacking apparatus of the type described in which means are provided for rendering ineffective during the sewing operation the suction currents which withdraw the stocking through the inspection form to evert the same.

Some of the objects of the invention having been stated, other objects will appear as the description proceeds when taken in connection with the accompanying drawings, in which:

FIGURE 1 is a plan view of the apparatus of the present invention;

FIGURE 2 is a front elevational view of the apparatus of FIGURE 1;

FIGURE 3 is a rear elevational view of the apparatus of FIGURE 1;

FIGURE 4 is an enlarged horizontal sectional view taken substantially along the line 4—4 in FIGURE 2;

FIGURE 5 is a view looking along the line 5—5 in FIGURE 4 and with parts in section and parts broken away, illustrating the pivotal support of the inspection form; and

FIGURE 6 is a wiring diagram schematically illustrating the manner in which the main parts are connected so that their operation is coordinated.

Referring generally to FIGURES 1–3, the apparatus of the present invention generally includes a modified hosiery inspection, turning and stacking device, broadly designated at A, and an overedge sewing machine, broadly designated at B. The inspection device A and the sewing machine B are arranged in such a manner that a single operator may quickly carry out the inspection and sewing of the toe portion of successive stockings in a continuous and economical manner.

The inspection, turning and stacking device A is a modification of the apparatus shown in the Thomas H. De Spain Patent No. 2,990,982, issued July 4, 1961. The inspection device includes a pair of vertical legs **10**, **11** which support a horizontal table top **12** at their upper ends. An inspection form **13** is supported at one end for rotation in a bearing housing **14** and has an axial passageway **15** extending therethrough from the free end thereof (FIGURES 5 and 6). The bearing housing **14** is provided with a vertically disposed pivot shaft **16** (FIGURE 5) which permits pivotal movement of the inspecton form **13** between the solid line and dotted line positions shown in FIGURE 1. The shaft **16** is pivotally supported in a flanged bearing support **17** which is fixed on the upper surface of and adjacent one end of the table **12**.

A suction duct **18** is communicatively connected at one end to the hollow passageway **15** in the inspection form **13** and its other end is connected to an outlet nozzle housing **20** (FIGURES 2 and 6) which is in turn supported in spaced relation below the table top **12**. Suction is created in the outlet nozzle housing **20** by means of a suction duct **21** (FIGURE 3), one end of which is suitably connected to the outlet nozzle housing **20** and the other end of which is connected to one side of a T-connection **22**. The lower portion of the T-connection **22** is connected to a vacuum pump **23**, having an outlet conduit **24** and a muffler **25**. The vacuum pump **23** is siutably supported on a shelf **26** which is connected at oppoiste ends to the vertical legs **10**, **11**. An electric motor **27** is also supported on the shelf **26** and is drivingly connected to the vacuum pump **23** by means of a belt **28**.

A pair of gripping jaws, not shown, are supported in one end of a traversing housing **30** which is in turn supported for movement along a pair of support rods **31**, **32** beneath the table **12**. Back and forth movement is imparted to the traversing housing **30** by means of an electric motor **33** which is supported beneath the table **12** (FIGURE 3). The motor **33** is drivingly connected to an electromagnetic drive clutch device **34** and a chain sprocket pulley **25** by means of respective belts **36** and **37**. A drive chain, not shown, is connected to the traversing housing **30** and when rotation is imparted thereto, the traversing housing **30** moves right to left in FIGURE 2 to withdraw a stocking from the outlet nozzle housing **20** so that

it may fall, in a substantially straightened out condition, into a stacking bin, not shown. A vacuum responsive switch **40** (FIGURE 3) is connected to the T-connection **22** by a vacuum line **41** and operates to start the traversing cycle of the housing **30** when a stocking is present in the outlet nozzle housing **20**, in the manner described in detail in said De Spain Patent No. 2,990,982.

In accordance with the present invention, a table extension **42** is connected to one end of the inspection table **12** and supports the overedge sewing machine B. The sewing machine B is of the conventional type normally used to sew the toe end portions of stockings. An electric motor **45** is suitably supported beneath the table extension **42** and is connected by means of a clutch lever **46** to a drive pulley **47**. A drive belt **48** connects the drive pulley **47** with the drive pulley of the sewing machine B. A solenoid **50** is connected to one end of the clutch lever **46** and is at times actuated, in a manner to be presently described, to move the clutch lever **46** so that the electric motor **45** is drivingly connected to the pulley **47** and starts operation of the sewing machine B. When the solenoid **50** is not energized, the clutch lever **46** is resiliently urged to another position so that the driving connection between electric motor **45** and the pulley **47** is broken, to stop operation of the sewing machine B.

As is well known, the conventional type of sewing machine normally used to sew the toe end of a stocking includes a trimmer or clipper which cuts the excess fabric beyond the seam. This waste fabric is preferably carried away by means of a suction pipe **52**, one end of which is disposed adjacent the front edge of the table extension **42** and the other end of which is suitably connected to a collection chamber, not shown.

In order to coordinate the activation of the suction currents in the hollow inspection form **13** and the operation of the sewing machine B, a control switch **55** (FIGURE 4) is supported adjacent the pivotal support of the inspection form **13**. A cam ring **56** is supported for rotational adjustment on the shaft **16** and has a raised cam surface **57** thereon. As the inspection form **13** is moved from the dotted line position shown in FIGURE 1 to the solid line position, the cam **57** engages the switch **55** to complete an electric circuit, to be presently described, and thereby deactivate the suction in the form **13** and start operation of the sewing machine B.

As shown in the electrical diagram of FIGURE 6, electric current is supplied to the sewing machine drive motor **45** by means of main wires **60**, **61** and **62**, which have a main switch **63** interposed therein. Electric current is supplied to the vacuum motor **27** by means of wires **64** and **65** which are connected at one end to the respective main wires **61**, **62** and their other ends to the motor **27**. A main switch **66** is interposed in the wires **64**, **65**. One end of branch wires **67**, **68** are connected to the respective wires **64**, **65** and their other ends are connected to the traversing housing drive motor **33**.

A valve plate **70** is pivotally supported at its upper end on the T-connection **22** and is normally held in the closed position shown in FIGURE 6 by means of a tension spring **71**. A solenoid **72** is connected to the lower end of the valve plate **70** and is operable to move the same to the open dotted line position when the solenoid **72** is energized, in a manner to be presently described. A wire **74** is connected at one end to the main wire **61** and its other end is connected intermediate the end of a wire **75**, opposite ends of which connect the solenoids **50**, **72**.

The solenoid **50** is connected to one switch position of a relay switch **76** by a wire **77** and the solenoid **72** is connected to the other switch position of the relay **76** by means of a wire **78**. The two switch elements of the relay **76** are connected to the main wire **62** by means of a wire **80**. The operating solenoid of the relay **76** is connected to the switch **55** by a wire **81** and to the main wire **61** by a wire **82**. The other side of the switch **55** is connected to the main wire **62** by means of a wire **83**.

Operation

The inspection form **13** is initially moved to the dotted line position shown in FIGURE 1 so that its free end is out of alignment with the sewing machine B. With the inspection form **13** in this position, the switch **55** is out of contact with the raised cam surface **57** (FIGURE 6) so that the switch **55** is in an open position and the relay **76** is deactivated and the two switch elements are open. The solenoids **50** and **72** are thus deenergized so that the spring **71** pulls the valve plate **70** to the closed position and the vacuum pump **23** creates a suction in the outlet nozzle housing **20**, suction duct **18** and passageway **15** of the inspection form **13**. The clutch lever **46** is positioned so that the drive from the motor **45** to the pulley **47** is not completed and the sewing machine B does not operate.

A stocking, such as that illustrated at S in FIGURE 1 is drawn over the free open end and onto the boarding form **13** so that it may be inspected by the operator for runs and the like. The form **13** may be rotated so that both sides of the stocking may be inspected while the form **13** is in the dotted line position shown in FIGURE 1. At this point, the toe end of the stocking S is open and although suction is present in the passageway **15** of the form **13**, the stocking will not be drawn into the form and everted, since the toe portion is open.

After the inspection step is completed, the operator swings the inspection form **13** to the solid line position shown in FIGURE 1 so that the free end is positioned closely adjacent the sewing machine B. At this point, the toe end of the stocking is partially withdrawn from the form to substantially the position shown in FIGURE 1, so that the toe end portion may be guided into the sewing machine B by the operator while the major portion of the leg of the stocking remains on the boarding form **13**. If desired, the form may be adopted for limited pivotal movement while in the solid line or sewing position (FIGURE 1) to assist in the sewing operation.

As the form **13** is swung from the dotted line position to the solid line position (FIGURE 1), the raised cam **57** closes the switch **55** (FIGURE 6) to complete the electrical circuit and energize both the solenoid **50** and the solenoid **72**. Energization of the solenoid **50** moves the clutch lever **46** to drivingly connect electric motor **45** with the sewing machine B and start operation of the sewing machine. As the solenoid **72** is energized, the plate valve **70** is moved to the dotted line position shown in FIGURE 6 to thereby open the side of the T-connection **22** to the atmosphere so that the vacuum pump **23** draws air in through this T-connection to deactivate the suction in the form **13**.

The operator then guides the free end of the stocking S through the sewing machine to form the desired seam at the toe end of the stocking. The sewing machine B preferably forms an overedge seam and automatically trims the excess fabric from the end of the stocking as the seam is being formed. This waste material may drop down into the removal tube **52** to be removed to a suitable collection chamber, not shown.

After completion of the sewing operation, the operator then draws at least some of the toe end of the stocking S back onto the inspection form **13** and swings the inspection form from the solid line to the dotted line position where the stocking may again be inspected, if desired. As the form **13** is moved from the solid line to the dotted line position, the cam **57** moves out of engagement with the switch **55** so that the electrical circuit to the solenoids **50** and **72** is broken and the sewing machine is stopped as the suction currents are again created in the inspection form **13**. It is desirable to start and stop the sewing machine to effect a saving of sewing thread and to prevent the formation of long stitch chains.

The stocking will then be removed from the inspection form **13** as the suction currents draw the toe end of the stocking into the passageway **15** at the free end of the

inspection form **13** and the stocking is everted as it is drawn therein. Depending upon the amount of suction and the type of stocking, it may be necessary for the operator to push the toe end of the stocking into the free end of the inspection form. In the case of stretch stockings, it may be necessary for the operator to push the leg portion of the stocking down the insepection form to aid in the withdrawal of the stocking therefrom. The stocking then passes through the suction duct **18** and up into the outlet nozzle housing **20**. As the stocking is drawn into the outlet nozzle housing **20**, the vacuum in the line **21** and T-connection **22** increases, thereby detecting the presence of a stocking in the position to be withdrawn and stacked, and causing the vacuum responsive switch **40** to operate.

As the switch **40** operates, it energizes the electromagnetic clutch **34** so that motion is imparted from the motor **33** to the chain sprocket drive pulley **35** to move the traversing housing **30** from right to left in FIGURE 2. As the traversing housing **30** begins to move, the gripping jaws engage the toe end of the stocking to withdraw the stocking from the outlet nozzle housing **20** and draw the stocking out in a substantially horizontal position. As the traversing housing **30** reaches the end of its path of travel, at the left-hand end of the apparatus in FIGURE 2, the gripping jaws release the toe of the stocking so that the stocking can fall, in a substantially horizontal position, into a stacking bin or the like, not shown. The traversing housing **30** then moves back to its original position adjacent the outlet nozzle housing **20**, and in position to receive and withdraw the next stocking.

Most hosiery mills now inspect and sew stockings in two completely separate and distinct operations and usually in different locations. This practice requires at least two separate handlings of the stockings which increase the likelihood of picks. These mills have the sewing machines grouped together and the stockings are sewn and then taken to the inspecting and everting operation. Therefore, most mills already have a group of sewing machines and a group of inspecting machines. In accordance with the present invention, hosiery manufacturers can inspect and sew stockings in a single operation which reduces the number of times the hosiery must be handled and thereby reduces the chances of picking the same. Also, the combining of the sewing machine and the inspection device with simple modifications to the inspection device and the sewing machine, as described herein, results in a much more economical operation. In the conventional inspection device, the inspection form is normally supported below the table top **12** and adjacent the front of the apparatus with its free end facing in the opposite direction from that shown in FIGURE 2.

In order to adapt the conventional inspection device to the present use, it is merely necessary to remove the hoisery inspection form and mount it on top of the table **12**, facing in the direction shown in FIGURE 2, and mount **2**, and mount the same in such a manner that it will pivot or swing substantially in a horizontal plane whereby its free end may be moved into and out of alignment with the sewing machine. The operation of the suction currents and the sewing machine is made responsive to pivotal movement of the boarding form by the provision of simple control means. This control means includes the T-connection **22** and the vacuum plate valve **70** which is operated by the solenoid **72**. The cam **57** moves with pivotal movement of the insepection form **13** to operate the switch **55** and control the operation of the vacuum plate valve **70** and the operation of the clutch lever **46** of the sewing machine motor **45**. The timing of the operation of the sewing machine can be varied by adjusting the position or size of the cam **57**.

While the stocking insepecting and sewing apparatus of the present invention is described as being formed by combining inspecting devices and sewing machines of the type which are already available in mose hosiery mills, it is to be understood that it could also be manufactured with new or especially designed inspection forms and sewing machines. Also, it is to be understood that the invention is not limited to the particular type of inspection apparatus or sewing machine shown, but may utilize any desired type of hosiery inspection form and sewing machine.

In the drawings and specification there has been set forth a preferred embodiment of the invention and, although specific terms are employed, they are used in a generic and descriptive sense only and not for purposes of limitation, the scope of the invention being defined in the claims.

I claim:

1. Apparatus for inspecting and sewing stockings comprising:

(a) a sewing machine;

(b) an inspection form having a free end over which a stocking may be drawn and serving to support the stocking in position to be sewn by said sewing machine;

(c) means supporting said inspection form for pivotal movement in a substantially horizontal plane to a first position wherein the stocking may be applied thereon and to a second position wherein said form is disposed in operative association with said sewing machine; and

(d) control means connected to said sewing machine for activating the same to sew the toe end of the stocking when said form occupies said second position and for deactivating said sewing machine when said form occupies said first position, said control means being responsive to pivotal movement of said form between said first and said second positions for controlling operation of said sewing machine.

2. Apparatus according to claim **1** wherein said means (d) includes a cam movable with said form and switch means operatively associated with said cam and electrically connected to said sewing machine for controlling the operation thereof.

3. Apparatus for inspecting and sewing stockings comprising:

(a) a sewing machine;

(b) an elongated hollow inspection form having an open free end over which a stocking may be drawn and serving to support the stocking in position to be sewn by said sewing machine;

(c) means operatively connected to said form for creating suction currents therein for everting the stocking after sewing;

(d) means supporting said inspection form for pivotal movement in a substantially horizontal plane to a first position wherein the stocking may be applied thereon and to a second position wherein said form is disposed in operative association with said sewing machine; and

(e) control means connected to said sewing machine for activating the same to sew the toe end of the stocking when said form occupies said second position and for deactivating said sewing machine when said form occupies said first position.

4. Apparatus according to claim **3** wherein said suction creating means is activated upon pivotal movement of said form from said second position to said first position and is deactivated upon pivotal movement of said form from said first position to said second position.

5. Apparatus according to claim **4** wherein said means (d) is also connected to said suction creating means for controlling its activation and deactivation, said means (d) including a cam movable with said form and switch means operatively associated with said cam and operatively connected to said suction creating means for controlling the operation thereof.

6. A stocking inspection and everting apparatus adapted to be operated in conjunction with a sewing machine, said apparatus comprising:

(a) a hollow inspection form having a free open end over which a stocking may be drawn;

(b) means supporting the other end of said inspection form for pivotal movement in a substantially horizontal plane to a first position wherein the stocking may be applied thereon and to a second position wherein the free end is positioned closely adjacent a sewing machine to permit sewing of the toe end of a stocking while the major portion of the stocking remains on the inspection form;

(c) suction means for creating a flow of air through said hollow form from said open end, and

(d) control means opertively connected between said hollow form and said suction means responsive to pivotal movement of said inspection form between said first and second positions for activating said suction means when said form is in said first position to withdraw a sewn stocking inwardly through said hollow form and evert the same and for deactiving said suction means when said form is in said second position to permit sewing of the stocking.

7. The stocking inspecting and everting apparatus defined in claim **6** wherein said control means includes means operatively connecting said hollow form and said sewing machine for controlling operation of said sewing machine in response to pivotal movement of said form between said first and said second position.

8. The socking inspecting and everting apparatus defined in claim **7** wherein said control means further comprises switch means operatively connected in an electric circuit controlling operation of said sewing machine, and means movable with said hollow form upon pivotal movement thereof between said first and second positions for actuating said switch to activate said sewing machine when said form is in said second position and to deactivate said sewing machine when said form is in said first position.

9. A hosiery inspecting and toe closing apparatus comprising an elongated inspection form having a free end and a passage extending longitudinally therethrough from an opening in said free end, duct means connected to said passage and to a source of pneumatic pressure differential for inducing a flow of air through said passage from said opening, said duct means including valve means operable

to control the flow of air through said passage, support means at the end of said form opposite said one end mounting said form for free rotation about its longitudinal axis and for limited pivotal movement about a substantially vertical axis between an inspecting and everting position and a toe closing position, a sewing machine mounted adjacent said free end of said form at toe closing position, drive means for operating said sewing machine, and control means responsive to the pivotal position of said form for controlling operation of said valve means and said drive means to provide a flow of air through said passage and to stop operation of said sewing machine when said form is in said inspecting and everting position and to stop the flow of air through said passage and drive said sewing machine when said form is in said toe closing position.

10. A hosiery inspecting and toe closing apparatus according to claim **9** wherein said control means further comprises switch means operatively connected in an electric circuit controlling operation of said sewing machine drive means, and actuator means movable by said form upon movement thereof between said inspecting and everting position and said toe closing position for engaging and actuating said switch.

11. The hosiery inspecting and toe closing apparatus defined in claim **10** wherein said switch means further controls operation of said valve means to control the flow of air through said form.

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U.S. Cl. X.R.

112—102, 219; 223—43