April 5, 1960 T. H. DE SPAIN 2,931,544

HOSIERY TURNING AND STACKING APPARATUS

Filed Feb. 18, 1955 3 Sheets-Sheet 1

FIG. 1.

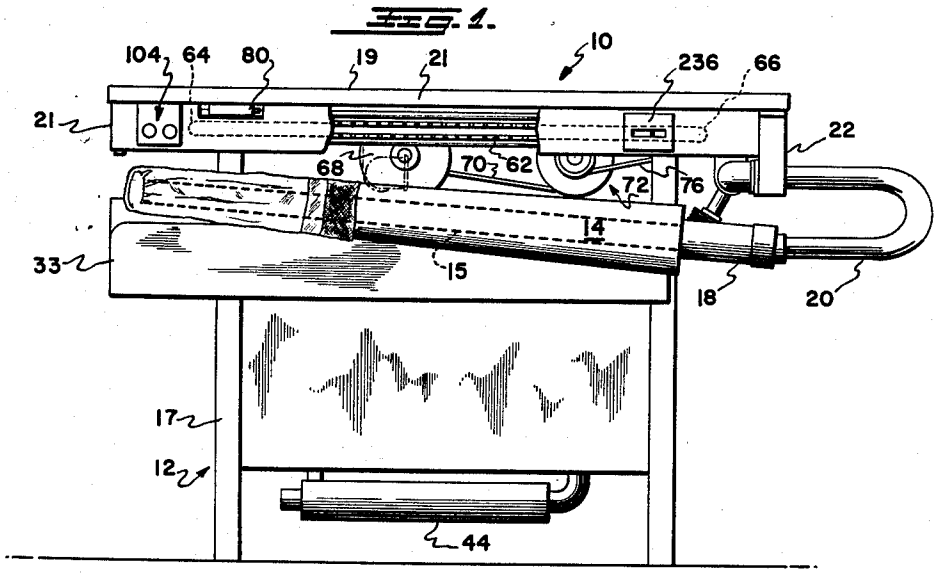
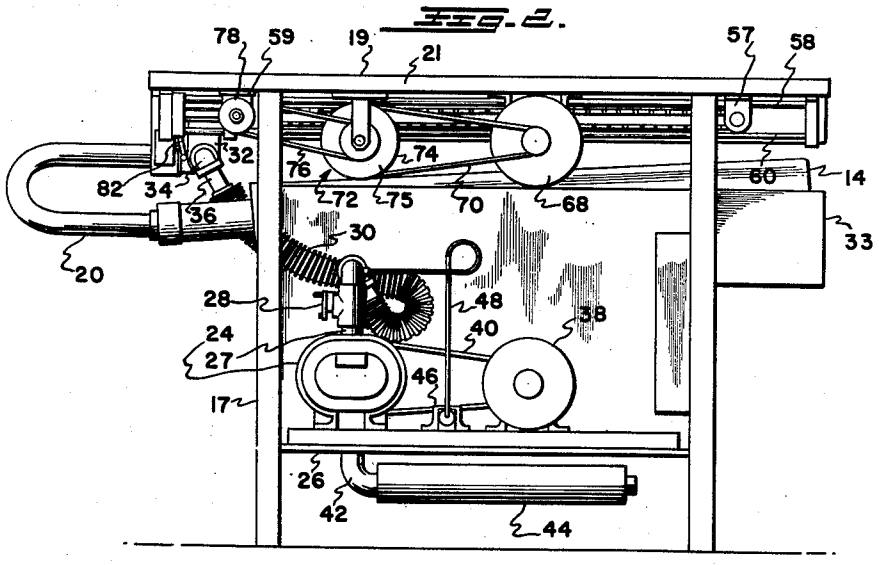


FIG. 2.



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HOSIERY TURNING AND STACKING APPARATUS

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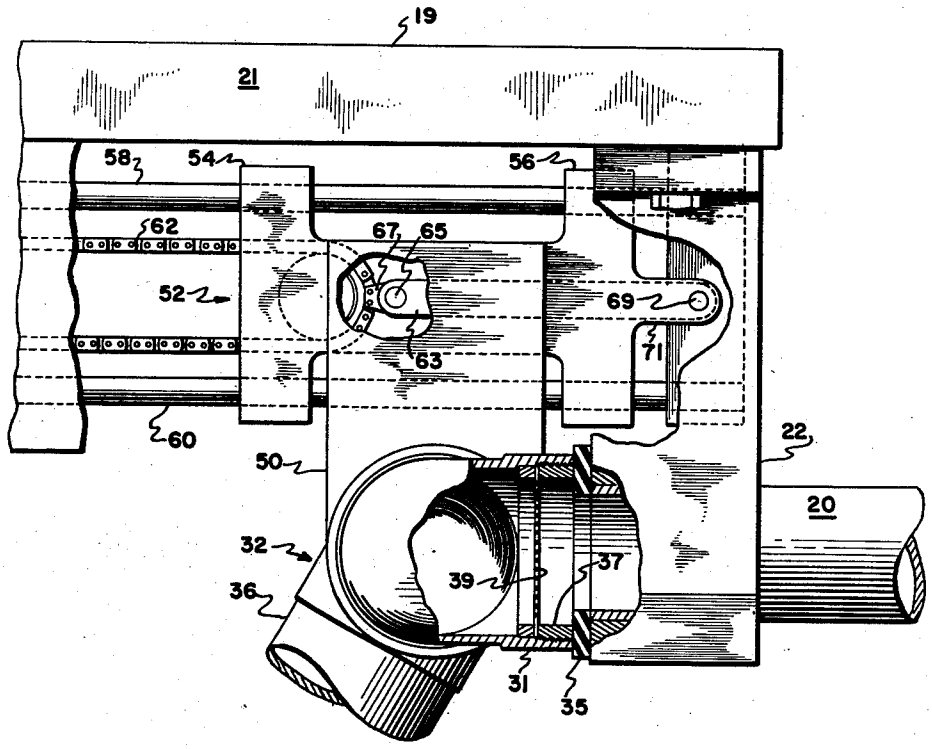


Fig. 3.

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HOSIERY TURNING AND STACKING APPARATUS

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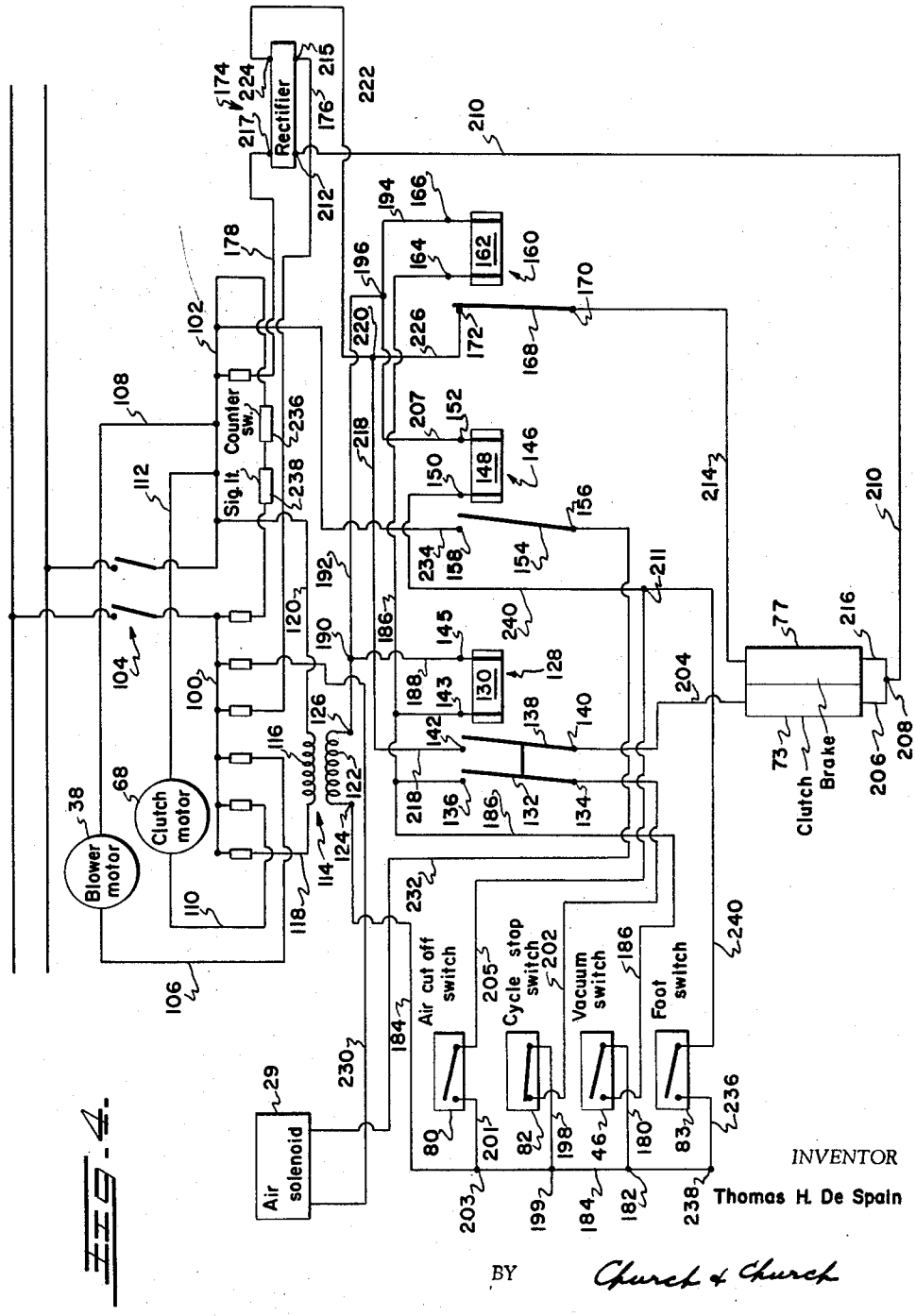


FIG. 4.

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United States Patent Office 2,931,544 Patented Apr. 5, 1960

2,931,544

HOSIERY TURNING AND STACKING APPARATUS

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Application February 18, 1955, Serial No. 489,221

7 Claims. (Cl. 223—43)

This invention relates to apparatus for turning and stacking hosiery following an inspection operation. More particularly, this invention relates to a hosiery turning and stacking apparatus having an improved sensing means for initiating a stacking operation.

In the manufacture of women's hosiery, it is the general practice to inspect the hosiery in inside-out position on the inspection form.

Apparatus for turning and stacking hosiery following an inspection operation is disclosed in application Serial No. 209,574, of Edward R. Ammon, filed February 6, 1951, now Patent No. 2,722,348 and in my copending application Serial No. 368,625, filed July 17, 1953, now Patent No. 2,818,205. Both of these patents are assigned to the same assignee as the present application. While the apparatus disclosed in these prior applications automatically performs the hosiery turning and stacking functions in a very satisfactory manner, the apparatus of these applications is expensive to manufacture.

In a hosiery turning and stacking machine, it is important that the timing of the stacking operation be properly coordinated with the position of the hosiery relative to the stacking mechanism. This coordination of the stacking operation timing to the position of the hosiery may be obtained by the use of an appropriate sensing means for detecting a predetermined relation of the hosiery to the stacking mechanism. It is important that the sensing means employed for this purpose be reliable in operation and always be actuated by the passage or presence of the hosiery in a predetermined relation to the stacking mechanism. It is also important that the nature of the sensing means be such as not to injure in any manner the delicate material of which the hosiery is made.

It is an object of this invention to provide a simple, reliable, and relatively inexpensive apparatus which automatically removes hosiery from an inspection form, turning the hosiery during the removal operation, and which deposits the hosiery in outstretched stacked relation in a predetermined position adjacent the inspection form.

It is still another object of this invention to provide a hosiery turning and stacking apparatus having an improved means for sensing the arrival of hosiery at a predetermined position relative to the hosiery stacking elements and for initiating a stacking operation in response to the arrival of hosiery at the predetermined position.

It is a still further object of this invention to provide a pneumatic hosiery transfer means having an improved means for providing a pneumatic pressure differential to assist in the turning and stacking operations.

In achievement of these objectives, this invention provides a combined hosiery turning and stacking machine comprising a form on which the hosiery is positioned for inspection, the form being provided on its interior with a passage for receiving the hosiery after completion of the inspection step. The passage is open at one end for receiving the hosiery and is connected at its opposite end to a pneumatic pressure differential producing means in the form of a positive displacement air pump or blower. A

reciprocably movable traversing means is movable into sealed communication with the same end of the hosiery receiving passage of the hosiery form as that connected to the pressure differential producing means. With the traversing means in sealed communication with the hosiery receiving passage of the form, suction from the air pump draws the hosiery through the hosiery receiving form and into engagement with the traversing means. A sensing means responsive to pneumatic pressure senses the arrival of the hosiery at the traversing means due to change in pressure differential in the pneumatic system caused by the arrival of the hosiery at the traversing means. The sensing means connects the traversing means. The sensing means connects the traversing means to a drive mechanism which causes the traversing means to move out of sealed communication with the interior of the hosiery form and along a predetermined path.

During the movement of the traversing means, an end of the hosiery is retained by the traversing means, the traversing movement causing the hosiery to be drawn in elongated relation along the path of movement. After a predetermined movement of the traversing means has occurred, the hosiery is released and drops in neatly stacked relation onto a suitable receiver. The traversing means completes its cycle of movement and returns into sealed communication with the interior of the hosiery form in readiness for another cycle of operations.

Further objects and advantages of the invention will become apparent from the following description taken in conjunction with the accompanying drawings in which:

Fig. 1 is a front elevation view of a hosiery inspecting, turning and stacking machine in accordance with the invention;

Fig. 2 is a rear elevation view of the machine of Fig. 1;

Fig. 3 is an enlarged fragmentary elevation view, partially in section, showing details of the traversing mechanism, with the traversing duct section being shown in sealed engagement with the fixed duct section; and

Fig. 4 is a diagram of the electrical circuit connections which may be used in connection with the apparatus of Figs. 1–3.

Referring now to the drawings, and more particularly to Figs. 1–3, there is shown a hosiery inspecting, turning, and stacking apparatus generally indicated at **10** supported upon a framework generally indicated at **12**. Framework **12** is provided with vertical leg members **17** which support at their upper ends a horizontal top member **19**. At the front of the apparatus, a panel member **21** extends vertically downwardly a short distance from top member **19**. The apparatus includes a hosiery inspection form **14** which is rigidly supported by framework **12** at the front of the framework and intermediate the height thereof. Form **14** is provided on its interior with an axially extending hosiery receiving hollow passage **15**. Passage **15** is open at its left-hand end with respect to the view shown in Fig. 1 and is connected at its right-hand end with respect to the same figure to a stationary suction inlet duct **18** which communicates with the interior of the hollow passage. The outer end of inlet duct **18** is connected to a generally U-shaped fixed duct section **20**. Duct section **20** is supported at its end opposite that attached to duct secion **18** by a bracket **22** which forms a part of framework **12**.

A source of suction comprising a positive displacement vacuum pump **24** is supported by a shelf **26** adjacent the lower end of framework **12** and at the rear of the apparatus. Pump **24** is provided with a stationary inlet duct **27** in which is positioned a valve **28** controlled by an electrical solenoid **29**. Energization of solenoid **29** actuates valve **28** to break the vacuum, as will be explained later in more detail. To the outer end of inlet conduit **27** is

connected a flexible conduit or duct 30 which is connected at its upper or outer end to a suction head 32 by means of an elbow 34 and a coupling member 36.

Pump 24 is driven by a constantly operating motor 38 which is connected to the pump by means of a belt drive 40. The pump is provided with an outlet pipe 42 connected to a muffler 44. A vacuum switch generally indicated at 46 is supported by shelf 26 and is connected by a tube member 48 to the interior of the stationary inlet duct 27 adjacent the connection of duct 27 to flexible conduit 30.

As best seen in Fig. 3, suction head 32 includes a horizontal duct portion 31 which is adapted to engage a resilient peripheral sealing ring 35 carried by the outer end of stationary duct section 20. When suction head 32 is in sealed engagement with resilient ring 35 of duct 20 as shown in Fig. 3, suction from pump 24 is communicated through flexible duct 30 and suction head 32 to the duct sections 20 and 18 and thence to the interior of hosiery receiving passage 15 of inspection form 14. The outer end of horizontal duct portion 31 of suction head 32 is provided with a threaded sleeve 37 which is in threaded engagement with the inner surface of duct portion 31. Sleeve 37 supports a screen member 39 which permits communication of the suction from suction head 32 to the interior of hosiery inspection form 14 but which prevents passage of hosiery from the inspection form to the interior of flexible duct section 30.

Suction head 32 and the attached flexible duct section 30 are reciprocably moved in a traversing path to withdraw hosiery from stationary duct section 20 and to drop the hosiery in neatly stacked relation in an elongated tray or receptacle 33 disposed beneath the path of reciprocation of suction head 32. Suction head 32 is supported at the lower end of a vertical bracket member 50 which forms a part of and depends downwardly from a slidably movable crosshead or carriage generally indicated at 52. Crosshead 52 is a generally H-shaped member in vertical elevation, having a pair of vertical legs 54 and 56. Each vertical leg 54 and 56 is provided at its upper and lower ends, respectively, with horizontally extending passages which receive upper and lower horizontal rod members 58 and 60 supported at the opposite ends of the upper portion of framework 12.

A drive chain 62 for imparting a reciprocatory traversing movement to crosshead 52 and thus to suction head 32 is mounted for rotation lengthwise of the upper end of the apparatus in a plane parallel to and adjacent guide rods 58 and 60. Chain 62 rotates about a pair of oppositely disposed sprocket members 64 and 66 (Fig. 1) which are suitably supported for rotation by brackets 57 and 59 attached to the top 19 of the supporting framework.

Reciprocating crosshead 52 is connected to drive chain 62 by means of a connecting link 63 which is pivotally connected at 65 to a link 67 of chain 62. The opposite end of link 63 is pivotally connected at 69 to an extension arm 71 formed integrally with vertical leg 56 of crosshead 52. By pivotally connecting crosshead 52 to chain 62 by means of link 63 as just described, the rotary movement of chain 62 imparts a reciprocating forward and reverse movement to the crosshead and consequently to suction head 32 and flexible conduit 30.

Drive chain 62 is driven from a continuously operating motor 68 which is connected through a drive belt 70 to the constantly driven input pulley member 74 of a clutch generally indicated at 72. Clutch 72 also includes an intermittently driven output pulley 75 to which the input pulley 74 is connected in driving relation by an electrically operated clutching element 73. An electrically operated brake 77 is normally energized to prevent rotation of output pulley 75. Output pulley 75 is connected by a drive belt 76 to a pulley 78 mounted on the same shaft as chain sprocket 66. Power is transmitted from motor 68 to drive chain 62 when electrically operated clutch element 73 is energized to permit clutch input and output pulleys 74 and 75 to engage in driving relation, and when electrically operated brake 77 is simultaneously de-energized to permit output pulley 75 to rotate.

A normally open microswitch or other suitable switch 80 (Fig. 1) is mounted in the path of reciprocably movable crosshead 52 adjacent the end of the forward stroke of the crosshead and is closed by crosshead 52 to cause the energization of solenoid 29 of electrically operated valve 28 in the inlet conduit 27 of pump 24. Closing of valve 28 separates flexible conduit 30 and suction head 32 from the source of suction, pump 24, allowing air in flexible conduit 30 and suction head 32 to return to atmospheric pressure to permit the hosiery adhering to the end of screen 39 to drop in stacked relation into the receiving tray or receptacle 33. Also, a normally closed microswitch or other suitable switch 82 (Fig. 2) is disposed adjacent the mouth of duct section 20 and is opened by engagement with the horizontal duct portion 31 of suction head 32. Opening of switch 82 by contact with suction head 32 results in the de-energization of electric clutch element 73 and the re-energization of electric brake 77. This results in the declutching of driving clutch pulley 74 from driven clutch pulley 75 to thereby disconnect drive motor 68 from chain 62, and also causes electric brake 77 to engage clutch pulley 75 to prevent movement of chain 62.

The electrical control circuit of the apparatus is shown in Fig. 4. In the embodiment shown, the electrical apparatus is connected to power lines 100 and 102 which are connected to a suitable source of 110-volt A.C. power through a disconnect switch generally indicated at 104. Continuously operating motor 38 which drives the positive displacement suction pump 24 is connected to power lines 100 and 102 through conductors 106 and 108, respectively. Continuously operating motor 68 for the drive chain 62 is connected across power lines 100 and 102 by conductors 110 and 112, respectively.

A step-down transformer generally indicated at 114 is provided for supplying operating voltages for the magnetic operating coils of the various electrical relays used in the control circuit and includes a primary winding 116 which is connected to power lines 100 and 102 by means of conductors 118 and 120, respectively, and a secondary winding 122 having output terminals 124 and 126.

A normally open relay 128 is provided for controlling clutch element 73. Relay 128 has a magnetic operating coil 130 connected across terminals 143 and 145, a normally open contact 132 movable to bridge terminals 134 and 136 of the relay when coil 130 is energized and a normally open contact 138 movable to bridge terminals 140 and 142 when coil 130 is energized.

A normally open relay 146 is provided for controlling the solenoid 29 of air valve 28 to permit dropping of the hosiery at the end of the forward traversing movement of suction head 32. Relay 146 includes a magnetic operating coil 148 connected across terminals 150 and 152 and a normally open contact 154 which is movable to bridge terminals 156 and 158 of the relay when operating coil 148 is energized.

A normally closed relay 160 is provided for controlling electric brake 77. Relay 160 includes a magnetic operating coil 162 connected across terminals 164 and 166 and a normally closed contact 168 which normally bridges terminals 170 and 172 of the relay when operating coil 162 is not energized and which is movable to open position when coil 162 is energized.

A bridge rectifier generally indicated at 174 is provided, the input terminals 215 and 217 of the rectifier being connected to power lines 100 and 102 through conductors 176 and 178, respectively.

Vacuum switch 46 which is operated to closed condi-

tion by the presence of hosiery on screen 39 of suction head 32 is connected in such manner as to have its closing simultaneously cause the energization of normally open relay 128 of normally closed relay 160, thereby starting the transversing cycle of the suction head 32 from its sealed position as shown in Figs. 1, 2 and 3, and causing the hosiery to be drawn out of tube section 20. One side of vacuum switch 46 is connected to terminal 124 of secondary transformer winding 122 by means of conductor 180, junction 182, and conductor 184 which is connected to terminal 124 of transformer winding 122. The other side of vacuum switch 46 is connected by means of conductor 186 to terminal 143 of magnetic operating coil 130 of the normally open relay 128. Conductor 186 is also connected directly to terminal 164 of magnetic operating coil 162 of normally closed relay 160. Terminal 145 of magnetic operating coil 130 of relay 128 is connected by means of conductor 188, junction 190 and conductor 192 to terminal 126 of transformer winding 122. Also, terminal 166 of magnetic operating coil 162 of normally closed relay 160 is connected by means of conductor 194, junction 196 and conductor 192 to terminal 126 of secondary coil 122. Thus, closure of vacuum switch 46 by the presence of hosiery against screen 39 of suction head 32 results in the energization of both magnetic operating coils 130 and 162 of normally open relay 128 and of normally closed relay 160, respectively.

Normally open contact 132 of relay 128 closes a sealing-in or holding circuit for magnetic operating coil 130 of relay 128 through cycle stop switch 82. One side of cycle stop switch 82 is connected by means of conductor 198 and junction 199 to conductor 184 and thence to terminal 124 of secondary winding 122. The other side of cycle stop switch 82 is connected by conductor 202 to terminal 134 of relay 128. Hence, the closing of contact 132 due to the energization of magnetic operating coil 130 when vacuum switch 46 is actuated, establishes the following holding circuit for magnetic coil 130: from terminal 124 of secondary winding 122, through conductor 184, junction 199, conductor 198, cycle stop switch 82 (which is closed as soon as suction head 32 moves out of engagement with duct section 20), conductor 202, terminal 134, contact 132, terminal 136, conductor 186 to terminal 143 of coil 130. The other side of coil 130 is already connected to terminal 126 of secondary winding 122 through conductors 188, junction 190 and conductor 192.

Terminal 140 of relay 128 is connected by means of conductor 204 to one side of electric clutch element 73. The opposite side of electric clutch element 73 is connected by conductor 206, junction 208 and conductor 210 to the output terminal 212 of rectifier bridge 174. Terminal 142 of normally open relay 128 is connected by conductor 218, junction 220 and conductor 222 to the output 224 of rectifier bridge 174. Thus, when contact 138 of relay 128 bridges terminals 140 and 142 of the relay due to energization of magnetic operating coil 130, electric clutch element 73 is connected across the output terminals 212 and 224 of rectifier bridge 174 through the following circuit: terminal 212 of the rectifier bridge, through conductor 210, junction 208, conductor 206, clutch element 73, conductor 204, terminal 140 of relay 128, contact 138, terminal 142, conductor 218, junction 220, conductor 222 to terminal 224 of rectifier bridge 174.

Terminal 170 of normally closed relay 160 is connected by means of conductor 214 to one side of electric brake 77, the other side of brake 77 being connected by means of conductor 216, junction 208 and conductor 210 to output terminal 212 of rectifier bridge 174.

Terminal 172 of normally closed relay 160 is connected by means of conductor 226, junction 220, conductor 222 to terminal 224 of rectifier bridge 174. Thus, when normally closed contact 168 of relay 160 is in its normally closed position, electric brake 77 is connected across the output terminals 212 and 224 of rectifier bridge 174 through the following circuit: from terminal 212 of bridge 174 through conductor 210, junction 208, conductor 216, brake 77, conductor 214, terminal 170 of relay 160, normally closed contact 168, terminal 172, conductor 226, junction 220, conductor 222 and terminal 224 of rectifier 174.

As has been mentioned, the function of normally open relay 146 is to energize air solenoid valve 28 to vent flexible conduit 30 and suction head 32 to atmosphere when the traversing suction head 32 has reached the extreme limit of its forward movement, to thereby cause the toe of the hosiery adhering to screen 39 to be released. One side of the operating solenoid 29 of air vent valve 28 is connected to power line 100 by conductor 230. The opposite side of air solenoid 29 is connected by conductor 232 to terminal 156 of normally open relay 146. Terminal 158 of the relay 146 is connected by conductor 234 to power line 102. Thus, when normally open contact 154 bridges terminals 156 and 158 upon the energization of magnetic coil 148, the operating solenoid 29 of air valve 28 is momentarily energized through the following circuit: from power line 100 through conductor 230, through solenoid 29, through conductor 232 to terminal 156 of relay 146, through normally open contact 154 to terminal 158, thence through conductor 234 to power line 102.

The energization of magnetic coil 148 of relay 146 is controlled by air cut-off switch 80 which is contacted by the slidably movable crosshead 52 at the end of the forward traverse stroke of crosshead 52. One side of air cut-off switch 80 is connected to terminal 124 of secondary winding 122 of step-down transformer 114 through conductor 201, junction 203, and conductor 184. The other side of air cut-off switch 80 is connected through conductor 205, junction 211 and conductor 240, to terminal 150 of magnetic operating coil 148. Terminal 152 of operating coil 148 is connected by conductor 207, junction 196 and conductor 192 to terminal 126 of secondary winding 122. Thus, closure of air cut-off switch 80 completes the energization circuit of magnetic coil 148 of relay 146 in the following manner: from terminal 124 of secondary winding 122, through conductor 184, junction 203, conductor 201, air cut-off switch 80, conductor 205, junction 211, conductor 240, terminal 150 of relay 146, magnetic coil 148, terminal 152, conductor 207, junction 196, conductor 192 to terminal 126 of secondary winding 122.

A foot or manually operated switch 83 is placed in electrically parallel relation with air cut-off switch to permit manually closing the energization circuit of solenoid 29 of valve 28 to brake the vacuum inside of form 14 when the operator is putting the stocking on the form. At this time, suction head 32 engages the sealing ring 35 on duct section 20. Manually operated or foot operated switch 83 is connected by means of conductor 236 and junction 238 to conductor 184 and thence to terminal 124 of secondary winding 122. The opposite side of switch 83 is connected through conductor 240 to terminal 150 of magnetic operating coil 148 of relay 146. Thus, manual closure of switch 83 results in the momentary energization of operating coil 148 and closure of contact 154 of relay 146, thereby energizing solenoid 29 of valve 28. This closes valve 28 and brakes the vacuum inside of form 14 while the operator is putting the stocking on the form.

In order that the operator may know when a predetermined batch of hosiery has been stacked, a counter switch 236 and signal light 238 are provided. Switch 236 and light 238 are connected in series with each other across power lines 100 and 102. The crosshead or carriage 52 trips a counter lever connected to switch 236 on each forward traversing movement of the crosshead. At the end of a predetermined number of cycles of operation; say twelve, for example, switch 236 is closed and energizes light 238 so that the operator will know

that a predetermined quantity of hosiery has been stacked.

The cycle of operation of the apparatus will now be described.

Cycle of operation

The hosiery to be inspected is positioned on the inspection form **14** in inside-out relation with the toe end of the hosiery at the left-hand end of the form as viewed in Fig. 1. After the inspection operation has been completed, the operator permits the hosiery to be drawn by the suction into the open mouth of passage **15**. At this time, the suction head is in sealed engagement with the sealing ring **35** of the stationary suction duct **20**. Since switch **104** is closed blower motor **38** is continuously operating to produce suction through flexible conduit **30**, suction head **32**, stationary duct sections **20** and **18** and thence suction in the hosiery receiving passage **15** in the interior of hollow inspection form **14**.

As the suction pulls the hosiery into the passage **15** of the form, the hosiery is reversed from its inside-out condition to right-side-out condition. The hosiery passes through passage **15** of inspection form **14** and through duct sections **18** and **20** into engagement with the face of screen **39** of suction head **32**. The presence of the toe of the stocking across the face of screen **39** increases the vacuum or suction in the portion of the duct system which includes the inlet pipe **27** connected to blower **24** with the result that this increased vacuum actuates vacuum switch **46** to closed position.

Closing of vacuum switch **46** energizes operating coil **130** of normally open relay **128** through the following circuit: from terminal **124** of secondary winding **122**, through conductor **184**, junction **182**, conductor **180**, vacuum switch **46**, conductor **186** to terminal **143** of coil **130**, through coil **130** to terminal **145** of the coil, thence through conductor **188**, junction **190**, conductor **192** to terminal **126** of secondary winding **122**. Relay coil **130** is thereby energized and closes normally open contacts **132** and **138**.

Closure of contact **132** completes a holding circuit for coil **130** in the following manner: from terminal **124** of secondary winding **122**, through conductor **184**, junction **199**, conductor **198**, normally closed cycle stop switch **82**, conductor **202** to terminal **134** of normally open relay **128**, through switch contact **132** to terminal **136**, conductor **186**, terminal **143**, through magnetic operating coil **130**, terminal **145**, conductor **188**, junction **190**, conductor **192** to terminal **126** of secondary winding **122**.

Closure of normally open contact **138** results in the energization of electric clutch element **73** through the following circuit: from terminal **224** of rectifier bridge **174**, through conductor **222** to junction **220**, through conductor **218** to terminal **142** of relay **128**, through contact **138** to terminal **140**, through conductor **204** to clutch element **73**, through clutch element **73**, through conductor **206** to junction **208**, through conductor **210** to terminal **212** of rectifier bridge **174**. Clutch element **73** is thereby energized.

The closing of vacuum switch **46** by the presence of hosiery at screen **39** also energizes the magnetic operating coil **162** of normally closed relay **160** through the following circuit: from terminal **124** of transformer winding **122**, through conductor **184**, junction **182**, conductor **180**, vacuum switch **46**, conductor **186** to terminal **164** of magnetic operating coil **162**, through coil **162** to terminal **166**, through conductor **194** to junction **196**, through conductor **192** to terminal **126** of secondary winding **122**. Magnetic operating coil **162** of relay **106** is thereby energized to open the normally closed contact **162** to thereby de-energize the circuit of electric brake **77** simultaneously with the energization of clutch element **73**.

The same holding circuit through the cycle stop switch **82** which holds relay **128** energized also holds relay **160** energized until the cycle stop switch **82** opens at the end of the traversing cycle of suction head **32**. Vacuum switch **46** opens as soon as suction head **32** moves away from sealing ring **35** of duct section **20** on the forward stroke. However, relays **128** and **160** remain energized despite the opening of vacuum switch **46**, due to the holding circuit.

The simultaneous energization of clutch element **73** and de-energization of electric brake **77** permits power to be transmitted from continuously operating drive motor **68** through drive belt **70**, clutch pulleys **74** and **75**, drive belt **76**, to pulley **78** and thence to the drive sprocket **66** of chain **62**.

The movement of drive chain **62** causes crosshead **52** to be moved to the left with respect to the views shown in Figs. 1 and 3 to cause suction head **32** to move out of said sealed engagement with the end **35** of stationary duct section **20**. While the suction head is moving away from duct section **20** on its forward stroke, suction still continues to be exerted from blower **24** through flexible conduit **30** to suction head **32** causing the toe of the stocking to be securely held against the outer face of screen **39**. Crosshead **52** is moved to the left with respect to the views shown in Figs. 1 and 3 due to the pivotally connected link **63** between drive chain **62** and arm **71** of the crosshead. As suction head **32** moves away from duct section **20**, the hosiery is drawn from the duct section **20** in longitudinally outstretched relation, the toe of the hosiery adhering to screen **39**.

When suction head **32** has completed the limit of its movement in a forward direction or to the left with respect to Figs. 1 and 3, the normally open air cut-off switch **80** is momentarily actuated to closed position by contact with the movable carriage **52**. Closure of air cut-off switch **80** results in the closing of venting valve **28** controlled by solenoid **29**. The circuit of air cut-off switch **80** may be traced in the following manner: from terminal **124** of secondary winding **122**, through conductor **184**, junction **203**, conductor **201**, air cut-off switch **80**, conductor **205**, junction **211**, conductor **240** to terminal **150** of normally open relay **146**, through magnetic operating coil **148** to terminal **152**, through conductor **207**, junction **196**, conductor **192** to terminal **126** of secondary winding **122**. Completion of the circuit just described by the momentary closure of air cut-off switch **80** causes magnetic operating coil **148** of relay **146** to be energized. Energization of operating coil **148** closes normally open contact **154** to bridge terminals **150** and **156** of relay **146**. This momentarily completes a circuit to solenoid **29** of air vent valve **28** in the following manner: from power line **100** through conductor **230**, through solenoid **29**, through conductor **232** to terminal **156** of relay **146**, through normally open contact **154** to terminal **158**, through conductor **234** to power line **102**. This results in the momentary energization of solenoid **29** to cause the momentary closing of valve **28**. The closing of valve **28** momentarily disconnects flexible conduit **30** and suction head **32** from pump **24**, thereby breaking the vacuum at suction head **32**.

The cutting off of the suction at screen **39** due to the temporary venting action provided by the momentary energization of valve **28** permits the toe of the hosiery to be released and permits the hosiery to drop in outstretched stacked relation into the hosiery receiver or tray **33** disposed beneath the traversing path of suction head **32**.

As soon as the slidable crosshead **52** has moved out of contact with air cut-off switch **80**, the switch **80** re-opens and de-energizes magnetic operating coil **148** of relay **146**. This permits normally open contact **154** to again open and thereby opens the circuit of solenoid **29** permitting air vent valve **28** controlled by that solenoid to re-open and restoring the suction to the flexible suction conduit **30** and suction head **32**. The continued movement of chain **62** causes crosshead **52** to move along the

return path and finally into sealed engagement with the open end 35 of stationary conduit 20 as shown in Fig. 3.

As suction head 32 reaches the completion of its return stroke in which the suction head engages end 35 of stationary suction conduit 20 in sealed relation, crosshead 52 engages cycle stop switch 82 to thereby open the holding circuit of control relays 128 and 160. This results in the de-energization of magnetic coil 130 of relay 128 and the opening of normally open contacts 132 and 138, and also in the de-energization of operating coil 162 of relay 160. The de-energization of operating coil 130 of relay 128 results in the opening of contacts 132 and 138. The opening of contact 138 de-energizes electrical clutch element 73, removing motor 68 from driving relation with respect to chain 62. The opening of contact 132 further opens the holding circuit for operating coil 130.

The de-energization of operating coil 162 of normally closed relay 160 permits normally closed contact 168 to reclose, to complete the energization circuit of electric brake 77. Brake 77 acts on pulley member 75 to prevent further rotation of chain 62. Due to the combined effects of the de-energization of the electric clutch element 73 and the re-energization of the electric brake 77, crosshead 52 with suction head 32 remains in the position shown in the drawings with suction head 32 in sealed engagement with the end of duct 20 in readiness for another cycle of operation, to be initiated by the presence of another stocking at screen 39 of suction head 32.

It can be seen from the foregoing that there is provided in accordance with this invention an improved apparatus for automatically turning and stacking hosiery in conjunction with an inspection operation. The turning and stacking device of the invention is simple in construction and operation and permits a rapid handling of the hosiery in the inspection process. Furthermore, the device of the invention permits the turning and stacking device to be integrally combined in the same apparatus with the inspection form. The positive displacement blower or pump provides an efficient means for producing a pneumatic pressure differential which assists in both the turning and stacking operations. Furthermore, the use of the positive displacement pump for providing suction cooperates with the vacuum switch to provide an efficient and reliable sensing means which initiates the traversing cycle of the reciprocating suction head which transfers the hosiery to stacked position.

While there has been shown and described a particular embodiment of the invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention and, therefore, it is aimed to cover all such changes and modifications as fall within the true spirit and scope of the invention.

What I claim as my invention is:

1. A hosiery turning and stacking apparatus comprising a hosiery form, said form having a hosiery receiving passage extending therethrough, a traversing means movable into communication with said passage, means for applying a pneumatic pressure differential to the interior of said passage whereby hosiery is drawn through said passage and into engagement with said traversing means, and means responsive to a change in said pneumatic pressure differential produced by the presence of hosiery at said traversing means for causing a traversing movement of said traversing means along a predetermined path whereby hosiery is drawn by said traversing means in elongated outstretched relation along said path.

2. A hosiery turning and stacking apparatus comprising a hosiery form, said form having a hosiery receiving passage extending therethrough, a traversing means movable into communication with said passage, means for applying a pneumatic pressure differential to the interior of said passage whereby hosiery is drawn through said passage and into engagement with said traversing means, means for retaining said hosiery at said traversing means, and means responsive to a change in said pneumatic pressure differential produced by the presence of hosiery at said traversing means for causing a traversing movement of said traversing means along a predetermined path whereby hosiery is drawn by said traversing means in elongated outstretched relation along said path.

3. A hosiery turning and stacking apparatus comprising a hosiery form, said form having a hosiery receiving passage extending therethrough, a traversing means movable into sealed communication with said passage, means for applying a pneumatic pressure differential to the interior of said passage whereby hosiery is drawn through said passage and into engagement with said traversing means, means responsive to a change in said pneumatic pressure differential produced by the presence of hosiery at said traversing means for causing a traversing movement of said traversing means along a predetermined path, said hosiery being retained by said traversing means during said movement, and means for causing said traversing means to release said hosiery at the end of a predetermined movement.

4. A hosiery turning and stacking apparatus comprising a hosiery form, said form having a hosiery receiving passage extending therethrough, a traversing means movable into sealed communication with said passage, a positive displacement pump means for applying a pneumatic pressure differential to the interior of said passage whereby hosiery is drawn through said passage and into engagement with said traversing means, and means responsive to a change in said pneumatic pressure differential produced by the presence of hosiery at said traversing means for causing a traversing movement of said traversing means along a predetermined path whereby hosiery is drawn in elongated outstretched relation along said path.

5. A hosiery turning and stacking apparatus comprising a hosiery form, said form having a hosiery receiving passage extending therethrough, a traversing means movable into sealed communication with said passage, a positive displacement pump means for producing a vacuum in the interior of said passage whereby hosiery is drawn through said passage and into engagement with said traversing means, and switch means responsive to change in degree of vacuum produced by the presence of hosiery at said traversing means for causing a traversing movement of said traversing means along a predetermined path whereby hosiery is drawn in elongated outstretched relation along said path.

6. A hosiery turning and stacking apparatus comprising a hosiery form, said form having a hosiery receiving passage extending therethrough, a traversing means movable into sealed communication with said passage, a positive displacement pump means for producing a vacuum in the interior of said passage whereby hosiery is drawn through said passage and into engagement with said traversing means, means responsive to change in degree of vacuum produced by the presence of hosiery at said traversing means for causing a traversing movement of said traversing means along a predetermined path, said hosiery being retained by said traversing means during said movement, and means for causing said traversing means to release said hosiery at the end of a predetermined movement.

7. A hosiery turning and stacking apparatus comprising a hosiery form, said form having a hosiery receiving passage extending therethrough, a traversing means movable into sealed communication with said passage, pump means for producing a pneumatic pressure differential, said pump means being continuously connected to said traversing means, said pneumatic pressure differential

being applied to said passage when said traversing means is in sealed communication with said passage whereby hosiery is drawn through said passage and into engagement with siad traversing means, means responsive to a change in said pneumatic pressure differential produced by the presence of hosiery at said traversing means for causing a traversing movement of said traversing means along a predetermined path whereby hosiery is drawn in elongated outstretched relation along said path, said hosiery being retained at said traversing means by pneumatic pressure differential during said traversing movement, and means for removing said pneumatic pressure

differential at said traversing means at the end of a predetermined traversing movement whereby said hosiery is released by said traversing means.

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