United States Patent

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[54] **CONTROL SYSTEM FOR CYCLICALLY OPERATED STITCHING MACHINES**
7 Claims, 4 Drawing Figs.

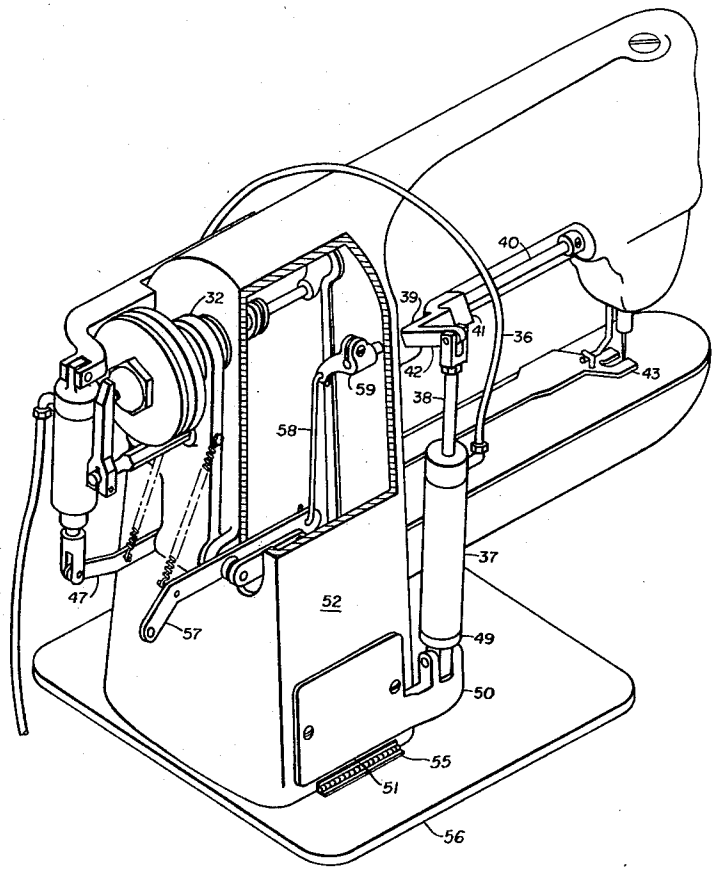
[52] **U.S. Cl.** **112/67**
[51] **Int. Cl.** **D05b 69/20**
[50] **Field of Search** ..... 112/67, 65, 219, 219 (A), 220, 239, (Suction Digest), (Fluid Flow Digest)

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ABSTRACT: An improved demountable control system for cyclically operated stitching machines. The system interlocks the functions of (1) raising and lowering of the fabric-holding presser foot, and, (2) machine starting, with preexisting machine functions. A single-foot pedal serves for operator control.



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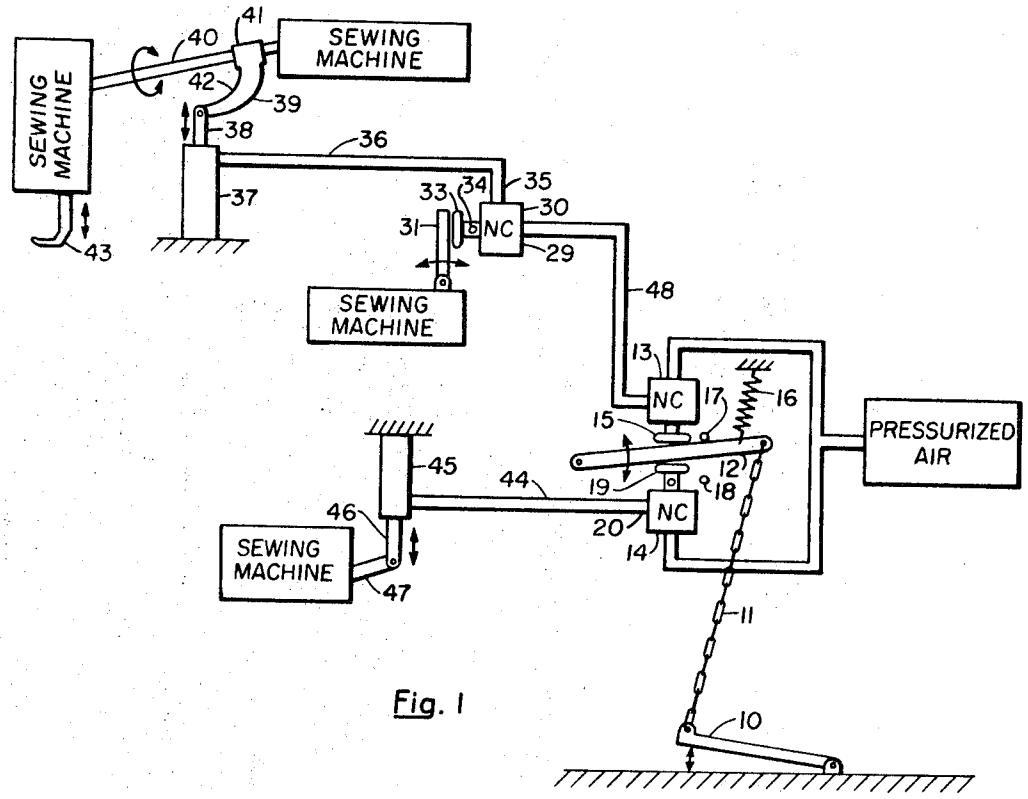


Fig. 1

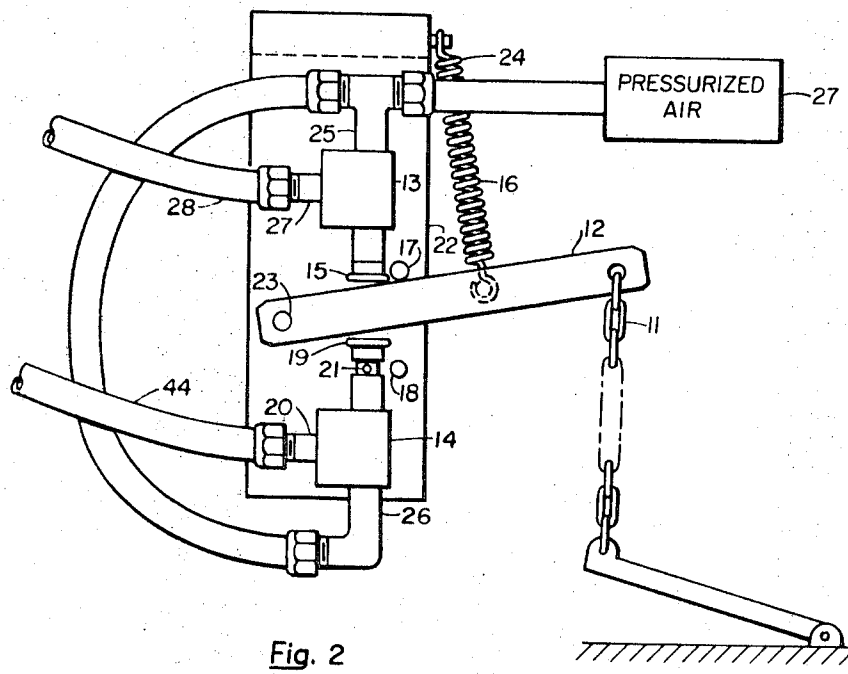


Fig. 2

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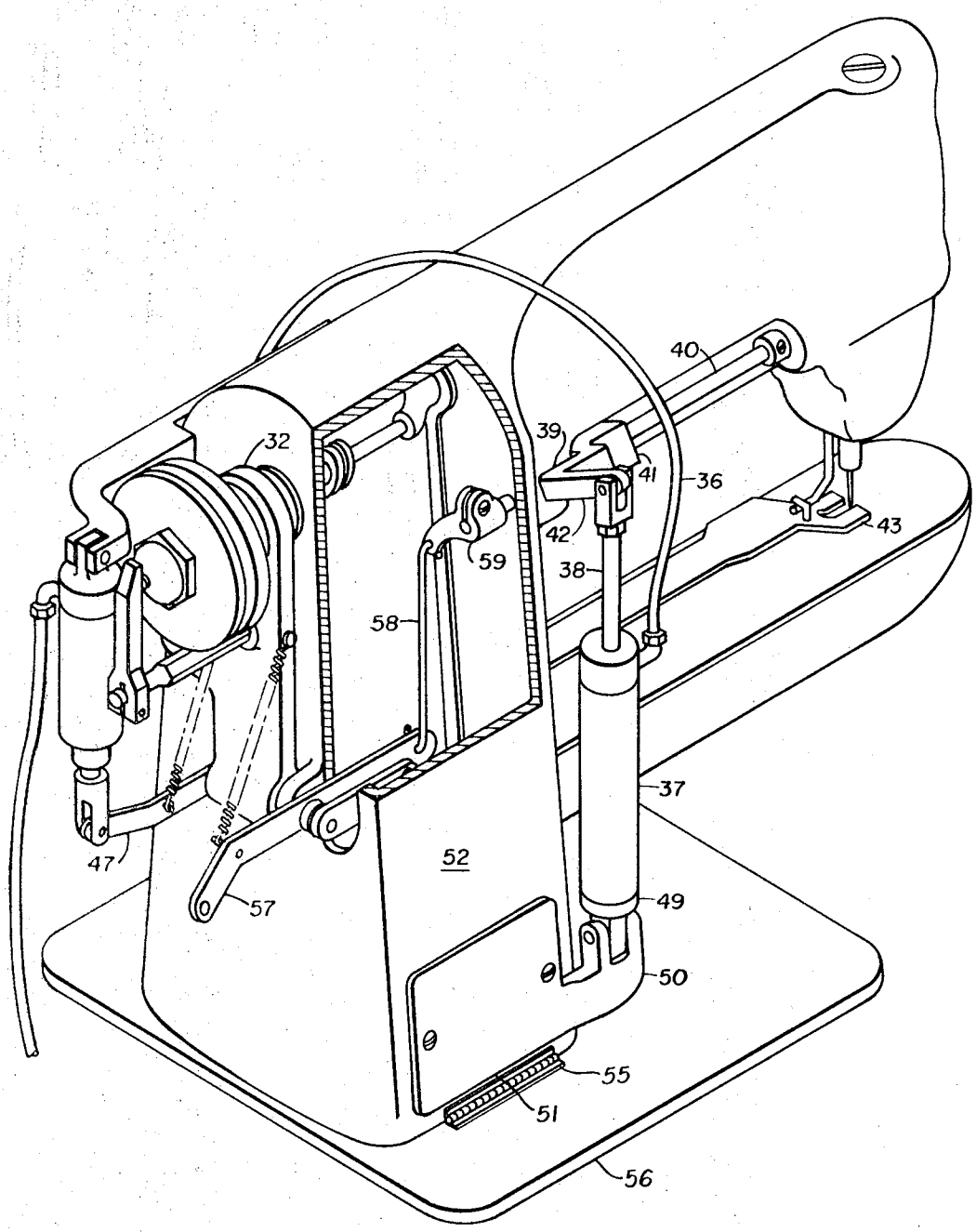


Fig. 3

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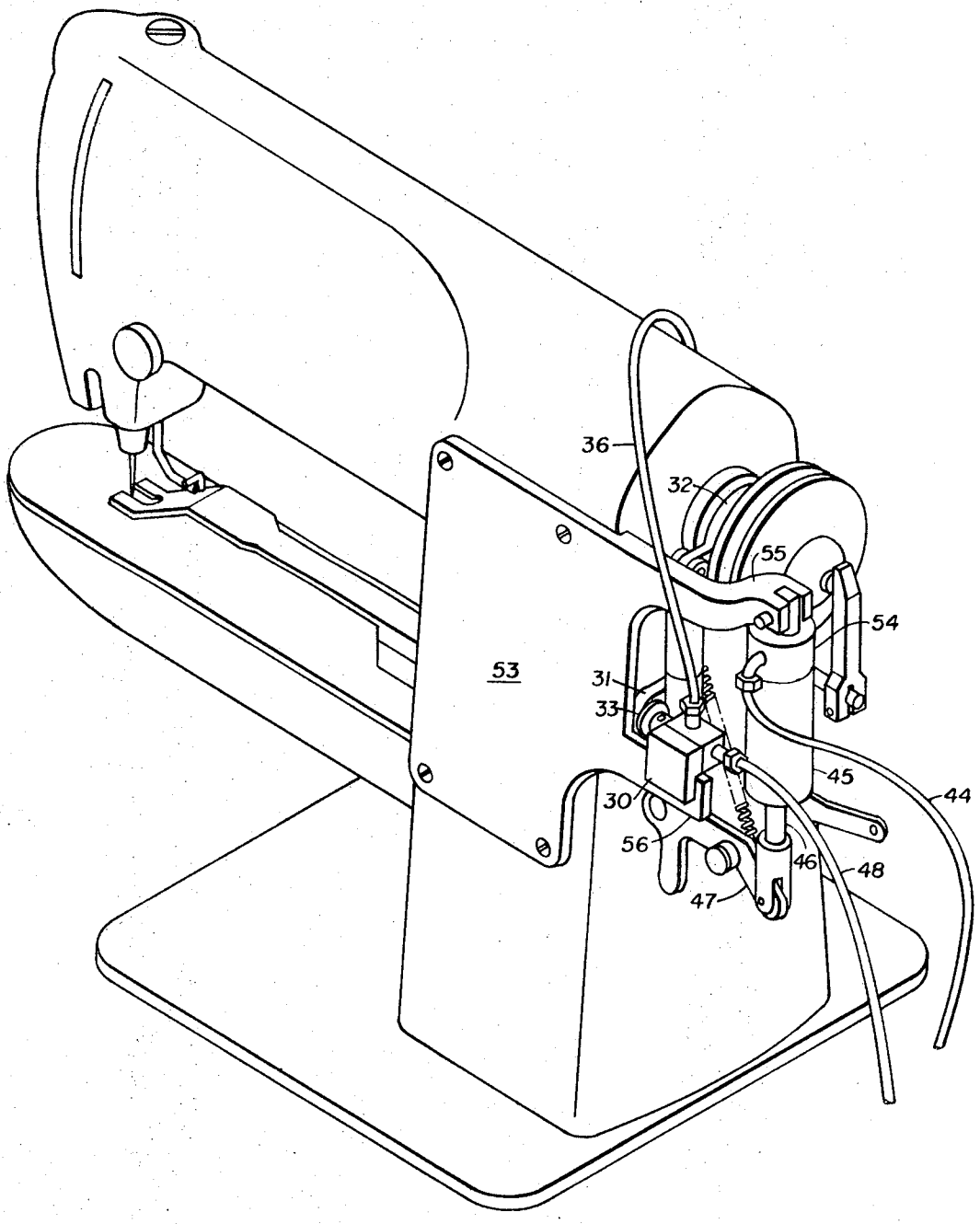


Fig. 4

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CONTROL SYSTEM FOR CYCLICALLY OPERATED STITCHING MACHINES

FIELD OF THE INVENTION

This invention relates to control systems for cyclically operated stitching machines, particularly tackers of the Model 269 series of the Singer Sewing Machine Company.

DESCRIPTION OF PRIOR ART

Cyclically operated stitching machines include those stitching machines which, when activated, sew a predetermined number of stitches and then automatically deactivate themselves.

Control systems for cyclically operated stitching machines conventionally comprise two pneumatic cylinders and a complicated pneumatic control system controlled by an operator. One piston rod will be attached by a chain, cable or lever to that machine mechanism which raises and/or lowers the presser foot. The other piston rod will be connected similarly to the start-motion machine mechanism. In some systems one operator-controlled foot pedal is provided for each pneumatic cylinder. Other systems utilize a single-foot pedal. Complicated, elaborate schemes have been conceived to interlock the presser foot raising function with the machine start-stop function. Consequently, these prior art systems consume valuable operator time in manipulating the control system, are relatively slow in reaction time, are expensive to manufacture, and are the source of much machine downtime.

The present invention is of the single foot-pedal-type control system. A primary purpose of this invention is to provide a control system which reacts substantially instantaneously with operator activation, is uncomplicated in design, relatively maintenance free, and therefore economically desirable.

A further problem associated with prior art control systems is "operator participation." By this term it is meant that the prior art systems require excessive participation by the operator. In the textile industry particularly, operator output is critical in that the operator's salary is most frequently dependent upon the quantity of the operator's output. This situation promotes speed on the part of the operator. Speed promotes a relatively greater number of operator errors. It is also an object of the present invention to reduce operator participation in the stitching operation to a minimum.

As pertains to the control function of raising the workpiece clamp, traditionally, the prior art systems are connected to a lever which, when moved, will open or close the clamp. Many existing machines, Singer Model 269 series, of the Singer Sewing Machine Company, for example, are provided with a lever projecting from the head of the machine to which the control system of one's choice may be attached for opening and/or closing the clamp.

In the Singer Model 269 series, this lever is pivotally mounted at its approximate center in the machine housing. Thus one portion of the lever extends interiorly of the housing. By means of a slender rod, this interiorly disposed end of the lever is operatively connected to a shaft whose rotation effects raising of a presser foot (workpiece clamp). The rod-to-shaft connection is through a connector comprising a collar section encircling the shaft and clamped in frictional contact therewith, and an arm integral with the collar section and projecting there from normally to the longitudinal axis of the shaft and receiving the rod. To activate this lever requires significant force. This force is transmitted through the aforesaid slender rod, the frictional connector and the shaft to effect movement of the presser foot. A great part of the malfunctions of these 269 and other like models occur within this lever-to-presser foot force-transmission mechanism. Basically, these malfunctions involve mechanical failure of the slender rod and/or slippage of the friction connector on the shaft, hence improper rotation of the shaft, hence improper movement of the presser foot. The rod and rod-to-shaft connection, being located interiorly of the machine housing, are relatively inaccessible for maintenance purposes. Consequently, these malfunctions result is excessive down time of the machine and large repair costs.

Known prior art pedal-actuated pneumatic control systems require the operator to pass the pedal to and through several discrete positions. By "discrete positions" it is meant that the pedal must be moved by the operator away from a position and to a different definite position to obtain partial performance of the overall control function. To obtain performance of the full control operation, the pedal of prior art systems must move sequentially to, and then on through, several such discrete positions.

In the present invention, the operator control possesses only two positions, both of which are operative positions. By means of this concept, there is provided a control system of improved speed and simplicity of operation, hence increased operator productivity. Other advantages will become apparent from the following description.

SUMMARY OF THE INVENTION

The present invention is an improved demountable, single-foot-pedal-operated, control system for cyclically operated stitching machines. Single-acting pneumatic cylinders mounted directly on the machine, and whose piston rods are directly connected to the presser-foot-raising machine mechanism and to the start-motion machine mechanism, are sequentially activated and deactivated by a single depression-release movement of the foot pedal. The pneumatic transfer arrangement comprises first and second valves means operatively disposed one each on opposite sides of a single lever operable by the operator from a first resiliently biased operative position of engagement with the first valve means to a second operative position of engagement with the second valve means. A third valve means, serially connected with the first valve means and operatively disposed with respect to a preexisting machine mechanism movably responsive to machine start-stop motion, combines functionally with the first valve means to effect raising of the presser foot only when the machine is inoperative. Actuation of the second valve means effects startup of the machine cycle. Each valve means is provided with automatic downstream exhausting means operative when the valve means is disengaged.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a diagrammatic representation of the present control system and illustrating the relationship of the various components thereof as between themselves and as between the system components and the stitching machine;

FIG. 2 is a front elevation view of the fluid control means employed in the present invention;

FIG. 3 is an isometric representation of a Singer series 269 model cyclically operated stitching machine and depicting the presser foot raising portion of the present control system, and also including a cutaway view of the prior art mode of transmitting force to the presser foot to raise the same; and

FIG. 4 is an isometric representation of the stitching machine of FIG. 3 and depicting that portion of the present control system associated with startup of the stitching machine, as well as the relationship of one valve means and that portion of the machine responsive to start-stop motion of the machine and operatively associated with said valve means.

DESCRIPTION OF PREFERRED EMBODIMENT

The present invention is depicted diagrammatically in FIG. 1. A single pivoted foot pedal 10, adapted for movement thereof by an operator is connected by means of a chain 11, or the like, to a lever 12 pivotally mounted between a first normally closed valve 13 and a second normally closed valve 14. Lever 12 is resiliently biased in contact with the spindle 15 of valve 13 by means of spring 16. Stop means 17 and 18 are provided to limit the travel of lever 12 when moving under the influence of spring 16 or operator control. It is noted that when the foot pedal is depressed by an operator, lever 12 will move

away from contact with spindle **15** and into contact with spindle **19** of valve **14**.

Valves **13** and **14** are identical in construction and operation. Referring to FIG. **2**, in each valve, (valve **14** being typical) the spindle **19** is resiliently biased in the "out" position. This is the "closed" position, hence the valve is normally closed. When closed, the valve is designed to provide a passageway from its outlet side **20** through its spindle **19** to an exhaust port **21** in the spindle. This ability of the valve, when closed, to exhaust downstream pressure is critical to the present invention as will become apparent hereinafter.

The spatial relationship of valves **13** and **14** and lever **12** is depicted in FIGS. **1** and **2**. In a preferred embodiment, valves **13** and **14** are fixedly secured to a base **22** adapted to mount on preexisting machine support superstructure or on the machine itself as desired. The valves are aligned vertically with their spindle axes coincident. Lever **12** is pivoted by bolt means **23** to base **22** and extends laterally between the spindles **15** and **19** such that pivotal movement of the lever vertically upward will push spindle **15** in and thus open valve **13**. Pivotal movement of the lever vertically downward will permit spindle **15** to move out, closing valve **13**, and will push spindle **19** in and thus open valve **14**. Lugs **17** and **18** are provided on base **22** to limit the pivotal movement of lever **12**.

As shown in FIG. **2**, a spring **16** secured at one of its ends **24** to base **22** and at its other end to lever **12** maintains lever **12** resiliently biased upward in contact with spindle **15** thereby maintaining valve **13** open at all times except when the lever is pulled downward by an operator acting through the foot pedal.

The inlets **25** and **26** of valves **13** and **14**, respectively, are connected to a common source of pressurized air **27** as depicted in FIGS. **1** and **2**. The outlet **27** of valve **13** is connected, by means of conduit **28**, to the inlet **29** of a third normally closed valve **30**. This third valve **30** is identical in construction and operation to the aforedescribed valves **13** and **14**. Preferably, valves **13**, **14** and **30** are of the type described as Model MJV-3 in undated Bulletin No. 166 of Clippard Instrument Laboratory, Inc., Cincinnati, Ohio.

Valve **30** is disposed proximately to a preexisting lug portion **31** extending laterally from a yoke **32** (See FIG. **4**) preexisting on the stitching machine and depicted schematically in FIG. **1**. This yoke **32**, hence the lateral lug **31** reciprocates with "start" and "stop" of the machine. When the machine stops, the yoke and its lug move to the right in FIG. **1**, thus contacting spindle **33** of valve **30** and pushing the spindle in to open valve **30**. When the machine starts, the yoke and its lug move away from the spindle and valve **30** closes. Of course, when valve **30** is closed, its downstream side is exhausted to the atmosphere through port **34** in spindle **33**. The outlet **35** of valve **30** is connected by conduit **36** to a single-acting air cylinder **37**. The piston **38** of air-cylinder **37** is operatively connected, by appropriate means such as fitting **39**, to preexisting shaft **40** on the stitching machine. The connection between piston **38** and shaft **40** must be such as will result in the linear travel of piston **38** imparting rotational motion to shaft **40**. As depicted in FIGS. **1** and **3**, this connection can be accomplished by means of fitting **39** comprising a collar portion **41** fixedly secured on shaft **40** having an arm portion **42** integral with the collar portion and extending therefrom to receive piston **37**. On the stitching machine in question, shaft **40** operates through preexisting mechanical connections to raise and lower the fabric-holding presser foot **43** of the machine.

The outlet **20** of valve **14** is connected by means of conduit **44** to a single-acting air cylinder **45** whose piston **46** is connected directly to the "start" lever **47** of the stitching machine.

The Singer Model 269 series stitching machine is cyclically operated. After being started, the machine performs a predetermined member of stitches and automatically shuts itself off.

In a typical stitching operation controlled by the present invention and starting from the "stop" position of the machine, the operator positions the fabric and depresses the foot pedal to commence an automatic stitching cycle. The pedal can be immediately released by the operator. As will become apparent hereinafter, no harm can occur if the operator fails to release the pedal, however.

Depressing the foot pedal first closes valve **13**, exhausting air pressure downstream as far as air cylinder **37** and allows the presser foot **43** to lower by virtue of its spring-biased-lowered design (valve **30** is open when the machine is stopped). Secondly, valve **14** is opened by the motion of lever **12**, admitting pressurized air to air cylinder **45**, which in turn acts to move lever **47** and start the machine. Partly by virtue of the spatial relationship of valves **13** and **14** and lever **12** and partly by virtue of the overall design of the present control system, lowering of the presser foot and startup of the machine occur sequentially but almost simultaneously. Thus the reaction time of the machine is very small, yet the control is positive, thereby enhancing an operator's output.

Upon startup of the machine, the yoke **32** (FIG. **4**) and its lug **31** move away from spindle **33** of valve **30** and the valve closes. Valve **30** remains closed so long as the machine is running and thus precludes raising of the presser foot during the stitching cycle. The downstream exhaust feature of valve **30** acts as a further safeguard against unforeseen pressure buildup within cylinder **37** and inadvertent raising of the presser foot.

The operator can immediately release the foot pedal whereupon lever **12** returns to contact with spindle **15** of valve **13** and thus opens said valve. Air pressure is thereupon reestablished within conduit **48** up to, but not past, valve **30**. Once lever **12** has moved away from spindle **19** of valve **14**, air pressure downstream of valve **14** (within conduit **44** and cylinder **45**) exhausts and the piston **46** of air cylinder **45** is free. At this point it is noted that before the cycle is completed fluid pressure has been established to a point in the system such that at the moment the machine becomes inoperative upon completing its stitching cycle, and valve **30** opens, the presser foot will be raised without further effort or influence of the operator. This feature of the present invention has proven significant in increasing operator output.

After cycling, the machine automatically stops, lever **47** moves to an "off" position, the lug **31** of yoke **32** moves into contact with spindle **33** of valve **30** and opens said valve, permitting air pressure to pass to air cylinder **37** hence raising the presser foot, all without operator effort or influence.

It is to be noted that as long as the operator maintains the foot pedal depressed, valve **14** will remain open and air pressure will be established to air cylinder **45** which, in turn, will maintain lever **47** in the "start" position. If the foot pedal is held down through a complete cycle, the only thing which can occur is commencement of another cycle. Importantly, the presser foot can never be raised even though the operator forgets to release the foot pedal since valves **13** and **30** automatically exhaust downstream when deactivated. Further, by virtue of the relationship of valve **30** to the lug **31** of yoke **32**, the presser foot can not be raised during machine cycling if the operator does release the foot pedal. It is therefore of importance to note the extreme simplicity of operation of the present control system. The operator's only function is to depress the foot pedal once. If the operator "rides" the foot pedal, that is keeps it partway down, no disastrous result will occur, for if the pedal is far enough down to allow valve **13** to close nothing occurs; if far enough down to open valve **14**, nothing occurs for lever **47** is already in the "start" position. This simplicity of operation has been demonstrated to be a vast improvement over prior art foot-pedal-operated control systems, particularly those wherein the operator, through the foot pedal, maintains a positive control over the raising and lowering of the presser foot and/or starting and stopping of the machine. Further this simplicity of operation is achieved in the present invention while providing complete safeguard against operator error.

Referring now to FIG. 3, wherein a Singer Model 269 tacker is schematically depicted, one may visualize the ready adaptability of the present control system to existing machines. To effect raising of the presser foot 43, air cylinder 37 is secured at its base end 49 to a yoke 50 extending from a plate 51 bolted to the machine housing 52. This piston 38 of the air cylinder is pivotally bolted to the arm portion 42 of fitting 39 whose integral collar portion 41 is fixedly secured to the preexisting shaft 40 of the machine. Conduit 36 leads from cylinder 37 to valve 30 (see FIG. 4.).

As shown in FIG. 4, valve 30 and air cylinder 45 are mounted on the machine by means of a plate 53 bolted to the machine housing. The base end 54 of cylinder 45 is mounted on yoke 55 extending from the plate. The piston 46 of cylinder 45 is pivotally connected to the "start" lever 47 preexisting on the machine. Valve 30 is fixedly secured on arm 56 also extending from plate 53. As positioned, the spindle 33 of valve 30 is presented to the lug 31 of yoke 32 for coaction therewith as has been described hereinbefore. Conduits 48 and 44 lead from valve 30 and cylinder 45 to the control arrangement shown in FIG. 2.

Plates 51 and 53 are chosen to be dimensionally identical to preexisting maintenance port covers. Thus in attaching the present control system to the preexisting machine, one need only remove the preexisting covers, mount plates 51 and 53 over the ports, attach base 22 to the machine table, secure fitting 39 to shaft 40, connect pistons 38 and 46, and connect a preexisting foot pedal to lever 12.

It is noted that cylinder 45 is mounted above "start" lever 47 and the piston 46 is connected directly to lever 47. As previously stated, the prior art control systems employ a chain or cable as the connecting link between the piston and the lever. To perform maintenance on the underside of the machine, the typical machine is designed to be tilted backward with respect to its mounting platform 56 by means of hinge 55. During this operation, the chain must be disconnected so as to avoid entangling it in the machine. The present invention eliminates this chain, as well as the like chain normally associated with the presser foot-raising lever 57, hence reduces maintenance downtime. However, by mounting cylinder 45 above lever 47, the inventor simultaneously achieves compactness, positive engagement with the "start" lever, and retains the ability to employ a chain for manual control of the machine in the event there occurs a loss of pneumatic pressure. As may be visualized from FIGS. 3 and 4, to convert from control by the present invention to manual control, one need only disconnect pistons 38 and 46 and connect control chains to levers 47 and 57. No part of the present control system will interfere with conversion or reconversion of a machine to manual control.

The present control system bypasses the troublesome portion of the prior art presser-foot-raising mechanism. By operatively connecting piston rod 38 to shaft 40 (FIG. 3), the present invention eliminates the destructive forces imposed upon the lever 57, slender rod 58, and friction fitting 59. Consequently, machines fitted with the present control system enjoy significantly less downtime and concomitant economic benefits over prior art control systems.

I claim:

1. Apparatus for effecting the sequential functioning of the presser foot and cycling of a platform mounted cyclically operated stitching machine having a shaft whose rotation effects movement of the presser foot between clamping and unclamping positions, a cycle actuator, and means reciprocatable in response to start and stop of said machine, said stitching machine including means to permit tilting thereof with respect to said platform to expose the underside of said machine, comprising, in combination with said stitching machine:

first and second piston and cylinder actuators, each of said cylinders having a base means:

first and second mounting means pivotally securing the respective bases of said cylinders on or above the upper surface of said platform, said first cylinder being mounted with its accompanying piston element disposed adjacent said shaft and said second cylinder being mounted with its accompanying piston element disposed adjacent said cycle actuator;

link means pivotally connecting said first piston element to said shaft whereby movement of said piston within its respective cylinder in response to pressure applied to said cylinder produces rotation of said shaft and movement of said presser foot to its unclamping position;

rigid connector means pivotally joining said second piston element to said cycle actuator whereby movement of said piston within its respective cylinder in response to pressure applied to said cylinder moves said cycle actuator to commence the stitching cycle, and whereby said pivotal mountings of said pistons and cylinders permit tilting of said machine with respect to said platform without disconnecting said actuators;

a source of pressurized fluid;

duct means joining said source of pressurized fluid with said cylinders; and

valve means interposed in said duct means, and valve control means controlling the flow of pressurized fluid to said cylinders in accordance with a selected sequence.

2. The apparatus of claim 1 wherein said valve means comprises first and third normally closed valves, each including spindle elements, said spindle elements of said valves being aligned coincidentally and spaced apart, and operator controlled lever means disposed between said valve spindles whereby movement of said lever into contact with said third valve and away from said first valve opens said third valve and permits said first valve to close, and movement of said lever into contact with said first valve and away from said third valve opens said first valve and permits said third valve to close, means biasing said lever against said spindle of said first valve, and second valve means serially connected between said first valve and said first cylinder and having its spindle disposed adjacent said reciprocatable machine component whereby said machine component moves into contact with said spindle of said second valve and opens said valve when said machine stops.

3. The apparatus of claim 2 and including a base member, said lever and said first and third valves being mounted on said base member, said valves being secured on opposite sides of said lever, and said biasing means comprising spring means secured at one of its ends to said base member and at its other end to said lever whereby said first and third valve means and their actuator are readily mounted to said platform.

4. The apparatus of claim 1 wherein said first and second mounting means comprise first and second plate means including a yoke, said bases of said first and second cylinders being pivotally received in respective ones of said yokes.

5. The apparatus of claim 4 wherein said plate means are secured directly to said stitching machine.

6. The apparatus of claim 4 wherein said first and second plate means are secured on opposite sides of said stitching machine.

7. Apparatus for effecting the sequential functioning of the presser foot and cycling of a platform mounted cyclically operated stitching machine having means for moving the presser foot between clamping and unclamping positions, a cycle actuator, and means reciprocatable in response to start and stop of said machine, said stitching machine including means to permit tilting thereof with respect to said platform to expose the underside of said machine, comprising, in combination with said stitching machine:

first and second piston and cylinder actuators, each of said cylinders having a base means,

first and second mounting means pivotally securing the respective bases of said cylinders on or above the upper surface of said platform, said first cylinder being mounted with its accompanying piston element disposed adjacent said means for moving said presser foot and said second cylinder being mounted with its accompanying piston element disposed adjacent said cycle actuator;

means connecting said first piston element to said means for moving said presser foot whereby movement of said piston within its respective cylinder in response to pressure applied to said cylinder produces movement of said presser foot to its unclamping position;

rigid connector means pivotally joining said second piston element to said cycle actuator whereby movement of said piston within its respective cylinder in response to pressure applied to said cylinder moves said cycle actuator to commence the stitching cycle, and whereby said pivotal mountings of said pistons and cylinders permit tilting of said machine with respect to said platform without disconnecting said actuators;

a source of pressurized fluid;

duct means joining said source of pressurized fluid with said cylinders;

valve means interposed in said duct means; and

a valve control means controlling the flow of pressurized fluid to said cylinders in accordance with a selected sequence.