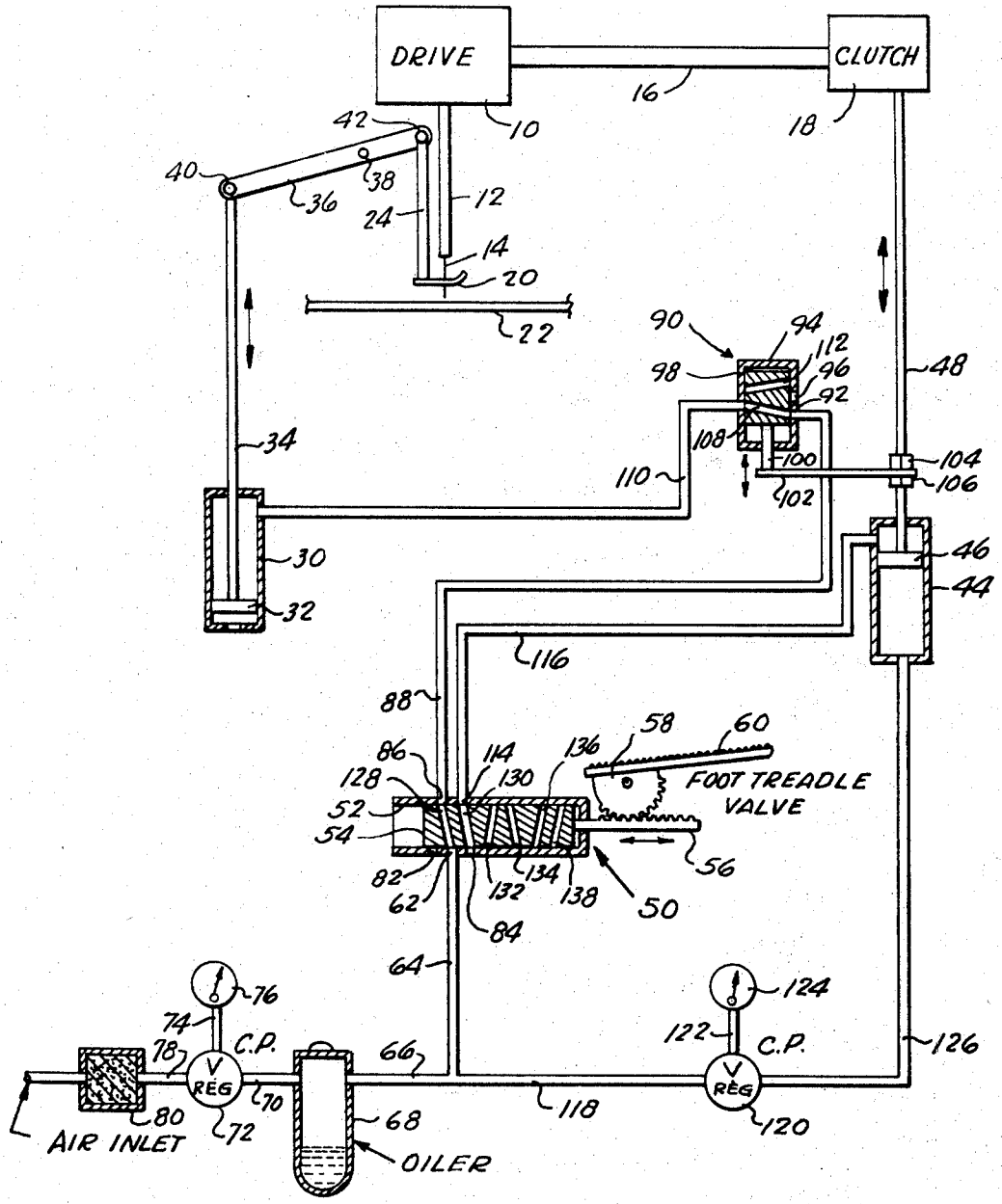
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AUTOMATIC AIR LIFT FOR SEWING MACHINES

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AUTOMATIC AIR LIFT FOR SEWING MACHINES

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ABSTRACT OF THE DISCLOSURE

A pneumatic control system for a sewing machine pressure foot and drive mechanism having a four-way three-position open exhaust center valve connected to an air inlet and to two piston actuators for selectively lifting the pressure foot in a first position, lowering the pressure foot in a center second position of the valve, and actuating the drive mechanism in the third position of the valve and a valve to prevent the pressure foot from being lifted while the drive mechanism is energized is described.

Background of the invention

Field of the invention.—This invention relates to sewing machines and particularly to sewing machine control mechanisms and systems.

Description of the prior art.—Mechanisms and systems for automatically controlling all or part of sewing machine operations are well known in the prior art. Such systems are described, for example, in Patents No. 2,722,184, Sweet, Nov. 1, 1955; No. 2,758,556, Hopkins, Aug. 14, 1956; No. 3,156,204, Harnish et al., Nov. 10, 1964; and No. 3,245,369, Myska, Apr. 12, 1966. The present invention differs from those of the prior art in that a control system which is entirely fluid controlled and operated is disclosed. In addition, a novel three-position valving arrangement permits more versatile control of sewing machines than the devices heretofore described.

Summary

The present invention is directed to a control system for sewing machines in which the pressure foot is normally held in a raised position, away from a sewing surface, at the normal first position of a three-way valve. When the valve is pressed to a center second position, the pressure foot is permitted to fall or be depressed to engage the material to be sewn but the sewing machine is held in a de-energized condition to permit adjustment and checking of the adjustment of the material to be sewn and, in the third position of the valve, the sewing machine pressure foot is held or permitted to remain in the depressed position engaging the material to be sewn and the sewing machine is energized. A safety valve mechanism is provided to prevent the sewing machine pressure foot from being lifted at any time while the sewing machine is energized. The specific novelty and the object of the invention relates to the combination of two fluid actuators, a fluid valve, and, in the preferred embodiment, a safety fluid valve combined in the specific manner disclosed to accomplish the novel control described.

Brief description of the drawing

The figure discloses the system of the invention showing some of the elements in partial cross-section, the system generally being shown in schematic form.

Description of the preferred embodiments

Reference is now made to the drawing in detail. The control system of this invention is intended for use with sewing machines such as are well known in the prior art and which include a drive mechanism shown generally

at **10** which is connected by an operator of conventional type shown generally at **12** to a needle **14** which accomplishes the sewing operation. The drive mechanism is controlled through an interconnection **16** by a clutch **18** or by another energizing control mechanism. Since the control system of this invention is wholly pneumatic and is connected to conventional sewing machines which may be hydraulically, electrically, or mechanically operated, the details of the sewing machine are not shown. In addition, the actual sewing machine construction constitutes no part of the present invention. The control system described herein may be used on household sewing machines but its most valued application is relative to heavy industrial sewing machines such as may be used for shoes, or heavy production work. Such sewing machines conventionally include a pressure foot **20** which is positioned above or adjacent a sewing surface **22**. The pressure foot may be controlled by a connecting or actuating rod or mechanism **24**. Similarly, the exact details of the pressure foot and its relation to the sewing surface is of no consequence to the present invention and is well known in the prior art.

The control system of this invention includes a first fluid actuator which may be a cylinder **30** having a piston **32** therein which is connected by a rod **34** to a lever **36** which may be pivoted at a point **38** and connected at its respective ends by pivotal connectors **40** and **42** to the rod **34** and control rod **24**, respectively, to lift and to permit lowering of the shoe. Normally, the shoe may be biased, such as by a spring, a counterweight, or may have sufficient weight in and of itself to lower once it is released. Since such biasing mechanisms are a conventional part of sewing machines no further description is deemed necessary.

The control system also includes a second fluid actuator which may be a cylinder **44** having a piston **46** therein which is connected by rod **48** to the clutch **18** or to the drive mechanism control of whatever nature the sewing machine includes. Obviously, a clutch, an electric switch, a pneumatic valve, or the equivalent energization control for the drive mechanism may be connected in any desired manner to the fluid actuator.

Fluid actuators such as Bimba air cylinders, model 091–B, with a piston rod clevis have performed satisfactorily in operation. Obviously, equivalent fluid actuators would also be satisfactory.

The invention also includes a four-way three-position open exhaust center valve shown generally at **50**. The valve **50** is shown in a generally schematic manner in partial cross-section to illustrate its working mechanisms. The Wabco model PA23501–1200 Super Spool Valve is a valve of this type; however, any valve having an equivalent operation would also perform satisfactorily. In the preferred embodiment, the valve is a foot treadle valve; however, a hand operated valve would also be satisfactory where hand operation was desired. The valve, in its schematic form, includes a cylinder **52** and a piston **54** mounted for reciprocable movement therein. The reciprocable movement of piston **54** is controlled by a rod **56** which, schematically is shown as a rack which is controlled by a pinion **58** which is in turn controlled by a foot peddle **60**. In practice, more elegant control mechanisms are actually used but the nature of the control mechanism is not an essential feature of he present invention and the drawing is given as illustrative of the operation of the valve and is not intended to limit the actual physical construction of such a valve.

The valve has an inlet port **62** which is connected by conduits **64** and **66** to an oiler **68**, such as a Rego Mini Air Line Lubricator model 8741, or an equivalent type, and through conduit **70** to a constant pressure output regulator **72** which may include, connected to conduit

74, a pressure gauge 76. A Rego Air Line Regulator model 8701 or similar type has performed satisfactorily in operation. The regulator 72 is connected through conduit 78 to a Rego Air Line filter or similar type 80 and thence to an air inlet, which constitutes a source of air pressure.

Valve 50 also has exhaust ports 82 and 84 and a first outlet port 86 which is connected through conduit 88 to input port 92 of valve 90, which in a preferred embodiment may be a Clippered MJV–3 with a model 11916 Push Button Operator. Of course, any valve of equivalent operation would be satisfactory.

Valve 90, as schematically shown, may include a cylinder 94 having, in addition to inlet port 92, an exhaust port 96. A piston 98, which is controlled by a rod 100 which is in turn controlled by an operator arm 102 connected to rod 48 by adjustable means 104 and 106, is provided. Piston 98 has two passages, 108 and 112 therethrough. As shown in the figure, in a first position, passage 108 communicates from conduit 88 through inlet port 92 to conduit 110 and to cylinder 30. In the other position of valve 90, conduit 110 would communicate through passage 112 to vent port 96.

Referring again to valve 50, a second outlet port 114 is connected and communicates through conduit 116 to one end of cylinder 44. The other end of cylinder 44 is connected by conduit 126 to a regulator 120, which may be connected through conduit 122 to meter 124, and through conduit 118 to the air inlet. Normally, regulator 120 is adjusted to provide substantially lower pressure to the other end of cylinder 44 that may be applied to the first end of cylinder 44 through conduit 116.

Valve 50 is shown in a first position in which a first passage 128 permits communication between conduit 64 and conduit 88 and a second passage 130 permits communication between conduit 116 and vent port 84.

In a second position, which is the center position, both conduits 88 and 116 are vented through passages 132 and 134 respectively and vent ports 82 and 84 respectively.

In the third position conduit 88 is vented through passage 136 and vent port 82 while pressure is applied from conduit 64 through passage 138 to conduit 116.

Operation

The operation of the control system will be described with reference to the figure starting in its normal position, which is shown in the drawing. Valve 50 would normally be biased to the position shown in the drawing and would normally automatically return to this position; however, such biasing is not necessary to the operation.

In the position shown, air pressure is applied, at a first pressure which is regulated by pressure regulator 72 to conduit 64, passage 128 of valve 50, conduit 88, passage 108 of valve 90, and through conduit 110 to one end of cylinder 30. The pressure applied depresses piston 32 thereby raising pressure foot 20. This is the normal position of the sewing machine before the sewing operation is begun. It will be noted that the top of cylinder 44 is vented through conduit 116 and passage 130 to vent port 84. A pressure is applied through conduit 118 and regulator 120 and through conduit 126 to the other end of cylinder 44. Regulator 120 is adjusted to apply a considerably lesser pressure than is applied through conduit 64 to the other end of the cylinder 44 and constitutes a bias source for maintaining the sewing machine drive mechanism in de-energized condition. This also maintains valve 90 in the first position as shown in the drawing by maintaining actuator arm 102 in its upward position.

When it is desired to operate the sewing machine, the material to be sewn is placed between pressure foot 20 and sewing surface 22 and the valve 50 is moved to its center second position. In this position, conduit 116 is vented through passage 134 and piston 46 remains in the position shown. In the second position, however, conduit 88 is also vented through passage 132 and vent port 82. This permits pressure shoe 20 to move, under its own weight or through conventional bias means, into holding engagement with the material to be sewn. At this stage, the material to be sewn may be adjusted or the adjustment of the material may be checked. If it is desired to make additional adjustment of the position of the material to be sewn, the valve 50 is returned to its first position thereby lifting the pressure foot as previously described.

Once the material to be sewn is properly adjusted and the pressure foot is in its depressed condition, engaging the material to be sewn and securing it against the sewing surface 22, the valve is moved from its second position to its third position. In this position, conduit 88 is vented through passage 136 and vent port 82 as valve 50 is in the second position; but pressure is applied from conduit 64 through passage 138 to conduit 116 to the top of cylinder 46 to thereby depress piston 46. This actuates the drive mechanism for the sewing machine and starts the sewing machine cycle. When piston 46 moves downwardly, actuator arm 102 moves downwardly permitting piston 98 to move to its second position thereby venting cylinder 30 through passage 112 and vent port 96. This also prevents the application of air pressure through conduit 88 and conduit 110 to cylinder 30 at any time while the sewing machine drive mechanism is energized. This prevents the pressure foot from being lifted while the sewing machine is energized and thereby prevents accidents which may result as well as a defective sewing operation. It will be noted that it is necessary to maintain the pressure in conduit 126 at a sufficiently low value relative to the pressure in conduit 116 to permit piston 46 to move downwardly.

When the sewing cycle is completed, valve 50 is returned to its first position to lift pressure foot 20 and permit release of the material which has been sewn.

Obviously, the present control system may be used in conjunction with other control systems which perform specific functions with regard to other mechanisms in the sewing machine.

In addition, it will be realized that while the control system of this invention has been abstracted, summarized, and described in specific terms with reference to specific embodiments, the disclosure is drawn in specific terms to describe the operation of the system to those skilled in the art and the disclosure is not intended in the limiting sense. Apparatus equivalent to those described and shown may be used without departing from the spirit of the invention. The scope of the invention is defined in the appended claims.

I claim:

1. In a system for controlling a sewing machine wherein the pressure foot thereof is normally biased toward the material to be sewn and is actuated in coordination with the sewing machine drive mechanism, the improved control system comprising:

an air inlet conduit;

a four-way three-position open exhaust center valve having an inlet, two exhaust ports, and two outlets;

conduit means connecting the valve inlet to the air inlet conduit;

a first cylinder and first piston actuator connected to the pressure foot;

conduit means connecting the first cylinder to one of said valve outlets for moving said first piston to lift the pressure shoe when air pressure is applied to the first cylinder;

a second cylinder and second piston actuator connected to the drive mechanism;

conduit means connecting the second cylinder to the other of said valve outlets for moving said second piston to energize the sewing machine drive mechanism when air pressure is applied to the second cylinder;

the valve being movable between a first position wherein the first cylinder is supplied with air pressure to

lift the pressure foot and the second cylinder is vented to de-energize the sewing machine drive mechanism, a second position wherein the first cylinder is vented to allow the pressure foot to move downwardly to engage material to be sewn and the second cylinder is vented to de-energize the sewing machine drive mechanism, and a third position wherein the first cylinder is vented to allow the pressure foot to remain down in engagement with the material to be sewn and the second cylinder is supplied with air pressure to energize the sewing machine drive mechanism; and

means for sequentially moving the valve between the first, second and third positions.

2. The invention of claim 1 further comprising:

a two-position valve, in the conduit means connecting the first cylinder to a first valve outlet, for venting said first cylinder to prevent lifting of the pressure foot at all times when the drive mechanism is energized; and

means connected to the second piston for controlling said two-position valve.

3. The invention of claim 2 further comprising:

a constant pressure output regulator for reducing air pressure to a pressure lower than that applied to the valve inlet; and

conduit means connecting the regulator between the air inlet conduit and the second cylinder to bias the second piston to normally maintain the drive mechanism in de-energized condition.

4. In a system for controlling a sewing machine wherein the pressure foot thereof is normally biased toward the material to be sewn and is actuated in coordination with the sewing machine drive mechanism, the improved control system comprising:

a fluid inlet conduit;

a four-way three-position open exhaust center valve comprising

a housing having

an inlet;

first and second exhaust ports; and

first and second outlets;

a valve member movably mounted in the housing having

a first passage for connecting the fluid inlet to the first outlet;

a second passage for connecting the second fluid outlet to the second exhaust port when the first passage connects the fluid inlet to the first outlet;

a third passage for connecting the first fluid outlet to the first exhaust port;

a fourth passage for connecting the second fluid outlet to the second exhaust port when the third passage connects the first outlet to the first exhaust port;

a fifth passage for connecting the first outlet to the first exhaust port; and

a sixth passage for connecting the second outlet to the fluid inlet when the fifth passage connects the first outlet to the first exhaust port;

the valve member having a first position in the housing wherein the first and second passages are operative, a second position in the housing wherein the third and fourth passages are operative and a third position in the housing wherein the fifth and sixth passages are operative;

means for moving the valve member sequentially to the first, second and third positions;

a first cylinder and piston actuator connected to the pressure foot;

first conduit means connecting the cylinder of the first actuator to the first valve outlet for moving the piston of the first actuator to lift the pressure foot when fluid pressure is applied to the cylinder of the first actuator;

a second cylinder and piston actuator connected to the drive mechanism for selective energization thereof; and

second conduit means connecting the cylinder of the second actuator to the second valve outlet for moving the piston of the second actuator to energize the sewing machine drive mechanism when fluid pressure is applied to the cylinder of the second actuator;

whereby when the valve member is in the first position the pressure foot is held in a lifted position by fluid pressure in the cylinder of the first actuator; when the valve member is in the second position the pressure foot is allowed to move downwardly to engage the material to be sewn with the sewing machine drive mechanism being inactive; and when the valve member is in the third position the pressure foot remains down in engagement with the material to be sewn with the sewing machine drive mechanism being energized.

5. The system of claim 4 further comprising

a two-position valve in the first conduit for venting the cylinder of the first actuator independently of the position of the valve member at all times when the drive mechanism is energized, the two-position valve comprising

a housing having

an inlet;

an outlet; and

an exhaust port;

a valve member having

a first passage for connecting the inlet to the outlet;

a second passage for connecting the outlet to the exhaust port; and

means connected to the piston of the second actuator for moving the valve member of the two-position valve from a first position wherein the first passage connects the inlet and outlet of the two-position valve to a second position wherein the second passage connects the outlet and the exhaust port of the two-position valve upon movement of the valve member of the three-position valve to the third position.

6. In the system of claim 4 further comprising

a constant pressure output regulator for reducing air pressure to a pressure lower than that applied to the three-position valve inlet; and

third conduit means connecting the regulator between the fluid inlet conduit and the cylinder of the second actuator to bias the piston thereof to normally maintain the drive mechanism in de-energized condition.

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