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[54] **CONTROL SYSTEM FOR ASSEMBLING APPARATUS**

[75] Inventors: **Erich A. Schmidt; Volker E. Schmidt,** both of Lexington, Ky.

[73] Assignee: **Textron Inc.,** Providence, R.I.

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[52] **U.S. Cl.** ..... **29/208 C,** 29/207.5

[51] **Int. Cl.** **B23p 19/04**

[58] **Field of Search** ..... 29/208 C, 208 R, 208 D, 29/207.5, 208 F

[56] **References Cited**

UNITED STATES PATENTS

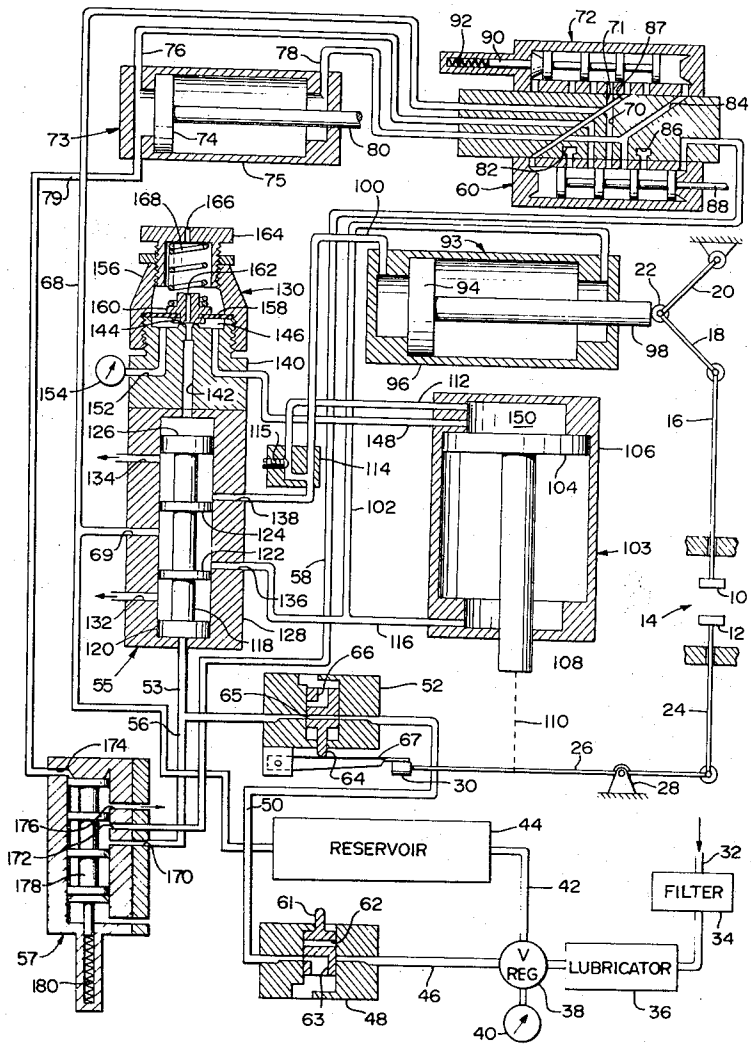
3,570,101 3/1971 Stead ..... 29/208 C

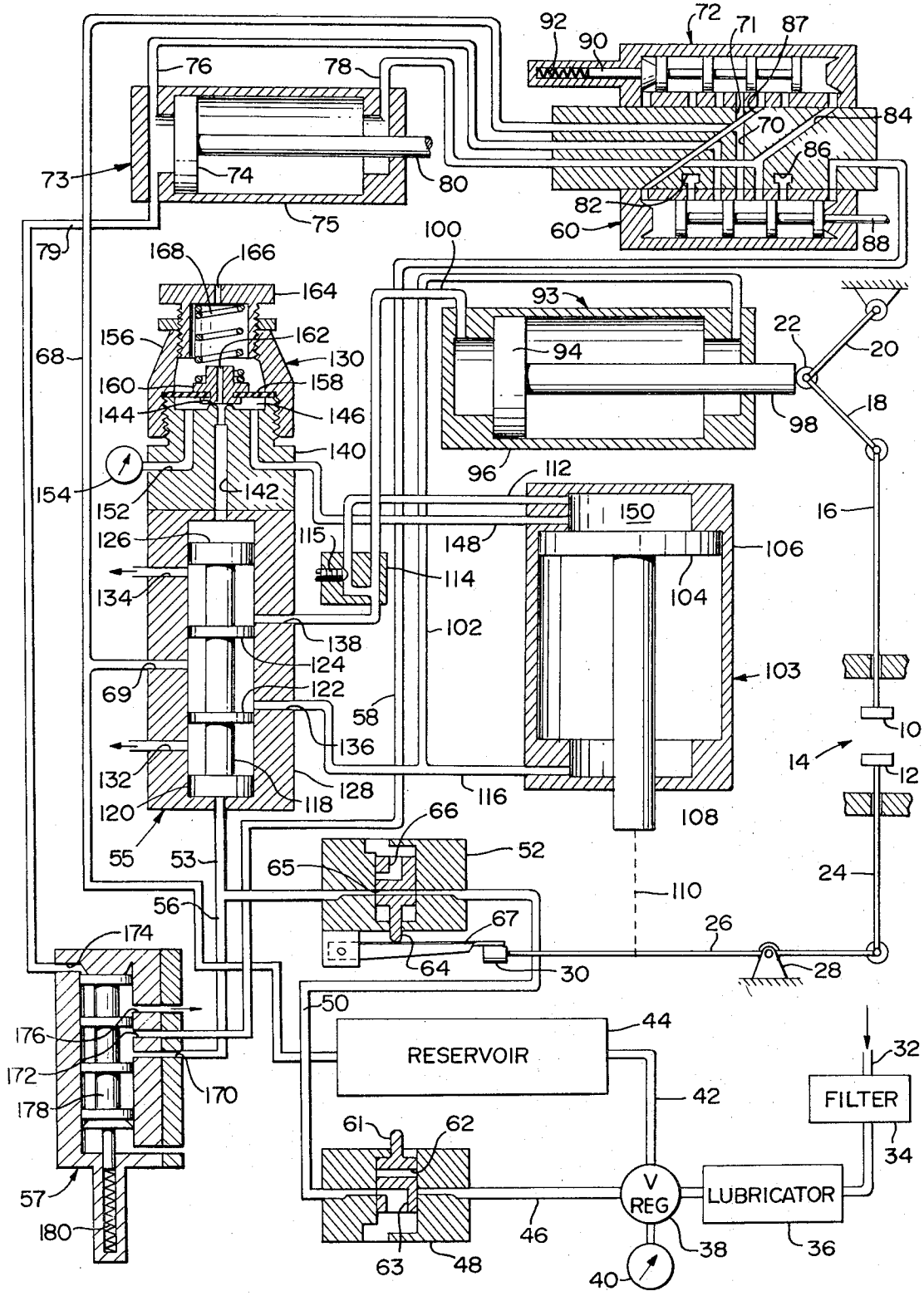
Primary Examiner—Thomas H. Eager

[57] **ABSTRACT**

A control system for apparatus for assembling head and backing elements of a fastener with a piece of material includes a ram driven by a fluid motor for moving a backing element to an attaching station, an anvil driven by a fluid motor for moving a head element to the attaching station, a control valve supplying pressure to the fluid motors to drive the ram and anvil, a restriction delaying the supply of pressure to the anvil during fluid motor such that the ram is moved toward the attaching station before the anvil, and a pressure responsive assembly sensing pressure at the anvil driving fluid motor and responsive to a predetermined pressure thereat to operate the control valve to separate the ram and anvil automatically after the ram and anvil meet. Delivery means for supplying the fastener elements to the ram and anvil is controlled by a cycle of a fluid motor and a cycle control valve is responsive to operation of the delivery fluid motor to prevent the supply of pressure to a control valve for the delivery fluid motor until the delivery fluid motor has completed a cycle.

20 Claims, 1 Drawing Figure

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CONTROL SYSTEM FOR ASSEMBLING APPARATUS

CROSS REFERENCE TO RELATED APPLICATION

This is a continuation-in-part application of pending application Ser. No. 270,755 filed July 11, 1972, now abandoned.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention pertains to control systems for assembling apparatus and, more particularly, to a fluidic control system for assembling apparatus for attaching fastener elements to a piece of material.

2. Discussion of the Prior Art

Fasteners such as buttons, snap fasteners, rivets and the like, characterized by including at least two components to be assembled together through a piece of material such as a garment, are becoming extremely popular due to the inexpensive manufacture thereof and the inexpensive assembly of the fastener elements with a piece of material. The components of such fasteners will hereinafter be referred to as head elements having prongs extending therefrom and mating backing elements for receiving the prongs of the head elements.

The head and backing elements are normally stored in separate hoppers and are fed via separate chutes to an attaching station where an anvil and ram drive the elements together to fix the fastener to the material. During the driving of the elements together the prongs of the head element are upset or deformed in the backing element to secure the fastener elements together.

Systems for controlling the operation of the anvil and ram apparatus for assembling fasteners must be extremely precise in order to avoid damage to either the fastener elements or the material to which they are to be fixed; however, in order to make such assembling apparatus economically feasible, such apparatus must be automatic and require as little manual labor and supervision as possible. To this extent, the control system should be as simple as is feasible and require a minimum of moving parts in order to avoid costly delays due to breakdown and replacement of parts.

Prior art control systems for such assembling apparatus have required precision meeting of the anvil and ram at the level of the material to which the fastener components are to be fixed; and, thereafter, the anvil and ram have been moved together, normally in the direction of movement of the ram, for a predetermined distance, which distance of travel of the ram and anvil is detected after a predetermined length to cause the ram and anvil to separate and return to their ready positions for uniting the next fastener elements to be supplied thereto. The operation of detecting movement of the ram and anvil is imprecise and further requires the use of structure subjected to shock and vibration and, therefore, prone to frequent replacement or fixing.

Another disadvantage of prior art control systems for assembling apparatus is that the delivery means for supplying the fastener elements to the attaching station, normally formed of hoppers and chutes as described above, is conventionally controlled by a fluid motor in such a manner that control system failure or untimely operation of the apparatus by an operator can adversely affect the cycling of the fluid motor. It is important that the cycling of the delivery means be maintained constant with each cycle completed prior to initiation of the next cycle in order to prevent jamming of the delivery means and improper and untimely positioning of the fastener elements at the attaching station.

SUMMARY OF THE INVENTION

The present invention is generally characterized in a control system for assembling apparatus having a ram and anvil driven toward each other, the control system including a ram driving fluid motor for controlling movement of the ram toward and away from the anvil, an anvil driving fluid motor for controlling movement of the anvil toward and away from the ram, control means having a drive state for supplying pressure to the ram driving fluid motor and the anvil driving fluid motor to drive the ram and anvil toward each other and a return state for separating the ram and anvil, a selectively operated valve for placing the control means in the drive state, and a pressure responsive assembly for sensing fluid pressure at the anvil driving fluid motor and placing the control means in the return state when the pressure at the anvil driving fluid motor exeeds a predetermined pressure whereby the ram and anvil are automatically separated after the ram and anvil meet.

The present invention is further generally characterized in a control system for apparatus for assembling fastener elements supplied by delivery means to an attaching station including a fluid motor for operating the fastener element delivery means, control valve means for moving the fluid motor through a complete cycle, selectively operated valve means for supplying fluid to commence operation of the apparatus, and cycle control means for supplying fluid from the selectively operated valve means to the control valve means to commence the cycle, the cycle control means being responsive to operation of the fluid motor once the cycle has commenced to prevent supply of fluid from the selectively operated valve means to the control means until the cycle is completed.

Accordingly, it is an object of the present invention to provide a control system for fastener assembling apparatus overcoming the above-mentioned disadvantages of the prior art.

Another object of the present invention is to construct a control system for assembling apparatus including a ram and anvil such that the ram and anvil meet with a predetermined pressure at an attaching station to limit the wearing of parts of the assembling apparatus.

A further object of the present invention is to separate a ram and anvil of an assembling apparatus after a predetermined pressure is applied to either the ram or anvil.

The present invention has another object in that a maximum pressure limit can be set with respect to the meeting of a ram and anvil of an assembling apparatus, and once the predetermined maximum pressure is reached the ram and anvil are separated.

Yet an additional object of the present invention is to provide a control system for a ram and anvil assembling apparatus including a pressure adjustment device for regulating the pressure at which the ram and anvil are separated after assembly of a fastener.

A further object of the control system of the present invention is to actuate a ram before an anvil of a fastener assembling apparatus such that a backing element carried by the ram engages a piece of material prior to the insertion of prongs of a head element carried by the anvil through the material and into the backing element for attachment thereto whereby damage to the material is minimized during assembly of the fastener elements.

Another object of the present invention is to prevent the supply of fluid to a control valve controlling the operation of a fluid motor operating delivery means to supply fastener element to an attaching station such that the control valve cannot be actuated until a full cycle of the fluid motor is completed.

Some of the advantages of the present invention over the prior art are that by separating the ram and anvil in response to pressure rather than distance, the chances of injury to personnel as well as damage to the material to which the components are fixed are reduced, there is less wear on the parts of the assembling apparatus and the control system, the pressure at which the ram and anvil separate is easily adjusted, and the fastener element delivery means is operated with constant uninterrupted cycling.

Other objects and advantages of the present invention will become apparent from the following description of the preferred embodiment taken in conjunction with the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

The FIGURE is a diagrammatic illustration of a control system according to the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

A control system according to the present invention is shown in the FIGURE and will be described hereinafter with respect to the attachment of a fastener composed of head and backing elements to a piece of material; however, the control system of the present invention is not limited to such use and may be utilized with any assembling apparatus wherein a ram and anvil or similar elements such as dies are driven together. The structure of the assembling apparatus relating to the delivery of the head and backing elements of the fastener to the ram and anvil does not form a part of the present invention and, accordingly, is not specifically described herein in that any suitable delivery means, such as a hopper and chute mechanism, may be utilized with the present invention to deliver elements to the ram and anvil. Reference is made, however, to copending patent application Ser. No. 205,550 filed Dec. 7, 1971, entitled "Snap Attaching Apparatus" and assigned to the assignee of the present application for further details and reference with respect to assembling apparatus with which the control system of the present invention may be utilized, the above-mentioned patent application being incorporated herein by reference.

The control system of the present invention is illustrated in the FIGURE as operating a ram **10** and an anvil **12** at an attaching station **14.** As mentioned above, a backing element will be supplied to ram **10** and a head element supplied to anvil **12** with a piece of material being positioned by suitable means between the ram and anvil. The ram **10** is mounted for vertical reciprocating movement by means of a rod **16** in response to movement of pivotally connected links **18** and **20** which are joined at a pivotal couple **22.** Anvil **12** is similarly mounted for vertical reciprocation by means of a rod **24** pivotally connected to one end of a lever **26** supported at a fulcrum **28** and carrying an abutment **30** on the other end thereof.

The control system will be described for illustrative purposes as being operated with air; however, any suitable fluid medium may be utilized to provide the desired control. Air is supplied to an inlet **32** to the system from any suitable source, such as a compressor, and passes through a filter **34** and a lubricator **36** to a pressure regulating valve **38.** A pressure guage **40** communicates with pressure regulating valve **38** to provide a visual indication of the regulated pressure, and pressure regulating valve **38** has a main outlet communicating through a conduit **42** with a reserve tank or reservoir **44** and a pilot outlet communicating through a conduit **46,** a miniature control valve **48,** a conduit **50,** a miniature control valve **52,** a conduit **53** with a main four-way control valve **55** while a conduit **56** provides communication from conduit **53** through a four-way cycle control valve **57** and a conduit **58** with a four-way control valve **60.**

Miniature control valve **48** includes a plunger **61,** having a through-passage **62** and a port **63** communicating with the atmosphere, and miniature control valve **52** similarly includes a plunger **64** having a through-passage **65** and a port **66** communicating with the atmosphere. The plunger **61** of control valve **48** extends from the valve casing and is adapted to be depressed to initiate operation of the control system. Accordingly, control valve **48** is disposed within easy reach of an operator, preferably near the floor for foot operation. The plunger **64** of control valve **52** extends from the valve casing to engage an actuator lever **67** which is pivotally mounted at one end and has the other end engaging abutment **30** carried by lever **26.**

The reservoir **44** supplies air to a main conduit **68** which communicates through a port **69** with main control valve **55** and through passages **70** and **71** with control valve **60** and a four-way control valve **72,** respectively. Control valves **60** and **72** operate a fluid motor **73** including a piston **74** movable in a cylinder **75** through an inlet conduit **76** at an inlet end of the cylinder and an exhaust conduit **78** at an outlet end of the cylinder, and the inlet end of cylinder **75** communicates with cycle control valve **57** through a conduit **79.** Piston **74** carries a rod **80** which is adapted to operate a hopper and chute mechanism to deliver head and backing elements to the ram and anvil in any suitable manner; and, if desired, a pair of similar fluid motors may be operated in tandem to provide the required supply of fastener elements. Inlet conduit **76** is exhausted to the atmosphere through a port **82** in control valve **60** when the control valve is in its inoperative or rest position as illustrated, and exhaust conduit **78** communicates with passage **66** through control valve **60** in its operative position and through a leg **84** with an end chamber of control valve **70.** Control valve **60** has an exhaust port **86** to the atmosphere and communicates through a passage **87** with control valve **72.** A reciprocating rod **88** carrying four spaced pistons is movable in control valve **60,** and control valve **72** has a reciprocating rod **90** carrying four spaced pistons biased by a spring **92.**

The main control valve 55 controls a ram driving fluid motor 93 including a piston 94 slidable in a cylinder 96 and having a rod 98 engaging couple 22 between links 18 and 20 of the ram reciprocating linkage. Cylinder 96 is controlled through an inlet conduit 100 and an exhaust conduit 102. Main control valve 55 also controls an anvil driving fluid motor 103 including a piston 104 slidable in a cylinder 106 and carrying a rod 108 engaging lever 26 as indicated by dotted line 110. Cylinder 106 communicates with conduit 100 through an inlet conduit 112 and an adjustable restriction 114 including a screw 115 movable into and out of the conduit, and cylinder 106 has an exhaust conduit 116 communicating with exhaust conduit 102 of ram cylinder 96.

Main control valve 55 includes a rod 118 carrying spaced pistons 120, 122, 124 and 126 movable within a cylinder 128 under the control of valves 48 and 52 and a drive pressure regulating assembly generally indicated at 130. Cylinder 128 has ports 132 and 134 exhausting to the atmosphere and receives fluid from reservoir 44 through main conduit 68 and port 69. With the rod 118 in the rest or return state, as illustrated, communication is established between port 69 and a port 136 communicating with exhaust conduits 102 and 116 of the ram and anvil cylinders, respectively, and atmospheric pressure is communicated through exhaust port 134 to inlet conduit 100 of ram cylinder 96 and inlet conduit 112 of anvil cylinder 106 through a port 138. Pistons 122 and 124 are spaced such that when rod 118 is moved to place main control valve 55 in the drive state, port 69 communicates with port 138 and port 132 communicates with port 136 thereby communicating pressure from main conduit 68 to inlet conduits 100 and 112 of the ram and anvil cylinders and venting exhaust conduits 102 and 116 of the ram and anvil cylinders to the atmosphere.

Drive pressure regulating assembly 130 includes a block 140 having a central passage 142 therein communicating at one end with main control valve 55 adjacent piston 126 and through a valve seat 144 at the opposite end to a chamber 146. Chamber 146 communicates through a conduit 148 with a driving pressure chamber 150 in anvil cylinder 106 and through a passage 152 with a pressure gauge 154. Block 140 has an externally threaded nipple receiving an internally threaded member 156 which has an annular shoulder sealably compressing a diaphragm 158 with the end of the externally threaded nipple of block 140. A valve member 160 is centrally carried by diaphragm 158 to engage valve seat 144 and valve member 160 has a bleed passage 162 extending centrally therethrough in alignment with passage 142. A pressure adjusting, externally threaded screw 164 has a bleed port 166 therein, and a helicoidal spring 168 is mounted in compression between member 164 and an annular shoulder on valve member 160. Spring 168 supplies pressure to diaphragm 158 through valve member 160 such that diaphragm 158 deflects upward away from valve seat 144 when the pressure in chamber 146 is greater than the pressure supplied by spring 168.

The cycle control valve 57 receives air from conduit 56 at a port 170; and, with the cycle control valve in the inoperative position, the air received at port 170 is supplied through a port 172 to conduit 58. The end chamber of cycle control valve 57 communicates with conduit 79 through a port 174, and a port 176 communicates with the atmosphere. A reciprocating rod 178 carrying spaced pistons is movable in cycle control valve 57 and biased toward the inoperative position by a spring 180.

Since the structure and operation of four-way control valves are well known, the structure of control valves 57, 60 and 72 has not been described in detail; however, the main control valve 55 has been described in detail due to the important role thereof in the operation of the control system of the present invention.

The control system is illustrated in the FIGURE in the inoperative or rest position with ram piston 94 and anvil piston 104 withdrawn into cylinders 96 and 106, respectively, due to pressure supplied from main conduit 68 through ports 59 and 136 of main control valve 55 to exhaust conduits 102 and 116. Fluid motor 73 is similarly in its inoperative position with piston 74 withdrawn in cylinder 75 due to pressure from main conduit 68 supplied through passage 70, control valve 60 and exhaust conduit 78 and inlet conduit 76 being vented to the atmosphere through port 82 in control valve 60. Since inlet conduit 76 is vented to the atmosphere, the end chamber of each control valve 57 will sense atmospheric pressure and spring 180 will bias rod 178 upward to the inoperative position to place cycle control valve 57 in an enable state permitting communication between ports 170 and 172. Thus, with the control system in the rest position ram 10 and anvil 12 are moved away from attachment station 14 to spaced positions in preparation for assembly of a fastener to a piece of material and rod 80 is withdrawn into cylinder 75 in preparation for supplying head and backing elements to the attaching station 14.

In order to commence operation of the control system for the assembling apparatus, the plunger 61 in miniature control valve 48 is depressed such as by the foot of the operator. With control valve 48 actuated, the through-passage 62 in the plunger passes air from pressure regulating valve 38 to miniature control valve 52, which is normally open to supply pressure to main control valve 55 through conduit 53, ports 170 and 172 in cycle control valve 57 and conduit 58 to control valve 60. The pressure supplied to control valve 60 moves rod 88 to the left such that pressure from main conduit 68 is supplied through passage 70, control valve 60 and inlet conduit 76 to move piston 74 within cylinder 75. As mentioned above, the rod 80 extending from piston 74 is utilized to either directly or indirectly move backing and head elements to the attaching station 14 adjacent ram 10 and anvil 12, respectively.

Movement of rod 88 in control valve 60 is permitted by the exhausting of the end chamber through passage 87 to control valve 72. Rod 90 in control valve 72 is moved to the right by spring 92 due to the exhausting of the end chamber through passage 84 and port 86 in control valve 60 to the atmosphere, and the movement of rod 90 permits communication between main conduit 68 and passage 87 through passage 70 to move rod 88 to the right to its inoperative position. With control valve 60 returned to its inoperative position, control valve 72 is returned to its inoperative position due to the pressure supplied to passage 84 through control valve 60 and fluid motor 73 is returned to its inoperative position due to the pressure supplied to exhaust conduit 78 through passage 70 and control valve 60. The monostable-type interaction between control valves 60 and 72 is accomplished in a predetermined

period of time according to the period required to move the head and backing elements to the attaching station.

Cycle control valve **57**, which is normally in its inoperative position as shown in the drawing, always assures a complete cycle of the fluid motor **73** and the hopper and chute mechanism is provided for each attaching operation in that, upon initial depressing of plunger **61** to actuate miniature control valve **48**, only a single shot of air is supplied to control valve **60** and further shots of air, either from continuous or premature depression of the plunger **61** or from system failure, are prevented from being supplied to control valve **60** until fluid motor **73** has completed its cycle. Initially air is supplied through ports **170** and **172** in cycle control valve **57** in the enable state to control valve **60** to operate fluid motor **73** in the manner described above; however, when air is supplied to inlet conduit **76**, the air pressure is communicated to the end chamber of cycle control valve **57** through conduit **79** and port **174** to move rod **178** downward to its operative position and place cycle control valve **57** in the inhibit state to prevent communication between ports **170** and **172** and vent conduit **58** to the atmosphere through port **176**. Accordingly, no further shots of air can be supplied to control valve **60** until cycle control valve **57** is returned to the inoperative state by spring **180**.

When fluid motor **73** is returned to the inoperative position as described above, inlet conduit **76** is vented to the atmosphere; and, thus, the end chamber in cycle control valve **57** is vented to the atmosphere to permit spring **180** to return the cycle control valve to the enable state to permit another shot of air to be supplied to control valve **60** the next time plunger **61** is depressed. Accordingly, cycle control valve **57** is responsive to operation of the fluid motor **73** to inhibit operation of the control valve **60** once a cycle is commenced to supply head and backing elements to the attaching station and to enable operation of control valve **60** again only after fluid motor **73** has completed a full cycle.

The pressure in conduit **53** moves rod **118** up in cylinder **128** to place main control valve **55** in the drive state. The movement of rod **118** exhausts the end chamber in cylinder **128** through passage **142** and bleed passage **162**. With main control valve **55** in the drive state, the exhaust conduits **102** and **116** of cylinders **96** and **106**, respectively, communicate with the atmosphere through ports **132** and **136**. At the same time pressure from main conduit **68** is supplied through ports **69** and **138** in main control valve **55** to the inlet conduits **100** and **112** of cylinders **96** and **106**, respectively.

Pressure is immediately supplied to ram cylinder **96** to move piston **94** to the right such that rod **98** moves couple **22** to drive ram **10** down toward anvil **12**. The pressure supplied through inlet conduit **112** to anvil cylinder **106** is delayed by restriction **114**; and, accordingly, piston **104** is moved down at a slower rate within cylinder **106** relative to the movement of piston **94** in cylinder **96**. Upon movement, which is variable in accordance with the setting of screw **115**, piston **104** is moved down and rod **108** contacts lever **26** thereby moving anvil **12** up toward ram **10** such that the prongs in the head element pierce the material and are upset in the backing element carried by ram **10**. Movement of lever **26** also lowers abutment **30** which permits the plunger **64** in miniature control valve **52** to move down and place conduit **53** in communication with the atmosphere.

Once ram **10** and anvil **12** meet, the pressure in chamber **150** upstream of anvil piston **104** is increased, and this increase in pressure is communicated through conduit **148** to chamber **146** in the pressure regulating assembly **130**. When the pressure in chamber **150** is increased above the pressure from spring **168**, as set by adjustment of screw **164**, diaphragm **158** will deflect upward to move valve member **160** away from valve seat **144** and communicate pressure to piston **126** of main control valve **58**. The pressure applied to piston **126** forces rod **118** down to place main control valve **55** in the rest or return state thereby supplying pressure to the exhaust conduits of cylinders **96** and **102** to return pistons **94** and **104** to their inoperative positions. Once the pressure in chamber **146** is sufficiently reduced, the force from spring **168** will move diaphragm **158** down such that valve member **160** engages valve seat **144**. Any pressure in the chamber defined above piston **126** in valve **58** can escape to the atmosphere through passages **142**, **162** and **166**.

The pressure gauge **154** provides a visual indication of the pressure at which the ram and anvil separate, and the separating pressure may be adjusted by movement of screw **164** to permit separation at any desired pressure as determined for optimum performance.

The control system of the present invention, thus, operates to automatically separate the ram and anvil after they meet to assemble the fastener elements to a piece of material by sensing the increase in pressure in the drive pressure chamber corresponding to the force transmitted from the meeting of the ram and anvil through the anvil driving rod and piston. The pressure at which the ram and anvil are separated may be adjusted by rotating the adjusting screw to decrease or increase the force from the helicoidal spring. For instance, while the pressure of the fluid in the reservoir may be **80** psi, the ram and anvil may separate at a pressure of **40** psi or the separation pressure may be adjusted as desired, for instance to **60** psi by tightening the adjusting screw.

Inasmuch as the present invention is subject to many variations, modifications and changes in detail, it is intended that all matter described above or shown in the accompanying drawing be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. A control system for assembling apparatus including a ram and anvil adapted to be driven toward each other, said control system comprising

ram driving fluid motor means including a rod for controlling movement of the ram toward and away from the anvil;

anvil driving fluid motor means including a rod for controlling movement of the anvil toward and away from the ram;

control means for selectively supplying fluid pressure to said ram driving fluid motor means and said anvil driving fluid motor means, said control means having a drive state for moving said ram driving rod in a direction for driving the ram toward the anvil and for moving said anvil driving rod in a direction for driving the anvil toward the ram, and said control means having a return state for moving said

ram driving rod and said anvil driving rod to separate the ram and anvil;

selectively operated valve means communicating with said control means to place said control means in said drive state; and

pressure responsive means communicating with said anvil driving fluid motor means for sensing fluid pressure at said anvil driving fluid motor means, said pressure responsive means communicating with said control means and being responsive to a predetermined pressure at said anvil driving fluid motor means to place said control means in said return state whereby the ram and anvil are separated in response to pressure at said anvil driving fluid motor means.

2. The control system as recited in claim **1** wherein said pressure responsive means includes means for adjusting said predetermined pressure at which said control means is placed in said return state.

3. The control system as recited in claim **1** wherein said anvil driving fluid motor means includes a cylinder, a piston slidable in said cylinder and carrying said anvil driving rod, a drive pressure chamber disposed in said cylinder, inlet conduit means communicating with said control means and said drive pressure chamber to supply pressure to said piston when said control means is in said drive state to move said rod to drive the anvil toward the ram, and said pressure responsive means includes conduit means communicating with said drive pressure chamber to sense fluid pressure therein.

4. The control system as recited in claim **3** wherein said pressure responsive means includes pressure operated valve means for controlling supplying of pressure to said control means, said pressure operated valve means being responsive to said predetermined pressure in said drive pressure chamber to open and supply pressure to said control means to place said control means in said return state.

5. The control system as recited in claim **4** wherein said pressure operated valve means includes a diaphragm defining a pressure sensing chamber on one side thereof, said pressure sensing chamber communicating with said drive pressure chamber through said conduit means, bias means applying a pressure corresponding to said predetermined pressure to the opposite side of said diaphragm, a valve seat disposed between said pressure sensing chamber and said control means, and a valve member carried by said diaphragm for engaging said valve seat, said diaphragm moving said valve member away from said valve seat when the pressure in said pressure sensing chamber exceeds said predetermined pressure.

6. The control system as recited in claim **5** wherein said bias means includes an adjustable screw and a spring mounted in compression between said diaphragm and said screw, said predetermined pressure being adjustable by adjustment of said screw.

7. The control system as recited in claim **5** wherein said ram driving fluid motor means includes inlet conduit means and exhaust conduit means, said anvil driving fluid motor means includes exhaust conduit means, and said control means includes a supply of fluid under pressure and a control valve having first port means communicating with said fluid supply, second port means communicating with the atmosphere, third port means communicating with said ram driving inlet conduit means and said anvil driving inlet conduit means, fourth port means communicating with said ram driving exhaust means and said anvil driving exhaust means, and a slidable valve member providing communication between said first and third port means and said second and fourth port means with said control means in said drive state and providing communication between said first and fourth port means and said second and third port means with said control means in said return state.

8. The control system as recited in claim **7** wherein said control means includes restriction means in said anvil driving inlet conduit means to delay movement of said anvil driving rod until movement of said ram driving rod has commenced.

9. The control system as recited in claim **1** wherein said control means includes restriction means for delaying the supply of driving pressure to said anvil driving fluid motor means such that said anvil driving rod is moved to drive the anvil toward the ram after said ram driving rod commences movement to drive the ram toward the anvil.

10. A fluid control system for apparatus for assembling head and backing elements of a fastener to a piece of material at an attaching station, said fluid control system comprising

a ram adapted to move a backing element to the attaching station;

first reciprocating means supporting the ram for movement toward and away from the attaching stateion;

an anvil adapted to move a head element to the attaching station;

second reciprocating means supporting the anvil for movement toward and away from the attaching station;

a ram driving fluid motor including a cylinder having a drive pressure chamber therein, a piston slidable in said cylinder, a rod attached to said piston for operating said first reciprocating means, inlet conduit means communicating with said cylinder, and exhaust conduit means communicating with said cylinder;

an anvil driving fluid motor including a cylinder, a piston slidable in said cylinder, a rod attached to said piston for operating said second reciprocating means, inlet conduit means communicating with said cylinder, and exhaust conduit means communicating with said cylinder;

a supply of fluid under pressure;

control valve means communicating with said fluid supply, said ram driving fluid motor and said anvil driving fluid motor, said control valve means having a drive state supplying pressure to said ram driving inlet conduit means and said anvil driving inlet conduit means to move said ram dirving rod and said anvil driving rod to operate said first and second reciprocating means and move said ram and anvil toward the attaching station to assemble the head and backing elements with the piece of material, and said control valve means having a return state supply-ing pressure to said ram driving exhaust conduit means and said anvil driving exhaust conduit means to move said ram driving rod and said anvil driving rod to operate said first and second reciprocating means and move said ram and anvil away from the attaching station to separate said ram and anvil;

selectively operated valve means communicating with said control valve means to place said control valve means in said drive state; and

pressure sensing means communicating with said drive pressure chamber in said anvil driving cylinder and said control valve means and responsive to the pressure in said drive pressure chamber reaching a predetermined level to place said control valve means in said return state whereby said ram and said anvil are automatically separated after said anvil meets said ram.

11. The control system as recited in claim **10** wherein said anvil driving inlet conduit means has a restriction therein to delay the supply of pressure to said anvil driving cylinder relative to the supply of pressure to said ram driving cylinder whereby said ram is moved toward said attaching station before said anvil is moved toward said attaching station.

12. The control system as recited in claim **10** wherein said pressure sensing means includes pressure operated valve means opened in response to the pressure in said drive pressure chamber reaching said predetermined level to place said control valve means in said return state.

13. The control system as recited in claim **12** wherein said pressure sensing means includes a diaphragm defining a pressure sensing chamber on one side thereof, conduit means communicating with said pressure sensing chamber and said drive pressure chamber and bias means applying a pressure to the other side of said diaphragm corresponding to said predetermined pressure, and said pressure operated valve means includes a valve seat, a passage communicating with said control valve means and said valve seat, and a valve member carried by said diaphragm and movable to be in contact with and away from said valve seat to control communication through said valve seat between said pressure sensing chamber and said passage, said diaphragm deflecting to move said valve member away from said valve seat when said pressure in said pressure sensing chamber exceeds said predetermined level.

14. The control system as recited in claim **12** wherein said bias means includes an adjustable screw and a spring mounted in compression between said diaphragm and said screw, said pre-determined pressure being adjustable by adjustment of said screw.

15. The control system as recited in claim **14** wherein said valve member has a bleed passage therethrough communicating with said control valve means through said passage, and said adjustable screw has a vent to the atmosphere therethrough.

16. A fluid control system for apparatus for assembling fastener elements supplied by delivery means to an attaching station comprising

fluid motor means for operating the fastener element delivery means;

control valve means for moving said fluid motor means through a complete cycle;

selectively operated valve means for supplying fluid to commence operation of said apparatus; and

cycle control means for supplying fluid from said selectively operated valve means to said control valve means to commence said cycle, said cycle control means being responsive to operation of said fluid motor means once said cycle has commenced to prevent supply of fluid from said selectively operated valve means to said control valve means until said cycle is completed.

17. The control system as recited in claim **16** wherein said fluid motor means includes a piston and rod slidable in a cylinder having inlet and outlet ends, said control valve means includes an inlet conduit for supplying fluid to said inlet end of said cylinder to move said piston and rod in a forward stroke and an exhaust conduit for supplying fluid to said outlet end of said cylinder to move said piston and rod in a return stroke, said forward and return strokes constituting said cycle, and said cycle control means having an enable state permitting the supply of fluid from said selectively operated valve means to said control valve means and an inhibit state responsive to fluid pressure at said inlet end of said cylinder to prevent the supply of fluid from said selectively operated valve means to said control valve means until said cycle is completed.

18. The control system in claim **17** wherein said control valve means includes first and second control valves communicating to control said cycle over a predetermined time period.

19. The control system as recited in claim **16** wherein said assembling apparatus includes a ram and anvil adapted to be driven toward each other, said control system further comprising ram driving fluid motor means including a rod for controlling movement of the ram toward and away from the anvil; anvil driving fluid motor means including a rod for controlling movement of the anvil toward and away from the ram; control means for selectively supplying fluid pressure to said ram driving fluid motor means and said anvil driving fluid motor means, said control means having a drive state responsive to fluid supplied by said selectively operated valve means for moving said ram driving rod in a direction for driving the ram toward the anvil and for moving said anvil driving rod in a direction for driving the anvil toward the ram, and said control means having a return state for moving said ram driving rod and said anvil driving rod to separate the ram and anvil; and pressure responsive means communicating with said anvil driving fluid motor means for sensing fluid pressure at said anvil driving fluid motor means, said pressure responsive means communicating with said control means and being responsive to a predetermined pressure at said anvil driving fluid motor means to place said control means in said return state whereby the ram and anvil are separated in response to pressure at said anvil driving fluid motor means.

20. The control system as recited in claim **19** wherein said control means includes restriction means for delaying movement of said control means to said drive state in response to fluid supplied by said selectively operated valve means such that said fluid motor means for operating the fastener element delivery means is operated prior to said control means.

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