

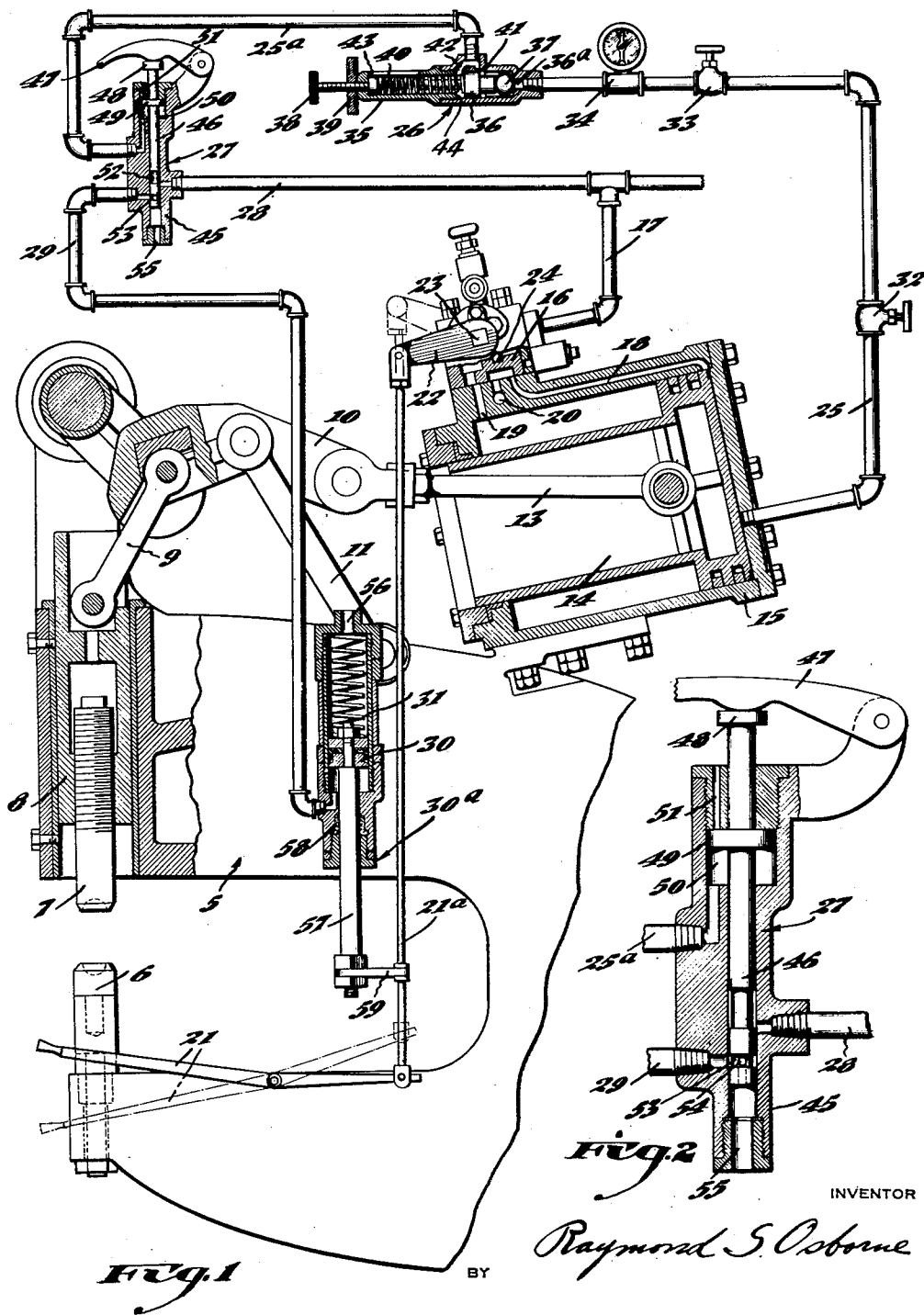
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RIVETER

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UNITED STATES PATENT OFFICE

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RIVETER

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This invention relates to improvements in compression riveters which act by direct pressure, and is particularly directed to apparatus for controlling the pressure developed within the riveter and against the work and for returning the rivet driving mechanism after a driving movement.

As disclosed in the Osborne Patent No. 1,660,720, a mechanism is provided for automatically controlling the riveter for relieving the pressure to the rivet driving cylinder at a predetermined degree as determined by the size of the rivet and the type of the work. This control was designed to eliminate damage to the work and rivets by excess pressures, having particular application to riveters used in field work and general plate or structural shops where a uniform line pressure must be maintained for operating various pneumatic devices.

Each riveter is operated under independent pressure control by means of the patented automatic control set forth above. The driving cycle is initiated by a hand lever in direct mechanical connection with the main valve of the riveter, and the lever automatically returned when a predetermined pressure has developed in the rivet driving cylinder sufficient to pass into a control cylinder which returns the released control lever.

It is an object of this invention to provide an improved control for automatically relieving the pressure applied to the rivet by the power piston at an arbitrarily set pressure and to additionally permit the use of a hand control means entirely manually operated independently of the automatic pressure relieving control, whereby any desired degree of pressure or all the line pressure may be applied for reversing the main valve of the riveter if the automatic system is not needed. The control system and devices for automatically stopping and returning or entirely manually controlling the rivet driving piston have been shown applied for operating the usual main valve of a standard commercial rivet of the toggle type, the entirely manual control referred to being a conventional part of this standard riveter with the improvement in this instance residing in the

cooperating system for selective manual or automatic control.

Another object is to provide a trigger valve which is manually moved for initiating the power stroke of the piston and which is automatically actuated by a control valve for automatically stopping the power stroke at a predetermined pressure.

Another object is to provide that the trigger valve may be disposed at any convenient position in the air conduits to the riveter, depending on the position of the operator for advantageous operation of the riveter.

It is a further object of this invention to provide a piston stroke controlling means which after a predetermined degree of pressure has been developed behind the piston in its driving stroke and upon the desired pressure being applied, automatically relieves the pressure and returns the piston under full line pressure. This arrangement is exceedingly efficient because of the simplicity and rapidity with which the driving piston is returned, the speed of return always being uniform and independent of the particular driving pressure exerted. It is advantageous to use a high pressure air supply greater than that needed to drive the rivets since the speed of the main or power piston is much higher than if only the amount of pressure needed to drive the rivet is in the supply. It will readily be seen that utilizing high pressure to fill the driving cylinder and cutting off the pressure when sufficient is much faster than to supply the total pressure needed and wait for the cylinder to fill up completely with this pressure of air. In other words, assuming that rivets are being driven under low pressure, the high pressure from the field line has greater velocity in entering the driving cylinder and the piston consequently moves more rapidly to that low pressure at which the drive is relieved.

It will readily be apparent in the application to the standard toggle type riveter that the piston against which the air is admitted directly from the trigger valve of the control may either be the independent piston connected to the lever operating the standard control slide valve of the power piston as

illustrated, or the slide valve may be in the form of a piston directly actuated by air from the trigger valve. Each arrangement is distinctly advantageous.

Further objects and advantages will be more fully set forth in the description of the accompanying drawings, in which:

Figure 1 is a general view showing the invention mounted in operative position relative to a pneumatic compression riveter of toggle joint type for operating the usual power piston control valve, certain portions of the improved control mechanism and riveter being shown in section to fully illustrate the mechanism and the air circuit.

Figure 2 is a sectional view taken longitudinally of the trigger valve which controls the degree of pressure applied to the rivets.

The improvement is illustrated in conjunction with a commercial toggle type riveter, driving the rivets under direct pressure. The issued patent, mentioned above, discloses a control piston directly connected to the lever actuating the main valve on the toggle actuating air motor, the air to the control piston being supplied from the power or driving side of the motor through an unloader or control valve. The unloader or control valve is adjustable to permit the passage of air at a desired degree of pressure, thus actuating the control piston and returning the control lever to normal position, whereupon the main valve of the motor is reversed and the motor piston returned under full line pressure.

The rivet setting stroke in the present construction is manually started either through a hand lever, which is disposed relative to the dies of the riveter, or through an automatically reversed trigger valve which may be placed at any convenient point. Through independent use of the hand lever it is possible to operate the riveter to use any or full line pressure independent of the automatic mechanism which must act through the trigger valve. The power piston is returned in the instance of independent use of the hand lever by manually shifting or releasing a spring returned hand lever. When the throttle valve is used, the operator need pay no more attention to that operation after releasing the throttle since it is automatically reversed and the power piston thereafter returned.

Therefore, the following description sets forth two methods of control whereby the riveter can be operated entirely manually through the usual control lever at the dies, or through a trigger valve either at the point of the dies or at any remote position, the trigger valve being manually tripped to initiate the driving stroke and automatically reversed for returning the mechanism to normal position.

Referring to the figures of the drawings, the yoke frame 5 of the riveter provides a

throat into which the plates, or work to be riveted, are inserted. The lower die 6 is immovably fixed to one side of the yoke and the upper die 7 is attached to a plunger 8. The plunger 8 is reciprocated in the yoke frame by a toggle 9 actuated by a main lever 10, the lever guided by means of a link 11. The main toggle lever 10 is pivotally connected to the outer end of a piston rod 13 connecting with the piston 14 of the air motor.

The cylinder 15 of the air motor has a main control valve 16 mounted thereon, to which valve the main air supply line 17 is connected. Three passageways 18, 19, 20, extend from the casing of the valve, 18 thereof extending to the back of the cylinder, being the feed conduit for the rivet driving stroke, 19 extending to the front end of the cylinder for returning the piston, and 20 extending to the atmosphere as an exhaust passageway.

The valve 16 within the casing provides a recess 21 alternately connecting the forward and reverse passageways 18, 19 with the exhaust passageway 20, and alternately opening one of the passageways 18, 19 to the main air supply 17 through the interior of the valve casing. The valve 16 is actuated by means of an arm 22 connected to the outer squared end of a rock shaft 23 carrying a slide valve actuating finger 24. The arm 22 is connected to the swinging end of a fulcrumed hand lever 21 pivoted to the lower jaw of the frame, the connection being by means of a link 21a pivotally connected at its respective ends to the arm 22 and to the control lever 21.

The foregoing description sets forth the arrangement of the parts in the commercial type riveter, providing a simple manual control in the form of a hand lever for starting the rivet driving stroke and reversing the same when the operator has determined that a sufficient pressure has been applied to the rivet. It usually occurs through this arrangement, that the full line pressure is applied to the rivet, the application of partial line pressure requiring careful timing since the riveter acts extremely rapidly.

The control circuit of the present invention comprises, in general, an air conduit 25 extending from the rear of the air motor to an unloader or control valve 26, then from the control valve 26 to a trigger valve 27, the trigger valve controlling the flow of air from a branch 28 of the main air line to a conduit 29 extending to the control piston 30. The trigger valve 27 is operative, when actuated manually, to connect the main air passageway with the control piston 30 as above described, and is automatically reversed by air under pressure coming through the control valve thereby exhausting the air in back of the control piston to permit a spring 31 to return the control lever to normal starting position and cause the reverse movement of the air

motor piston. The control piston is disposed in a cylinder attached to the riveter frame, and the piston rod thereof is connected to the manually operated control linkage.

- 5 Describing the various elements of the control circuit in detail, a stop valve 32, a choke valve 33, and an air pressure gauge 34 are inserted in the conduit extending from the forward end of the cylinder of the air motor.
- 10 The choke valve is inserted in the line for the purpose of delicately controlling the flow of air to the unloader valve, it having been found that as the main valve of the air motor is opened, a sudden rush of air to the back of the
- 15 large piston causes a sudden flow of air through the control line and the control valve is unseated prematurely or improperly. Adjustment of the choke valve eliminates this premature action.
- 20 Through the use of the gauge, the exact pressure at which the control valve acts may be determined, and by adjustment of the valve, an exact degree of pressure may be exerted on the rivet in a given operation. By
- 25 means of a scale and pointer on the control valve, the scale determined by pressure readings at various settings of the pointer, the gauge can be dispensed with after the scale is determined.
- 30 The control valve comprises a body or casing 35 and a spring-pressed plunger 36 having a ball 37 at its forward end seated against the intake opening of the valve. An adjustment screw 38 and lock nut 39 are provided
- 35 for varying the compression of the spring 40 in adjusting the valve to cause the plunger to be unseated at the desired pressure. The outlet of the control valve provides two passageways 41, 42, the passageway 41 extending to the forward end of the plunger, and the
- 40 passageway 42 extending to the rear end of the plunger and to the atmosphere through a slot 43 in the wall of the casing.
- 45 The forward end of the plunger is of much greater area than the outlet 41, thereby causing the plunger to act rapidly and to seat against a seat 44 formed within the casing for preventing exhaust through the slot. The ball 37 is slidably mounted and the air passes
- 50 around the same through grooves in the wall of the valve bore. After the control valve has been actuated and the plunger is seated against the rear seat 44, the air flows through the unloader valve and thence to the throttle
- 55 valve 27 through conduit 25^a.
- The area of the plunger 36 is greater than that of the inlet opening 36^a thereby causing quick action of the plunger when the ball 37 is unseated and preventing fluttering of the plunger 36 since a greater pressure is needed to close the valve than to open it. This insures the valve staying open a proper time even though the pressure drops due to velocity head in the line.
- 65 The trigger valve comprises a casing 45 and

a plunger 46. The plunger is actuated by means of a trigger 47 pivotally mounted on the casing and engaging a button 48 formed on the exteriorly extending end of the plunger. The plunger is formed with a piston portion 49 of a large diameter moving in a cylinder 50 within the casing, the conduit from the control valve entering into the cylinder at the forward side of the piston portion to force the plunger outwardly. An exhaust port 51 is provided for exhausting the opposite side of the cylinder.

The plunger is formed to control the flow of air from the main air line to the control piston. This is accomplished by having the main air line 28 enter the plunger bore at one side, and the discharge conduit 29 leading to the control piston entering the opposite side but slightly offset, and a groove portion 52 formed on the piston for overlapping the respective ports of the conduits into the plunger bore. Therefore, when the trigger of the trigger valve is depressed to move the piston toward the intake end of the cylinder, the groove portion thereof is disposed as above stated, this being the position for initially starting the power stroke of the riveter.

When the pressure in the riveter has reached the desired degree and the unloading takes place, the plunger is moved outwardly and the groove portion of the plunger disaligned from the two openings, thereby cutting off the air from the main air line and thereupon opening the line 29 to a second groove 53 in the trigger valve plunger, which groove is connected to the atmosphere through a radially and axially formed port 54 extending to the end of the plunger, and thence exhausting through a port 55 leading from the end of the plunger bore.

The air conduit 29 leading to the control piston connects to the cylinder 30^a thereof below the piston, and the spring 31 is provided under compression between the opposite side of the piston and the end wall of the cylinder, the end wall of the cylinder being ported as at 56 to properly exhaust that side. A piston rod 57 extends from the control piston through packing 58 to the exterior and is connected to an arm 59, the arm in turn being connected to the control lever link 21^a, which link is disposed parallel to the piston rod.

In order to make the two types of operation of the present device perfectly apparent, the following description of the operation is given. Assuming that the operator desires to apply a certain degree of pressure uniformly to the rivets, he then uses the trigger valve 27. The normal position of rest of the trigger valve is with the trigger 47 raised inasmuch as the plunger has been previously actuated by air from the unloader valve to assume this position. The plunger is maintained in this position against accidental displacement by virtue of the snug fit of the

plunger in the bore or by any other suitable means.

Upon depression of the trigger 47, the air under pressure flows from the main supply line 28 through the trigger valve via the overlapping groove and through the line 29 to the lower end of the control cylinder 30^a. The line pressure being high quickly raises the control piston 30, and consequently the link 21^a is actuated to move the main valve 16 on the air motor to a position for supplying air from the main air line 17 to the back of the main air piston 14. The toggle 9 is thereupon actuated and the riveting stroke performed.

When the degree of pressure to which the control valve has been set is reached at the back of the air motor, the air unloads through the control valve 26 to the cylinder 50 in the trigger valve, actuating the plunger 46 to move the exhaust groove 53 in the plunger into registry with the port of the line 29 leading to the control cylinder 30^a and the lower end of the control cylinder 30^a is thereupon exhausted to the atmosphere. The spring 31 then acts to return the main valve 16 on the air motor to the position shown in Figure 1, in which position the air is supplied to the reverse side of the piston for reverse movement thereof, and the rear side is exhausted. The pressure in the control valve 26 then drops and the control valve again closes, permitting the air behind the piston 49 of the plunger 46 in the trigger valve 27 to be exhausted through the control valve, via the slot 43. If the operator should depress the trigger of the trigger valve unnecessary long, the piston 49 thereof is of sufficient area that it will be moved by the unloading air pressure despite ordinary hand pressure on the trigger.

The foregoing movements have also moved the manually operated lever, but this is immaterial inasmuch as the movement of this control lever is not of consequence in the described operation.

If no regard need be given to the pressure applied to the rivets, or if it is desired to vary the pressures applied to each rivet, and accuracy of pressure applied is not essential, the hand lever is used entirely. It will be readily apparent that this is possible inasmuch as the only active part when the lever is moved manually, outside of the lever 21, the link 21^a, and the valve 16, provided, of course, the valve 32 in the line leading to the unloader valve is closed, is the piston 30 in the control cylinder 30^a. This piston must be moved up against spring pressure and upon release of the hand lever, the spring will cause the return of the piston and lever 21 and thereafter sudden reversing of the power. The operator may either leave the hand lever on until the full line pressure is exerted, or he may release the same when he feels that the proper pressure has been applied.

It is also possible to operate the trigger valve entirely manually with the valve 32 closed for preventing automatic air supply to the trigger valve. The trigger could then be dispensed with and the head of the plunger grasped for manipulation of the valve plunger in both directions.

Having described my invention, I claim:

1. A control system for an air driven transmission, comprising in combination, a main cylinder, a piston therein in connection with the parts to be driven, a valve for controlling forward and reverse movements of the main air cylinder, a main air line extending to said valve, a control cylinder, a piston therein, a mechanical connection between the control piston and the main valve, a trigger valve for connecting the main air line with the control cylinder, a control valve in communication with the driving side of the main air cylinder and with the trigger valve, and a piston in said trigger valve actuated for a reversing of the control piston and main valve as the control valve acts at a predetermined pressure in the driving side of the cylinder.

2. A control system for an air driven transmission, comprising, a main air cylinder, a piston therein in connection with the parts to be driven, a main valve for controlling said piston, a main air supply line extending to said valve, a control cylinder and piston, mechanical connection between the piston and the valve, a hand lever attached to said mechanical connection, a trigger valve for connecting the main air line to the control cylinder, a piston formed on said trigger valve, the trigger valve casing having a cylinder therein containing the piston of said trigger valve, and a control valve in communication with the driving side of the main air cylinder and with the reverse side of the cylinder in the trigger valve, whereby the trigger valve is actuated for a reversing of the control piston and main valve as the control valve acts under a predetermined pressure in the driving side of the power cylinder.

3. A control system for an air driven transmission, comprising, a main air cylinder, a piston therein in connection with the parts to be driven, a main control valve for said piston, a main air line extending to said valve, a trigger valve, the main air line connected to said main control valve, operative means between said trigger valve and said main control valve, a piston formed on said trigger valve, the trigger valve casing having a cylinder therein containing said trigger valve piston, and a control valve in connection with the driving side of the main air cylinder and with the reverse side of the cylinder in the trigger valve, whereby the trigger valve is moved for actuating said main valve through said means and reversing said main driving piston as the control valve acts under a pre-

determined pressure in the driving side of the power cylinder.

4. A control device for pneumatically operated mechanism, comprising, a driving cylinder, a driving piston therein, a main air supply line connected to said cylinder, a main valve controlling the air to the cylinder, a trigger valve, said air supply connected to said trigger valve, said trigger valve including an air operative means, an air connection between said air operative means of said trigger valve and the driving end of said driving cylinder, valve means in said latter connection permitting air flow from the driving cylinder to said air operative means of said trigger valve at a predetermined driving pressure in the driving cylinder, and means operative when there is air flow from the driving cylinder to said air operated means of said trigger valve, said means extending from said trigger valve to the main valve and operative thereupon to reverse the main valve.

In witness whereof, I hereunto subscribe my name.

RAYMOND S. OSBORNE.

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