April 3, 1945. H. R. FISCHER ET AL 2,372,942

COMPRESSION RIVETER

Original Filed June 6, 1941

Fig. 1.

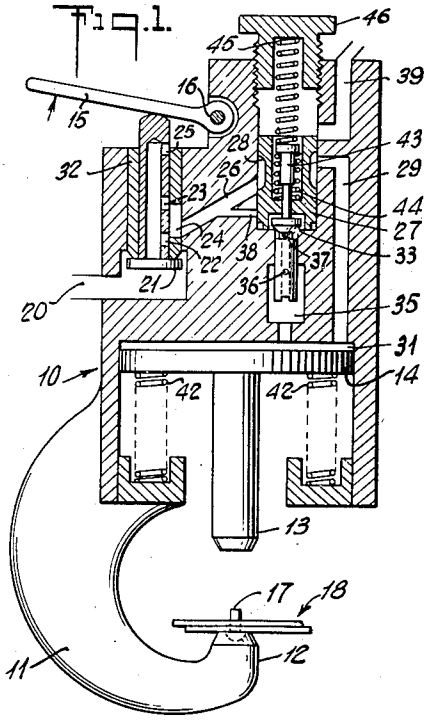


Fig. 2.

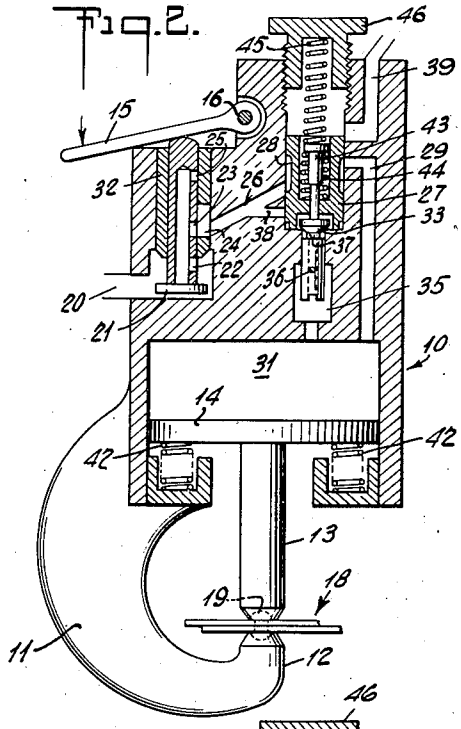


Fig. 3.

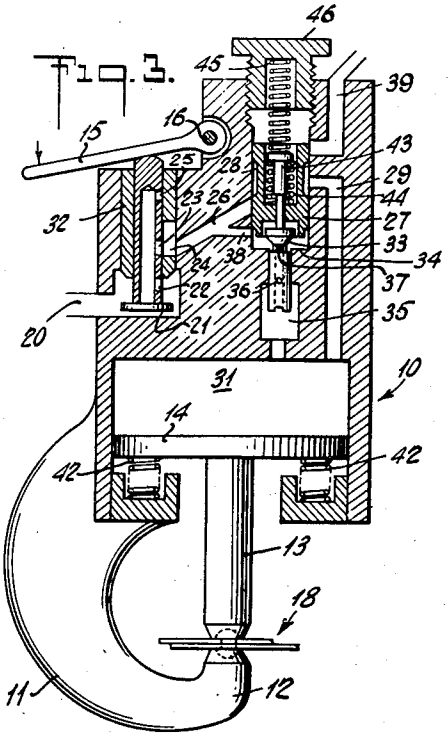
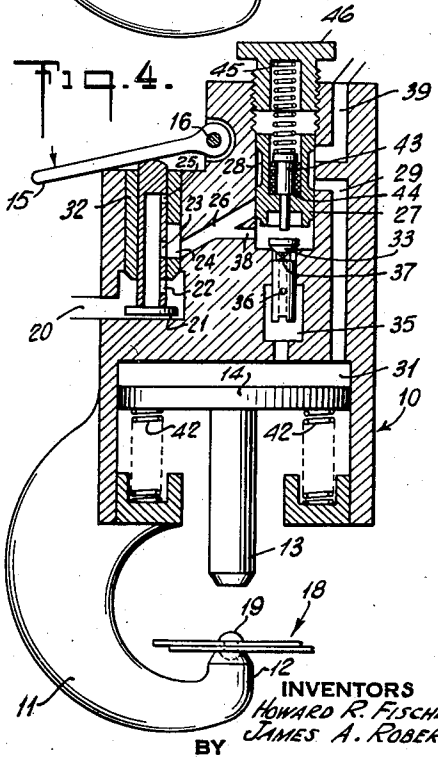


Fig. 4.



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COMPRESSION RIVETER

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Original application June 6, 1941, Serial No. 396,880, now Patent No. 2,355,520, dated August 8, 1944. Divided and this application July 11, 1944, Serial No. 544,391

8 Claims. (Cl. 121—38)

The present invention relates to power operated compression machines for riveting and the like, comprising tools of the class which are held in the hand of the operator when in use and manually applied to the work, and particularly to a fluid pressure control system therefor.

This application is a division of the copending application Serial No. 396,880, filed June 6, 1941, by the applicants herein for Compression riveter, now Patent No. 2,355,520, issued August 8, 1944.

Among the objects of the invention are to return the piston automatically to initial position following each power stroke; to simplify the construction; and to lighten the tool.

A feature of the machine includes an improved distributing valve assembly for the pressure fluid driving the tool, the valve assembly being associated with a movable member capable of shifting the distributing valve to close the pressure fluid supply to the motor upon attainment of a predetermined high fluid pressure in the latter and simultaneously open the exhaust of said motor to allow return to initial condition. Another feature resides in a spring for returning the piston when the air pressure behind it is relieved.

Other objects and features will be more fully disclosed in the following description in conjunction with the accompanying drawing in which:

Fig. 1 is mainly a diagrammatic sectional view of a riveting and compressing tool made according to the invention, the tool being shown in inoperative condition with the throttle valve off;

Fig. 2 is a similar view showing the tool near the end of the power stroke;

Fig. 3 is a further view of the same character showing the tool immediately following the termination of the power stroke when the distributing valve has acted to cut off the supply of pressure fluid; and

Fig. 4 illustrates the tool at the end of the return stroke of the piston and prior to the release of the throttle valve.

The illustrative machine principally includes a tool body or housing, generally indicated at 10, which has the lower or front working end formed into a rigid yoke or jaw 11 terminating in a stationary riveting anvil 12 toward which a movable rivet set 13 is adapted to be driven by piston 14 when pressure fluid is allowed access to said piston upon depression of manual lever 15 pivoted at 16 on the housing 10. The anvil 12 on yoke 11 is adapted to support the rivet 17 in the work 18 (Fig. 1) and when the machine is operated as will be described, the rivet is headed as indicated at 19 in Figs. 2 and 4.

In the construction shown, the compressed air inlet 20 communicates with the space below throttle valve 21, and, upon depression of the valve (Fig. 2) compressed air may flow to the interior of the hollow valve stem through a port 22 therein. A second port 23 in the valve stem is brought to registry with a bushing port 24 by opening movement of the throttle valve, while a third port 25, normally open to atmosphere, is closed. Bushing port 24 is connected to a passageway 26 leading to distributing valve 27. Passageway 26 is in turn connected around a peripheral groove 28 in valve 27 to a passage 29 opening directly into the compression chamber 31 in tool body 10. Thus, opening of the throttle valve 21 serves to establish communication between the pressure fluid supply line and compression chamber 31, thereby initiating a working stroke of the piston assembly. In the closed position of the throttle valve (Fig. 1), chamber 31, supply passages 29 and 26, and the interior of the throttle valve stem are opened to exhaust through port 25 which is at this time positioned above the bushing 32.

Tools of this class are customarily provided with means for terminating automatically the working stroke of the piston assembly when the air pressure within the piston chamber reaches a predetermined height, say 90 pounds per square inch. In this manner the same pressure, for example 3,000 pounds, may be applied to each of a series of rivets, and the pressure capabilities of the tool may be modified to meet the requirements of each size and type of rivet. Control means of an improved character is provided in the present tool for this purpose.

The distributing valve 27 is movable vertically to the partly and fully actuated positions of Figs. 3 and 4, in both of which positions the peripheral groove 28 of the valve is placed out of registry with the passage 26. Communication between passages 26 and 29 is thereby cut off and the supply of pressure fluid to the chamber 31 is discontinued, even though the throttle valve 21 is held open. The distributing valve 27 is shifted from the normal position of Figs. 1 and 2 by means including a control element 33, which is positioned co-axially of the valve 27 and is formed as a piston slidably mounted within the tool body 10. The element 33 comprises a valve-like head seated against a valve seat 34 in the tool housing 10 (Fig. 3) and a stem or body portion of reduced diameter extending past said valve seat into a chamber 35 communicating with the compression chamber 31. A pair of longitudinally spaced

ports 36 and 37 in the element 33 provide for the entry and exit of air to and from the hollow stem thereof. The port 37 is positioned just below the valve head although it could be spaced a distance therefrom, while the outwardly positioned port 36 normally lies within the chamber 35. When the pressure within the chamber 31, as communicated through chamber 35 to the lower end of piston valve 33, rises to a sufficient height the piston element will be shifted axially to the position shown in Fig. 3. The head of element 33 lies adjacent one end of the distributing valve 27 and the above described axial movement of the control element opens port 37 therein to permit air from compression chamber 31 to move the distributing valve to the partly and fully actuated positions of Figs. 3 and 4. In moving to the partly actuated position of Fig. 3, the valve 27 interrupts the supply of pressure fluid to the chamber 31, but the chamber is not yet connected to exhaust. This initial movement of the valve 27 is caused to open a branch 38 of the supply passage 26 by which live air is directed to that end of the distributing valve adjacent the element 33. Under the combined pressures of the air from chamber 31 and branch passage 38, the distributing valve is caused to complete its movement to fully actuated position and, as shown in Fig. 4, then vents the chamber 31 through passage 29 which is now connected around groove 28 to an exhaust passage 39. In response to this operation the piston 14 within tool body or housing 10 begins its return stroke together with rivet set 13, being returned by return springs 42 and accomplishes such movement without encountering the resistance of trapped air in back of the piston.

Actuation of the pressure-relief control element 33 is opposed by a plunger 43 mounted for axial movement within the distributing valve 27 and controlled by a pair of oppositely disposed compression springs 44 and 45. The spring 45, of greater strength than the spring 44, presses the control element toward seated position and has a base in an adjustable nut 46. Through manipulation of the nut 46 the pressure of the spring 45 may be increased and decreased and corresponding changes thereby made in the resistance to actuation of the piston 33. It will be noted that the air supplied through branch passage 38 for shifting the valve 27 to fully actuated position acts also to return the control element to seated position. The escape of live air through the ports 37 and 36, while the distributing valve is held actuated, is thus prevented. When the throttle valve 21 is returned to closed position branch passage 38 is disconnected from the pressure fluid source and the distributing valve permitted to return to normal through the coaction of springs 44 and 45. Passage 38 and communicating areas are at this time vented through throttle valve stem port 25.

The operation of the pressure relief valve 33 and the distributing valve 27 is as follows: During the power stroke, when pressure builds up in the work cylinder 31 and against the lower end of the relief valve 33, to a point slightly greater than the tension of the control spring 45, the relief valve 33 is lifted off its seat, allowing live air to flow through ports 36 and 37 to act against the lower face of the distributing valve 27 to move it to its upper position, as illustrated in Fig. 4. With the distributing valve in its upper position, the pressure in the work cylinder 31 instantly drops to near the zero point, and as pressure is removed from the lower face of relief valve 33, it is closed by pressure acting on its upper face, but the distributing valve 27 is held in its upper position by live air supplied through ports 22, 23, 24 and 38. However, when the source of live air is cut off from the above ports by the throttle valve, the distributing valve 27 is carried through part of its return stroke by the control spring 45 and through the balance of the stroke by the lighter spring 44. The purpose of this light coil spring 44 is to allow the pressure relief valve 33 to open against the tension of the control spring 45 only, thereby eliminating all friction due to the close working fit of the distributor valve. The cylindrical portion of the pressure relief valve 33 having a rather loose fit in its bearing, friction is reduced to a minimum. Such reduction of friction prevents wide variations in the final pressure and makes possible uniform results in driving rivets.

While in the foregoing, the housing or tool body 10 is shown integral with the cylinder 31 and particularly yoke 11, and piston 14 is shown directly connected to rivet set 13 these and other features may differ from the construction described and specifically shown herein within the scope of the invention, and may therefore constitute distinct parts secured together by any suitable means and arranged in similar manner as the equivalent parts are disposed and secured in the disclosure of the copending application already mentioned and of which this is a division. In both cases the governing principles are substantially the same although various modifications are thus possible.

What is claimed is:

1. In a riveting or like machine, the combination of a piston chamber, a pressure fluid supply passage leading to said piston chamber, an exhaust passage leading from said piston chamber, a variably settable distributing valve operable in a first position to open said supply passage and operable in a second position to open said exhaust passage, said valve acting to close said supply passage when moved from first position and to close said exhaust passage when moved from second position, first means acting in response to the attainment of a predetermined pressure in said piston chamber to move said distributing valve from first position, and additional means controlled by said distributing valve for supplementing said first means in moving said valve to second position.

2. A riveting or like machine according to claim 1, characterized in that operation of the additional means is initiated by movement of the distributing valve from first position.

3. A riveting or like machine according to claim 1, characterized in that the additional means comprises a pressure fluid passage communicating with the supply passage at the source thereof and opened by movement of the distributing valve from first position.

4. In a riveting or like machine, the combination of a piston chamber having a piston slidably mounted therein, a pressure fluid supply passage leading to the rear end of said piston chamber for supplying pressure fluid to drive said piston forwardly, an exhaust passage leading from the rear end of the piston chamber, the front end of the latter being constantly vented to atmosphere, distinct means effective to return said piston to initial position in open condition of the exhaust passage, a variably settable distributing valve operable in a first position to open said supply passage and operable in a second position

to open said exhaust passage, said valve acting to close said supply passage when moved from first position and to close said exhaust passage when moved from second position, first means acting in response to the attainment of a predetermined pressure in said piston chamber to move said distributing valve from first position, and additional means controlled by said distributing valve for supplementing said first means in moving said valve to second position.

5. A riveting or like machine according to claim 4, including the feature that operation of the additional means is initiated by movement of the distributing valve from first position.

6. A riveting or like machine according to claim 4, including the feature that the additional means comprises a pressure fluid passage communicating with the supply passage at the source thereof and opened by movement of the distributing valve from first position.

7. In a riveting or like machine, the combination of a piston chamber having a piston slidably mounted therein, a pressure fluid supply passage leading to the rear end of said piston chamber for supplying pressure fluid to drive said piston forwardly, an exhaust passage leading from the rear end of the piston chamber, the front end of the latter being constantly vented to atmosphere, resilient means including at least one return spring disposed in a position to be effective to return said piston to initial position in open condition of the exhaust passage, a variably settable distributing valve operable in a first position to open said supply passage and operable in a second position to open said exhaust passage, said valve acting to close said supply passage when moved from first position and to close said exhaust passage when moved from second position, first means acting in response to the attainment of a predetermined pressure in said piston chamber to move said distributing valve from first position, and additional means controlled by said distributing valve for supplementing said first means in moving said valve to second position.

8. A riveting or like machine according to claim 7 which includes a manually operated throttle valve in said supply passage and in which the distributing valve is held in said second position as long as the throttle valve remains open, whereby the piston is held in its rearmost position until the operator closes and then reopens the throttle valve.

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