April 2, 1946. W. R. KOVACS 2,397,871

CYCLE CONTROLLING DEVICE

Filed Feb. 8, 1943

Fig. 1

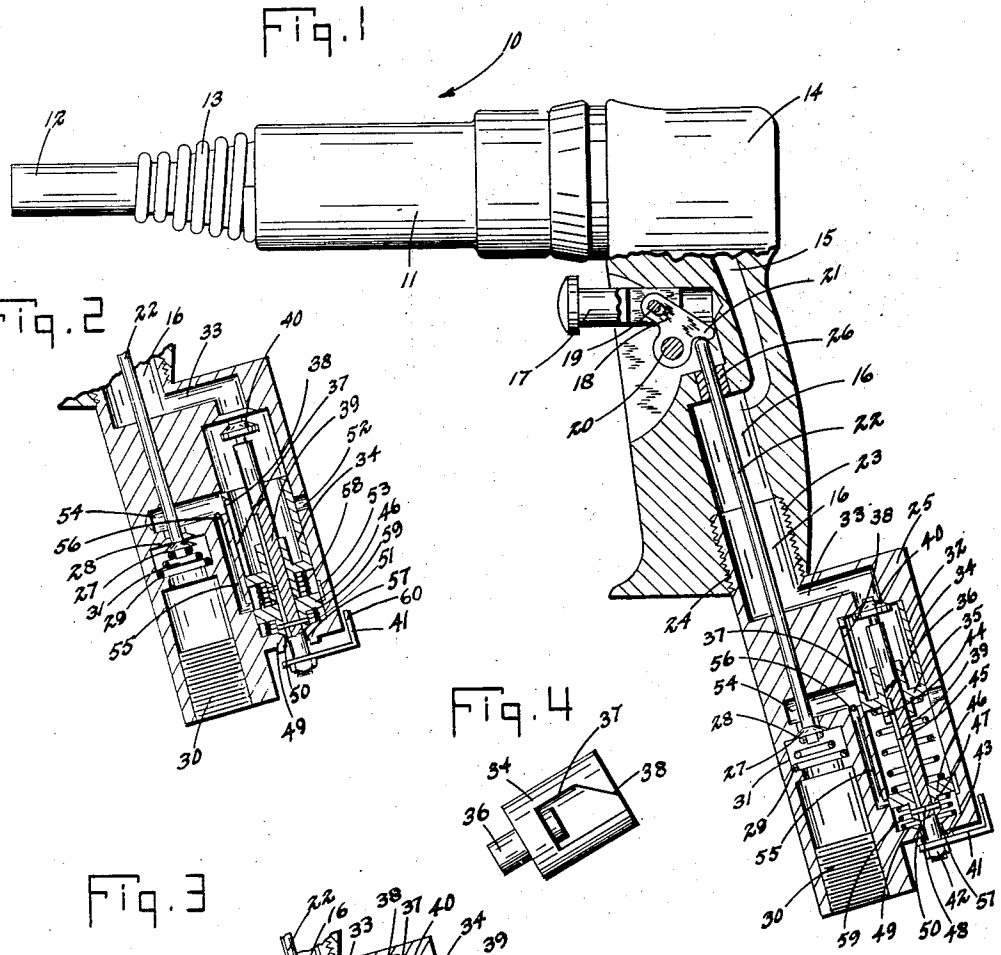
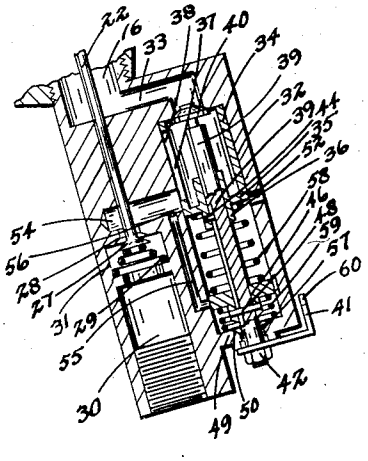


Fig. 2

Fig. 4

Fig. 3



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CYCLE CONTROLLING DEVICE

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5 Claims. (Cl. 137—145)

The present invention relates broadly to fluid actuated tools, but more particularly to fluid actuated riveting hammers of the type used for upsetting rivets. Still more particularly, this invention deals with an improved cycle control or timing device for fluid actuated riveting hammers.

The primary object of the invention is to provide an improved mechanism for automatically controlling the cycle of operation of a riveting hammer to an extent whereby fluid under pressure will be gradually supplied until a predetermined maximum has been reached to accelerate the hammer for upsetting the rivet, and the maximum pressure maintained for a predetermined interval of time before termination of the cycle.

Another object of the invention resides in the provision of an improved cycle control or timing device having the above characteristics which is designed to accurately produce rivet bucktails of uniform height and diameter. In accordance with the present invention, the riveting cycle is pre-set and ceases automatically when the rivet has been upset, thereby avoiding the possibility of damage to the sheet and reducing to a minimum the number of rejects or damaged rivets.

A further object of the invention is to provide a mechanism of this type which can be attached to, or incorporated in, the handle of a fluid actuated riveting hammer with but slight modification of the tool.

Other objects and advantages more or less ancillary to the foregoing reside in the specific construction and aggroupment of the elements peculiar to this structure, as will become apparent from a more complete examination of this specification.

In the drawing which illustrates the invention:

Fig. 1 is a side elevational view of a riveting hammer with the improved cycle control mechanism attached to the handle thereof, the handle and attachment being in section to show details of construction.

Fig. 2 is a view of a portion of the handle shown in Fig. 1 with the parts in another position.

Fig. 3 is a view similar to Fig. 2 with the parts in still another position.

Fig. 4 is a perspective view of the slidable cylinder through which the pressure fluid flows, the same being removed from its housing.

Referring to the drawing for a more detailed description thereof, a fluid actuated riveting hammer is generally designated by the reference numeral 10 and includes a cylinder 11 having a piston (not shown) reciprocable therein and active on a rivet set 12 which is operatively mounted within the front end of the cylinder 11 and secured in position by a suitable retainer 13. To the cylinder 11 is threaded, or otherwise affixed, a handle 14 provided in its upper end with a passage 15 which leads into the cylinder 11 for admitting motive fluid, such as compressed air, therein to effect reciprocation of the piston and thereby cause rapidly recurring impacts to be delivered to the rivet set 12. The outer end of the passage 15 communicates with a relatively large cylindrical shaped bore 16 which bore extends outwardly through the end of the handle as clearly shown in Fig. 1 of the drawing.

A depressable trigger 17 is slidably mounted in the handle 14 and is preferably positioned adjacent the connecting end of said handle for convenience of the operator handling the tool. A lever 18 has one end 19 pivotally attached to the inner end of the trigger 17 by a pin and slot connection and said lever is pivotally connected at 20 to the handle 14. A cam-like portion 21 is formed integral with the lever 18 and is normally in engagement with the upper end of a slidable supported rod 22 for a purpose to be hereinafter more fully described.

The outlet end of the bore 16 is interiorly threaded as indicated at 23 for receiving the threaded end 24 of a housing 25, said housing enclosing the cycle controlling mechanism about to be described. As shown in Fig. 1 of the drawing, the housing 25 depends from the handle 14 and the rod 22 extends downwardly through the bore 16 and into said housing. The upper end of the rod 22 passes through a bushing 26 provided in the handle 14 while the lower end of said rod carries a valve 27 which is normally urged into contact with its seat 28 by means of a compression spring 29. The housing 25 is adapted to be connected with a motive fluid supply conduit (not shown) through the threaded end 30, and for convenience of operation, the threaded end 30 is preferably disposed so as to be in alignment with the bore 16 and threaded end 23. The threaded end 30 communicates with a recess 31 in which is housed the compression spring 29.

The housing 25 is also formed with a cylindrical bore 32 which communicates with the bore 16 and threaded end 24 through the passage 33, and mounted for slidable movement within the bore 32, is a hollow cylinder or plunger 34 formed with a bottom wall 35 and sleeve 36 of integral construction. The cylinder 34 is formed with an opening 37 and, as more particularly shown in Fig. 4 of the drawing, said opening is of substan-

tially the same size throughout the major portion of its length, but one wall thereof inclines inwardly toward the upper end of said cylinder to form a restricted opening 38 for a purpose to be hereinafter described.

Also mounted within the bore 32, there is a stem 39 which carries a valve 40 on its upper end for controlling the passage of fluid from the bore 32 into the passage 33. Supported on the lower end of the stem 39 which projects through an orifice 57 in the end wall of the housing 25 is a lever 41, the same being attached thereto by means of the nut 42. A washer 43 is provided for spacing the lever 41 from the end wall of the housing.

The cylinder 34 is supported on the stem 39 for rotation therewith and for longitudinal movement relative thereto, it being noted that said stem is guided through the sleeve 36 and that said sleeve carries a pin 44 which is engageable within a slot 45 formed longitudinally of said stem. It will thus be seen that the cylinder 34 will rotate with the stem 39 as the latter is rotated by the lever 41 and, as will hereinafter appear, the cylinder 34 is rotated when the position of the opening 37 is to be changed. As will also hereinafter appear, entrance of air under pressure through the opening 37 of the cylinder 34 will move said cylinder downwardly on the stem 39, the cylinder being guided through engagement of the pin 44 within the slot 45. The stem 39, adjacent its lower end, supports a piston 46 and said piston is formed with a depending portion 47 of a reduced diameter through which passes a pin 48 for locking the piston to the stem 39. Thus, the piston 46 is supported on the lower end of the stem 39 for movement therewith in a longitudinal as well as a rotary direction. The end wall 49 of the housing 25 is formed with a cup-shaped valve seat 50 through which the stem 39 projects, and is adapted to support therein the tapered end 51 of the piston 46 during one phase of the cycle. By this construction, the reduced end of the piston 46 acts as a valve for preventing the escape of motive fluid through the orifice 57, said orifice acting as a vent for the lower end of the bore 32, communication therewith being provided through the recess 53. A second vent 52 is formed substantially intermediate the ends of the bore 32 whereby said bore may be additionally vented at the termination of the cycle. Interposed between the upper face of the piston 46 and the bottom wall of the cylinder 34, there is a spring 58 which normally maintains said cylinder in the upper end of the bore 32. A similar spring 59 is interposed between the bottom face of the piston 46 and the bottom wall 49 for maintaining said piston in its normal position shown in Figs. 1 and 3.

A horizontally extending passage 54 is formed above the valve 27 and communicates with the vertical bore 32. With the valve 27 in open position, air under pressure is admitted through the inlet 30 and flows through the passage 54 and opening 37 of the cylinder 34. A restricted passage 55 communicates with the passage 54 adjacent its discharge end and the lower end of the passage 55 communicates with the bore 32 adjacent its lower end. The upper end of the passage 55 is controlled by means of a needle valve or the like 56, while the discharge end thereof is controlled by the piston 46.

In the operation of the device, with the parts in the position shown in Fig. 1 of the drawing, the rivet set is positioned adjacent the rivet to be upset and the operator depresses the trigger 17 for urging the rod 22 outwardly through the action of the lever 18 to unseat the valve 27, said valve being displaced from its seat against the pressure of the spring 31. Air under pressure then enters the passage 54 and flows into the cylinder 34 through the opening 37. By referring to Fig. 3 of the drawing it will be noted that the valve 27 is in open position while the valve 40 is in closed position and therefore the pressure of the air entering the cylinder 34 will urge said cylinder downwardly on the stem 39 until the lower end of the sleeve 36 contacts the upper face of the piston 46. The cylinder 34 continues to move downwardly on the stem 39 and forces the piston 46 downwardly until the tapered end 51 thereof is seated on its seat 50. As clearly shown in Fig. 2 of the drawing, downward movement of the cylinder 34 will collapse the spring 58 and likewise downward movement of the piston 46 will collapse the spring 59. During the downward movement of the cylinder 34, the stem 39 remains stationary until contact is made with the piston 46 and as said piston is forced downwardly, the stem 39 will be similarly moved to unseat the valve 40, thereby allowing the air to be discharged through the passage 33 into the bore 16 and passage 15 for action on the hammer. At this phase of the cycle, the parts are all in the position and in the relation shown in Fig. 2 and it will be observed that the restricted opening 38 of the cylinder 34 is then disposed substantially opposite to the passage 54. Since the lower end of the restricted passage 55 has been uncovered by movement of the piston 46, a certain amount of air under pressure will be discharged in the area between the bottom wall 35 of the cylinder 34 and the upper face of the piston 46 and the pressure therein is gradually built up until the cylinder 34 is caused to move upwardly on the stem 39. The pressure of air on the face of the piston 46 will maintain said piston in its Fig. 2 position until the cylinder 34 has returned to its normal position at which time the air within the bore 32 will be vented through the outlet 52 whereupon the pressure of the spring 59 will be sufficient to return the piston 46 to its normal position to close the discharge end of the passage 55. Of course, upward movement of the piston 46 will cause the stem 39 to be moved upwardly to seat the valve 40 and thereby shut off the flow of air to the hammer.

A feature of the present invention provides for the gradual flow of air under pressure to the hammer until a maximum pressure has been reached and the maximum pressure maintained for a predetermined interval of time before termination of the cycle. The restricted opening 38 of the cylinder 34, with said cylinder in the Fig. 2 position, will cause a gradual feeding of air under pressure to the hammer until said cylinder begins to rise on the stem 39 in the manner previously described. As the cylinder rises the opening 38 will move upwardly beyond the passage 54 and gradually increase in size until the full opening 37 is opposite the passage 54 at which time maximum pressure is being fed to the hammer and that pressure will be maintained until the piston 46 moves from the Fig. 2 to the Fig. 3 position for closing the valve 40.

The lever 41 forms the means for controlling the size of the opening 37 that is exposed to the passage 54 and the size of the opening governs the amount of pressure being supplied to the

hammer. As is understood, the larger the size of the opening the larger the volume of pressure to be supplied and conversely the smaller the size of the opening the smaller the volume of pressure that will be supplied to the hammer. If desired, a suitable gauge can be attached to the outer wall of the housing 25 and the upturned end 60 of the lever 41 will point to the gauge and serve as an indicator for denoting the size of the opening as the stem 39 and cylinder 34 are rotated under the action of the lever 41.

The upper end of the restricted passage 55 is controlled by a needle valve or the like 56 and is adjusted by the operator. Restricting the inlet opening to the passage 55 will delay the action of the cylinder 34 providing a longer time cycle and conversely an unrestricted opening will increase the flow of air through said passage to speed up the time cycle.

From the above description when taken in connection with the accompanying drawing, it will be readily apparent that there has been provided an improved mechanism for automatically controlling the cycle of operation of a riveting hammer to an extent whereby pressure will be gradually applied until a predetermined maximum has been reached to accelerate the hammer and the maximum pressure maintained for a predetermined interval of time before termination of the cycle. The width of the opening 37, 38 governs the amount of pressure to be fed to the hammer the reduced end 38 providing for gradually building up the pressure to the hammer. The entire operation is automatic and is beyond the control of the operator after the trigger has been depressed. In view of the fact that the riveting cycle is pre-set through the medium of the handle 41 and needle valve 56, and will cease automatically when the rivet has been upset, there is very little possibility of damage to the sheet as well as a reduction to a minimum of the number of rejects or damaged rivets. Moreover it will be seen that a riveting tool or hammer embodying the control means herein disclosed can be used for rapidly driving a series of individual rivets in succession, and that since the riveting operation is automatically controlled and terminated all of the rivets of the series will be subjected to substantially the same riveting operation and will be upset to substantially an identical extent.

Although the foregoing description is necessarily of a detailed character, in order to completely set forth the invention, it is to be understood that the specific terminology is not intended to be restrictive or confining and it is to be further understood that various rearrangements of parts and modifications of structural detail may be resorted to without departing from the scope or spirit of the invention as herein claimed.

I claim:

1. In mechanism of the character described, a housing having a bore with a valve seat at one end thereof, a stem in said bore carrying a valve cooperating with said seat, a spring active upon said stem for biasing it toward valve closing position, a piston fixed upon said stem movable in said bore, a plunger in said bore between said valve and said piston slidable on said stem, said housing having an intake for pressure fluid communicating with said bore functioning to exert pressure on said piston for opening the valve, and functioning thereafter to exert pressure between said piston and said plunger for gradually moving the plunger away from the piston, and means controlled by the latter movement of the plunger for relieving the pressure on said piston and thereby permitting said spring to shift the valve to closed position.

2. In mechanism of the character described, a housing having a bore with a valve seat at one end thereof, a stem in said bore carrying a valve cooperating with said seat, a spring active upon said stem for biasing it toward valve closing position, a piston fixed upon said stem movable in said bore, a plunger in said bore between said valve and said piston slidable on said stem, said housing having an intake for pressure fluid communicating with said bore functioning to exert pressure against the valve side of said plunger, and against the valve side of said piston for opening the valve, and functioning thereafter to exert pressure between said piston and said plunger for gradually moving the plunger away from the piston, and means controlled by the latter movement of the plunger for relieving the pressure on said piston and thereby permitting said spring to shift the valve to closed position.

3. In mechanism of the character described, a housing having a bore with a valve seat at one end thereof, a stem in said bore carrying a valve cooperating with said seat, a spring active upon said stem for biasing it toward valve closing position, a piston fixed upon said stem movable in said bore, a plunger in said bore between said valve and said piston slidable on said stem, said housing having an intake for pressure fluid with a relatively large port communicating with said bore on the valve side of said plunger and a relatively small port communicating with the bore on the opposite side of the plunger, said plunger being effective in response to flow through said larger port for shifting said stem to open the valve, flow through said smaller port entering the space between said piston and said plunger for holding the piston in valve open position and gradually moving the plunger away from the piston, and means controlled by said plunger in its latter movement for relieving the pressure on said piston and permitting said spring to shift the valve to closed position.

4. The mechanism defined in claim 3 characterized in that said piston, in its position corresponding with closed valve position, covers and blocks said smaller port and uncovers it in valve open position.

5. The mechanism defined in claim 1 characterized in that spring means are provided for assisting the movement of said plunger away from said piston.

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