March 7, 1944. C. W. CHERRY 2,343,278

RIVETING DEVICE

Filed Aug. 3, 1940 2 Sheets-Sheet 1

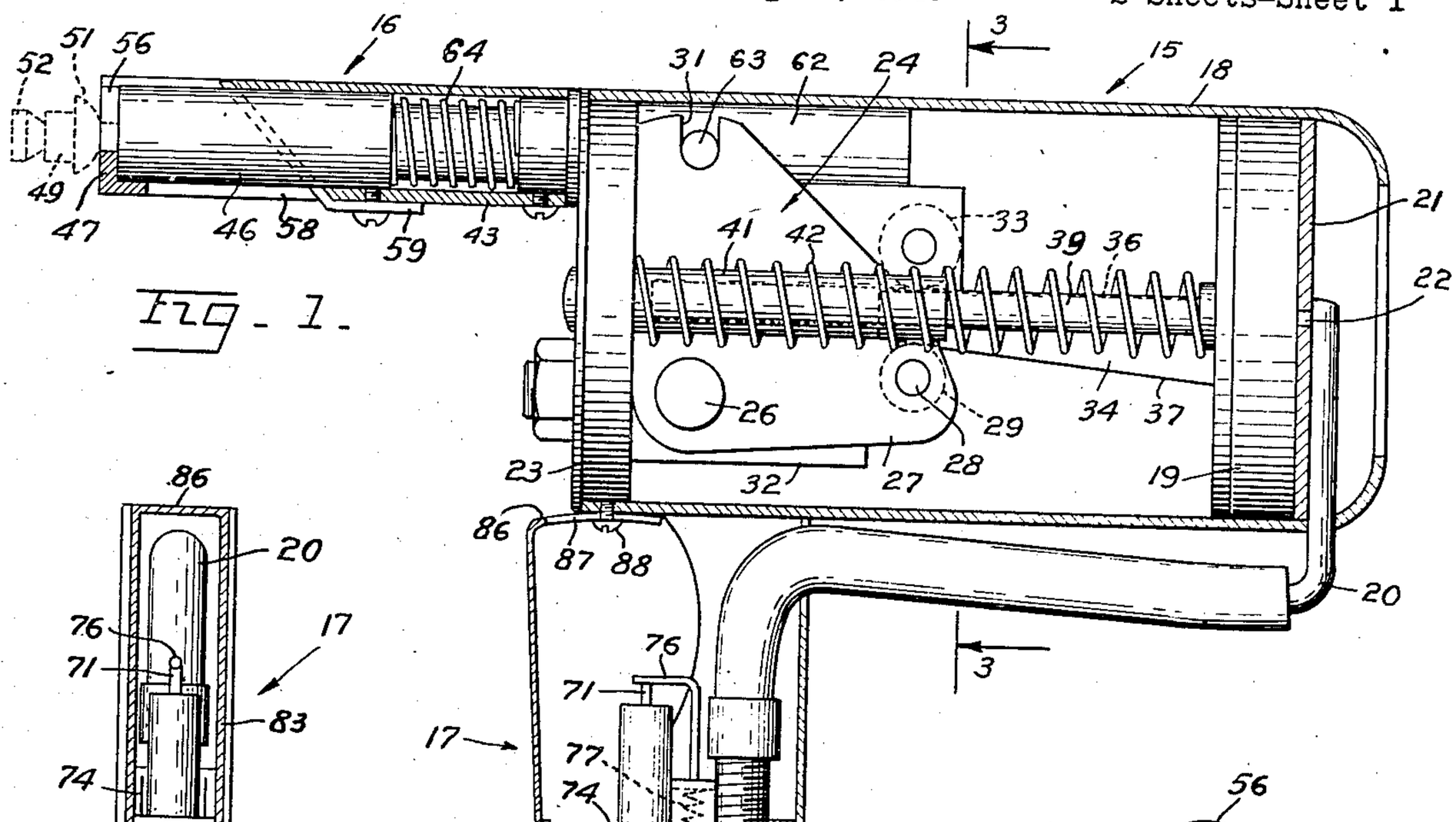


Fig. 1.

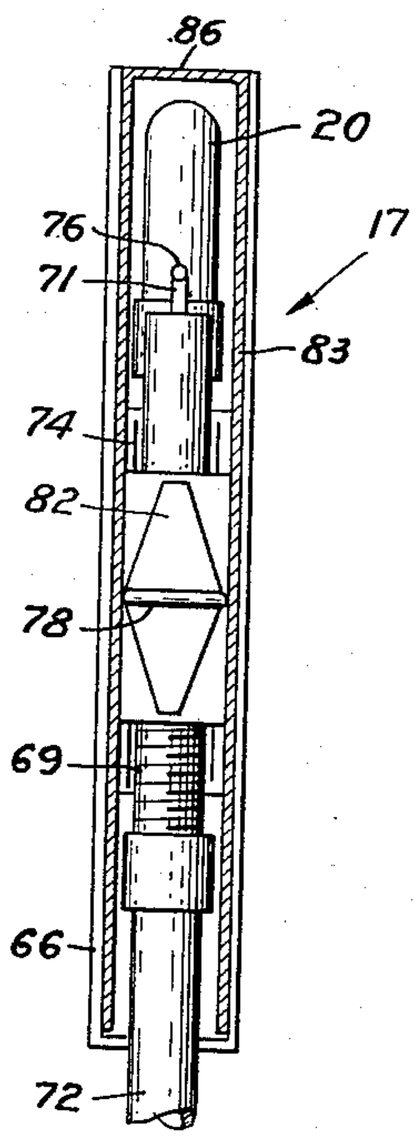
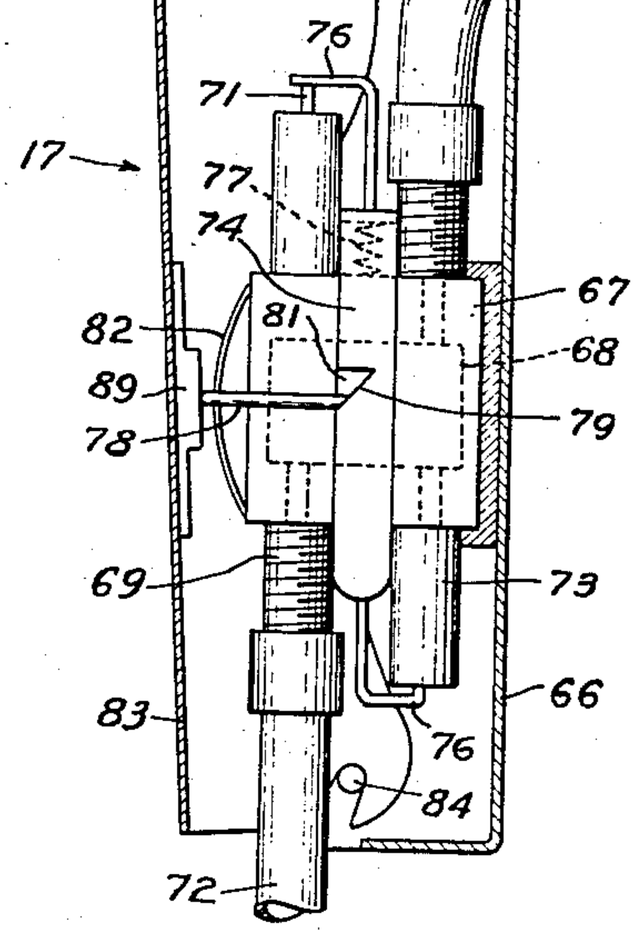


Fig. 2.



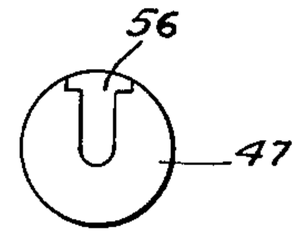


Fig. 4.

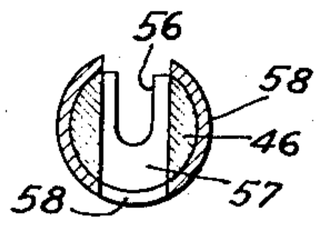


Fig. 5.

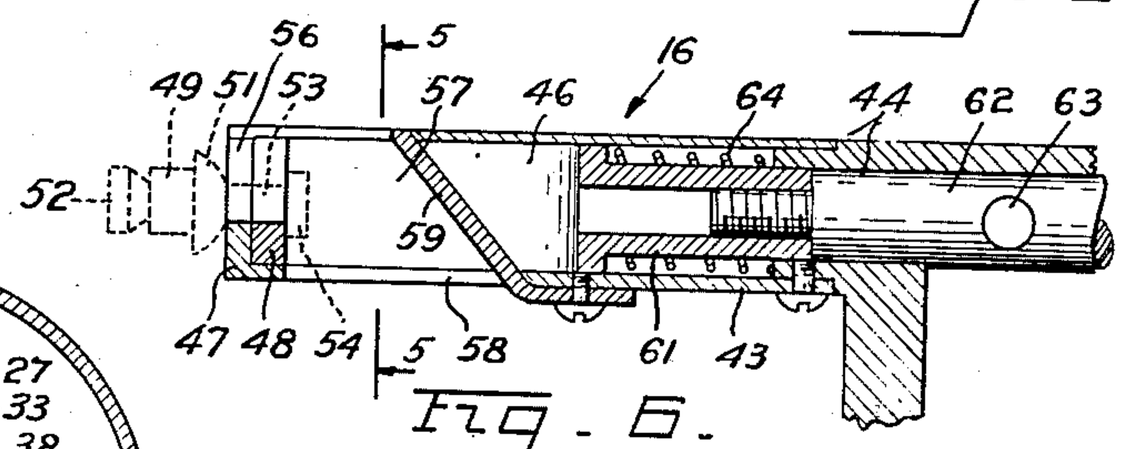


Fig. 6.

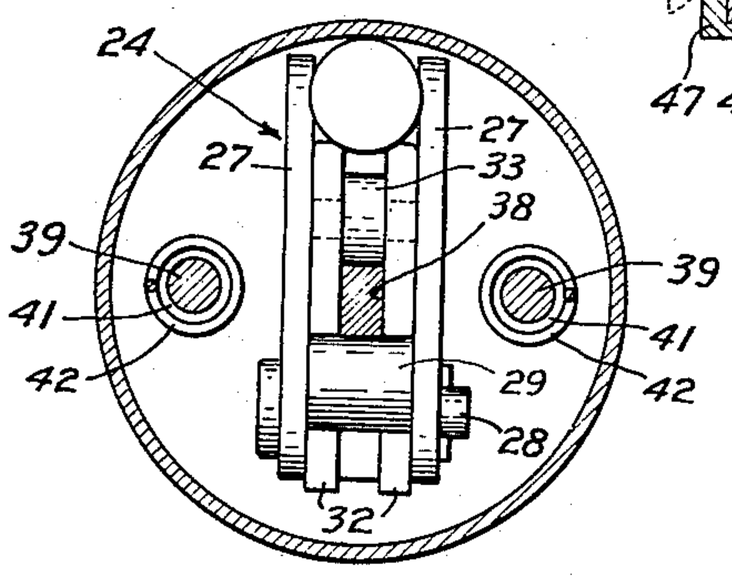


Fig. 3.

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RIVETING DEVICE

Filed Aug. 3, 1940 2 Sheets-Sheet 2

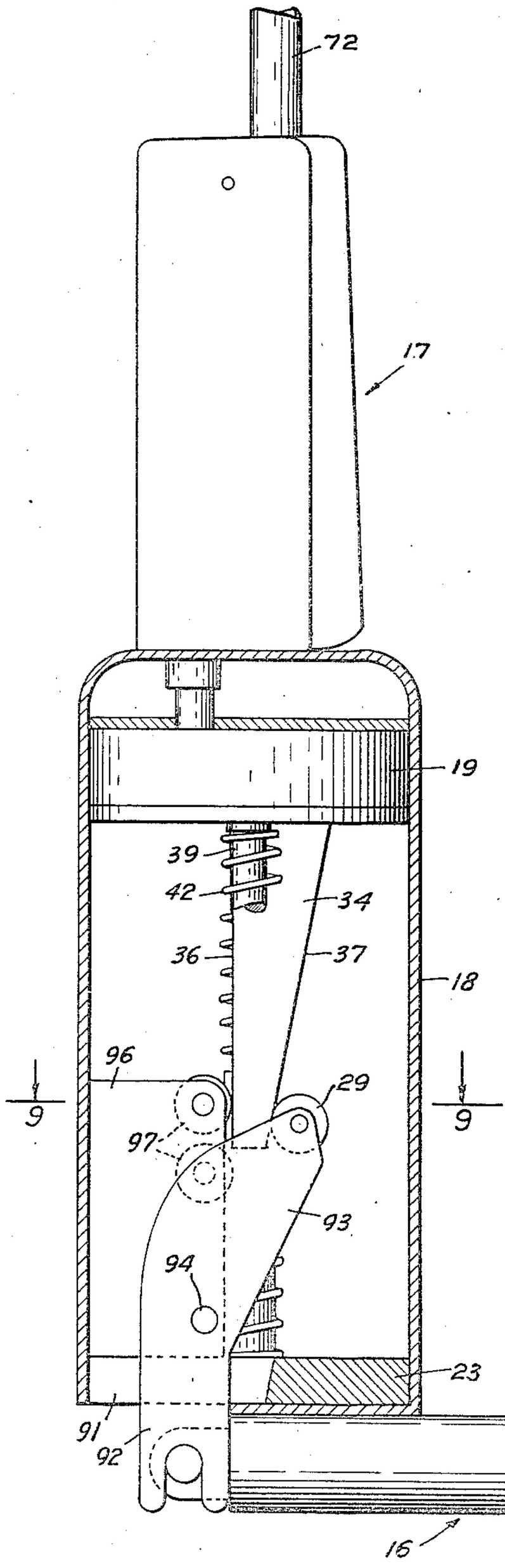

Fig. 7.

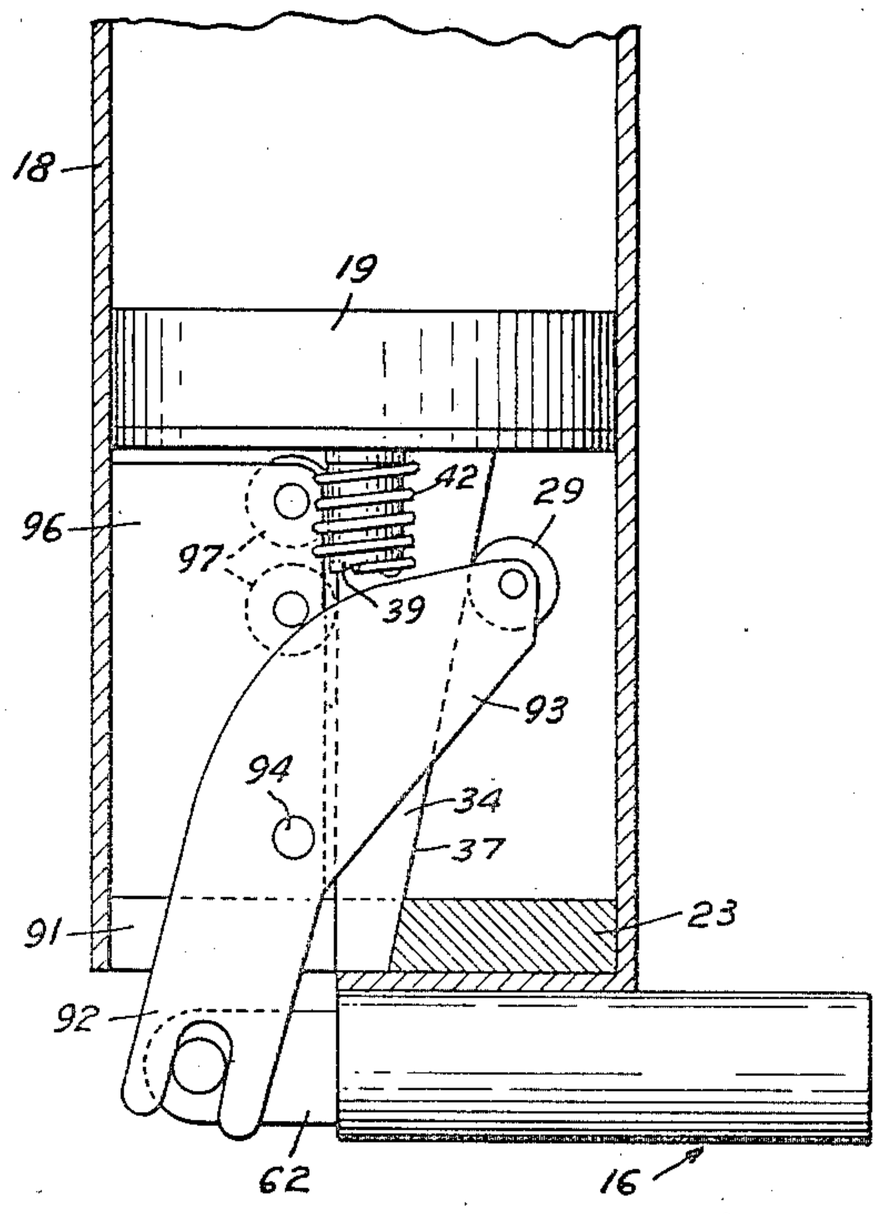

Fig. 8.

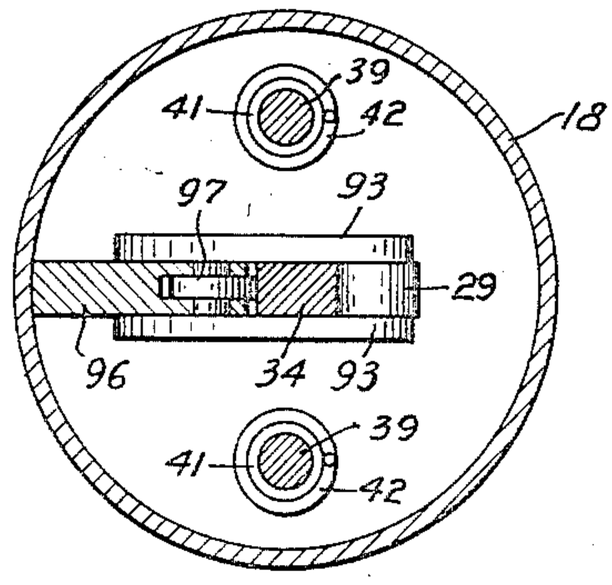

Fig. 9.

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RIVETING DEVICE

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Application August 3, 1940, Serial No. 351,279

6 Claims. (Cl. 218—19)

This invention relates to a riveting apparatus.

An advantage of this riveting apparatus is that it is easily handled while it carries and holds the rivet in operative position during the insertion of the rivet into the object to be riveted as well as during the riveting operation. This riveting apparatus is particularly adapted for use in connection with rivet assemblies adapted for riveting from one side only of the objects to be secured together, such a rivet assembly being shown in my Letters Patent No. 2,183,543, wherein the rivet assembly includes a tail former so arranged in a hollow rivet that the rivet is secured in place by exerting pressure on the head of the rivet and an opposite pull on the tail former for forming the rivet tail against the objects to be riveted.

An object of this invention is to provide a riveting apparatus in which a rivet assembly can be carried and held in operative position and placed into the rivet holes and which has a compact mechanism therein for transmitting power for the riveting operation at a desired angle relatively to the axis of the apparatus.

Another object of this invention is to provide a mechanism for transmitting the power from a reciprocating element to a riveting apparatus at a desired angle relatively to the axis of reciprocation and with a predetermined stroke and increased force.

Another object of this invention is to provide a riveting apparatus wherein the riveting force is transmitted to the riveting elements of the apparatus by a firmly fulcrumed transmission mechanism and by means to convert the reciprocating movement into suitable oscillation of the fulcrumed transmission mechanism wherein said converting means are utilized to increase the applied power.

Another object of this invention is to provide a riveting apparatus which is highly useful and simple in construction. Convenience of arrangement, lightness and comparative inexpense of manufacture are further objects which have been borne in mind in the production and development of the invention.

With the foregoing and other objects in view, my invention resides in the combination and arrangement of parts and in the details of construction hereinafter described and claimed, it being understood that changes in the precise embodiment of the invention hereinafter disclosed may be made within the scope of the appended claims without departing from the spirit of the invention.

The invention is clearly illustrated in the accompanying drawings, wherein:

Fig. 1 is a partly sectional side view of the riveting apparatus constructed in accordance with my invention.

Fig. 2 is an end view of the control valve of the riveting apparatus in the handle, the casing of the handle being cut away.

Fig. 3 is a sectional view taken through the lines 3—3 of Fig. 1.

Fig. 4 is an end view of the pressure member of the riveting tool.

Fig. 5 is a sectional detail view through the pressure and pulling members of the riveting tool of the apparatus, the section being taken through the lines 5—5 of Fig. 6.

Fig. 6 is a longitudinal section view of the riveting tool of the apparatus.

Fig. 7 is a partly sectional view of modified embodiment of the riveting apparatus.

Fig. 8 is a partly sectional view of said modified embodiment of the riveting apparatus showing it at the completion of the riveting stroke, and

Fig. 9 is a sectional view of the modified riveting apparatus taken through the lines 9—9 of Fig. 7.

In its general organization my invention includes a power transmitting mechanism, or a so-called riveting gun 15, means for carrying and holding the rivets and exerting riveting force on the rivets, namely the riveting tool or riveting head 16, and a handle or grip portion 17 containing the controls for the operation of the device.

The riveting gun 15 includes a casing or a cylinder 18 in which works a piston 19 toward and away from an end wall 21 of the cylinder. A port 22 in the end wall 21 serves as intake and exhaust port for the cylinder 18. A conduit 20 communicates the port 22 with the control mechanism in the handle 17. Power is transmitted from the piston 19 to the reveting head 16 through a transmission mechanism within the cylinder 18 disposed between the piston 19 and the riveting end 23 of the cylinder 18. A bell crank frame 24 is fulcrumed around a pivot 26 transversely of the cylinder 18. In the form illustrated in Fig. 1 this bell crank frame 24 is constructed of a pair of parallel and spaced substantially triangular discs 27 so as to form a pair of lever arms substantially at right angles to each other extending from the pivot 26 to the respective ends of the discs 27. The parallel discs 27 are connected to each other at their

ends nearest to the piston 19 by a pin 28 on which is rotatable a roller 29 in the space between the discs 27. The other ends of the discs 27 have notches 31 so arranged as to connect to the pulling parts of the riveting head 16.

A guide bracket 32 extends from the riveting end 23 of the cylinder 18 between the discs 27 and toward the piston 19. The guide bracket 32 has a guide roller 33 thereon opposite to and spaced from the initial position of the roller 29. A wedge-like projection 34 extends from the back of the piston 19 to between the rollers 29 and 33 so that the tapering edges of the projection 34 contact the rollers 29 and 33 and force the oscillating roller 29 away from the guide roller 33. The wedge-like projection 34 is a substantially flat rigid piece of material preferably integrally united with the piston 19. The upper edge 36 is substantially parallel with the axis of reciprocation and is in alignment with the lowermost point of the periphery of the guide roller 33 so that it moves linearly. The lower or tapering edge 37 of the projection 34 bears against the oscillating roller 29 so as to push the latter away from the guide roller 33 when advanced by the piston 19. The upper guide roller 33 prevents the tilting of the projection 34 upwardly under the forces exerted by and upon the tapering edge 37 of said wedge-like projection 34. The guide bracket 32 functions as a backing element for guiding the projection 34 on a straight linear path. The guide bracket 32 has side pieces inclosing a guide recess 38, as shown in Fig. 3, which pieces fit against the sides of the wedge-like projection 34 so as to prevent the twisting or turning of the projection 34.

As the oscillating roller 29 is forced away from the guide roller 33 it rocks the bell crank frame 24 around its fulcrum 26 so as to move the notched end of the bell crank frame 24 substantially opposite to the movement of the piston 19 and thus exert the riveting force in the riveting head 16. In order to counteract binding action on the piston 19 a pair of rods 39 are extended from the piston 19 so as to telescope into tubular guides 41 which latter fixedly extend from the riveting end 23 on opposite sides of the bell crank frame 24. A coil spring 42 around each of said tubular guides 41 bears at one end against the riveting end 23 of the cylinder 18 and at the other end against the back of the piston 19 so as to normally urge the piston 19 back to its initial position as shown in Fig. 1. During the power stroke of the piston 19 the wedge-like projection 34 oscillates the bell crank frame 24 in one direction to exert the riveting pull, and during the return stroke the bell crank frame 24 is rocked back to its original initial position by the force of spring 64 on the riveting tool proper. The power is increased and the stroke is reduced when the linear stroke of the piston 19 is converted into oscillation of the bell crank frame 24 by the coaction of the wedge edge 37 of the projection 34 and the roller 29 on the near end of the bell crank frame 24. The stroke and force exerted on the riveting head 16 are determined by the taper of the wedge edge 37 and by the relative distances of the respective ends of the bell crank frame 24 with respect to the fulcrum 26.

The riveting tool or riveting head 16 is particularly adapted to receive and hold a hollow rivet assembly in a position ready for riveting so that the rivet is carried by the riveting head 16 to the object to be riveted and inserted into the rivet hole from one side of said object. A sleeve 43 is secured to the riveting end wall 23 of the cylinder 18. This sleeve 43 in the illustration shown in Fig. 1 extends substantially parallel with the axis of the cylinder 18 but is offset to one side relative to said axis. A hole 44 in the riveting end wall 23 of the cylinder 18 is axially aligned with the hollow interior of the sleeve 43. Inside said sleeve 43 reciprocates a pulling bar 46. On the end of the sleeve 43 is formed a pressure head 47 adapted to be pressed against the rivet head of the rivet assembly. The outer end of the pulling bar 46 is hollow and has a pulling head or engagement head 48 for engaging the end of the tail former of the rivet assembly. Such a rivet assembly is shown in broken lines in Fig. 6 wherein the hollow rivet body 49 has a rivet head 51 on one end thereof, and has a tail former 52 opposite its tail end. The tail former has a stem 53 extended through the hollow rivet body 49. In this form the stem 53 has an engagement portion 54 thereon for engagement by the pulling head 48 of the pulling bar 46. It is to be noted that the initial spacing between the pressure head 47 and the pulling head 48 is the same as the spacing between the top of the rivet head 51 and the inner shoulder of the engagement portion 54 of the rivet stem 53. The adjacent outer ends of the pressure sleeve 43 and of the pulling bar 46, as well as the pressure head 47 and the engagement or pulling head 48 are provided with aligned slots 56 at one side for the side wise insertion of the rivet assembly into the riveting tool. The slots 56 in the pressure head 47 and in the pulling head 48 are just wide enough to accommodate the portion of the former stem 53 between the rivet head 51 and the engagement portion 54. In this manner the rivet assembly is held so that its component parts are received and carried in a uniform predetermined initial relation to each other and are inserted into the rivet hole in uniform relative position.

The pulling bar 46 has a hollow portion immediately adjacent the pulling head 48 which is formed by cutting through the bar so as to provide an open passage 57 through the pulling bar 46. The outer sleeve 43 has an opening 58 opposite the slots 56 and in registry with the passage 57 so that broken parts of the rivet assembly can be dropped out of the tool. A transverse guide 59 extends across the sleeve 43 and through the passage 57 of the pulling bar 46 so as to limit the outward travel of the pulling bar 46 and guide the broken rivet parts out of the passage 57. The pulling bar has a reduced inner end 61 into the end of which is threadedly secured a connecting rod 62 which latter in turn is slidable through the hole 44 in the riveting end wall 23 of the cylinder 18. The connecting rod 62 has oppositely extended cylindrical lugs 63 which engage the notches 31 in the upper end of the bell crank frame 24. A coil spring 64 in the sleeve 43 positioned around the inner end 61 of the pulling bar 46 urges the pulling bar 46 to its initial rivet receiving position and also assists in returning the bell crank frame 24 into its initial position during the return stroke of the piston 19 of the riveting apparatus. During the power stroke of the piston 19 the connecting rod 61 is pulled inwardly of the cylinder 18 and pulls the pulling bar 46 therewith so that the pulling head 48 pulls the former stem of the rivet and forces the tail former 52 into and against the rivet tail and thereby forms the rivet tail against the objects to be secured together and fastens the rivet in place. In some instances the former stem breaks

or loosens at the completion of the riveting operation and the broken parts are dropped out through the passage 57.

The handle or grip 17 of the apparatus has a casing 66 secured to the cylinder 18 so as to extend at a suitable angle for the convenient handling of the riveting gun. Inside this casing 66 is held a valve block 67 which has a chamber 68 therein. To one end of this chamber 68 is connected the conduit 20 leading to the cylinder port 22. In the other end of the chamber 68 is an intake valve 69 which in this instance is the usual type pneumatic valve actuated by a pin 71 extended through the opposite end of the block 67. A preferably flexible intake conduit 72 leads to the intake valve 69. A vent valve 73 is provided in the chamber 68. This vent valve 73 is also of the usual type pneumatic valve. A rectangular yoke 74 is slidably held in suitable grooves on the valve block 67 and is provided at its opposite ends with abutments 76 respectively aligned with the actuator pin 71 of the intake valve 69, and with the similar pin of the vent valve 73 so as to act on the respective valves in opposite directions. A compression spring 77 on the valve block 67 bears against the yoke 74 so as to urge it normally upward as seen in Figures 1 and 2 that position wherein the intake valve 71 is closed and the vent valve 73 is open as shown in Fig. 1. The yoke 74 is moved downwardly by a substantially U shaped lever 78 guided in grooves in the sides of the valve block 67 at right angles to the yoke 74 so that the ends of the lever 78 engage the inclined sides 79 of cam recesses 81 and push them downwardly against the action of said yoke spring 77. The lever 78 is resiliently maintained in its withdrawn position by a suitable leaf spring 82. The valve mechanism is actuated by means of a movable cover 83. This cover 83 covers the open side of the casing 66 and is pivoted at 84 on the lower side portions of the casing 66. The end 86 of the cover 83 is arcuate and has a slot 87 therein for slidable engagement with a set screw 88. A boss 89 on the inside face of the cover 83 bears against the top of the lever 78.

As the gun handle casing 66 is gripped the riveting gun is operated by pressing the cover 83 so as to move the lever 78 against the wedge sides 79 of the recesses 81 thereby to move the yoke 74 downwardly so as to open the intake valve 69 and to allow the vent valve 73 to close. The fluid or air under pressure passes through the chamber 68 of the valve block 67 and through the conduit 20 and port 22 against the piston 19. The pressure moves the piston 19 which latter operates the transmission and the rivet head or tool 16 as heretofore described. After the riveting operation the handle cover 83 is released allowing the actions of the springs 82 and 77 to return respectively the lever 78 and the yoke 74 to their initial positions, in which position the intake valve 69 is closed and the vent valve 73 is open. The air or fluid escapes from the path of the returning piston 19 through the vent valve 73.

In the modified embodiment of my device, shown in Figures 7, 8, and 9, the cylinder 18, the piston 19 and the valves in the handle or grip mechanism 17 operate similarly to the operation of the first embodiment heretofore described. However this modified embodiment is particularly adapted for use where the space near the riveting point is limited and a side wise application of the riveting apparatus is necessary. For this purpose the handle or grip 17 is mounted on the intake end of the cylinder 18 so as to form a comparatively narrow longitudinal unit. The riveting head or tool 16 is mounted on the riveting end 23 of the cylinder 18 so as to extend at right angles to the axis of the cylinder 18. An opening 91 in the riveting end 23 of the cylinder 18 is large enough to accommodate the rocking of the outer end 92 of the bell crank frame 93 around its fulcrum 94. In this form the fulcrum 93 is above the axis of reciprocation of the wedge-like projection 34. The inner end of the bell crank frame 93 has the oscillating roller 29 therein in contact with the tapering wedge edge 37 of the projection 34 for the converting of the piston reciprocation in the manner heretofore described in connection with the first embodiment of this invention. In the bracket or guide 96 are parallel guide rollers 97 for holding the wedge-like projection 34 against upward tilting. In other respects the riveting apparatus of both forms operate similarly.

In riveting operations the rivet assembly is fed into the riveting tool or head 16 and is carried by the gun into riveting position and into the rivet hole. Then the handle cover is pressed and the piston 19 is moved toward the riveting end of the cylinder. This movement of the piston 19 is converted by said wedge and bell crank action into a pulling force on the pulling elements of the riveting head 16 for pulling the tail former and forming the rivet tail into fastening position. The riveting operations are thus quickly and efficiently performed with uniformity even where the space for the riveting operation is limited.

I claim:

1. In an apparatus for setting rivet assemblies of a type including a tubular rivet element and a member extending therethrough for forming the rivet tail when pulled axially relatively to said rivet element, power operated means for engaging and pulling said member through the tubular rivet element, a casing, means on the casing for applying the reactionary force of the pull to the tubular rivet element as it is held against the structure being riveted, a piston working in the casing, a fulcrumed frame between the piston and the pulling member, an end of the frame on one side of the fulcrum engaging said pulling member for moving said pulling member, a projection extended from the piston to said frame, said projection having an inclined edge, means on the frame on the other side of the fulcrum contacting the inclined side of said projection so as to turn the frame around its fulcrum to pull said pulling member when the projection is moved by the power stroke of the piston and a stationary guide to back the projection against the force exerted on its inclined edge.

2. A riveting apparatus for a hollow rivet having a former stem extending therethrough, comprising a cylinder, a piston working in the cylinder, a riveting tool extended from the outside of said cylinder, said riveting tool including a member projecting beyond said cylinder to apply a reactive force on the hollow rivet, a movable element in said member adapted to engage said former stem so as to pull said former stem oppositely to said reactive force for forming the tail of said rivet, an oscillating frame in said cylinder, an end of said oscillating frame being connected to said movable element for moving the same oppositely to the direction of the strokes of said piston, a projection extended from the piston to the other end of said oscillating frame,

anti-friction means on the end of the oscillating frame adjacent said projection, means on said projection bearing on said anti-friction so as to oscillate said frame for pulling said stem when the piston is moved toward the end of the cylinder at which said riveting tool is located, a guide element engaging said projection to hold said projection in position against said frame, and means to control the working of said piston in the cylinder.

3. A power transmitting mechanism between a piston working in a cylinder and a pulling member of a riveting tool for pulling a tail forming member in a tubular rivet in a structure to be riveted, comprising a fulcrumed frame between the piston and said pulling member, said frame being connected for operating said pulling member, a stationary backing member adjacent said fulcrumed member, and means reciprocated by the piston for alternately forcing one end of said frame around its fulcrum away from said backing member and permitting said frame to return toward said backing member during the reciprocation of said piston respectively during the strokes of the piston toward and away from said riveting tool so as to pull said pulling member of the riveting tool during the first of said strokes of said piston.

4. A power transmitting device of the character described, comprising a cylinder, a piston working in the cylinder, power applying means extended to the outside of the cylinder, said power applying means including a reciprocating element offset from the axis of the cylinder, a bell-crank member fulcrumed in the cylinder so that one end thereof engages said reciprocating element and the other extends adjacent the axis of the cylinder, a rigid wedge extended axially from the piston, means on the bell-crank end adjacent the cylinder axis on which an inclined edge of the wedge rides when moved by the piston so as to move the bell-crank around its fulcrum so as to move said reciprocating element of the power applying means, and a stationary backing member engaging the edge of the wedge opposite said inclined edge, said bell-crank being so formed that the rocking force applied by the wedge is at an angle to the direction of the piston movement.

5. A power transmitting mechanism between a piston working in a cylinder and a pulling member of a riveting tool adapted to pull a tail-forming element through a tubular rivet in a structure to be riveted, comprising a fulcrumed frame between the piston and said pulling member, said frame being connected for operating said pulling member, a stationary backing member adjacent said fulcrumed member, anti-friction means on the opposed ends of said backing member and said frame, and a wedge-like element reciprocated between said anti-friction means by said piston for moving said frame around its fulcrum in one direction so as to pull said pulling member of the riveting tool when the piston is moved toward the end of the cylinder adjacent said riveting tool.

6. A riveting apparatus comprising a riveting tool for pulling a tail forming member through a hollow rivet so as to fasten the rivet; a mechanism for transmitting power to the pulling member of said riveting tool, including an oscillating frame fulcrumed between its ends, means to connect one end of the frame to said pulling member, a backing element at the other end of the frame, a wedge member movable between said backing element and the adjacent end of the frame for moving said frame in one direction, and means to reciprocate said wedge member at will.

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