Sept. 27, 1949. R. TEMPLE 2,483,112

EXPLOSIVELY ACTUATED BLIND RIVETING APPARATUS

Filed Jan. 21, 1948

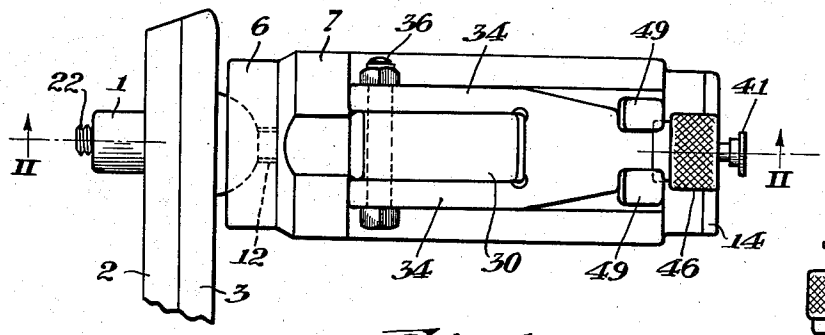


Fig. 1.

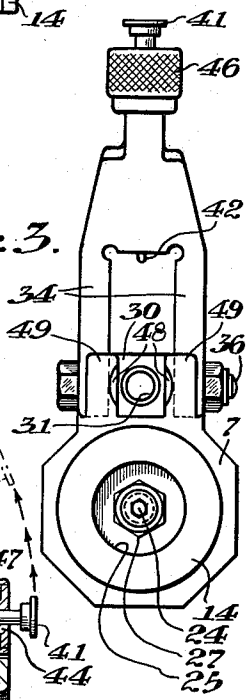


Fig. 3.

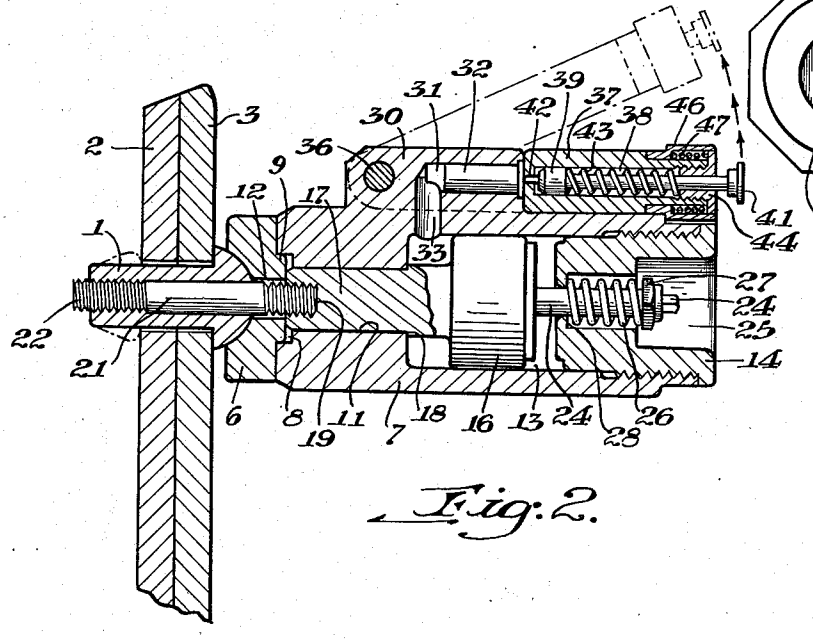


Fig. 2.

INVENTOR.
ROBERT TEMPLE

BY
Brown, Critchlow, Flick & Peckham
his ATTORNEYS.

Patented Sept. 27, 1949

2,483,112

UNITED STATES PATENT OFFICE

2,483,112

EXPLOSIVELY ACTUATED BLIND RIVETING APPARATUS

Robert Temple, Swissvale, Pa., assignor to Temple Velocity Equipment, Inc., Wilmington, Del., a corporation of Delaware

Application January 21, 1948, Serial No. 3,600

19 Claims. (Cl. 218—19)

1

This invention relates to riveting tools, and more particularly to those for upsetting the inner ends of blind hollow rivets.

It is among the objects of this invention to provide such a riveting tool which is actuated by an explosive charge, which can be used for upsetting heavy rivets, and which is small, portable, powerful, and convenient to use.

In accordance with this invention the frame of the tool has a front end adapted to engage the head of a hollow rivet extending through holes in plates or other members that are to be connected by it. The frame is provided with a barrel and with a bore connecting the front end of the barrel with the front end of the frame. A piston in the barrel is connected to an upsetting member that extends through the rivet and is connected to its inner end. The frame also is provided with a cartridge-receiving chamber communicating with the front end of the barrel. The frame carries means for detonating a cartridge in the chamber so that the piston will be driven backward in the barrel to cause the upsetting member to pull the inner end of the rivet toward its head and thereby upset the inner end of the rivet against the adjoining plate. The frame preferably includes a body member having a chuck at its front end for receiving the head of the rivet. The piston may include a stem, and the upsetting member preferably is a pin threaded at its opposite ends so that it can be screwed into the front end of the stem and the inner end of the rivet. The back of the piston may have a rod projecting therefrom so that the piston can be held stationary while the pin is being screwed into it or a rivet is being screwed onto the pin, or can be turned to unscrew it from the pin or to unscrew the pin from the upset rivet.

The preferred embodiment of this invention is illustrated in the accompanying drawings in which Fig. 1 is a plan view of the tool ready to upset the inner end of a blind rivet; Fig. 2 is a central vertical section taken on the line II—II of Fig. 1; and Fig. 3 is an end view of the tool with the breechblock swung upward to permit the tool to be loaded with a cartridge.

Referring to the drawings, a hollow rivet 1 is shown extending through aligned holes in a pair of metal plates 2 and 3, with the head of the rivet engaging the outer plate. The inner end of the rivet projects from the inner plate and is presumed to be in such a location that it is inaccessible. Consequently, the rivet is called a blind rivet.

Fitting over the head of the rivet is a chuck 6

2

which forms the front end of the frame of the riveting tool. The rest of the frame is formed from a metal block or body member 7 having a central recess 8 in its front end for receiving a central boss 9 on the back of the chuck to center the chuck against the body. Extending rearward in the frame body from this recess is a bore 11 which is in axial alignment with the opening through the rivet and with a central hole 12 in the chuck. The rear end of the bore opens into the front end of a larger bore or barrel 13 that extends backward through the rest of the body member and that has its rear end closed by a screw plug 14.

Slidably mounted in the body is a piston which has a head 16 in barrel 13 and a stem 17 in bore 11. The portion of the stem adjacent the head is enlarged to form a shoulder 18 which insures that the head will always be spaced from the front wall of the barrel for a purpose that will appear presently. The front end of the stem is provided with a threaded socket 19 in which is screwed the rear end of a pin 21 that extends through and fills the hollow rivet. The inner or front end of the pin likewise is provided with threads 22 which register with threads inside the inner end of the rivet.

Rigidly connected to the back of the piston head is a rod 24 that extends through an axial passage through the barrel plug. The outer portion of this passage is enlarged to form a recess 25 in which the squared outer end of the rod is always located. By holding the outer end of this rod the piston can be prevented from turning while pin 21 is being screwed into socket 19 and rivet 1 is being screwed onto the front end of the pin. Encircling the rod is a coil spring 26 which is compressed between a nut 27 on the rod and a shoulder 28 in the plug near the inner end of its axial passage. The purpose of this spring will be set forth presently.

The top of the body member 7 carries an integral block 30 that is provided with a cartridge chamber 31 parallel to the barrel and open at its rear end for receiving a blank cartridge 32. The front end of the chamber is connected by a vertical passage 33 with the space in the barrel between its front wall and the piston head. To permit the cartridge to be fired so that the force of the explosion will drive the piston head backward in the barrel, a yolk straddles the frame block 30 and has the free ends of its legs 34 pivotally connected by a pin 36 to the block in front of the cartridge chamber. The portion of the yolk behind block 30 forms a breechblock 37 that

holds the cartridge in the chamber. The breechblock is provided with a bore 38 in line with the cartridge and containing a firing pin that has a head 39 near its front end and a knob 41 projecting from the rear end of the yolk. The point 42 of the firing pin extends through a small hole in the front wall of the breechblock and is adapted to be driven against the cartridge cap by a coil spring 43 encircling the firing pin and compressed between its head and a bushing 44 screwed into the rear end of the bore 38. It will be seen that when the knob of the firing pin is released after having been retraced, the spring will drive the firing pin ahead with considerable force to detonate the cartridge.

To normally hold the yolk down against the top of the frame with the breechblock in operative position, a knob 46 is slidably mounted on the reduced rear end of the yolk. Inside of this knob there is a coil spring 47 that urges the knob forward into arcuate recesses 48 (Fig. 3) in adjacent rear edges of a pair of lugs 49 projecting upward from the top of the frame on opposite sides of the yolk. When knob 46 is pulled backward out of engagement with these lugs, the yolk can be swung upward, as shown in broken lines in Fig. 2 and in full lines in Fig. 3, to expose the cartridge so that it can be removed from chamber 31 and a new one inserted therein.

In operation, a hollow rivet 1, having an internally threaded inner end, is screwed onto the upsetting pin 21 until the head of the rivet presses chuck 6 against the front of body member 7. At this time the head 16 of the piston is as far forward in barrel 13 as shoulder 18 will permit it to go. The rivet is then inserted in the plates that it is to connect and its head is held against the outer plate. The firing pin then is pulled back and released so as to detonate the cartridge. The explosion, acting on the front face of the piston head, drives it backward in the barrel. The piston stem 17 therefore pulls pin 21 backward through the rivet and thereby upsets the attached inner end of the rivet against the exposed side of inner plate 2, as shown in broken lines on Fig. 2. At the same time the force of the explosion acting against the front wall of the barrel forces the frame tightly against the head of the rivet and thereby presses the head tightly against the outer plate 3 so that the two plates will be clamped tightly together between the opposite ends of the rivet. The plug 14 can be adjusted axially of the barrel to increase or decrease the length of the stroke of the piston, which in turn increases or decreases the amount of expansion of the rivet. This adjustment is desirable when working with rivets of various sizes, as large rivets may require a longer piston stroke for satisfactory upsetting than smaller rivets.

The length of rod 24 is such that its outer end never projects from plug 25, which otherwise might injure the hand of the operator. By turning the outer end of the rod, the piston is turned to unscrew it from the upsetting pin which then can be unscrewed from the rivet, or be cut off flush with its head so that the rivet will be solid. On the other hand, if desired, the pin may purposely be screwed into the piston stem so tightly initially that when the piston is rotated, the pin will be unscrewed from the upset rivet. Positive spacing of the piston from the front end of the barrel by means of shoulder 18 prevents the piston from closing vertical passage 33, so that if the cartridge is discharged accidentally the gases will not be blown back around the cartridge. Shoulder 18 also insures a uniform expansion chamber so that the pressures created by exploding cartridges are more uniform for a given powder load. The shape of the head-receiving recess in the front of chuck 6 will depend upon the shape of the head of the rivet being driven.

The spring 26 on rod 24 is for the purpose of holding the piston against plug 14 when a rivet is not connected to this tool. Therefore, if the cartridge is fired accidentally, the piston will not strike the plug at high velocity because they will be in contact already and the expansion chamber in front of the piston will have its maximum size.

According to the provisions of the patent statutes, I have explained the principle of my invention and have illustrated and described what I now consider to represent its best embodiment. However, I desire to have it understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

I claim:

1. An explosively actuated tool for upsetting the inner end of a blind hollow rivet, comprising a frame having a front end adapted to engage the head of the rivet, the frame being provided with a barrel and with a bore connecting the front end of the barrel with the front end of the frame, a piston in said barrel, an upsetting member connected to the piston and adapted to extend through the rivet and be connected to its inner end, said frame being provided with a cartridge-receiving chamber communicating with the front end of the barrel, and firing means mounted on said frame for detonating a cartridge in said chamber, whereby the piston will be driven backward in the barrel to cause said upsetting member to pull the inner end of the rivet toward its head and thereby upset said inner end.

2. An explosively actuated tool for upsetting the inner end of a blind hollow rivet, comprising a frame having a front end adapted to engage the head of the rivet, the frame being provided with a barrel and with a bore coaxial with the barrel connecting the front end of the barrel with the front end of the frame, a piston in said barrel, an upsetting member detachably connected to the piston and adapted to extend through the rivet and be connected to its inner end, said frame being provided with a cartridge-receiving chamber communicating with the front end of the barrel, and firing means mounted on said frame for detonating a cartridge in said chamber, whereby the piston will be driven backward in the barrel to cause said upsetting member to pull the inner end of the rivet toward its head and thereby upset said inner end.

3. An explosively actuated tool for upsetting the inner end of a blind hollow rivet, comprising a frame having a front end adapted to engage the head of the rivet, the frame being provided with a barrel and with a bore connecting the front end of the barrel with the front end of the frame, a piston having a head in said barrel and a stem slidably mounted in said bore, an upsetting member connected to the front end of the stem and adapted to extend through the rivet and be connected to its inner end, said frame being provided with a cartridge-receiving chamber communicating with the front end of the barrel, and firing means mounted on said

frame for detonating a cartridge in said chamber, whereby the piston head will be driven backward in the barrel to cause said upsetting member to pull the inner end of the rivet toward its head and thereby upset said inner end.

4. An explosively actuated tool for upsetting the inner end of a blind hollow rivet, comprising a frame having a front end adapted to engage the head of the rivet, the frame being provided with a barrel and with a bore connecting the front end of the barrel with the front end of the frame, a piston having a head in said barrel and a stem slidably mounted in said bore, a pin screwed into the front end of the stem and adapted to extend through the rivet and be connected to its inner end, said frame being provided with a cartridge-receiving chamber communicating with the front end of the barrel, and firing means mounted on said frame for detonating a cartridge in said chamber, whereby the piston head will be driven backward in the barrel to cause said pin to pull the inner end of the rivet toward its head and thereby upset said inner end.

5. An explosively actuated tool for upsetting the inner end of a blind hollow rivet, comprising a frame having a front end adapted to engage the head of the rivet, the frame being provided with a barrel and with a bore connecting the front end of the barrel with the front end of the frame, a piston having a head in said barrel and a stem slidably mounted in said bore, a pin threaded at both ends screwed into the front end of the stem and adapted to extend through the rivet and be threadably connected to its inner end, said frame being provided with a cartridge-receiving chamber communicating with the front end of the barrel, and firing means mounted on said frame for detonating a cartridge in said chamber, whereby the piston will be driven backward in the barrel to cause said pin to pull the inner end of the rivet toward its head and thereby upset said inner end.

6. An explosively actuated tool for upsetting the inner end of a blind hollow rivet, comprising a frame having a front end adapted to engage the head of the rivet, the frame being provided with a barrel and with a bore connecting the front end of the barrel with the front end of the frame, a piston head in said barrel, means spacing the piston head from the front end of the barrel, an upsetting member connected with the piston and adapted to extend through the rivet and be connected to its inner end, said frame being provided with a cartridge-receiving chamber and a passage leading therefrom to the space between the piston head and the front end of the barrel, and firing means mounted on said frame for detonating a cartridge in said chamber, whereby the piston head will be driven backward in the barrel to cause said upsetting member to pull the inner end of the rivet toward its head and thereby upset said inner end.

7. An explosively actuated tool for upsetting the inner end of a blind hollow rivet, comprising a frame having a front end adapted to engage the head of the rivet, the frame being provided with a barrel and with a bore connecting the front end of the barrel with the front end of the frame, a piston having a head in said barrel and a stem slidably mounted in said bore, the rear end portion of the stem being larger than the bore to space the piston head from the front wall of the barrel, an upsetting member connected to the front end of the stem and adapted to extend through the rivet and be connected to its inner end, said frame being provided with a cartridge-

receiving chamber communicating with the front end of the barrel, and firing means mounted on said frame for detonating a cartridge in said chamber, whereby the piston head will be driven backward in the barrel to cause said upsetting member to pull the inner end of the rivet toward its head and thereby upset said inner end.

8. An explosively actuated tool for upsetting the inner end of a blind hollow rivet, comprising a frame having a front end adapted to engage the head of the rivet, the frame being provided with a barrel and with a bore connecting the front end of the barrel with the front end of the frame, a piston having a head in said barrel and a stem slidably mounted in said bore, a piston-turning member projecting from the back of the piston head, a pin screwed into the front end of the stem and adapted to extend through the rivet and be connected to its inner end, said frame being provided with a cartridge-receiving chamber communicating with the front end of the barrel, and firing means mounted on said frame for detonating a cartridge in said chamber, whereby the piston head will be driven backward in the barrel to cause said upsetting member to upset the inner end of the rivet.

9. An explosively actuated tool for upsetting the inner end of a blind hollow rivet, comprising a frame having a front end adapted to engage the head of the rivet, the frame being provided with a barrel and with a bore connecting the front end of the barrel with the front end of the frame, a closure for the rear end of the barrel having an axial opening therethrough, a piston having a head in said barrel and a stem slidably mounted in said bore, a pin screwed into the front end of the stem and adapted to extend through the rivet and be connected to its inner end, a piston-turning rod projecting from the back of the piston head through said closure opening, said frame being provided with a cartridge-receiving chamber communicating with the front end of the barrel, and firing means mounted on said frame for detonating a cartridge in said chamber, whereby the piston head will be driven backward in the barrel to cause said upsetting member to upset the inner end of the rivet.

10. An explosively actuated tool for upsetting the inner end of a blind hollow rivet, comprising a frame having a front end adapted to engage the head of the rivet, the frame being provided with a barrel and with a bore connecting the front end of the barrel with the front end of the frame, a plug mounted in the rear end of the barrel and provided in its rear portion with an axial recess connected by an axial passage with the inside of the barrel, a piston having a head in said barrel and a stem slidably mounted in said bore, a pin screwed into the front end of the stem and adapted to extend through the rivet and be connected to its inner end, a manually rotatable piston-turning rod projecting from the back of the piston head through said plug passage and into said recess, a spring on said rod urging it rearward, said frame being provided with a cartridge-receiving chamber communicating with the front end of the barrel, and firing means mounted on said frame for detonating a cartridge in said chamber, whereby the piston head will be driven rearward in the barrel to cause said upsetting member to upset the inner end of the rivet.

11. An explosively actuated tool for upsetting the inner end of a blind hollow rivet, comprising a body member provided with a barrel and with

a bore connecting the front end of the barrel with the front end of said member, a chuck engaging the front end of the body member and adapted to receive the head of the rivet, said chuck having an axial passage in line with said bore, a piston in said barrel, an upsetting member connected to the piston and adapted to extend through the chuck passage and rivet and be connected to the inner end of the rivet, said frame being provided with a cartridge-receiving chamber communicating with the front end of the barrel, and firing means mounted on said frame for detonating a cartridge in said chamber, whereby the piston will be driven backward in the barrel to cause said upsetting member to pull the inner end of the rivet toward its head and thereby upset said inner end.

12. An explosively actuated tool for upsetting the inner end of a blind hollow rivet, comprising a frame having a front end adapted to engage the head of the rivet, the frame being provided with a barrel and with a bore connecting the front end of the barrel with the front end of the frame, a piston in said barrel, an upsetting member connected to the piston and adapted to extend through the rivet and be connected to its inner end, said frame being provided with a cartridge-receiving chamber communicating with the front end of the barrel, a pivoted yoke normally having a portion disposed behind said chamber, and firing means in the yoke for detonating a cartridge in said chamber, the yoke being adapted to be swung away from the back of said chamber to permit it to be reloaded.

13. An explosively actuated tool for upsetting the inner end of a blind hollow rivet, comprising a frame having a front end adapted to engage the head of the rivet, the frame being provided with a barrel and with a bore connecting the front end of the barrel with the front end of the frame, a piston in said barrel, a upsetting member connected to the piston and adapted to extend through the rivet and be connected to its inner end, said frame being provided with a cartridge-receiving chamber communicating with the front end of the barrel, a pivoted yoke, spring-biased means normally holding the yoke against the frame with a portion of the yoke disposed behind said chamber, and firing means carried by said yoke portion for detonating a cartridge in said chamber, said spring-biased means being adapted to be retracted to permit the yoke to be swung away from the frame to allow said chamber to be reloaded.

14. An explosively actuated tool for upsetting the inner end of a blind hollow rivet, comprising a frame having a front end adapted to engage the head of the rivet, the frame being provided with a barrel and with a bore connecting the front end of the barrel with the front end of the frame, a closure for the rear end of the barrel having an axial opening therethrough, a piston having a head in said barrel and a stem slidably mounted in said bore, a pin screwed into the front end of the stem and adapted to extend through the rivet and be connected to its inner end, a piston-turning rod projecting from the back of the piston head through said closure opening, a spring on said rod compressed against the back of said closure for urging the piston toward the closure, said frame being provided with a cartridge-receiving chamber communicating with the front end of the barrel, and firing means mounted on said frame for detonating a cartridge in said chamber, whereby the piston head will be driven backward in the barrel to cause said upsetting member to upset the inner end of the rivet.

15. An explosively actuated tool for upsetting the inner end of a blind hollow rivet, comprising a frame having a front end adapted to engage the head of the rivet, the frame being provided with a barrel and with a bore connecting the front end of the barrel with the front end of the frame, a piston in said barrel, an upsetting member connected to the piston and adapted to extend through the rivet and be connected to its inner end, said frame being provided with a cartridge-receiving chamber communicating with the front end of the barrel, firing means mounted on said frame for detonating a cartridge in said chamber, whereby the piston will be driven backward in the barrel to cause said upsetting member to pull the inner end of the rivet toward its head and thereby upset said inner end, and a plug mounted in the rear end of the barrel and adjustable axially thereof for controlling the length of the stroke of said piston.

16. An explosively actuated tool for upsetting the inner end of a blind hollow rivet, comprising a frame having a front end adapted to engage the head of the rivet, the frame being provided with a barrel and with a bore connecting the front end of the barrel with the front end of the frame, a piston in said barrel, a pin threaded at both ends screwed into the piston and adapted to extend through the rivet and be threadably connected to its inner end, said frame being provided with a cartridge-receiving chamber communicating with the front end of the barrel, and firing means mounted on said frame for detonating a cartridge in said chamber, whereby the piston will be driven backward in the barrel to cause said pin to pull the inner end of the rivet toward its head and thereby upset said inner end.

17. An explosively actuated tool for upsetting the inner end of a blind hollow rivet, comprising a frame having a front end adapted to engage the head of the rivet, the frame being provided with a barrel and with a bore connecting the front end of the barrel with the front end of the frame, a piston having a head in said barrel and a stem slidably mounted in said bore, the rear end portion of the stem being enlarged to form a shoulder to space the piston head from the front wall of the barrel, an upsetting member connected to the front end of the stem and adapted to extend through the rivet and be connected to its inner end, said tool being provided with a cartridge-receiving chamber communicating with the front end of the barrel, and firing means mounted on said tool for detonating a cartridge therein, whereby the piston head will be driven backward in the barrel to cause said upsetting member to pull the inner end of the rivet toward its head and thereby upset said inner end.

18. An explosively actuated tool for upsetting the inner end of a blind hollow rivet, comprising a frame having a front end adapted to engage the head of the rivet, the frame being provided with a barrel and with a bore connecting the front end of the barrel with the front end of the frame, a piston in said barrel, a piston-turning member projecting from the back of the piston, a pin screwed into the piston and adapted to extend through the rivet and be connected to its inner end, said frame being provided with a cartridge-receiving chamber communicating with the front end of the barrel, and firing means mounted on said frame for detonating a cartridge in said chamber, whereby the piston head will be driven

backward in the barrel to cause said upsetting member to upset the inner end of the rivet.

19. An explosively actuated tool for upsetting the inner end of a blind hollow rivet, comprising a frame having a front end adapted to engage the head of the rivet, the frame being provided with a barrel and with a bore connecting the front end of the barrel with the front end of the frame, a piston in said barrel, an upsetting member connected to the piston and adapted to extend through the rivet and be connected to its inner end, said frame being provided with a cartridge-receiving chamber communicating with the front

end of the barrel, firing means mounted on said frame for detonating a cartridge in said chamber, whereby the piston will be driven backward in the barrel to cause said upsetting member to pull the inner end of the rivet toward its head and thereby upset said inner end, and a plug connected to the rear end of the barrel and adjustable axially thereof for controlling the length of the stroke of said piston.

ROBERT TEMPLE.

No references cited.