

June 18, 1946.

P. STONE

2,402,303

RIVETING TOOL

Filed Sept. 25, 1943

2 Sheets-Sheet 1

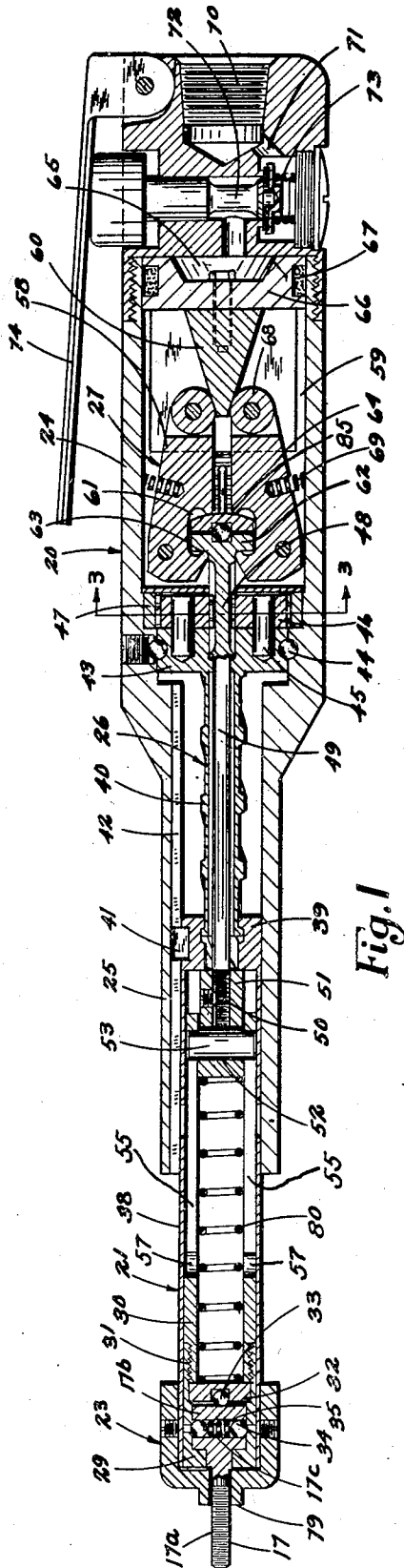


Fig. 1

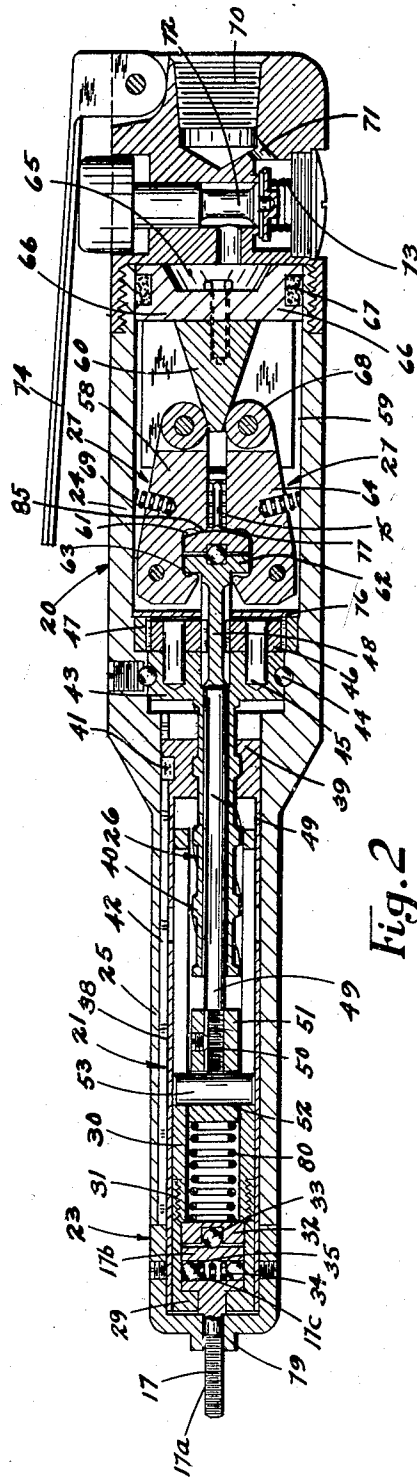


Fig. 2

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2 Sheets-Sheet 2

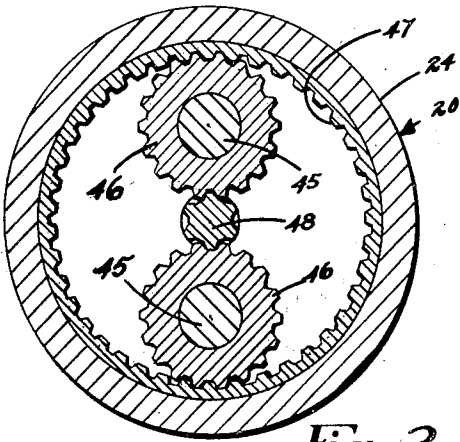


Fig. 3

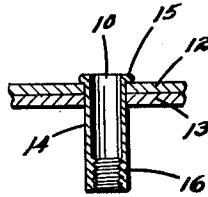


Fig. 7

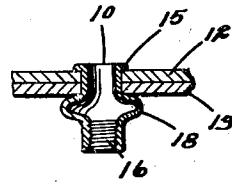


Fig. 8

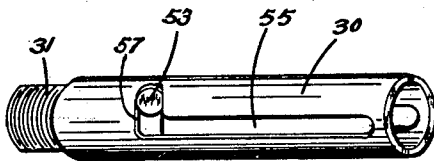


Fig. 4

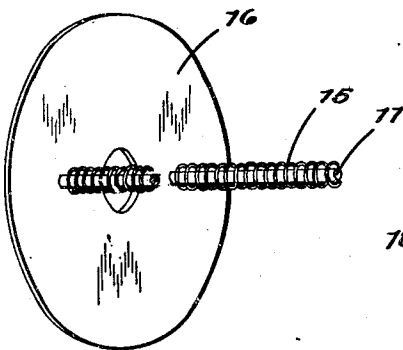


Fig. 6

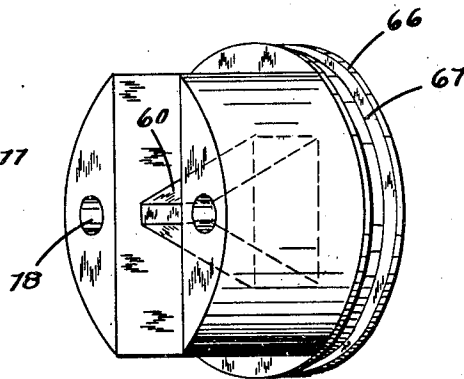


Fig. 5

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## UNITED STATES PATENT OFFICE

2,402,303

## RIVETING TOOL

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Application September 25, 1943, Serial No. 503,755

7 Claims. (Cl. 218-19)

**1**  
This invention relates to tools of the kind having a rotatable and axially movable chuck and more particularly to an improved tool of this character which can be used for driving certain forms of rivets and for various other purposes.

An object of this invention is to provide a tool of this character embodying novel mechanisms for successively imparting rotative and pulling movements to the chuck.

Another object of the invention is to provide an improved tool, of the character mentioned, having a handle member which is manually movable relative to the chuck for causing rotation of the latter and also embodies a pulling device for applying a pulling force to the chuck.

Still another object of this invention is to provide an improved tool, of the character referred to, in which a valve-controlled fluid pressure responsive means is employed for actuating the pulling device.

The invention may be further briefly summarized as consisting in certain novel combinations and arrangements of parts hereinafter described and particularly set out in the appended claims.

In the accompanying sheets of drawings,

Fig. 1 is a longitudinal sectional view taken through a tool constructed according to the present invention, the tool being shown in its extended condition;

Fig. 2 is a similar longitudinal sectional view showing the tool in its collapsed condition;

Fig. 3 is a transverse sectional view taken through the tool on line 3-3 of Fig. 1;

Fig. 4 is a perspective view showing the hollow spindle in detached relation;

Fig. 5 is a detached perspective view of the piston;

Fig. 6 is a detached perspective view showing seating and guide means for the springs which return the piston;

Fig. 7 is a sectional view showing a rivet of the kind adapted to be driven by my improved tool, the rivet being shown in position for driving, and

Fig. 8 is a sectional view taken through the same rivet after driving.

My improved tool to be hereinafter described in greater detail can be used for various purposes but is especially suitable for driving hollow rivets in work where access can be had from one side only. One form of rivet for which the present tool is well adapted is shown in Figs. 7 and 8. The rivet 10 is shown in Fig. 7 in position for driving in which position it extends through a pair of sheets or plates 12 and 13 to be con-

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nected. The rivet comprises a hollow stem or body 14 having a head or shoulder 15 at its outer end and an internally threaded section 16 adjacent its inner end. In driving this form of rivet, a threaded bit such as the bit 17, is inserted into the hollow rivet and screwed into the threaded section 16. A pulling force is then applied to the inner end of the rivet by means of the bit 17 thereby causing the rivet to be buckled or expanded into engagement with the inner side of the work as indicated at 18 in Fig. 8. After the rivet has been thus expanded, the bit is unscrewed and withdrawn therefrom for insertion in another such rivet.

15 As shown in the drawings, my improved tool comprises a pair of housing and stem members 20 and 21, the latter of which carries a nose 23 in which the bit 17 is rotatably mounted. The housing member 20 is constructed so as to provide an enlarged hollow handle portion 24 and a tube 25 projecting from such handle portion and in which the stem member 21 is relatively slidable.

As will be explained more in detail hereinafter, the housing member 20 embodies a mechanism 26 for rotating the bit 17 for screwing the same into the threaded section 16 of the rivet 10 and another mechanism 27 for applying a pulling force to the bit for causing the rivet to be expanded or upset. The housing member 20 is movable axially relative to the stem member 21 by manual force applied to the handle portion 24 and this relative axial movement is utilized to actuate the mechanism 26 to cause the rotation of the bit 17. The mechanism 27 for supplying the pulling force is preferably a power actuated device and in this instance is actuated by pressure fluid such as compressed air.

The bit 17 comprises a threaded stem 17a and a head 17b having a transverse opening 17c there-through. The head of the bit is retained in the nose 23 by being mounted in an end section 29 of a rotatable hollow spindle 30. The end section 29 is connected with the body of the spindle 30 by a threaded connection 31 at which point a disk 32 is mounted in fixed relation in the hollow spindle. The parts 29 and 32 together constitute a chuck for bit 17. A ball 33 seated in a recess of the disk 32 forms a thrust bearing which is engaged by the head 17b of the bit 17. Balls 34 mounted in the transverse opening 17c and having a coil spring 35 therebetween form a clutch member which cooperates with the end section 29. This clutch member releasably connects the bit 17 with the hollow spindle 30 so as to cause the

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bit to be screwed into, or unscrewed from, the threaded section 16 of the rivet when the hollow spindle is rotated. When the bit has been fully screwed into the rivet, the clutch member formed by the balls 34 will slip and will permit the bit to remain stationary while the hollow spindle 30 continues to rotate until the housing member 21 has completed its forward movement to bring the end of the sleeve portion 25 thereof into engagement with the nose 23 as shown in Fig. 2.

The rotatable hollow spindle 30 is supported in a non-rotatable tube or sleeve 38 and has limited axial sliding movement in this tube for a purpose to be hereinafter explained. The tube 38 is provided at its rear or inner end with an internally threaded portion or nut element 39 which forms a part of the mechanism 26 and cooperates with an externally threaded hollow stem or screw element 40. The tube 38 has relative sliding movement in the tube 25 of the housing member 20 and carries a key 41 which engages in a key-way 42 so as to prevent rotation of the nut element 39 during axial movements of the housing member.

The screw element 40 has an enlargement or disk portion 43 on the rear end thereof which disk portion is journaled in the housing member 20 by a suitable anti-friction bearing 44. The disk portion 43 carries pins 45 on which spur gears 46 are rotatably mounted. These spur gears are constantly in mesh with a ring gear 47 carried by the housing member 20 and with a pinion 48 formed on a rotatable and axially movable shaft 49 which extends through the hollow screw element 26.

The outer or forward end of the shaft 49 has a threaded portion 50 on which is mounted a connecting member 51 having a transverse opening 52 through which a locking pin 53 extends. As best shown in Fig. 4 of the drawings, the hollow spindle 30 has opposed axially extending slots or keyways 55 formed in the wall thereof into which the ends of the locking pin 53 extend. The pin 53 serves to form a drive connection between the shaft 49 and the hollow spindle 30 which will be effective for transmitting torque while the pin 53 is being shifted axially along the hollow spindle toward or away from the nose 23. In other words, as the housing member 20 is moved axially toward the nose 23, the pin 53 will shift along the slots 55 and will meanwhile maintain a driving connection between the shaft 49 and the hollow spindle 30. Since the nut element 39 and housing member 20 are held against relative rotation by the key 41, this axial movement of the housing member will cause the screw element 40 to be rotated thereby driving the disk member 43. The gearing connecting the disk member 43 with the shaft 49 causes rotation at an accelerated rate to be imparted to the shaft 49 and to the hollow spindle 30 through the connecting pin 53. The rotation thereby imparted to the bit 17 is preferably such that the bit will be fully screwed into the rivet by one full-stroke movement of the housing member 20 toward the nose 23.

As will be seen in the drawings, and particularly in Fig. 4, the forward ends of the slots 55 of the hollow spindle 30 have lateral or arcuate extensions 57 into which the ends of the locking pin 53 move when the pin has completed its axial travel. The engagement of the pin 53 in the extensions 57 forms a bayonet connection or lock between the shaft 49 and the hollow spindle 30 which will enable a pulling force to be applied to this spindle by the shaft 49. This pulling force

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is produced by the above mentioned mechanism 27 which is contained in the housing member 20.

The pulling mechanism 27 comprises a pair of levers 58 pivotally mounted in a chamber 59 of the housing member 20, and a spreader 60 for spreading or separating the levers 58 to cause a pulling force to be applied to the shaft 49. The levers 58 are constructed so as to have a recess 61 therein adapted to receive a head 62 carried by the rear end of the shaft 49. Adjacent the recess 61, the levers 58 have hook portions or thrust elements 63 thereon which engage under the head 62 and cause a pulling force to be applied to the shaft 49 when the levers 58 are separated. The head 62 is preferably formed in two parts, as shown in the drawings, with a thrust bearing or ball 64 therebetween.

The upper end of the chamber 59 of the housing member 20 forms a cylinder 65 in which a piston 66 is operable. The piston 66 has a suitable packing 67 thereon and carries the wedge 68. Friction between the wedge 68 and the levers 58 is reduced by mounting rollers 69 on the levers for cooperation with the beveled faces of the wedge. Compression springs 69 disposed between the levers 58 and the walls of the chamber 59 act to move the levers toward each other and to constantly hold the rollers 68 against the wedge 68, and also to cause bosses 85 on the levers to return shaft 49 to normal position.

Pressure fluid for causing the working stroke of the piston 66 may be supplied to the tool through a suitable threaded connection 70. A passage 71 connects the threaded opening 70 with the cylinder 65 and is controlled by a valve 72. This valve is urged toward its seat by a compression spring 73 and is adapted to be opened by manual actuation of a lever 74 hingedly mounted on the housing member 20 at a point for convenient manipulation by the user of the tool.

When the flow of pressure fluid to the cylinder 65 is cut off by the closing of the valve 72, the piston 66 is returned by a pair of compression springs 75, see Fig. 6, which engage the piston and seat against a transverse disk or wall 76 provided in the housing member 20. Pins 77 mounted in the wall 76 serve to guide the springs 75 and prevent buckling thereof. The springs 75 and the guide pins 77 extend into openings 78 provided in the body of the piston 66 on opposite sides of the wedge 60.

As mentioned above, the hollow spindle 30 has limited axial movement in the tube 38. This axial movement permits the threaded bit 17 to recede into the nose 23 to enable the tip 79 thereof to be held against the head of the rivet 10 while the sleeve 30 and bit 17 are being rotated to prevent the rivet from turning while the bit is being screwed thereinto. As the bit advances into the rivet it will move outwardly of the nose 23 while the tip 79 of the latter is being held against the head of the rivet. A compression spring 80 provided in the hollow spindle 30 seats against the connecting member 51 and acts on the fixed disk 32 tending to move the spindle 30 outwardly of the tube 38, that is to say, in a direction to propel or extend the bit 17 from the nose 23. The spring 80 also acts to move the housing member 20 away from the nose 23 to its extended position shown in Fig. 1 after the rivet has been driven.

In using the tool, after a rivet is in place in registering rivet holes of the plate to be joined as illustrated in Fig. 7, the tool is advanced to project the bit 17 into the rivet until the end of

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the bit engages the threads of the threaded section 16. A little pressure exerted on the tool housing 20 then advances sleeve 38 until the tip 79 of the nose 23 contacts the flange 15 of the rivet, the hollow spindle 30 and the chuck 29 receding relatively against the action of spring 80 to accommodate this movement. Further pressure upon the housing then advances the latter relative to the sleeve 38 and nut 39, thereby rotating hollow screw 40 and functioning through the planetary gear train to rotate shaft 49 and from it hollow spindle 30 with its chuck 29, 32 to which the bit 17 is frictionally joined by spring pressed balls 34. The spring 80 is compressed during this relative travel of the housing and the locking pin 53 is advanced along the slots 55 of the hollow spindle. Before the forward end of tube 25 contacts nose 23 the bit will have been threaded into the rivet as far as it can go. Thereafter the ball clutch will yield and the hollow spindle will turn without communicating motion to the head 17b of the bit. As soon as the forward end of tube 25 contacts the nose 23, pin 53 will come opposite the slot extensions 57 and will turn into them. Then the operator presses on lever 74 to admit pressure fluid to the cylinder 59 behind the piston 66, and the latter travels forward to spread levers 58 and exert a pull through pin 53 upon hollow spindle 30, which will cause the bit 17 to be retracted and to expand the rivet as indicated in Fig. 8. The operator then releases lever 74 whereupon springs 75 return the piston to its illustrated position, and the levers 58 return to their illustrated position because of the action of springs 69. Now the operator relieves the pressure which he has been exerting upon the housing and pulls back on it slightly to cause enough reverse rotation of pin 53 to remove it from slots 57, thereby enabling the spring 80 to extend the parts 25 and 38 relative to each other and move nut 39 from the Fig. 2 position to that of Fig. 1, which produces reverse rotation of screw 40 with corresponding reverse rotation of bit 17, whereby the bit 17 is screwed outwardly from the threaded section of the rivet and the tool is released for the next operation.

From the foregoing description and accompanying drawings, it will now be readily understood that I have provided a compact and efficient tool which can be used for various purposes but is especially suitable for expanding hollow rivets in work where such rivets are accessible from one side only of the work. It will be seen also that the tool can be manually actuated to rapidly screw a threaded bit into such a rivet, and upon manipulation of a conveniently located valve lever, a fluid pressure responsive device contained within the tool is actuated to apply a pulling force to the bit to expand the rivet.

While I have illustrated and described my improved tool in considerable detail it will be understood, of course, that I do not wish to be correspondingly limited but regard my invention as including all changes and modifications coming within the scope of the appended claims.

Having thus described my invention, I claim:

1. In a tool of the character described, a housing member, a sleeve projecting from said housing member, a spindle rotatable in said sleeve and having a chuck connected therewith, said housing member being axially movable relative to said sleeve, cooperating screw elements responsive to

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the axial movement of said housing, gearing connecting one of said screw elements with said spindle for driving the latter at an accelerated speed, and means in said housing member for applying a pulling force to said spindle and chuck.

2. In a tool of the character described, an axially fixed rotatable hollow screw, a non-rotatable axially movable nut cooperating therewith, a shaft within said hollow screw, and an operative connection between said screw and shaft for imparting rotation of the shaft responsive to axial movement of said nut, said connection permitting axial movement of said shaft.

3. In a tool of the character described, an axially fixed rotatable hollow screw, a non-rotatable axially movable nut cooperating therewith, a shaft within said hollow screw, an operative connection between said screw and said shaft responsive to axial movement of said nut for imparting rotation to the shaft at a speed higher than that of the screw, said connection permitting axial movement of said shaft.

4. In a tool of the character described, a threaded bit, and means for turning and pulling said bit comprising an axially fixed rotatable hollow screw, a non-rotatable axially movable nut cooperating therewith, a shaft within said hollow screw, an operative connection between said shaft and said bit, and an operative connection between said screw and shaft for imparting rotation to the shaft responsive to axial movement of said nut, said last named connection permitting axial movement of said shaft, and means for exerting a pull on said shaft independently of said screw.

5. In a tool of the character described, a hollow spindle, means for rotating said spindle, a threaded bit having a head extending into said hollow spindle, an abutment in said spindle, an antifriction thrust bearing between said abutment and said head, and a friction clutch between said head and said hollow spindle, whereby the spindle may rotate independently of the bit when the latter's resistance to rotation reaches a predetermined value.

6. In a tool of the character described, a rotatable and longitudinally movable shaft, a rotatable and longitudinally movable hollow spindle in alignment with said shaft, and a pin and slot connection between said shaft and spindle permitting relative longitudinal movement and preventing relative rotational movement, said slot having an angular extension at one end thereof permitting limited angular movement between the shaft and hollow spindle for locking the shaft and spindle together against relative movement in an axial direction, whereby longitudinal movement of the shaft may be communicated to the spindle.

7. In a tool of the character described, a housing member, a sleeve projecting from said housing member, a spindle rotatable in said sleeve, said housing member being axially movable relative to said sleeve, cooperating screw and nut elements responsive to the axial movement of said housing member relative to said sleeve for producing rotation of the screw element, a pulling device in said housing member, and means for connecting said pulling device with said spindle for exerting a pulling force thereupon and for connecting said screw element with said spindle for transmitting rotary motion therefo.

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