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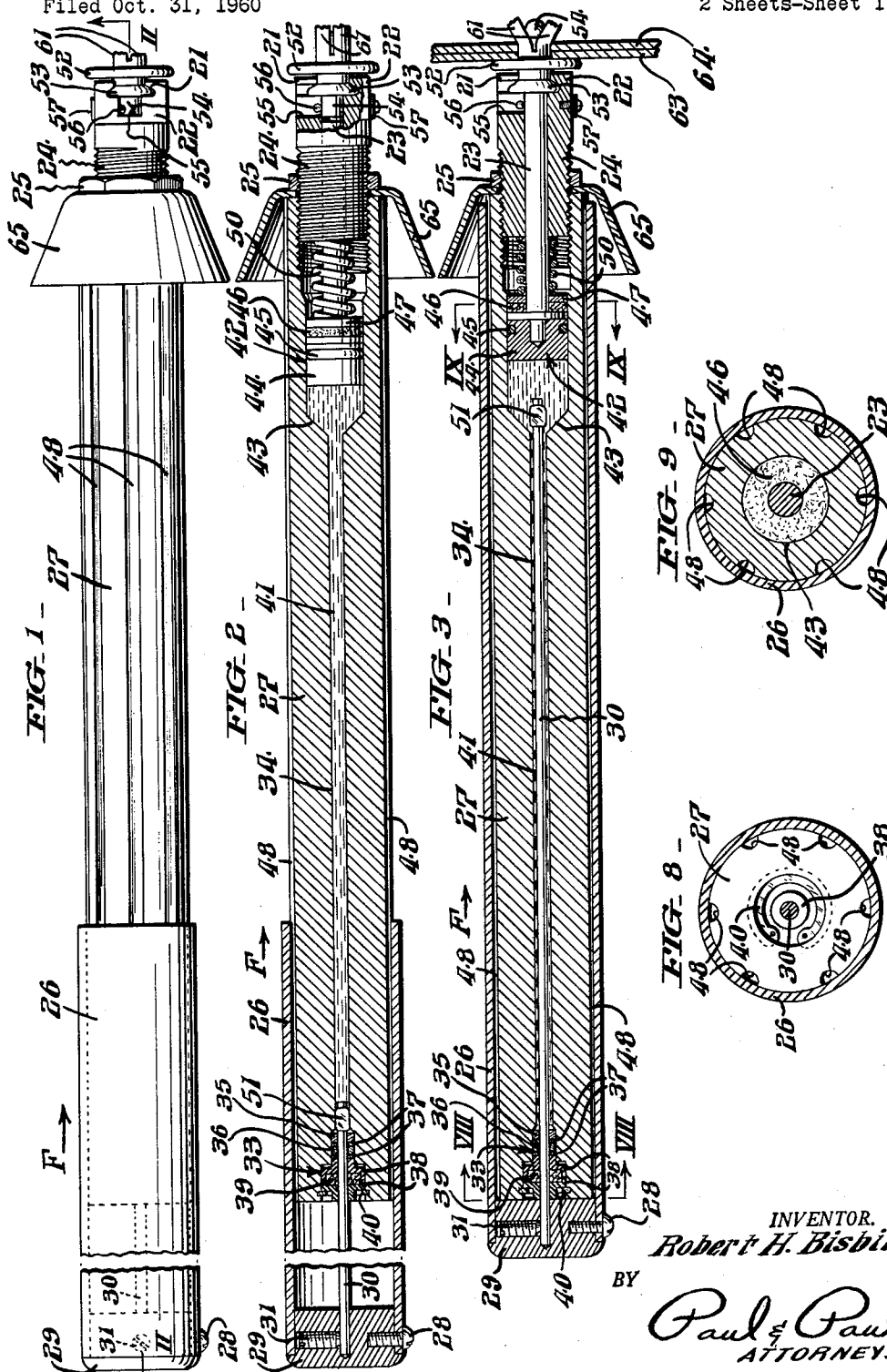
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INSTALLATION TOOL FOR FASTENERS

Filed Oct. 31, 1960

2 Sheets-Sheet 1



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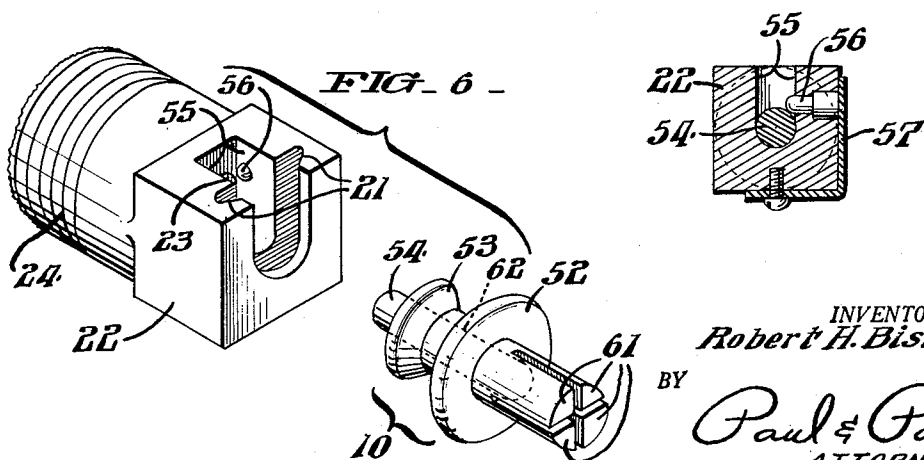
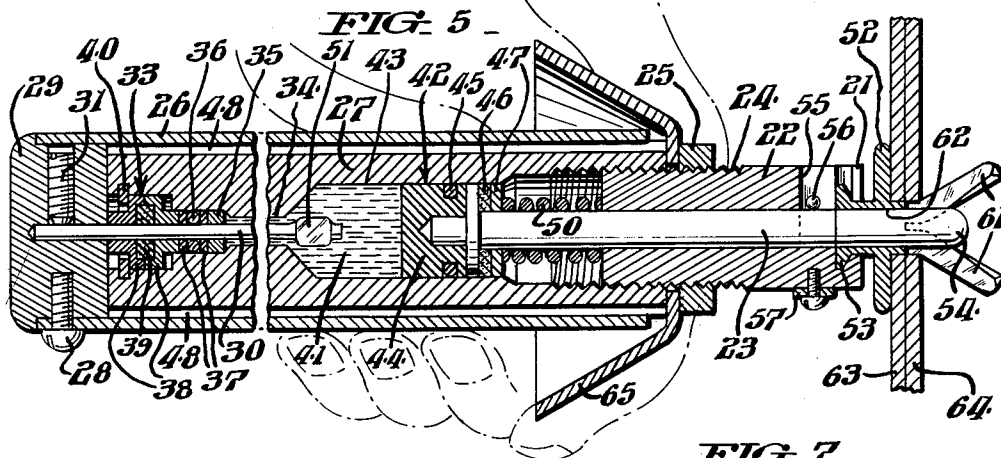
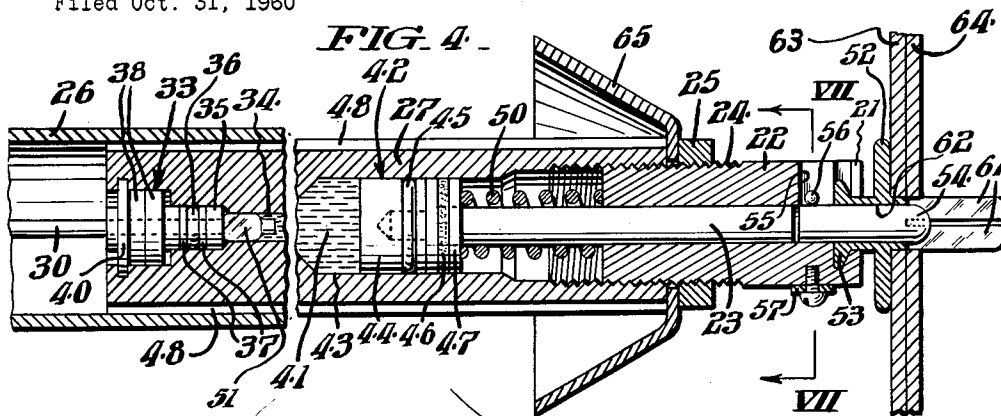
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INSTALLATION TOOL FOR FASTENERS

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6 Claims. (Cl. 1—348)

This invention relates to a manually operated tool for installing rivets and like fasteners requiring a high force to complete the installation.

The tool of the present invention is constructed to provide a force multiplication, that is, a driving force substantially greater than that which the hand (or foot) is capable of exerting alone.

My invention will become clear from a consideration of the following detailed description of a preferred embodiment selected for illustration in the drawing in which:

FIG. 1 is a view of a hand installation tool in accordance with the present invention showing the tool with the handle in extended position;

FIG. 2 is a view in section along the line II—II of FIG. 1;

FIG. 3 is a view in section substantially similar to that of FIG. 2 but showing the tool with the handle in compressed position;

FIG. 4 is a view in section showing on an enlarged scale details of the tool when the handle is in the extended position shown in FIGS. 1 and 2;

FIG. 5 is a view in section showing on an enlarged scale details of the tool when the handle is in the compressed position illustrated in FIG. 3;

FIG. 6 is an illustration showing a typical rivet and showing the head block of the installation tool having jaws specially shaped to receive the particular rivet shown;

FIG. 7 is a cross sectional view along the line VII—VII of FIG. 4 looking in the direction of the arrows; and

FIGS. 8 and 9 are cross sectional views along the lines VIII—VIII and IX—IX, respectively, of FIG. 3, in the direction indicated by the arrows.

In describing the preferred embodiment of the invention illustrated in the drawing, specific terminology has been resorted to for the sake of clarity. However, it is not the intention to be limited to the specific terms so selected, and it is to be understood that each specific term includes all technical equivalents which operate in a similar manner to accomplish a similar purpose.

Referring now to the drawing, a fastener, which in the present illustration is assumed to have the form of the rivet 10 shown in FIG. 6, is inserted in the jaws 21 of head block 22 of the installation tool. The manner in which the rivet 10 is inserted in the head block 22 is clearly seen in FIGS. 1-5 of the drawing. It should be understood that the jaws 21 of the head block 22, which are illustrated as forming a U-shaped slot, may have some other shape, being specially shaped to receive the particular type of rivet or other fastener to be installed.

The particular rivet 10 illustrated for installation in the drawing is an expansion rivet comprising, as shown in FIG. 6, a cylindrical shank cross-slotted at the forward end, thus dividing the shank into four prongs identified collectively by the reference numeral 61. The rivet includes a main head 52 and an auxiliary head 53 spaced rearwardly from the main head and located at the rearward end of the shank. The rearward portion of the shank of the rivet has an axial bore or cavity 62 which extends from the rear end of the shank forwardly to at least the slotted portion, as indicated by the dotted lines in FIG. 6. The cavity 62 contains the forward portion of a round-nosed spreader pin 54, the rearward portion of which extends or protrudes beyond the rear end of the shank prior to the expansion of the rivet. Spreader

2

pin 54 is to be considered an essential part of the rivet 10, each rivet being equipped with such a spreader pin.

The head block 22, shown in detail in FIG. 6, is especially adapted to receive a rivet having the particular form of rivet 10. The U-shaped slot formed by the jaws 21 receives the auxiliary head 53 of the rivet, and the chamber 55 receives the protruding portion of the pin 54. The function of auxiliary head 53 is to receive on its forward surface the rearward reaction force created when a forward force is applied to the rear end of the spreader pin 54. As seen most clearly in the cross-section view of FIG. 7, after the rivet 10 is inserted in the head 22 it is retained therein by the spring-loaded lock-in finger 56 whose rounded forward end extends through one wall of block 22 and protrudes into the chamber 55. Since the finger 56 is spring loaded, as by the L-shaped lead spring 57, when the pin 54 of the rivet 10 is pressed downwardly into the chamber 55, the finger 56 retracts momentarily to permit the pin 54 to be snapped into its seat in the bottom of the chamber 55.

Head block 22 is screwed into the threaded end of an externally-fluted cylindrical barrel 27, as shown in FIGS. 1-5. The axial position of the head block 22 with respect to the entire installation tool, including the plunger 23 later to be referred to, is adjustable by means of the threads 24 and the jam nut 25.

A tubular handle 26 is slidable over the barrel 27, the longitudinal flutes 48 of the barrel allowing the air to escape from the region in the handle 26. The handle 26 is fixed as by screw 28 to a cap 29. Cap 29 holds a long cylindrical rod 30 in an axial position, as by means of an axial hole in the cap 29 and the set screw 31. Rod 30 has a diameter which is smaller than the diameter of the bore 34 of the tubular handle 26 and a length sufficiently long to permit the rod 30 to enter into an axial bore 34 provided in the barrel 27 when the handle 26 overlaps the barrel 27 to a small extent. Near its forward end, rod 30 is provided with a flattened portion which forms a head 51 having two opposing flat surfaces, the other two opposing surfaces of the head being arcuate and conforming to the circular wall of the axial bore 34. Thus, the cross-sectional area of rod 30 even at its head 51 is less than that of the bore 34 so that hydraulic fluid may pass by the head 51 as well as the rod 30.

At the rearward end of barrel 27 is a packing assembly 33 having an axial bore through which rod 30 extends, the head 51 being always forward of the packing assembly 33. The packing assembly 33 comprises a bushing 35, an O-ring type seal 36, two anti-extrusion devices 37 for the O-ring 36, two caps 38 which enclose a lubricant-impregnated wiper 39, and an internal snap or retaining ring 40.

The forward end of the barrel 27 is provided with a chamber 43 for a main piston assembly 42. Main piston assembly 42 comprises a piston 44 having an annular groove for retaining an O-ring type seal 45. Projecting forwardly from piston 44 through a lubricant-impregnated wiper 46 and a washer 47 is the plunger 23, previously mentioned. A compression spring 50, inserted between washer 47 and the rearward end of the head block 22, holds the wiper 46 and washer 47 against the forward face of the piston 44.

Bore 34 and main piston chamber 43 of barrel 27 are provided with a hydraulic medium or fluid 41. When a force is applied manually to the handle 26 in the axial direction indicated by the arrow F, the rod 30 is moved forwardly through the packing assembly 33 and through the bore 34 of barrel 27 and in so doing displaces some of the fluid 41, forcing the displaced fluid into chamber 43, where it exerts a forward force on main piston 44 and a rearward force on barrel 27. The effect is to force the main piston 44 to move forwardly. Since the cross-

3

sectional area of the main piston 44 is substantially larger than that of the rod 30 or its head 51, the total force on the piston 44 is intensified, being substantially larger than that applied to the handle 26. Stated more specifically, the force applied to handle 26 is multiplied A times, where A is the relationship between the cross-sectional area of the piston and that of the rod 30 or its head 51. (In the illustrated form, the cross-sectional area of head 51 is the same as that of rod 30.) This intensified force is transmitted through plunger 23 to the spreader pin 54, and the pin 54 is forced forwardly. At the same time, the rearward reaction force which fluid 41 exerts on piston 27 is applied through head block 22 to the forward surface of auxiliary head 53. Thus, spreader pin 54 is forced forwardly into the rivet 10 thereby spreading the prongs 61 of the rivet 10, as seen in FIGS. 3 and 5.

When the main piston 44 moved forwardly, the compression spring 50 became compressed. At the termination of the forward stroke, when the handle 26 is retracted, the spring 50 assists in returning the main piston assembly 42 to its original position, thus forcing hydraulic fluid past head 51 into bore 34 and assuring against a vacuum build-up in the hydraulic medium. At the end of the back stroke, the head 51 on the forward end of the rod 30 makes contact with the bushing 35, thus preventing removal of the handle 26 from the rod 30.

It is not unusual to find that the sheets to be riveted together, as for example sheets 63 and 64 of the drawing, while of metal, such as steel or aluminum, are so thin as to tend to be bent by the unamplified manual force applied to handle 26 and transmitted to the work sheets through the barrel 27, head block 22, auxiliary head 53 and main head 52 of the rivet 10. To reduce this force, the installation tool may be provided with a skirt-like member 65 secured to the forward end of barrel 27 and adapted to be grasped, as by the left hand of the operator as illustrated in FIG. 5, for holding back the barrel 27 when the handle 26 is pushed forward, as by the right hand of the operator, to force the plunger 23 against the rivet pin 54 as heretofore described.

While the preferred embodiment of this invention has been described in some detail, it will be obvious to one skilled in the art that various modifications may be made without departing from the invention as hereinafter claimed.

Having thus described my invention, I claim:

1. A rivet expander tool for installing an expansion rivet of the type having a main head and an auxiliary head located rearward of the main head and having a spreader pin the forward portion of which is positioned within a cavity in the rearward end portion of the rivet, the remainder of the pin extending rearwardly from the rivet when unexpanded, said installation tool comprising: an elongated barrel having at its forward portion an axial piston chamber and having an axial bore rearward of said piston chamber and in communication therewith; a piston in said chamber having a plunger extending axially forward therefrom; a tubular handle slidable over said barrel in telescoping fashion, said handle having an elongated rod secured to its rearward end and projecting forward therefrom into said bore of said barrel, said rod being smaller in cross-sectional area than said bore; a fluid captive in said bore and in that portion of said piston chamber which is rearward of said piston; and a head block secured to the forward end of said barrel having an axial bore therethrough adapted to receive said plunger and having means to receive and grasp the rearward auxiliary head of an inserted rivet, and to hold said rivet in such position that said spreader pin is in axial alignment with the bore of said head block, said handle being adapted to be pushed forward over said barrel to move the rod secured to said handle forward through said bore of said barrel to displace fluid to force the displaced fluid into said piston chamber and to move said piston and thus said plunger forward against the spreader pin of

4

the rivet inserted in the head block, the reaction force of the fluid on said barrel being applied in a rearward direction against the forward surface of the auxiliary head of the inserted rivet.

2. A tool for installing an expansion rivet of the type having an auxiliary head located rearward of a main head and having a spreader pin the forward portion of which is positioned within a cavity in the rearward end portion of the rivet body, the remainder of the pin extending rearwardly from the rivet body prior to expansion, said installation tool comprising: an elongated barrel having at its forward portion an axial piston chamber and having an axial bore rearward of said piston chamber and in communication therewith, the diameter of said bore being substantially smaller than that of said piston chamber, a piston in said chamber having a plunger extending forward therefrom; a tubular handle slidable over said barrel in telescoping fashion, said handle having a cap closing its rearward end having an elongated rod secured thereto and projecting forward therefrom into said bore of said barrel, said rod being smaller in cross-sectional area than said bore; a hydraulic fluid captive in said bore and in that portion of said piston chamber which is rearward of said piston; and a head block secured to the forward end of said barrel having an axial bore therethrough adapted to receive said plunger and having a recess adapted to receive and grasp the rearward auxiliary head of a rivet and to hold said rivet in such position that the spreader pin is aligned with said bore in said head block, said handle being adapted to be pushed forward over said barrel to move the rod secured to said handle forward through said bore to displace fluid, to force the displaced fluid into said piston chamber to move said piston plunger forward against the spreader pin of a rivet inserted in the head block, the reaction force of the fluid on said barrel being applied by the forward surface of said head-block recess in a rearward direction against the forward surface of the auxiliary head of the inserted rivet.

3. An installation tool as claimed in claim 2, characterized in that said elongated rod is provided with a side-flattened head the cross-sectional area of which is equal to that of said rod, the long diameter of said head being substantially equal to that of said bore, whereby said head guides said rod as it is moved along said bore yet permits fluid to pass thereby.

4. An installation tool as claimed in claim 3 further characterized in that a compression spring is provided between the forward face of said piston and said head block for returning said piston rearward upon completion of the forward rivet expansion stroke.

5. An installation tool for installing an expansion type rivet having an auxiliary head rearward of a main head and having an expander pin positioned within an axial cavity within the rivet body, said expander pin extending rearward from the rivet body when the rivet is unexpanded, said installation tool comprising: a tool head having an axial bore; a plunger positioned within the axial bore in the tool head; spring means normally holding said plunger in retracted position, said tool head having means positioned forward of the plunger when retracted for receiving and grasping the auxiliary head of the rivet for holding the rivet in such position that its expander pin is in alignment with the axial bore of said tool head, said receiving means holding the rivet body against forward movement when the pin is driven forward during the expanding operation; an elongated barrel secured to said tool head having in the forward portion thereof an axial piston chamber and having in the rearward portion thereof and in communication with said piston chamber an axial bore of substantially smaller diameter than that of said piston chamber; a piston in said piston chamber adapted to move said plunger forward; an elongated rod in said barrel bore having a guide head of the same cross-sectional area as said rod, the cross-sectional area of said rod and of said guide head being less than that

5

of said bore; packing means at the rearward end of said barrel bore through which said rod extends; a fluid captive in said bore and in that portion of said piston chamber which is rearward of said piston; and handle means for pushing said rod forward to displace fluid in said bore and to drive said displaced fluid into said piston chamber for driving said piston forward to drive said plunger against the spreader pin of said rivet.

6. An installation tool as claimed in claim 5 character-

6

ized in that said means for grasping the auxiliary head of said rivet comprises a U-shaped recess having a forward flange, said recess being adapted to receive the auxiliary head of the rivet, said forward flange being adapted to prevent forward movement of the auxiliary head and hence of the rivet body when the pin is driven forward during the expanding operation.

No references cited.