Feb. 17, 1953 S. E. HINKLE 2,628,515

RIVET-BUCKING TOOL

Filed Feb. 13, 1948 2 SHEETS—SHEET 1

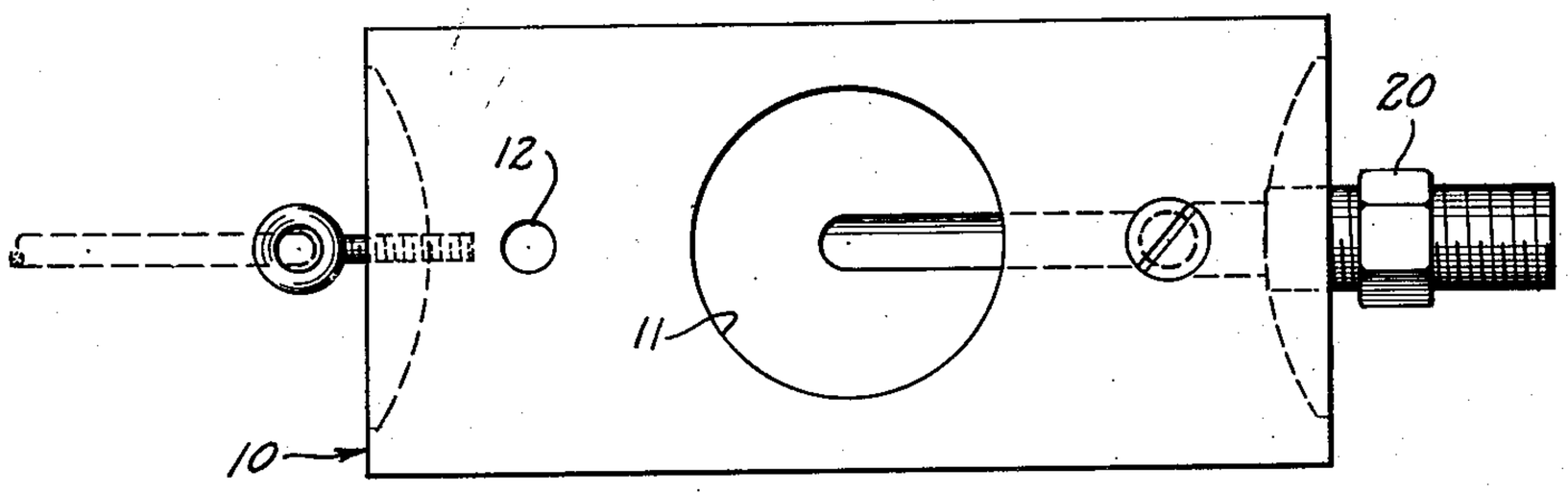

Fig. 1

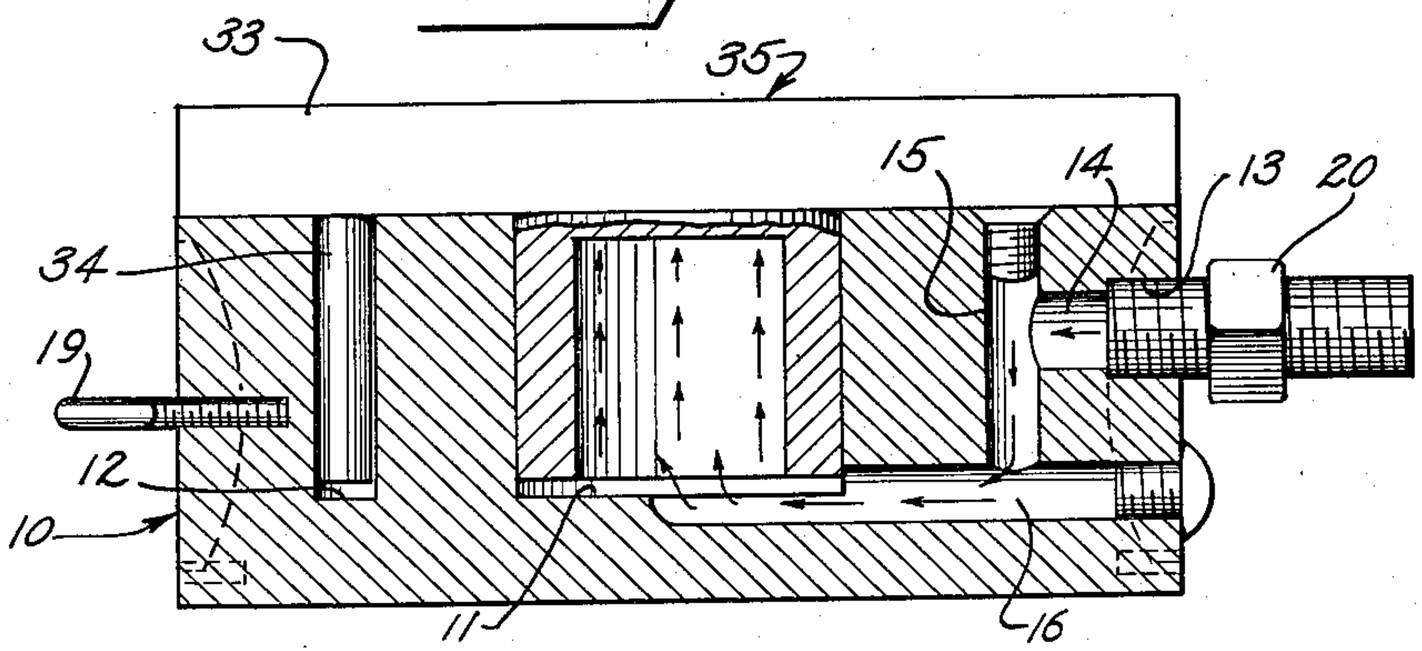

Fig. 2

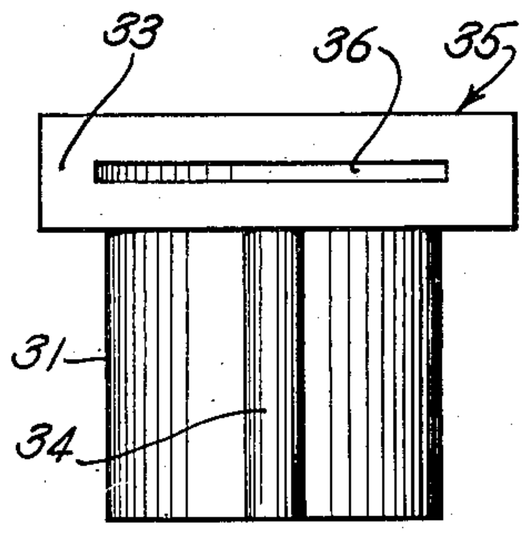

Fig. 3

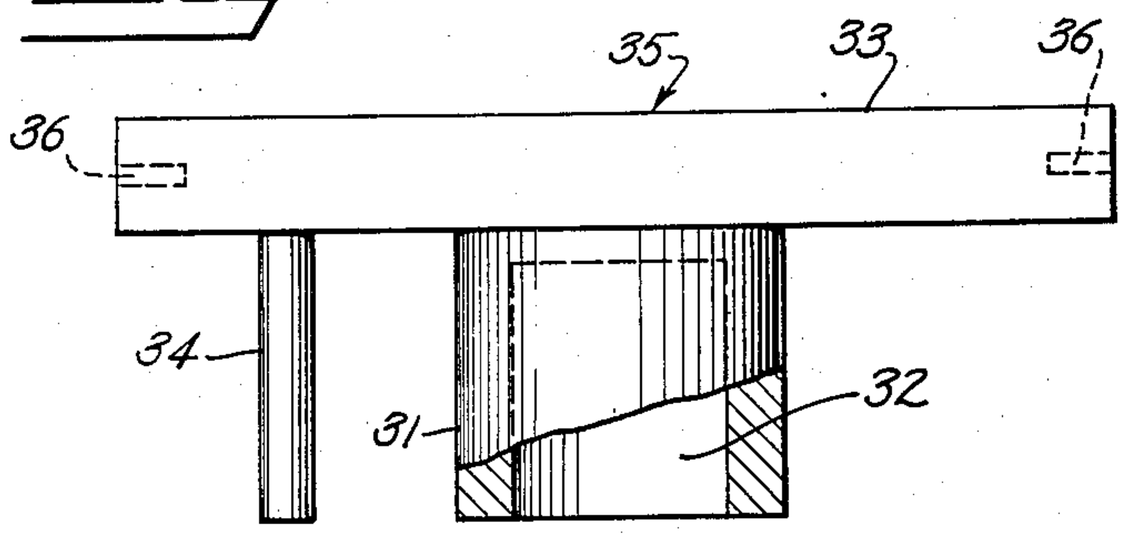

Fig. 4

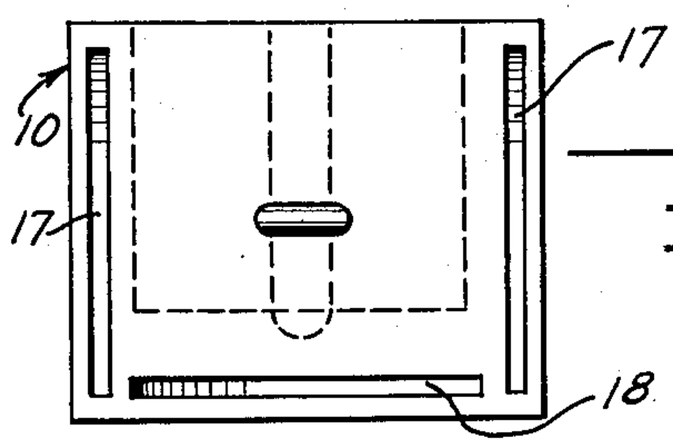

Fig. 5

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RIVET-BUCKING TOOL

Filed Feb. 13, 1948 2 SHEETS—SHEET 2

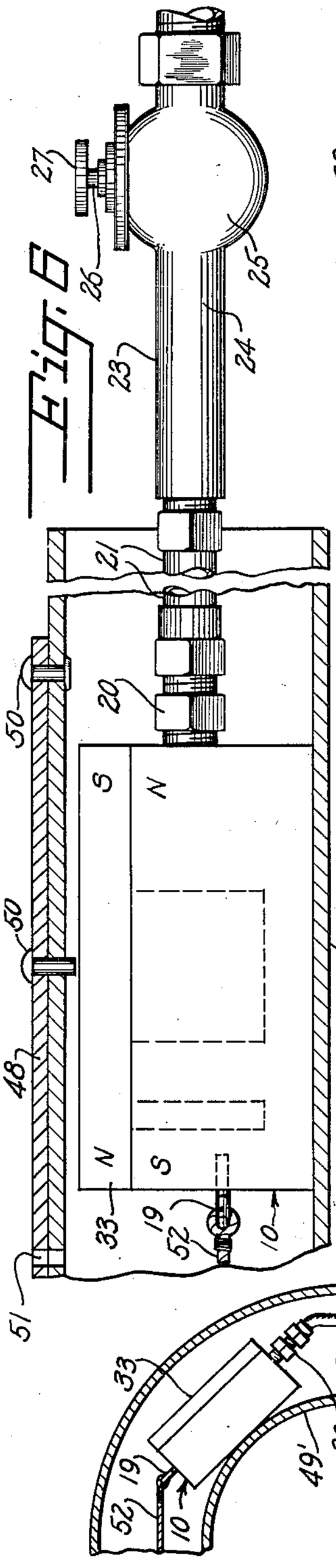

Fig. 6

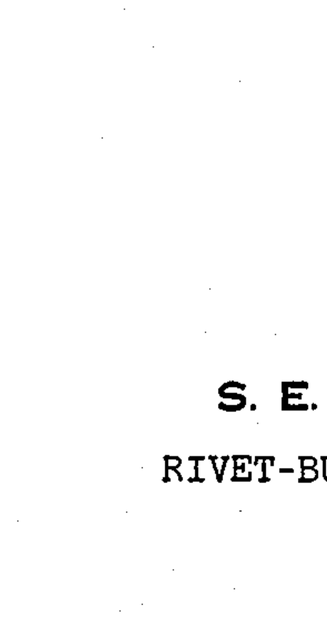

Fig. 8

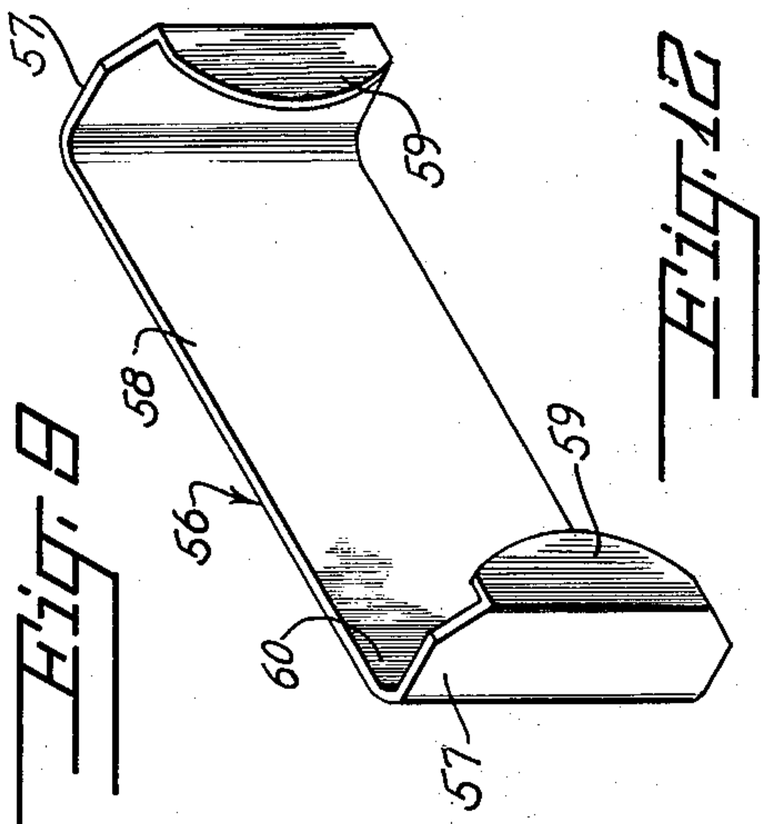

Fig. 12

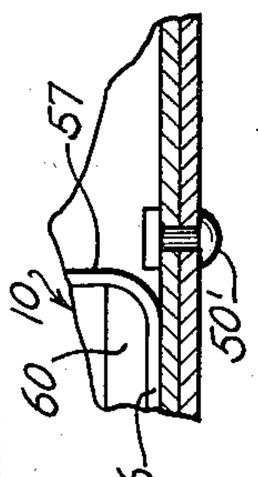

Fig. 9

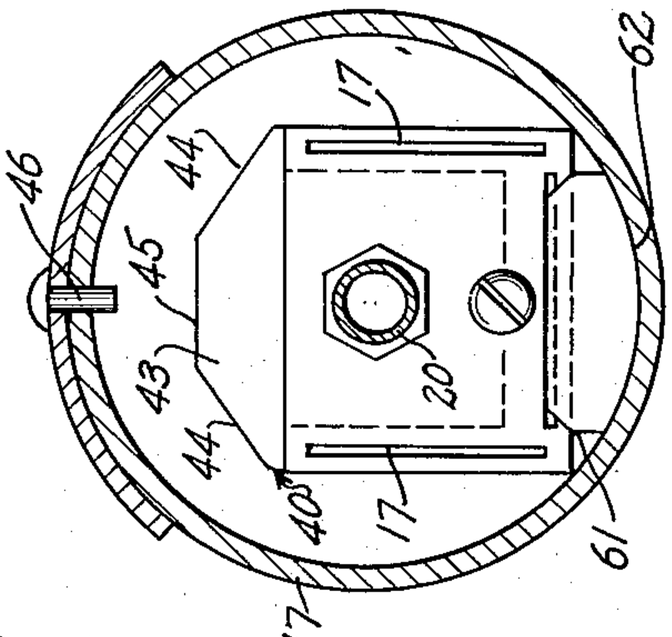

Fig. 11

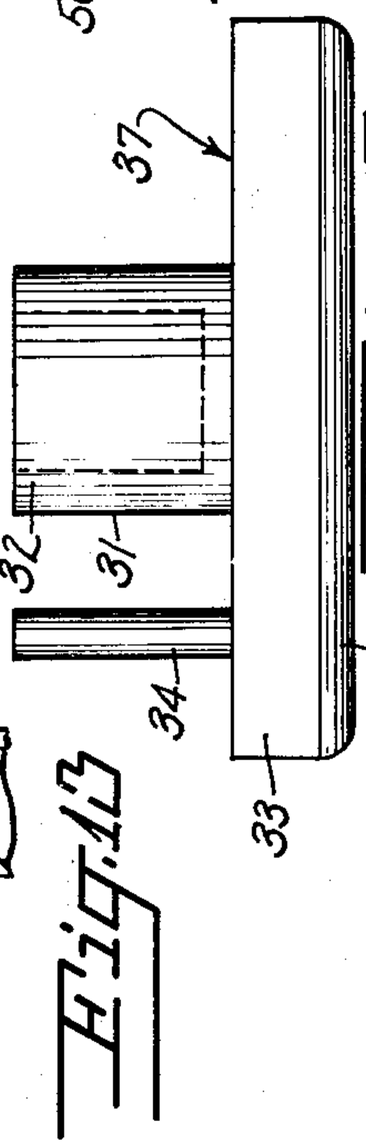

Fig. 7

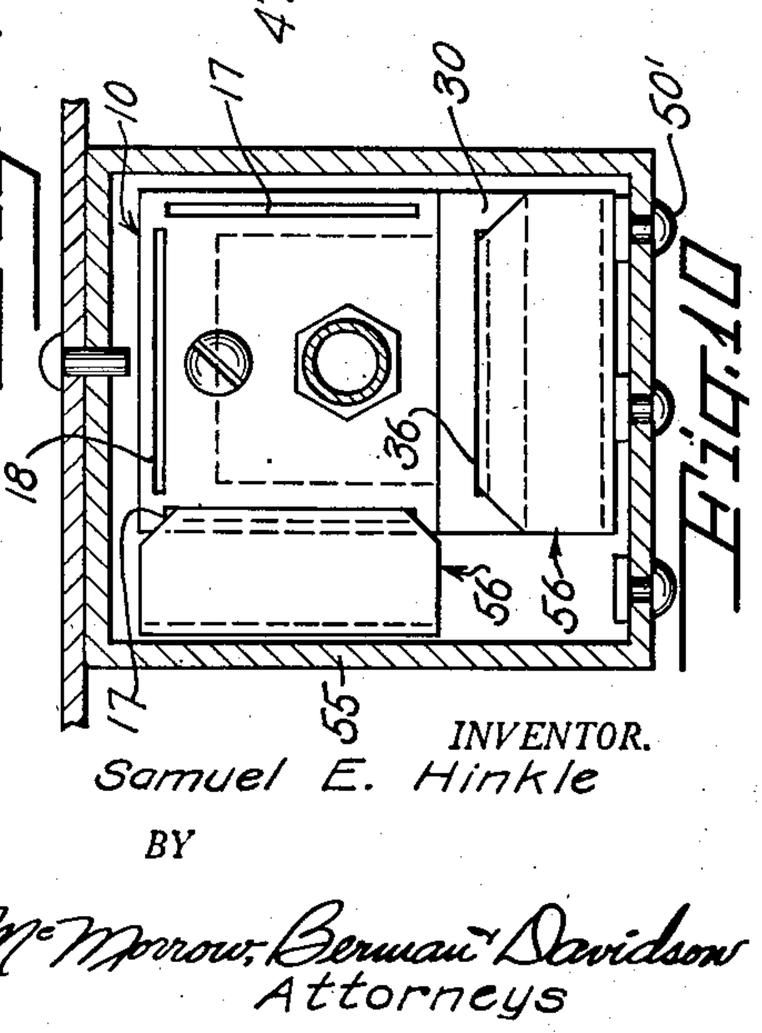

Fig. 10

Fig. 13

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RIVET-BUCKING TOOL

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2 Claims. (Cl. 78—53.5)

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This invention relates to improvements in riveting tools, and more particularly to an improved rivet-bucking tool for use in restricted spaces where it is not possible or convenient to use a riveting hammer or the usual manually applied bucker.

It is among the objects of the invention to provide an improved rivet-bucking tool for use in restricted spaces such as the spaces within tubes and conduits and in various sheet metal components of aircraft, which tool is operative to positively and firmly oppose a rivet end to upset the same when a rivet hammer is operatively applied to the opposite end of a rivet, or to oppose a rivet head while the rivet end is upset by the hammer, is readily adapted for use in conduits or other enclosures of various cross-sectional shapes and sizes, is expanded in operative position by manually-controlled fluid pressure and collapsed by the attraction of permanent magnetism of its major parts, and is simple, durable and economical in construction, and easy to operate.

A somewhat more specific object resides in the provision of an improved rivet-bucking tool comprising two operatively-associated, relatively movable, work-engaging bodies relatively movable in a separating direction by fluid pressure and relatively movable toward each other by magnetic attraction, and in the provision of various alternatively usable work-engaging bodies and adapters for accommodating the tool to the interiors of hollow work pieces of various shapes and sizes.

Other objects and advantages will become apparent from a consideration of the following description in conjunction with the accompanying drawing, wherein:

Figure 1 is a plan view of the major work-engaging body of the rivet-bucking tool;

Figure 2 is a longitudinal cross-section of the major tool body illustrated in Figure 1, and also illustrates a cooperating work-engaging body operatively associated with the major body and shown partly in section and partly in elevation;

Figure 3 is an end elevation of the cooperating work-engaging body;

Figure 4 is a side elevation of the work-engaging body illustrated in Figure 3, a portion being broken away and shown in cross-section to better illustrate the construction thereof;

Figure 5 is an end elevation of the major work-engaging body showing a strand-receiving eye applied thereto;

Figure 6 is a longitudinal cross-section of a tubular work piece with the improved bucking tool in operative position therein preparatory to performance of a riveting operation;

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Figure 7 is a side elevation of a modified form of cooperating work-engaging body, said modified body having a cushioned face and rounded ends;

Figure 8 is a longitudinal cross-section of a fragmentary portion of a work piece illustrating the operation therein of a modified work-engaging body having rounded ends;

Figure 9 is a cross-section of a fragmentary portion of the major work-engaging body and illustrates a modified form of cooperating work-engaging body in operative association with the major body, the modified body being in the shape of a piston;

Figure 10 is a transverse cross-section of a tubular work piece of rectangular cross-section showing the improved working tool in operative position therein and provided with adapters applicable to the particular size and shape of the work piece;

Figure 11 is a transverse cross-section of a tubular work piece of circular cross-sectional shape showing the bucking tool positioned therein and provided with a modified form of cooperating work-engaging body for use in a work piece of curved or circular contour;

Figure 12 is a perspective view of an adapter applicable to the improved bucking tool to support the tool in a work piece; and

Figure 13 is a somewhat diagrammatic cross-sectional view illustrating the manner in which the tool may be drawn through a tubular work piece having bends therein.

With continued reference to the drawings, the major work-engaging body of the tool, generally indicated at **10** and particularly illustrated in Figures 1 and 2, is an elongated, rectangular body of hard material, such as steel, and has a circular cylinder bore **11** therein perpendicular to and opening through one of the faces thereof. Adjacent the cylinder bore, the body is provided with a well or bore **12**, and has a fluid passage leading from an internally screw-threaded counter-bore **13** in one end of the body through bores **14**, **15** and **16** to the bottom or inner end of the cylinder bore **11**. The counter-bore **13** is positioned near the face of the body through which the cylinder bore **11** opens, and the bores **14**, **15** and **16** are provided to conduct fluid under pressure from this location to the bottom or inner end of the cylinder bore. The body **10** also has elongated recesses or grooves **17** and **18** in each end thereof, the grooves **18**

being adjacent and parallel to the face of the body opposite that through which the cylinder bore 11 opens and the grooves 17 being adjacent and parallel to the faces at opposite sides of the cylinder bore. A strand-receiving eye 19 is threaded into the end of the body opposite the end in which the counter-bore 13 is provided to receive a wire or cord by means of which the body may be pulled through a tubular conduit or other structural enclosure, and a screw-threaded hose coupling 20 has one end thereof threaded into the counter-bore 13 and the opposite end received in the adjacent end of a flexible hose 21 adapted to conduct fluid under pressure from a suitable source, such as a compressed air tank, to the major work-engaging body 10 of the bucking tool.

The work or rivet-engaging body which is operatively associated with the major body 10 is provided in several different forms, as illustrated in Figures 3, 4, and 7. The simplest form of such body is illustrated in Figure 9, and comprises a right cylinder 22 having a concentric, cylindrical recess 22′ therein opening to one end of the cylinder, the other end of the cylinder being closed and provided with a plain surface. The cylinder 22 is placed in the cylinder bore 11 of the major body with the open end of recess 22′ toward the bottom or inner end of the cylinder bore. With this arrangement, if fluid under pressure is admitted to the cylinder bore 11 through the fluid passage, the cylinder 21 will be forced outwardly of the cylinder bore, and, if the bucking tool is located in a structure providing an enclosed space of suitable dimensions, will be brought into engagement with one surface of the structure, the face of the major body opposite the face through which the cylinder bore opens being brought into contact with an opposite face of the structure. If a rivet be now inserted through an opening in the structure so that its inner end bears against either the outer face of piston 21 or the opposite face of body 10 and a riveting hammer be operatively applied to the outer end of the rivet, the inner end of the rivet will be upset to the condition of the rivets illustrated in Figures 8 and 10. The recess 22′ provides a resilient cushion supporting the body for recoil to hammer impacts.

The application of fluid under pressure, such as compressed air, to the inner end of the cylinder bore 11 is controlled by a manually-operated valve 23 interposed between the hose 21 and the source of fluid or pressure fluid, such as the compressed air tank mentioned above. This control valve may be of conventional construction and comprise a tubular portion 24, a valve housing 25, a valve, not illustrated, within the housing, and a plunger 26 having a head 27 providing a thumb button for controlling the valve.

Piston 22 is fitted into cylinder bore 11 with a sliding fit and with sufficient clearance so that the compressed air will gradually leak out of the space between the inner end of the piston and the bottom of the cylinder bore when the air is cut off at the valve 23. The piston is drawn back into the cylinder bore by the force of magnetic attraction, the piston 22, at least, being highly magnetized and constituting a permanent magnet having sufficient attraction for the major body 10 to retract the piston into the cylinder bore as the compressed air leaks out past the piston after the valve 23 is closed.

In the form of cooperating work-engaging

body, or anvil, illustrated in Figures 3 and 4, a piston 31 is provided, similar in all respects to the piston 22 and having a concentric cylindrical recess 32 therein. A rectangular plate 33 is formed or secured on the closed end of the piston 31 and may have longitudinal and lateral dimensions the same as those of the major body 10, as indicated in Figure 2. In this arrangement, the piston is slidably received in the cylinder bore of the major body 10, and a pin 34 projecting from the same side of plate 33 from which piston 31 projects is slidably received in the bore 12 of the major body and effectively restrains the cooperating body or anvil, generally indicated at 35, from rotation relative to the major body. A respective elongated groove 36 is provided in each end of the anvil plate 33 for the attachment to this plate of an adapter later to be described.

The modified form of cooperating work-engaging body, illustrated in Figure 7 and generally indicated at 37, has the same components 31, 33 and 34 as has the body 35 illustrated in Figures 3 and 4, but has a cushion 38 of some suitable material, such as leather or rubber, on the face thereof opposite the face from which the piston 31 extends. This cushioned cooperating body member is operatively associated with the major body member when it is desired to use the major body member itself to provide the bucking surface for the rivets. The cushion 38 then bears against the opposite side of the structure in which the bucking tool is located, so that such opposite surface will not be marred or damaged by the bucking tool, and frictional resistance to movement of the bucking tool in the structure will be provided.

A further modified form of cooperating work-engaging body is illustrated in Figure 11 and is particularly adapted for use in tubes or conduits of curved or circular cross-sectional shape. This modified body, generally indicated at 40, is similar to the body 35 illustrated in Figures 3 and 4, except that the upper surface of the plate 43, corresponding to the plate 33 of the body 35, is beveled along the longitudinal sides thereof, as indicated at 44, to provide a relatively narrow rivet-bucking surface 45 at the top of the plate which will contact the inner end of a rivet, such as is indicated at 46 in the tubular work piece 47, without interference by the contour of the inner surface of the work piece.

Where the cooperating body or anvil is provided with a plate, both work-engaging bodies of the tool are permanently magnetized in such a manner that the north and south poles of these permanent magnets are opposed, as illustrated in Figure 6, so that there will be a strong magnetic attraction between the two bodies tending to hold them together against accidental separation and also to move them relatively together after they have been moved in a separating direction by the application of fluid pressure to the inner end of the piston of the cooperating body or anvil.

Figure 6 illustrates the use of the improved bucking tool in a structure, such as a tubular conduit, in which the bucking tool substantially fits without the use of extensions or adapters. In this case, a plate or sheet 48 is being secured to the tubular structure 49 by rivets 50 inserted through holes 51 provided in the upper wall of the structure 49 and in the sheet or plate 48. In this operation, the bucking tool is located beneath a rivet hole, a rivet is inserted through the hole

and the thumb button 27 depressed to admit compressed air under the piston of the bucking tool anvil, thereby raising the anvil into contact with the upper wall of the structure 49. A riveting hammer is then applied to the head of the rivet at the upper side of the plate 48 and the rivet is hammered until its inner end is upset against the contacting surface of the bucking tool anvil, as is illustrated at the right-hand end of the structure 49. After the rivet has been suitably upset, thumb button 27 is released to close the valve 23, whereupon the magnetic attraction acting between the major body 10 and the anvil body pulls these two bodies together, the air in the cylinder bore of the major body escaping through the clearance between the cylinder bore and the piston of the anvil body. If the structure 49 is a relatively long conduit, a strand 52 is connected to the eye 19 and extended through the structure so that the bucking tool can be moved through the structure to the desired operative position. As illustrated in Figure 13, the tool may be drawn through a tubular structure 49' having a bend therein by use of the strand 52.

Where the cross-sectional area of the structure in which the bucking tool is used is materially larger than the cross-sectional area of the bucking tool itself, as is the case of the structure 55, illustrated in Figure 10, suitable extensions or adapters, generally indicated at 56, and illustrated in detail in Figure 12, are applied to the bucking tool to hold it in proper operative position in the structure. If the structure is of substantially the same width, but is deeper than the bucking tool, a single adapter may be applied to the side of the main body portion opposite the anvil or may be applied to the anvil portion of the tool, if the structure is of substantially the same depth as the bucking tool, but substantially wider, the extension may be applied to one side of the main body 10, or, if the structure is both wider and deeper than the bucking tool, one extension may be applied to a side of the main body and another extension applied to the anvil or to the part of the main body opposite the anvil. The application of two such adapters to the bucking tool is illustrated in Figure 10.

Each adapter comprises an elongated strip of thin, resilient metal having a width substantially equal to the width of the bucking tool and having bent-up end portions 57 disposed substantially at right angles to the intermediate portion 58 at the same side thereof. The outer ends of the end portions 57 are further bent at right angles to provide tongues 59 which are receivable in the grooves 17 and 18 in the ends of the main body 10, or in the grooves 36 of the anvil plate 33 to secure the adapters to the bucking tool. The ends of the tongues 59 are preferably rounded, as clearly illustrated in Figure 12, to facilitate the insertion of the tongues into the corresponding grooves in the bucking tool and facilitate the removal of the tongues from the grooves. When an extension is operatively secured to the bucking tool, its intermediate portion 58 provides a resilient support for the bucking tool and one or more such extensions may be used, as indicated above, to accurately position the bucking tool in the structure in which it is used.

The end portions 57 of the adapters 56 join the intermediate portions 58 thereof by curved fillets 60 of substantial radius, so that, when an adapter is at the bottom of the bucking tool, the bucking tool may be easily moved over obstructions, such as the upset inner ends of rivets 50', as illustrated in Figures 8 and 10.

When the bucking tool is used in a tubular work piece of circular section, as illustrated in Figure 11, a special adapter, generally indicated at 61, having a curved or partly cylindrical intermediate portion 62 corresponding to the straight intermediate portion 58 of the adapter 56, may be used to operatively support the bucking tool in such a work piece.

The adapters 56 are preferably provided in sets having end portions 58 of different lengths, so that, by the use of selected adapters, the bucking tool can be accommodated to structural enclosures of various shapes and sizes.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiments are, therefore, to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are, therefore, intended to be embraced therein.

I claim:

1. A rivet bucking tool adapted to be placed between the side walls of a work piece comprising a body having a bore opening through one face thereof, an anvil having a face adjacent said one face of said body, a piston projecting from said anvil and slidably received in the bore in said body, said body having a passage opening into said bore for the admission of a pressure fluid into the space between the inner end of said bore and the adjacent end of said piston to move said body and said anvil relative to each other in a separating direction, said body also having grooves in each end thereof adjacent the edges thereof at a location adjacent the opposite face of said body, and an adapter having inwardly extending tongues received in said grooves thereby attaching said adapter to said body to cover the face of said body opposite said one face, and said adapter being shaped to correspond to and be supported by one wall of a work piece while a rivet is being bucked at the opposite wall of the work piece by said anvil.

2. A rivet bucking tool adapted to be placed between the side walls of a work piece comprising a body having substantially parallel flat faces and flat side surfaces and a bore opening through one face thereof, an anvil having a face adjacent said one face of said body, a piston projecting from said anvil and slidably received in the bore in said body, said body having a passage opening into said bore for the admission of a pressure fluid into the space between the inner end of said bore and the adjacent end of said piston to move said body and said anvil relative to each other in a separating direction, said body also having grooves in each end thereof disposed one adjacent each edge of each side surface and one adjacent each edge of the face of said body opposite said one face, and adapters having inwardly extending tongues received in said grooves attaching said adapters to said body to cover the face of said body opposite said one face and the side surfaces of said body, said adapters being shaped to engage the adjacent walls of a work piece and support the bucking tool therein while a rivet is being bucked at the wall of a work piece adjacent said anvil.

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