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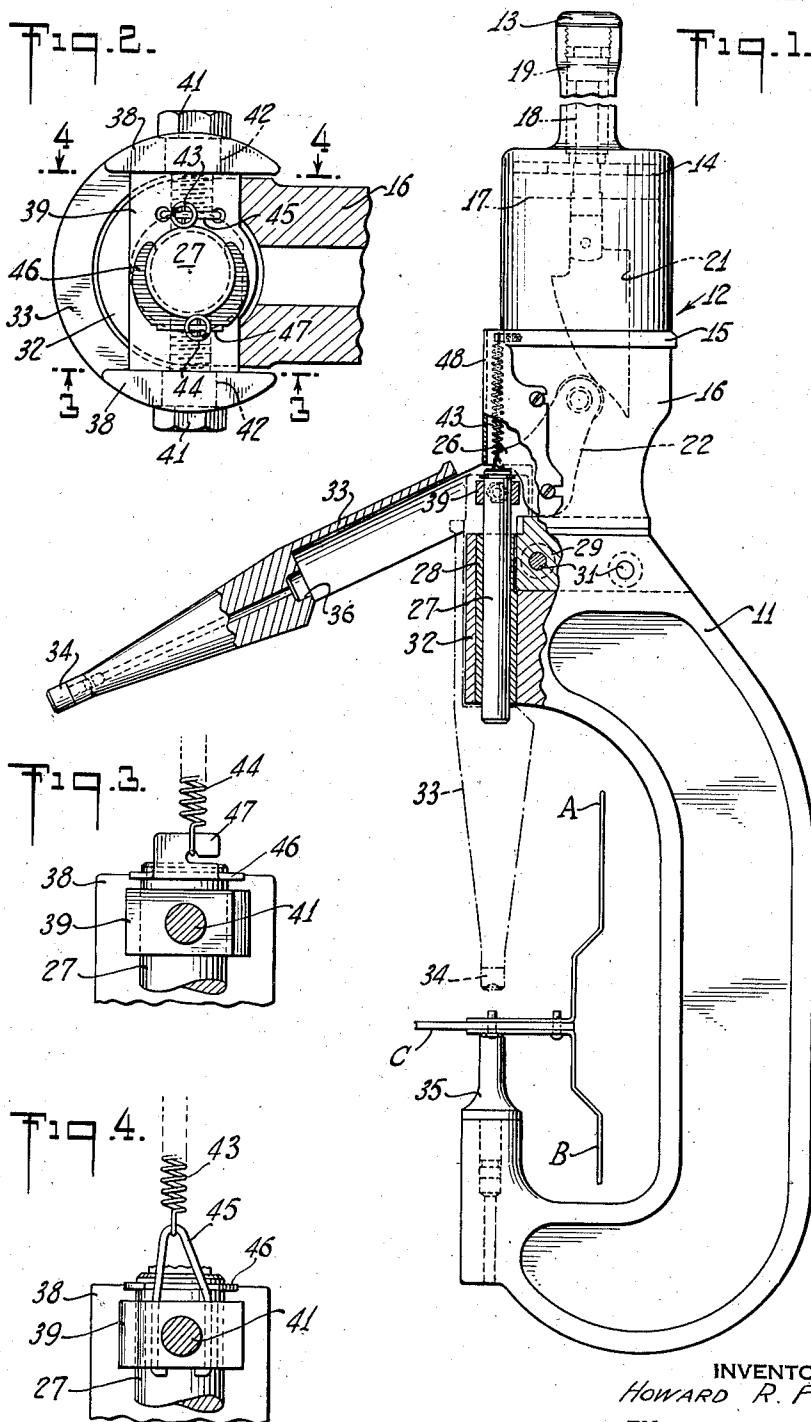
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2,316,946

RIVETING YOKE

Filed Nov. 8, 1941

4 Sheets-Sheet 1



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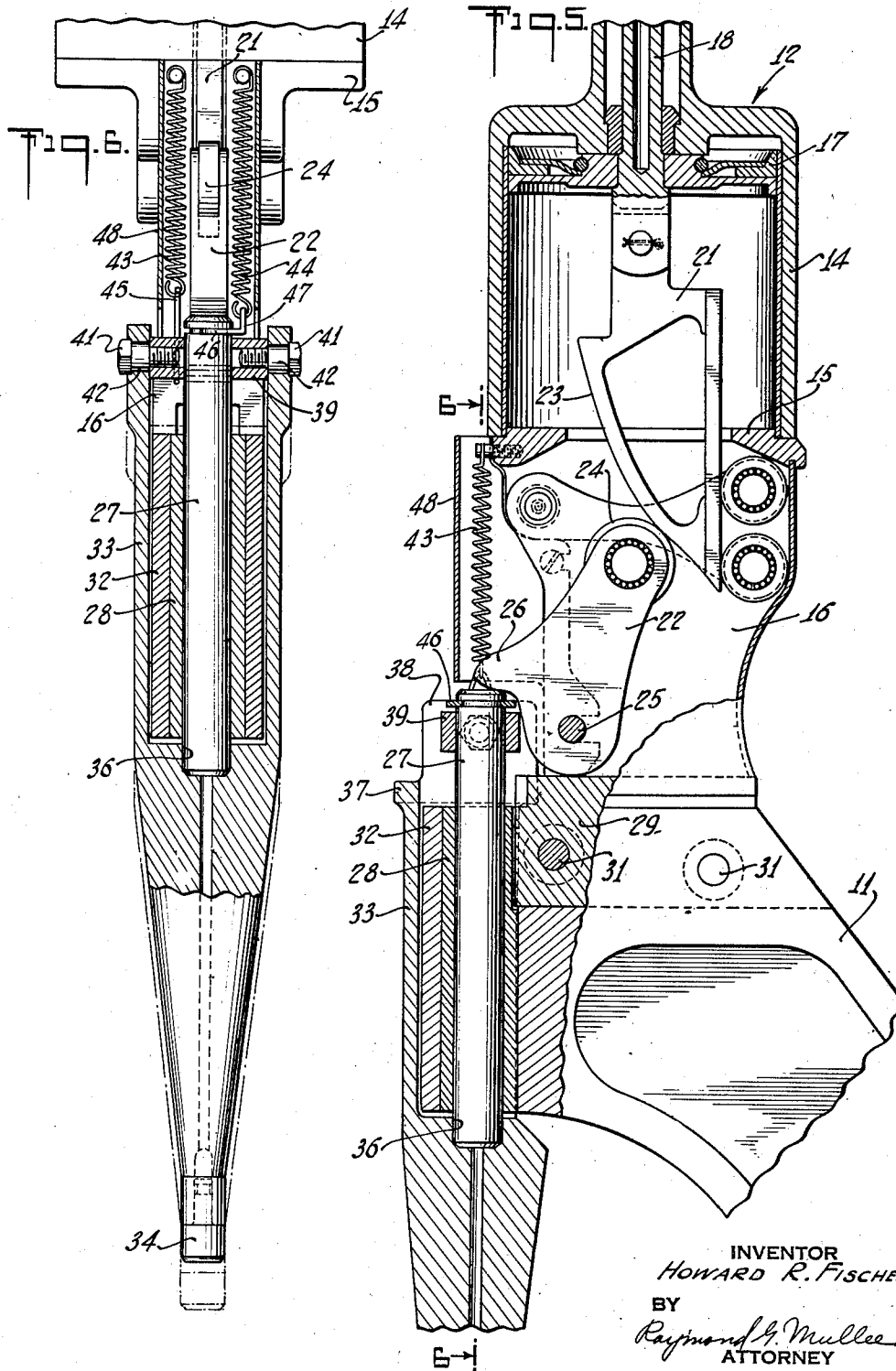
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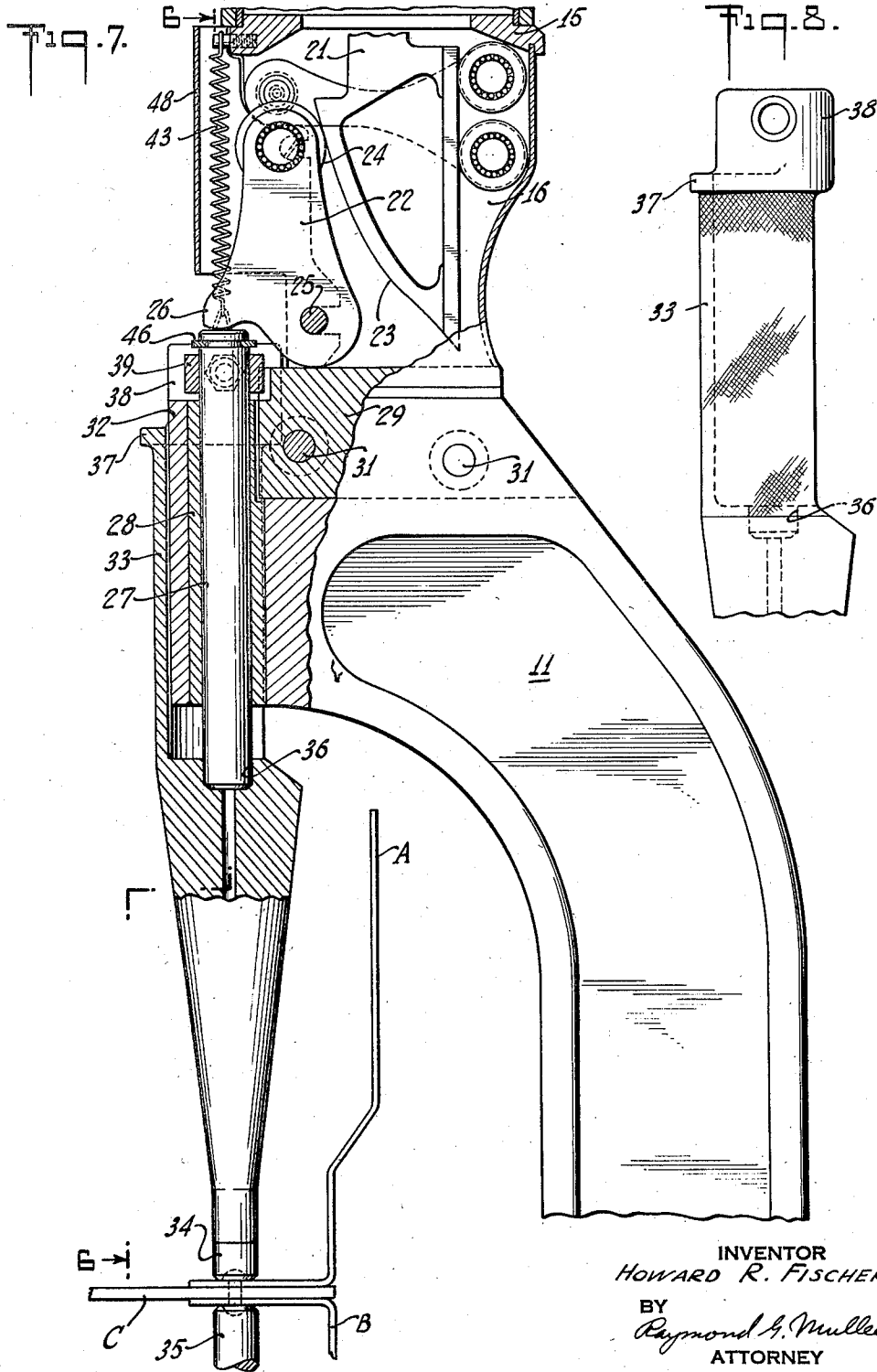
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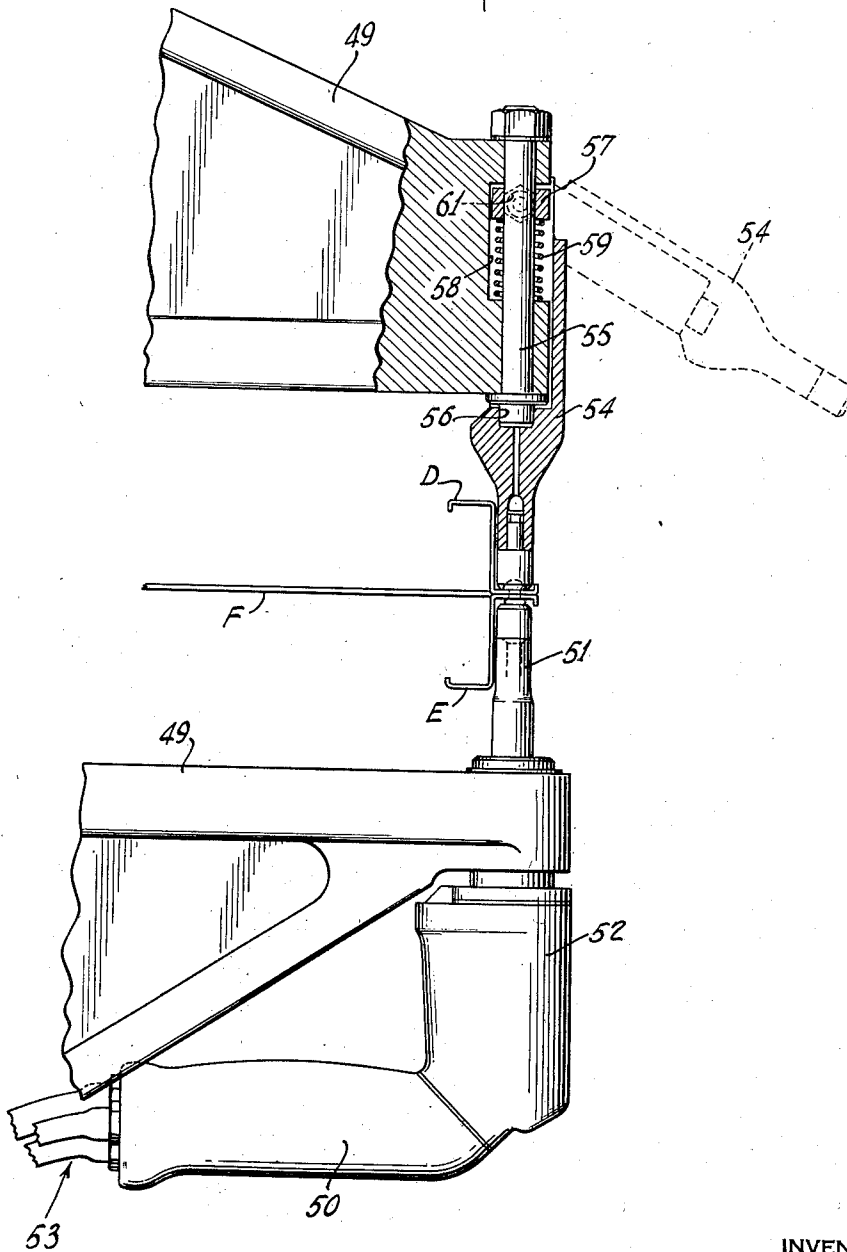
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2,316,946

RIVETING YOKE

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Application November 8, 1941, Serial No. 418,313

11 Claims. (Cl. 78—48)

This invention relates to riveting and like machines and more particularly to compression riveting assemblies comprising a generally C-shaped yoke adapted to embrace the work.

In such a machine the opposed ends of the yoke are provided with relatively movable work engaging jaws which have but a limited travel to and from fully open position. Frequently it happens that the maximum gap obtainable between the jaws is insufficient to permit the yoke to be passed around a particular class of work. In these instances, it has been necessary heretofore to design a special riveter much larger than is required properly to head the rivets, or to drive the rivets by methods other than that employing the compression or squeeze principle of operation. Special riveters, in addition to their disproportionate size, have the disadvantage of slow operation as a result of the excessive lost motion involved in each opening and closing movement of the work engaging jaws.

The general object of this invention is to overcome this problem. More specifically, the object is to enable a riveting machine to be moved into and out of working position even when the dimensions of the work pieces about which the machine must be passed are such as to prevent their entry between the work engaging jaws of the yoke.

A further object is to enable a riveting machine, in which the work engaging jaws have only a travel proportionate to a particular size of rivet, to be used in those classes of work requiring a larger gap between the jaws when applying the machine to the work and withdrawing it therefrom.

These objects have been accomplished by providing, in a riveting machine, a yoke of a size equal to the maximum requirements of the work, work engaging jaws in the opposed ends of the yoke cooperating in the manner of a conventional riveter and having only a normal travel, and a mounting for one of the jaws enabling it to be swung out of working position thereby to increase the size of the opening between the ends of the yoke. As long as the rivets are easily accessible the tool is applied to the work in the usual manner without adjustment of the movable jaw. However, should a class of work be encountered in which the rivet cannot be reached even with the jaws in the wide open position, the adjustable jaw is rocked out of alignment with the stationary jaw. The yoke then may be passed around the work and the movable jaw returned to working position, 55

whereupon the tool is actuated to drive the rivet in the usual manner. According to the invention the feature of adjustability may be embodied either in the rivet set or backing die, or in both of these elements which comprise the work engaging jaws.

Other objects and structural details of the invention will be apparent from the following description when read in conjunction with the accompanying drawings, wherein:

Fig. 1 is a view, in side elevation, of a compression riveting tool embodying a form of the invention in which the rivet set is made adjustable, the set being shown swung out of working position and a part of the machine being broken away to disclose the rivet set mounting;

Fig. 2 is a fragmentary end view of the rivet set holder and mounting therefor, looking downward;

Figs. 3 and 4 are fragmentary detail views, in longitudinal section, taken along the respective lines 3—3 and 4—4 of Fig. 2;

Fig. 5 is a fragmentary view, partly in side elevation and partly in longitudinal section, of the machine of Fig. 1, showing the rivet set holder in working position;

Fig. 6 is a fragmentary view, partly in longitudinal section and partly in front elevation, taken along the line 6—6 of Fig. 7;

Fig. 7 is a view similar to Fig. 5, showing the parts in the position they assume at the end of a rivet heading operation;

Fig. 8 is a fragmentary detail view, in side elevation, of the rivet set holder; and

Fig. 9 is a fragmentary view, partly in side elevation and partly in longitudinal section, of a modified riveting machine embodying a form of the invention in which the backing die is adjustable into and out of working position.

The embodiment of the invention selected for illustration in Figs. 1 to 8 is one in which the yoke has a long "reach" or opening therein, the yoke being especially adapted to encompass a section of an airplane wing spar assembly. Referring to Fig. 1, the yoke 11 is secured to the front end of a pressure developing and transmitting unit 12. The elements 11 and 12 are axially aligned and comprise an elongated assembly not secured to any fixture and movable by hand to and from each rivet setting position. At the rear of the unit 12 is a handle 13 which is grasped by the operator to support the tool or to guide it while the load of the tool is borne by an overhead support.

The power unit may follow the construction of

any conventional compression riveting machine. In the present instance, the unit 12 comprises a small, light, tubular casing containing pressure developing mechanism operating under the control of pressure fluid admitted to the tool through a hose line (not shown) leading from a remote pressure fluid source. The unit 12 includes a cylinder 14, an adapter 15, at the front of the cylinder, and a U-shaped bracket 16 extending forwardly from the adapter. Referring also to Fig. 5, a piston 17 is reciprocable within the cylinder 14 and is connected by a rod 18 to a smaller return piston 19 within the handle 13. Under the force of compressed air the piston assembly is driven through alternate power and return strokes forwardly and rearwardly in the unit. The piston 17 carries a wedge 21 extending forwardly through the adapter 15 and into cooperative relation with a lever 22 pivotally mounted within the U-shaped bracket 16. The wedge 21 has an inclined surface 23 of varying steepness engaged by a follower roller 24 on the lever 22. The lever 22 pivots about a stub shaft 25 extending between the arms of bracket 16 and is formed with an arm 26 overlying the upper end of a plunger 27. By means and in a manner hereinafter described the plunger 27 is spring pressed upward into contact with arm 26 and urges the lever 22 in a clockwise direction (Figs. 1 and 5) causing the roller 24 thereon constantly to engage the inclined surface 23 on wedge 21. Thus, as the piston 17 reciprocates within the cylinder 14 the wedge 21 moves forwardly and rearwardly within the bracket 16 and effects, through the cooperation of inclined surface 23 and follower roller 24, an oscillating motion of the lever 22 and thereby a reciprocating motion of the plunger 27.

The plunger 27 is arranged parallel to the longitudinal axis of the tool and moves within a bushing 28 pressed into a through opening in the upper end of the yoke 11. The upper end of the yoke is bifurcated to receive a forwardly extending rib 29 on the bracket 16. A pair of bolts 31 are passed transversely through the yoke and rib 29 and hold the elements 11 and 12 in assembled relation with the plunger 27 in the yoke aligned with and adjacent to its actuating lever 22 in the power unit. The arm 26 on lever 22 projects outside the bracket 16 in order to engage the plunger 27 which is positioned leftwardly or forwardly of the bifurcated portion of the yoke in a projecting portion 32 thereof. The projecting portion 32 has a rounded shape and is enclosed by a rivet set holder 33 (see also Fig. 8) axially aligned with the plunger 27. The upper or inner end of the rivet set holder 33 has a substantially semi-circular shape in cross section in order that it may receive the rounded portion 32. The lower or outer end of the holder is solid and has a generally conical shape, tapering from a base of maximum width, equal to the diameter of the inner end of the holder, to a point of reduced width at the outer end of the holder, which end has a rivet set 34 pressed therein. The base of the conical end portion is arranged to underlie the projecting portion 32 of the yoke, and, when so positioned, aligns the rivet set 34 with the plunger 27 and with a die 35 set in the lower end of the yoke. The yoke and its parts combine to form a C-shaped assembly. Mounted at the opposed ends of the C are the holder 33 and die 35 which, by a relative movement toward and from each other, act on the work placed therebetween. The die 35 is stationary and relative movement of the work performing jaws is accomplished

through reciprocation of the holder 33. Operation of the rivet set holder is effected by the plunger 27 which extends through the lower end of projecting yoke portion 32 and is adapted to seat in an axial recess or socket 36 in the base of the holder. With the plunger 27 so seated the holder 33 becomes, in effect, an extension of the plunger and is moved toward the work by lever 22 upon advance of the wedge 21.

The mounting of the rivet set holder 33 is such that it may be detached from engagement with the lower end of the plunger 27 and swung outward in order to facilitate movement of the tool into working position. Referring particularly to Figs. 2, 6 and 8, the hollow cylindrical portion of the holder 33 terminates at its inner end in a collar 37 from which extends a pair of oppositely disposed vertical ears 38. The ears 38 extend above the yoke 11 and lie on opposite sides of the upper end of plunger 27 and arm 26 on lever 22. A guide block 39 extends between the ears 38 and is formed with a central opening through which the plunger 27 passes. A bolt 41 extends through each ear 38 into the adjacent end of guide block 39. The shank of each bolt 41 is formed with a threaded portion for engagement in a complementary opening in the guide block and has also a bearing surface 42 between the threaded portion and the head of the bolt. The bearing surfaces 42 are aligned with the openings in ears 38 so that the bolts may act further as trunnions, permitting the rivet set holder 33 to be oscillated relatively thereto and to guide block 39.

In order that the rivet set holder 33 may be adjusted relatively to the plunger 27, each of these elements is controlled by an independent spring means. These means comprise separate springs 43 and 44 anchored to studs in the adapter 15 and connected at their outer ends to the guide block 39 and plunger 27 respectively. The spring 43 acts on the guide block 39 through a U-shaped clip 45 (see also Fig. 4), the two legs of which are passed through parallel openings in the block and bent inward at their ends to prevent withdrawal of the clip. The spring 44 is connected to the plunger 27 through a clip 46 (see also Fig. 3) which has the shape of a split ring and is positioned in an annular groove formed in the plunger at a point above the guide block 39. An upturned lug 47 on clip 46 provides a means for attaching spring 44 thereto. The lug 47 and U-shaped clip 45 lie on opposite sides of the plunger 27, and their associated springs 44 and 43 extend upwardly or rearwardly along spaced substantially parallel lines outside the bracket 16. A guard plate 48, on the bracket, encloses the spring assembly but is cut away at its lower end, this area being occupied by the holder ears 38 and guide block 39. The rivet set holder 33 and the plunger 27 are, in this manner, urged rearwardly in the tool. The holder is pressed by the spring 43 in a direction tending to seat the lower end of the plunger firmly in the base socket 36 of the holder, while the upper end of the plunger is maintained by the spring 44 in contact with actuating arm 26 on lever 22. The assembly comprising the rivet set holder and the plunger 27 therefore reciprocates as a unit, under the control of lever 22 and springs 43 and 44, toward and from the die 35 to complete a rivet heading operation.

When it is desired to swing the rivet set holder out of cooperative relation with the die 35, the holder is grasped at any point on its exterior and

first moved downward against the tension of spring 43 and relatively to the plunger 27. When the holder is lowered sufficiently to place the socket 36 therein out of engagement with the projecting lower end of the plunger, it is rocked outward about the trunnions 41 and permitted to rise, under the influence of spring 43. The guide block 39 rises with the holder and limits such movement of the assembly of which it is a part by engagement with the spring clip 43. The clip 46, it will be noted, exceeds the plunger 27 in diameter and in projecting outside the annular groove in which it is mounted defines, in effect, a flange on the upper end of the plunger. When so released from the plunger 27, the rivet set holder may be swung to the full line position of Fig. 1 or to any intermediate position sufficient to create a gap of the desired width above the die 35. After properly locating the tool with respect to the work the set holder is returned inward and downward into alignment with the plunger 27, and, when released, again assumes the working position of Fig. 5. The portion of the set holder between the flange 37 and the base of the conical outer end forms a natural grip portion and its exterior is knurled to facilitate manual shifting of the holder.

In Figs. 1 and 7 the tool is shown in the process of heading rivets in an airplane wing spar assembly. This assembly comprises long angular brackets A and B extending in opposite directions from a central support C, to which they are riveted. The overall width of the brackets A and B makes it impossible for them to be embraced by the yoke of conventional riveting machines. Accordingly, it heretofore was the practice to drive the rivets in this assembly by using a pair of tools, one of which was applied to one side of the support C to head the rivet and the other of which backed up the rivet on the other side of the support. The greater efficiency of a yoke type compression riveter in this and similar riveting problems has been made possible as a result of the present invention. Thus, in the example illustrated, when the set holder is unlatched from the plunger 27 the "reach" of the yoke 11 is increased to the full length of the opening therein, and the yoke may easily be passed around the spar assembly.

As shown in Fig. 9, a compression riveter may also be constructed in which the retractable set holder of the invention is used as the fixed backing die or dolly. In this example, a U-shaped yoke 49 is shown which receives the work between its outer ends. The riveting problem here overcome is one similar to that shown in Fig. 1. A pair of brackets D and E are to be secured together at the end of a long frame piece F, and are of such a size that the riveting positions can be reached only with difficulty, if at all, by a conventional yoke riveter. The rivet heading operation is performed, in this case, by a rod 51 connected to a piston (not shown) reciprocable within a cylinder 52 supported at one end of the yoke. The cylinder 52 forms one part of a known type of rivet setting "gun" operated by pressure fluid supplied to the handle 50 by a remote pressure developing unit through hose lines 53. Aligned with the piston rod 51 and slidably mounted on the opposite end of the yoke is a die holder 54 corresponding to the set holder 33 of the first embodiment. The holder 54 is constructed in a manner similar to the holder 33 and is supported and guided by equivalent elements. Thus, a fixed bolt 55 replaces the plunger

27, the lower end of the bolt being disposed for cooperation with a socket 56 in the holder 54 to retain the holder in working position. The bolt 55 further provides a mounting for a sliding guide block 57. The guide block 57 moves within a recess 58 in the front of the yoke and is pressed upward by a coil spring 59 in the recess, surrounding the bolt 55. The holder 54 is pivotally connected to the block 57 by means of trunnion bolts 61 and therefore is also urged upward.

When the piston rod 51 is retracted and the yoke 49 moved slightly upward from its working position, the die holder 54 may be released from the bolt 55 and rocked outward, thereby opening the gap between the jaws of the yoke to permit the tool to be withdrawn from the work. In bringing the tool to riveting position the die holder 54 is swung to disabled position, the yoke 49 is passed around the work, and the die holder returned to cooperation with the rivet set, whereupon the row of rivets then may be driven in the usual manner.

What is claimed is:

1. In a riveting or like machine, the combination of a yoke having opposed ends adapted to receive the work therebetween, relatively movable work engaging jaws at the opposed ends of said yoke, a holder for one of said jaws pivotally mounted for movement into and out of a position of alignment with the other of said jaws and shiftable relatively to said yoke longitudinally of said other jaw, and latching means acting when in effect to retain said holder in aligned position and to limit longitudinal movement thereof in one direction.
2. A riveting or like machine according to claim 1, characterized in that said latching means is disengaged by longitudinal movement of said holder in the opposite direction.
3. In a riveting or like machine, the combination of a yoke of generally C-shape having opposed ends adapted to receive the work therebetween, a stationary jaw on one of said opposed ends, a plunger mounted in the other of said ends for reciprocable movement toward and away from said stationary jaw, and a movable work performing element cooperable with said stationary jaw and attached to said yoke for rocking adjustment into and out of position between said plunger and said stationary jaw, said element acting in the former position as an extension of said plunger and acting by a movement to the latter position to establish a gap between said stationary jaw and said plunger.
4. In a riveting or like machine, the combination of a yoke of generally C-shape having opposed ends adapted to receive the work therebetween, a stationary jaw on one of said opposed ends, a plunger mounted in the other of said ends for reciprocable movement toward and away from said stationary jaw, and a movable work performing element acting as an extension of said plunger and mounted for pivotal movement relatively to said plunger whereby said element may be moved out of position between said plunger and said stationary jaw to establish a gap therebetween.
5. In a riveting or like machine, the combination of a yoke of generally C-shape having opposed ends adapted to receive the work therebetween, a stationary jaw on one of said opposed ends, a plunger mounted in the other of said ends for reciprocable movement toward and away from said stationary jaw, a movable work performing element cooperable with said stationary

jaw and acting as an extension of said plunger, and a mounting for said element enabling a pivotal movement thereof relatively to said plunger out of cooperative relation with said stationary jaw.

6. In a riveting or like machine, the combination of a yoke of generally C-shape having opposed ends adapted to receive the work therebetween, a stationary jaw on one of said opposed ends, a plunger mounted in the other of said ends for reciprocable movement toward and away from said stationary jaw, a movable work performing element cooperable with said stationary jaw and acting as an extension of said plunger, a mounting for said element enabling pivotal and longitudinal movements thereof relative to said plunger, and means for latching said element against pivotal movement and longitudinal movement in one direction, said means being disengaged by relative longitudinal movement of said element in the opposite direction.

7. A riveting or like machine according to claim 6, characterized in that said latching means comprises complementary locking portions on said plunger and said element operatively engaged by movement of said element in one direction and disengaged by movement of said element in the opposite direction, and spring means urging said element in a direction to engage said locking portions.

8. In a riveting or like machine, the combination of a yoke of generally C-shape having opposed ends adapted to receive the work therebetween, a stationary jaw on one of said opposed ends, a plunger mounted in the other of said ends for reciprocable movement toward and away from said stationary jaw, a movable work performing element cooperable with said stationary jaw and acting as an extension of said plunger, a mounting for said element enabling pivotal and longitudinal movements thereof relative to said plunger, said mounting comprising a guide block reciprocable on said plunger and oppositely disposed trunnions on said guide block providing a support for said element, and releasable means

latching said element against pivotal movement and against longitudinal movement in one direction relatively to said plunger.

9. In a riveting or like machine, the combination of a power unit, a yoke of generally C-shape secured to said power unit and having opposed ends adapted to receive the work therebetween, a stationary jaw on the outer of said opposed ends, a movable jaw and holder therefor reciprocably mounted on the inner end of said yoke, actuating means within said power unit for effecting movement of said holder toward said stationary jaw, said means including a reciprocable plunger engaging said holder, yielding means maintaining said holder in contact with said plunger, a pivotal mounting for said holder enabling it to be moved into and out of position between said plunger and said stationary jaw, and a releasable latching connection between said plunger and said holder acting when in effect to hold said movable jaw and holder in cooperative relation with said stationary jaw.

10. In a riveting or like machine, the combination of a yoke having opposed ends adapted to receive the work therebetween, relatively movable work engaging jaws aligned at the opposed ends of said yoke, a holder for one of said jaws, a mounting for said holder permitting movement thereof to a retracted position placing said jaws out of alignment, said mounting including a block to which said holder is pivotally connected, guide means on said yoke for said block permitting relative longitudinal movement of said block, and complementary locking portions on said guide means and said holder engageable to prevent movement of said holder to said retracted position, said locking portions being engaged and disengaged by longitudinal movement of said block relative to said guide means.

11. A riveting machine according to claim 10, characterized by means urging said block in a direction to engage said complementary locking portions.

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