Nov. 15, 1955 O. MUELLER 2,723,574

RIVETING DEVICE ON SLIDE OPERATING INDEPENDENT RIVETING DIE

Filed July 19, 1950 3 Sheets-Sheet 1

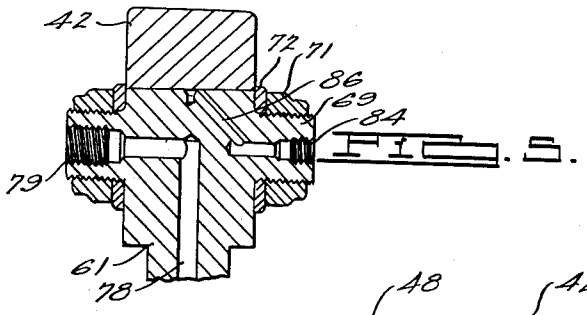


Fig. 5.

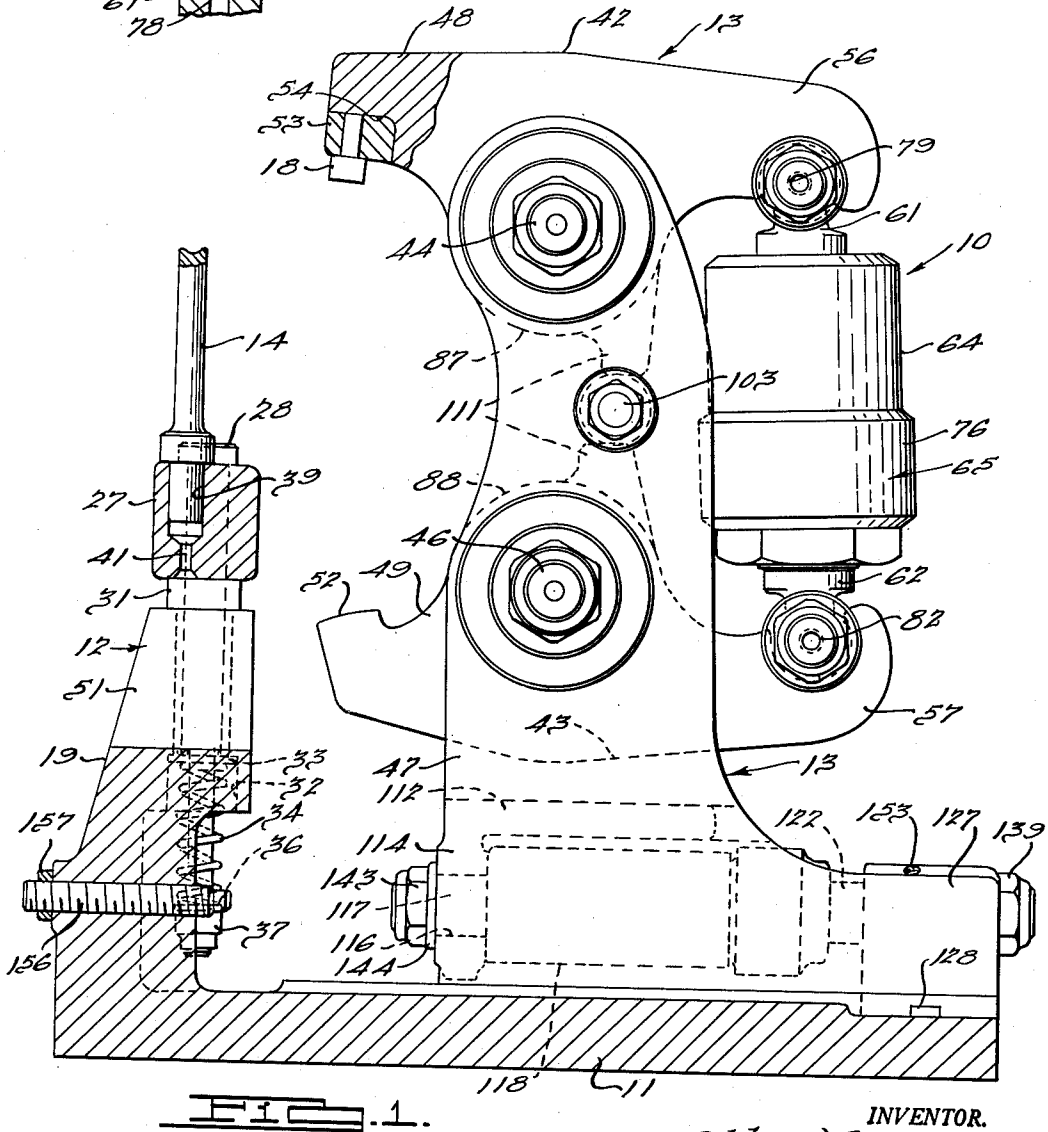


Fig. 1.

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Filed July 19, 1950 3 Sheets-Sheet 2

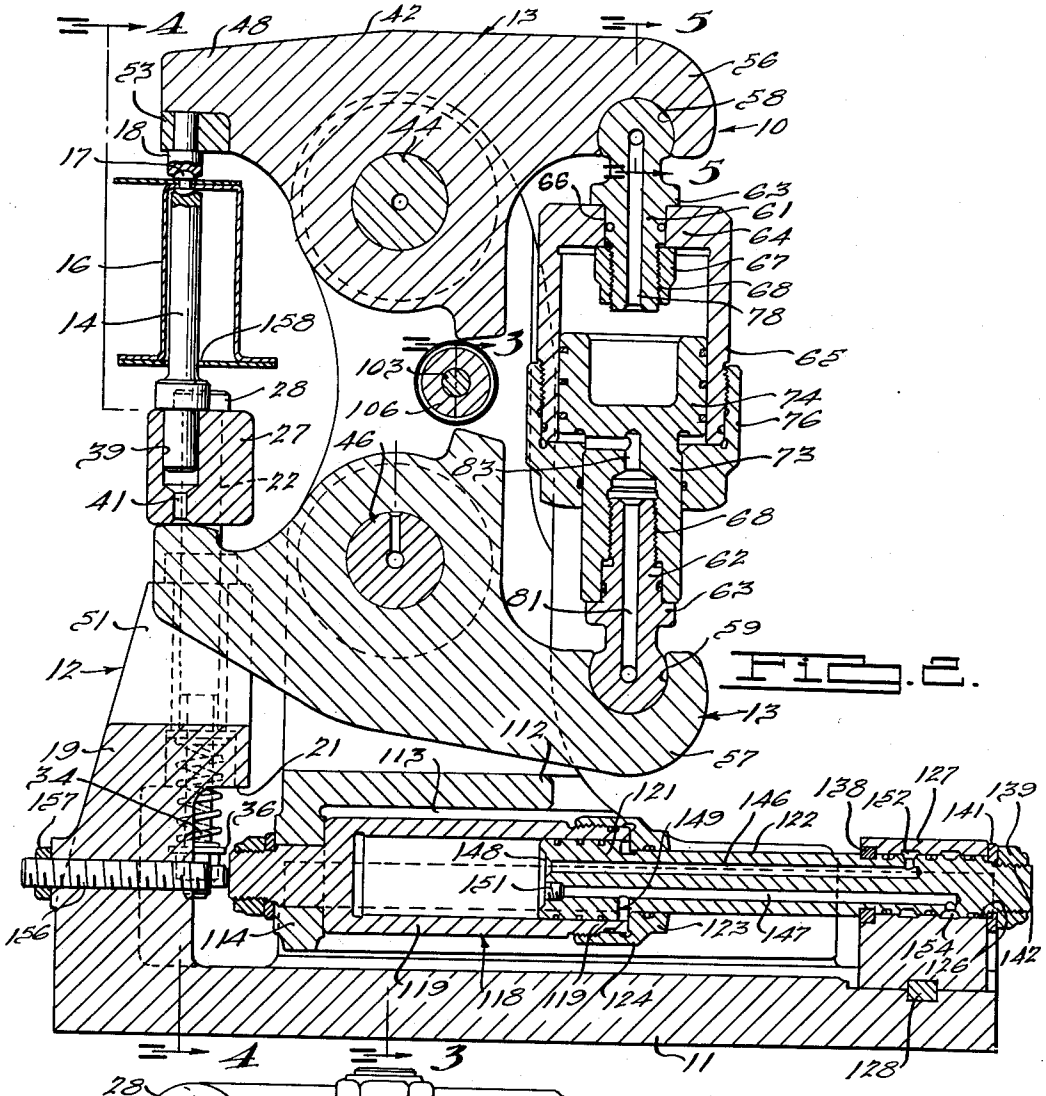


Fig. 5.

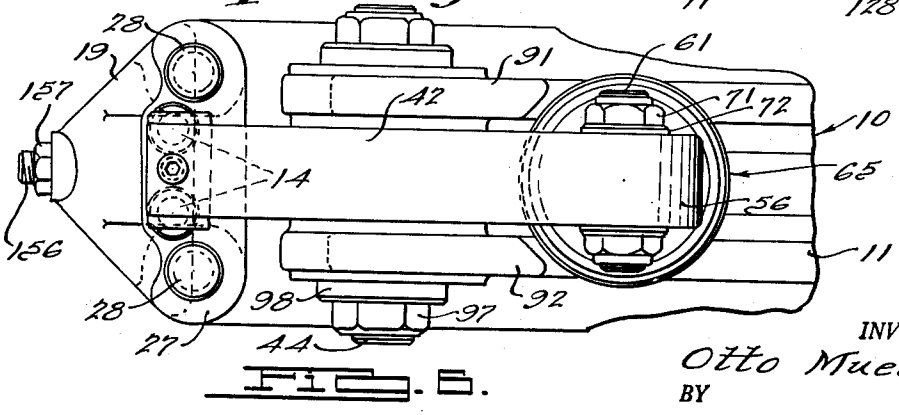


Fig. 6.

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RIVETING DEVICE ON SLIDE OPERATING INDEPENDENT RIVETING DIE

Filed July 19, 1950 3 Sheets-Sheet 3

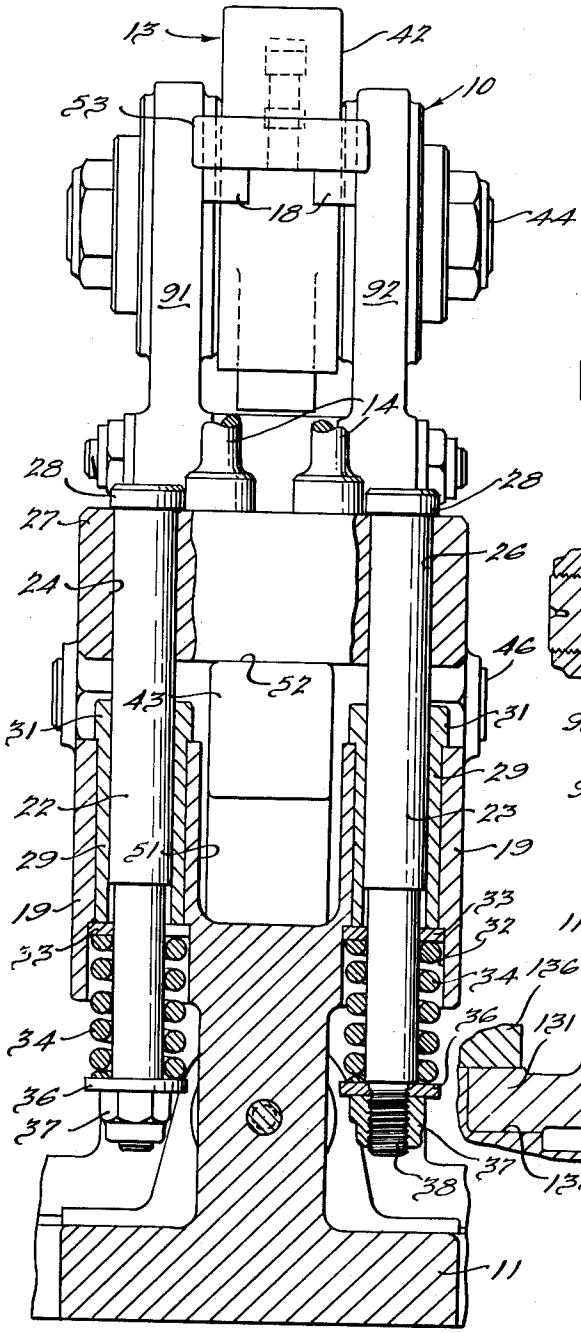


FIG. 4.

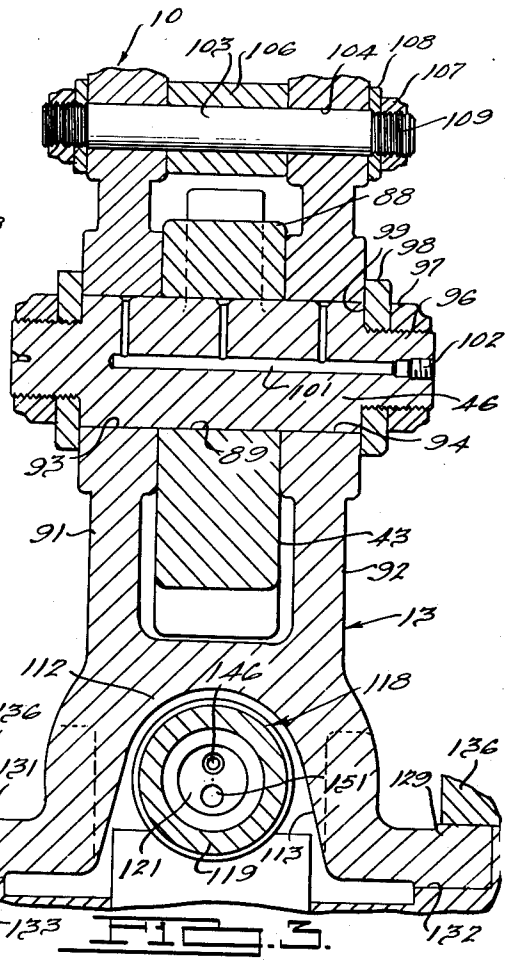


FIG. 3.

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United States Patent Office 2,723,574 Patented Nov. 15, 1955

2,723,574

RIVETING DEVICE ON SLIDE OPERATING INDEPENDENT RIVETING DIE

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Application July 19, 1950, Serial No. 174,619

10 Claims. (Cl. 78—48)

This invention relates to riveting devices, and particularly to a riveting device which advances one riveting die and the operating jaws into position to align and move another die relative to said first die.

Difficulty has been experienced when attempting to employ riveting machines for producing a riveting operation within channel or box-section structure because of the inaccessability of the rivet when applying the riveting dies thereto.

The present invention embodies the use of a crosshead having one or more riveting dies thereon over which the channel or box-shaped element to be riveted may be disposed. The other die or die elements are carried by one of the operating jaws which produce the riveting operation, which jaws are mounted on a slide so that they may move away from the crosshead so that the work may be disposed in and moved from riveting position. After the work has been placed in riveting position, the slide carries the jaws into engagement with the crosshead, with the die sets aligned with each other and the rivets, after which the jaws are operated to first engage the rivet head and thereafter to swage the ends thereof. The crosshead is retained in retracted position by springs which require a predetermined pressure to permit the crosshead to be moved toward the rivet to be swaged, thereby forcing the other die or plurality of dies against the head of the rivet or rivets to provide a clamping force between the pieces to be riveted together before the swaging operation is undertaken. It is only after the predetermined pressure is applied to the workpieces that the crosshead is then moved to move the die or dies into engagement with the ends of the shank of the rivet or rivets. Fluid under high pressure is then applied to the operating element for the jaws to produce the swaging of the shank end. The swaging operation occurs while the predetermined pressure is applied to the pieces to be riveted to insure tight riveting.

In the broad concept of the invention, the use of tools mounted on the crosshead separate from the jaws which produce work performed by the tools, may be of various types. Instead of riveting dies, dies which produce a punching operation could be utilized while employing the principle of having the die mounted on the crosshead and the dies to be aligned therewith carried by one of the jaws. The invention therefore applies broadly to the use of sets of dies or other tools, one portion of which is mounted on a crosshead separate from the force applying jaws, the mating portion of which is mounted directly upon one of the jaws.

Accordingly, the main objects of the invention are: to provide a force applying device for operating a tool set, one of which is carried by the jaw, the other of which is carried by a crosshead separate from the jaws; to provide a force applying device with a standard carrying a crosshead on which a tool may be mounted and mount the pressure applying jaws on a slide which is movable into engagement with the crosshead and having a mating tool carried by one of the jaws; to provide springs on a crosshead carrying a tool which resists the movement

thereof with a predetermined force for producing the operation of one of the jaws carrying a mating tool into engagement with the work with a predetermined pressure before the crosshead is moved relative thereto, and, in general, to provide a force applying device of the herein described type which is simple in construction, positive in operation and economical of manufacture.

Other objects and features of novelty of the invention will be specifically pointed out or will become apparent when referring, for a better understanding of the invention, to the following description taken in conjunction with the accompanying drawings, wherein:

Figure 1 is a view, partly in section and partly in elevation, of a riveting device embodying features of the present invention, with the force applying elements of the device illustrated in retracted position;

Fig. 2 is a vertical sectional view of the device illustrated in Fig. 1, with the force applying elements thereof moved into advanced riveting position;

Fig. 3 is an enlarged sectional view of the structure illustrated in Fig. 2, taken on the line 3—3 thereof;

Fig. 4 is a sectional view of the structure illustrated in Fig. 2, taken on the line 4—4 thereof;

Fig. 5 is a sectional view of the structure illustrated in Fig. 2, taken on the line 5—5 thereof, and

Fig. 6 is a broken plan view of the structure illustrated in Fig. 1.

In the structure disclosed by the drawings, a device **10** is illustrated which comprises a base **11** having a standard **12** at one end and a slide **13** which is movable toward and away from the standard. The standard **12** carries vertically movable dies **14** which, in operative position, are adapted to project within the interior of a workpiece **16** for the purpose of swaging the shank end of a rivet indicated at **17**.

The workpiece **16** is adapted to be positioned over the work performing tool **14** when the slide **13** is retracted from the standard **12**, as illustrated in Figure 1. The workpiece **16** is retained in work-performing position relative to the tool **14**, as illustrated in Figure 2, by supporting means (not shown), and, in such position, may be operated upon by other work-performing devices also not shown. Such work-performing devices may be riveting machines of the same kind as the riveting device **10**, or may be devices which perform piercing, welding, clamping or other operations. Any number of such devices or fixtures may be simultaneously employed for performing the various operations involved in an automatically controlled cycle of operations.

When swaging the rivet **17**, the dies **14** are adapted to operate with the dies **18** which are carried into and out of work-performing position relative to the rivet **17** by the slide **13**. The standard **12** has spaced bosses **19** which project upwardly above a recess **21** which is provided in the lower part thereof adjacent to the lower portion of the slide. The bosses **19** have vertical bearing sleeves **29** therein in which cylindrical rods **22** and **23** are supported for sliding movement. The upper ends of the rods **22** and **23** are secured in apertures **24** and **26** in a crosshead **27**, and are provided with heads **28** to prevent the crosshead **27** from shifting upwardly on the rods. The rods **22** and **23** are slidably mounted within the sleeve bearings **29**, which have collars **31** at the upper ends which limit the downward movement of the crosshead. The lower ends of sleeve bearings **29** terminate above cylindrical recesses **32** which receive washers **33** supporting the upper ends of coil springs **34** which are disposed about the lower extremities of the rods **22** and **23**. The opposite ends of the springs **34** abut washers **36** secured by nuts **37** upon the reduced threaded end **38** of the rods **22** and **23**. The springs **34** will resiliently oppose the movement of the crosshead **27** upwardly and away from the bosses **19** and

will tend to hold the head in retracted position against the top of the collars 31.

The crosshead 27 may support one or more work-performing tools such as the pair of riveting dies indicated by the numerals 14. The shanks of the dies 14 are retained in vertically disposed apertures 39 extending inwardly from the upper surface of the crosshead 27, as illustrated in Figs. 1 and 2. Openings 41 connected with the lower extremities of the apertures 39 permit the shanks of the dies 14 to be pressed from the openings 39 when the tools are to be removed. The dies 14 may be moved upwardly by any force applying means capable of engaging and moving the crosshead 27 upwardly. The springs 34 resist such upward movement of the crosshead and require a predetermined initial force to be exerted before the crosshead is moved, for a purpose which will be explained hereinafter.

The force applying means for moving the crosshead 27 and performing the swaging operation comprises a pair of clamping jaws 42 and 43 which are pivotally secured by fulcrum pins 44 and 46, respectively, to a standard 47 extending uwardly from the slide 13. The clamping jaws 42 and 43 have adjacent ends 48 and 49, respectively, one for engaging the crosshead 27, the other for cooperating therewith in the performance of the riveting operation. The jaw end 49 is movable into the space 51 between the bosses 19 beneath the crosshead 27. An arcuate end portion 52 formed on the upper part of the extremity of the jaw end 49 has tangential engagement with the lower surface of the crosshead 27 which rocks therein as the crosshead is raised and lowered. The end 48 of the jaw 42 supports the rivet head-engaging dies 18 which are mounted in apertures in a tool holder 53 which is secured in a notch 54 in the lower end of the jaw 48.

The opposite ends 56 and 57 of the jaws 42 and 43 have transverse cylindrical slots 58 and 59 formed adjacent the ends thereof for receiving T-shape pins 61 and 62. The pins 61 and 62 each have the laterally projecting ends threaded at 69 for receiving nuts 71 and washers 72. The washers 72 are disposed adjacent to the side surfaces of the jaw ends 56 and 57 for retaining the pins within the openings 58 in oscillating relation to the jaw ends.

The T-shaped pin 61 has a shoulder 63 for engaging the head end 64 of a cylinder 65 when extending through an aperture 66 through the head end. The pin 61 is secured in position by a nut 67 which engages a threaded end 68 within the cylinder 65. The pin 62 has a shoulder and a threaded end such as are indicated at 63 and 68, respectively. The shoulder 63 is secured by the threaded end 68 against the end of the rod end 73 of a piston 74 which is disposed in sealed relation with the inner surface of the cylinder 65. A threaded cap, indicated at 76, is secured in threaded relation to the cylinder 65 and in sealed relation to the rod end 73 of the piston 74.

The head end 64 of the cylinder 65 is provided with fluid for actuating the piston in one direction through a passage 78 in the pin 61, which communicates with a threaded port 79 to which a flexible or other suitable supply conduit (not shown) may be secured. The rod end of the cylinder 65 likewise is supplied with fluid for actuating the piston in the opposite direction through a passage 81 in the pin 62, which communicates with a threaded port 82 to which a flexible conduit (not shown) may be secured. The inner end of passage 81 communicates with a passage 83 in the rod end 73 which communicates with the cylinder 65 at the adjacent end of the piston 74.

The connecting pins 61 and 62 also are provided with threaded ports, indicated at 84, which communicate with passages 86 through which a lubricant is supplied to the cylindrical slots 58 in which the pins are journaled. Lubricant fittings (not shown) may be secured in the ports 84 through which lubricating fluid under pressure may be supplied.

The jaws 42 and 43 have bosses 87 and 88 projecting from adjacent surfaces thereof which are provided with transverse cylindrical openings 89 in which the fulcrum pins 44 and 46 are received. The bosses 87 and 88 are secured between spaced arms 91 and 92 which form the upper parts of the standard 47. Pairs of aligned apertures 93 and 94 extending through the arms 91 and 92 receive the opposite ends of the pins 44 and 46. The pins 44 and 46 are provided with reduced and threaded ends, indicated at 96, which receive nuts 97 for securing washers 98 against shoulders 99 formed on the pins adjacent to the reduced ends 96 thereof. The surface of the pins 44 and 46 is lubricated through the passage 101, which communicates with port 102 to which a pressure lubricating fitting (not shown) may be secured.

The opening movement of the jaws 42 and 43 is limited by a pin, indicated at 103, which is secured in aligned apertures 104 in the arms 91 and 92 at suitable location between the opposite ends 56 and 57 of the jaws 42 and 43. A spacing sleeve 106 is disposed on the pin 103 between the arms 91 and 92, and nuts 107 and washers 108 engage the opposite threaded ends 109 of the pin 103 to secure the pin against endwise movement. Lugs 111 project toward the spacing sleeve 106 from the bosses 87 and 88 in position to engage the spacing sleeve 106 when the jaws 42 and 43 are opened for positioning the jaws relative to each other and the standard.

The part of the standard 47 below the arms 91 and 92 is in the form of an arcuate transversely disposed web 112 which forms a recess 113 in the slide 13. The web 112 has an end flange 114 extending across the recess 113 and provided with an aperture 116 which receives a stud 117 projecting from the head end of a working cylinder 118 for moving the slide 13 to and from the standard 12. The stud 117 is secured to the web end 114 by a nut and washer 143 and 144, respectively.

The open end 119 of the working cylinder 118 is adapted to receive a piston 121 having a rod 122 projecting through a threaded cap 124 for sealing the end of the cylinder and piston rod 122. The opposite end of the rod 122 projects through an aperture 126 formed in a block 127 which is secured to one end of the base and aligned thereon by a key 128. The rod 122 is securely held in the opening 126 of the block between a split ring 138 engaging a groove in the piston rod at one end of the block and a nut 139 and washer 141 secured on the threaded end 142, which projects through the block.

The web 112 of the standard 47 is extended laterally at the bottom to form guides 129 and 131 of the slide. The guides are slidably disposed in parallel ways 132 and 133 formed in the base 11. Removal rails 136 secured to the base 11 complete the guideways 132 and 133 for securing the guides 129 and 131 therein.

A pair of passages 146 and 147 is formed longitudinally within the piston rod 122. The passage 146 communicates with the head end of the cylinder 118 through a port 148 at the head end of the piston 121, while the passage 147 communicates with the rod end of the cylinder 118 through a port 149 disposed through the rod 122 adjacent the piston 121. The end of passage 147 at the forward end of the piston is closed by a plug, indicated at 151.

Within the block 127 the passage 146 communicates with an annular port 152 which in turn communicates with the exterior surface of the block 127 through a threaded port 153. The passage 147 communicates with an annular passage 154 formed in the block 127, which communicates with the exterior surface of the block through a threaded port 153. The ports 153 are connected to pressure fluid supply and exhaust conduits, not shown.

When fluid under pressure is supplied to the head end of the working cylinder 118 through the passage 146 and exhausted from the rod end through the passage 147, the work slide 13 will move the jaws 48 and 49 into operative position with respect to crosshead 27 with the die sets 14 and 16 in aligned relation, as is illustrated by Figure 2.

When the fluid pressure conditions within the working cylinder **118** are reversed, supplying fluid under pressure through the passage **147** and exhausting fluid through passage **146**, the slide **13** will be moved into an operative or retracted position, as is illustrated in Figure 1. The forward movement of the slide **13** is accurately limited by a stud **156** which is adjustable in a threaded aperture in the boss **19** disposed in axial alignment with the stud **117** on the head end of the cylinder **118**. The adjustment of the stud **156** within the aperture in the boss **19** will determine the advanced position of the slide **13**, and after adjustment a lock nut **157** secures the stud **156** in locked, adjusted position.

In operation, the workpiece **16** is first placed in the machine over the dies **14** when the slide **13** is in retracted position, as is indicated in Figure 1. When the workpiece is of channel shape with the open face closed by a plate, apertures **158** through the plates are provided, through which the ends of the dies **14** extend. The workpiece **16** is supported by the machine in such position relative to the ends of the dies **14** that space is provided to permit the rivets **17** to be inserted in the openings and be supported by the rivet head without the ends of the shank portions engaging the upper end of the dies **14**. In such position the crosshead **27** will be resiliently held by the springs **34** in engagement with the upper end of the boss **19**.

Thereafter, the slide **13** will be moved into operative position by the cylinder **118**, as has been hereinbefore described. In such position the arcuate end **52** of the jaw **49** will be in position to engage the lower surface of the crosshead **27** and the dies **18** will be in alignment with the heads of the rivets **17**.

Fluid is thereafter introduced into the cylinder **65** through passage **78** as the fluid on the opposite side of piston **74** is exhausted through passage **81**. The extension of the piston rod **73** from the cylinder **65** rocks the jaws toward each other. The jaw **42** will move the dies **18** against the heads of the rivets **17** and force the workpieces **16** against each other in clamped relation. During the movement of the jaw **42**, the movement of the jaw **43** is arrested upon the engagement of the arcuate end **52** with the crosshead **27**. After the jaws **42** have moved the rivet heads to clamp the workpieces together, the jaws **43** move the crosshead **27** upwardly until the dies **14** engage the shank ends of the rivets **17**. The pressure of the fluid applied to the cylinder **65** is sufficient only to produce such sequence of movement to the jaws and is not great enough to swage the shank end of the rivet. Thereupon fluid at a greater pressure is applied to the head end of the cylinder **65**, which moves the jaw **43**, the crosshead **27** and the dies **14**, for swaging the shank end of the rivets **17**.

As soon as the swaging operation is completed the fluid under high pressure is bled off from the cylinder **65** and the flow of fluid therein is reversed by exhausting the head end of the cylinder through passage **78** and by supplying fluid to the rod end of the cylinder through passage **81**. Thereupon the jaw **43** will first move downwardly by the preponderance of force produced by the springs **34** of the crosshead **27**, and only thereafter will the jaw **42** be moved upwardly out of engagement with the rivet heads. At the end of the movement of the jaws the lugs **111** will engage the sleeve **106** supported by the pin **103**. Thereafter, through the reversal of the flow of fluid in the cylinder **118**, the slide **13** will be returned to its initial position.

The workpiece **16** thereupon may be removed from its support, and as soon as another workpiece is replaced thereon the riveting operation may be repeated, which follows that previously described.

A self-contained power unit suitable for supplying the fluid under different pressures for automatically performing the cycle of operations above described is disclosed in my Patent No. 2,669,841, issued February 23, 1954.

What is claimed is:

1. In a force applying device, a base having a standard, a crosshead carried by said standard, a tool mounted on said crosshead, a slide on said base, a pair of relatively movable force applying jaws carried by said slide, a tool on one of said jaws, and means for advancing said slide to move said one jaw and tool into alignment with said other tool and to move said other jaw into position to engage said crosshead.

2. In a force applying device, a base having a standard, a crosshead carried by said standard, a tool mounted on said crosshead, a slide on said base, a pair of relatively movable force applying jaws carried by said slide, a tool on one of said jaws, means for advancing said slide to move said one jaw and tool into alignment with said other tool and to move said other jaw into position to engage said crosshead, and means for moving said jaws toward each other for moving said crosshead and one of said tools toward said other tool.

3. In a force applying device, a base having a standard, a crosshead carried by said standard, a tool mounted on said crosshead, a slide on said base, a pair of relatively movable force applying jaws carried by said slide, a tool on one of said jaws, means for advancing said slide to move said one jaw and tool into alignment with said other tool and to move said other jaw into position to engage said crosshead, means for moving said jaws toward each other for moving said crosshead and one of said tools toward said other tool, and spring means for providing an initial resistance to movement of said crosshead whereby said one jaw and tool will move to apply a predetermined pressure before said crosshead and other tool are moved.

4. In a force applying device, a pair of tools for operating upon a workpiece, a movable support for carrying one of said tools, a pair of jaws movable toward and away from each other, one of said jaws supporting said other tool, means for relatively moving the jaws and tools into aligned relation with said one jaw having no tool thereon disposed in position to engage said movable support.

5. In a force applying device, a pair of tools for operating upon a workpiece, a movable support for carrying one of said tools, a pair of jaws movable toward and away from each other, one of said jaws supporting said other tool, means for relatively moving the jaws and tools into aligned relation with said one jaw having no tool thereon disposed in position to engage said movable support, resilient means for applying a resistance to the movement of said movable support, and means for applying pressure to said jaws, said resilient means causing said jaw with the tool thereon to move first to apply a predetermined initial pressure before said movable support, said other tool and said other jaw are moved.

6. In a force applying device, a base having a standard thereon, a movable support carried by said standard, a tool carried by said movable support, a slide on said base movable toward and away from said standard, a pair of rockable jaws carried by said slide, a tool carried by one of said jaws to be aligned with said other tool when the slide is advanced toward said standard, the other said jaw having no tool therein moving into position of engagement with said movable support, means for applying pressure to said jaws for moving them toward each other for advancing said tools to perform a predetermined operation on a work element.

7. In a force applying device, a base having a standard thereon, a movable support carried by said standard, a tool carried by said movable support, a slide on said base movable toward and away from said standard, a pair of rockable jaws carried by said slide, a tool carried by one of said jaws to be aligned with said other tool when the slide is advanced toward said standard, the other said jaw having no tool therein moving into position of engagement with said movable support, means for applying pressure to said jaws for moving them toward each other

for advancing said tools to perform a predetermined operation on a work element, and adjustable means for accurately limiting the movement of the slide to have the tools accurately aligned.

8. In a force applying device, a base having a standard thereon, a movable support carried by said standard, a tool carried by said movable support, a slide on said base movable toward and away from said standard, a pair of rockable jaws carried by said slide, a tool carried by one of said jaws to be aligned with said other tool when the slide is advanced toward said standard, the other said jaw having no tool therein moving into position of engagement with said movable support, means for applying pressure to said jaws for moving them toward each other for advancing said tools to perform a predetermined operation on a work element, adjustable means for accurately limiting the movement of the slide to have the tools accurately aligned, and spring means applied to said movable support to prevent its movement until a predetermined force has been applied thereto by one of the jaws to force the other jaw to move initially and to apply a predetermined pressure.

9. In a force applying device, a base having a standard thereon, a movable support carried by said standard, a tool carried by said movable support, a slide on said base movable toward and away from said standard, a pair of rockable jaws carried by said slide, a tool carried by one of said jaws to be aligned with said other tool when the slide is advanced toward said standard, the other said jaw having no tool therein moving into position of engagement with said movable support, means for applying pressure to said jaws for moving them toward each other for advancing said tools to perform a predetermined operation on a work element, adjustable means for accurately limiting the movement of the slide to have the tools accurately aligned, spring means applied to said movable

support to prevent its movement until a predetermined force has been applied thereto by one of the jaws to force the other jaw to move initially and to apply a predetermined pressure, and means on said slide for positioning said jaws relative to each other when in retracted position.

10. In a force applying device, a pair of tools for operating upon a workpiece, a movable support for carrying one of said tools, a pair of jaws movable toward and away from each other, one of said jaws supporting said other tool, a support for said jaws, means for moving said support for advancing the jaws for alignment with said movable support with the tools in aligned relation, said movable means comprising a piston and cylinder, with the head end of the cylinder secured directly to said support, and a base support directly secured to said piston, said base support having fluid passageways therein communicating with fluid passageways in said piston.

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