June 2, 1931. R. S. OSBORNE 1,808,431

RIVETING APPARATUS

Filed Oct. 18, 1928 3 Sheets-Sheet 1

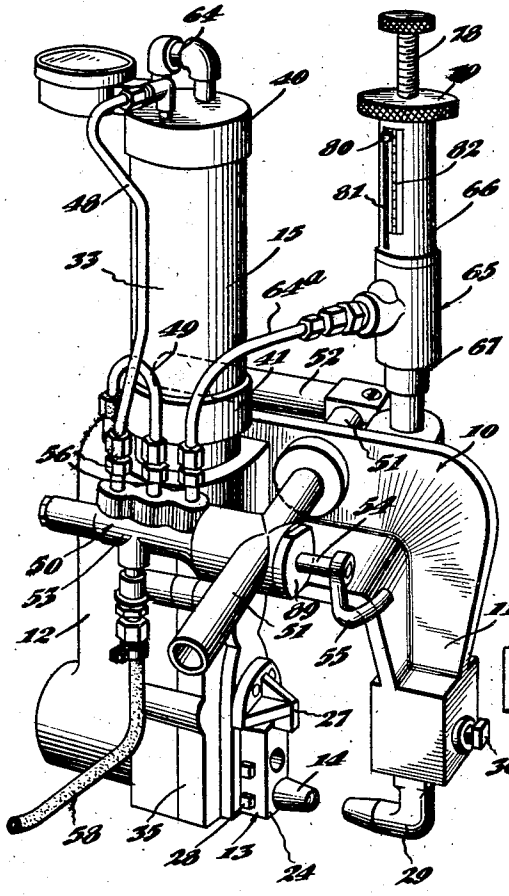


Fig. 1.

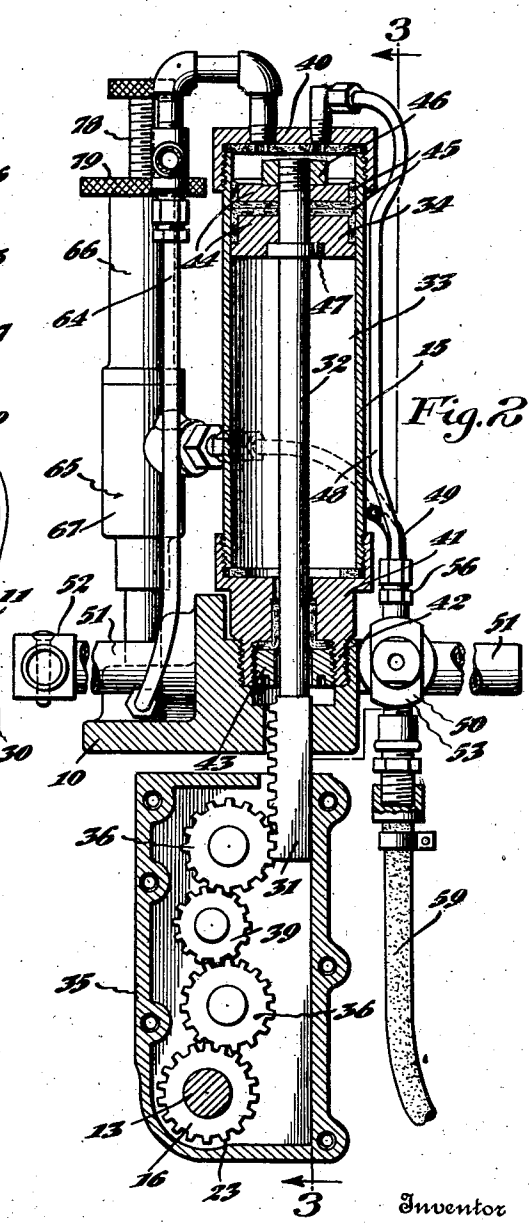


Fig. 2.

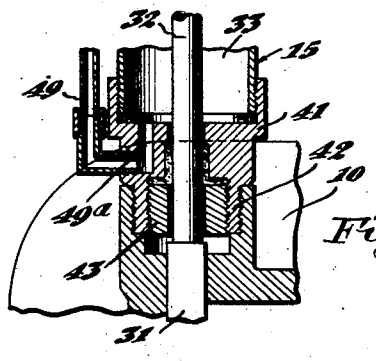


Fig. 7.

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RIVETING APPARATUS

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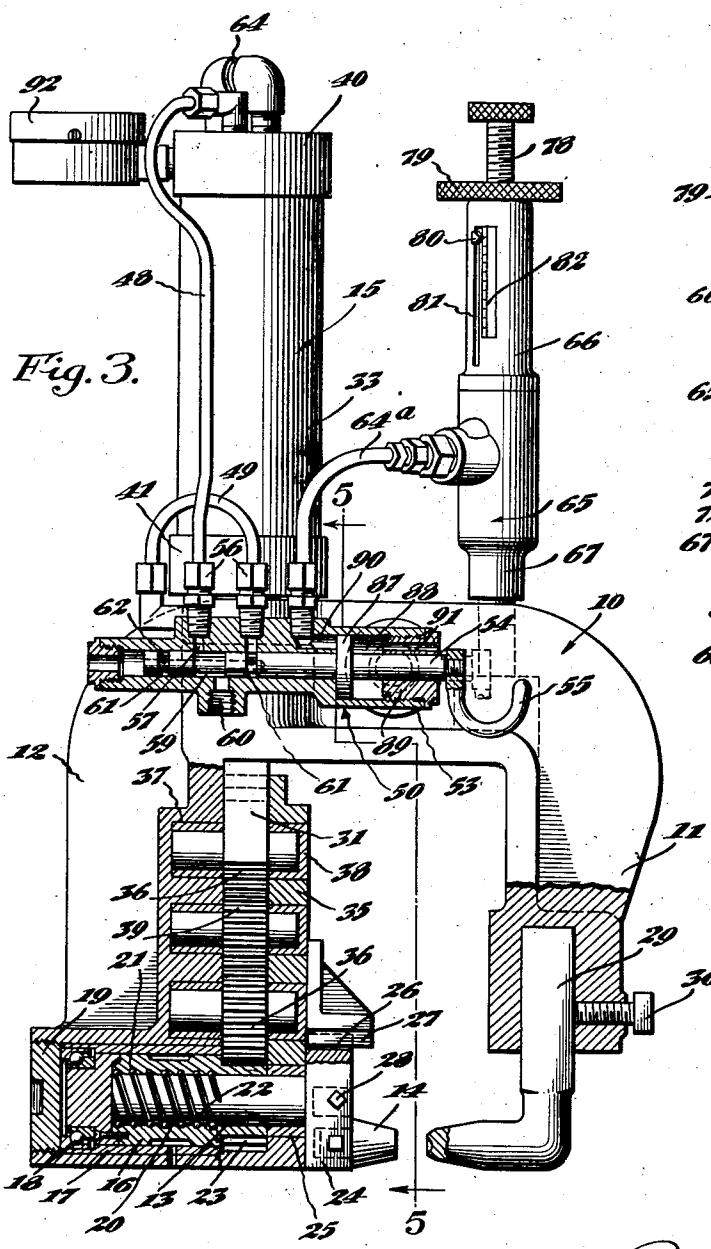


Fig. 3.

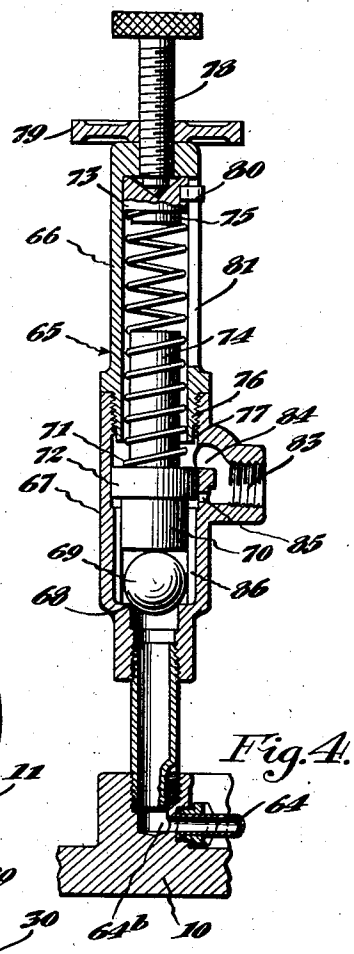


Fig. 4.

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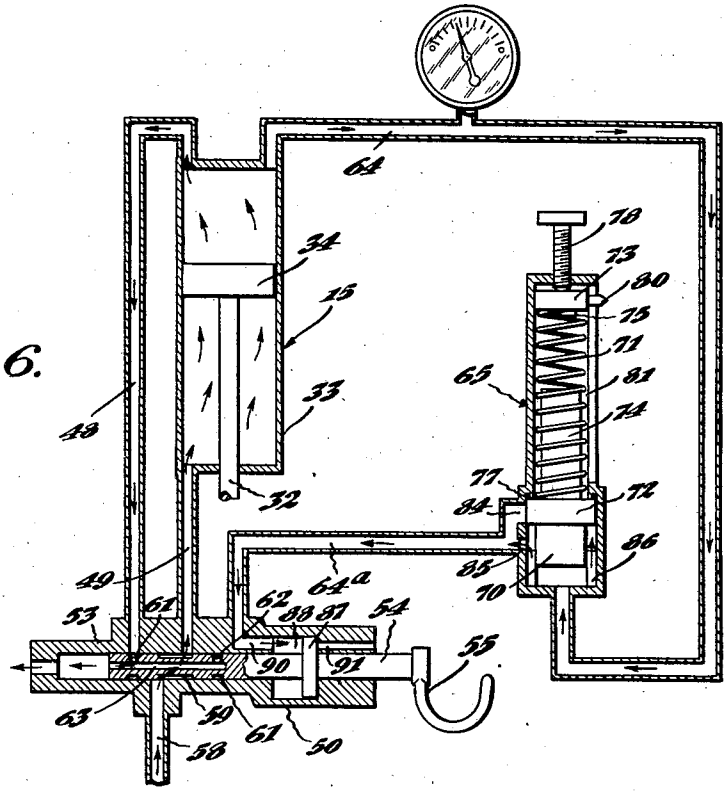
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RIVETING APPARATUS

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Fig. 6.



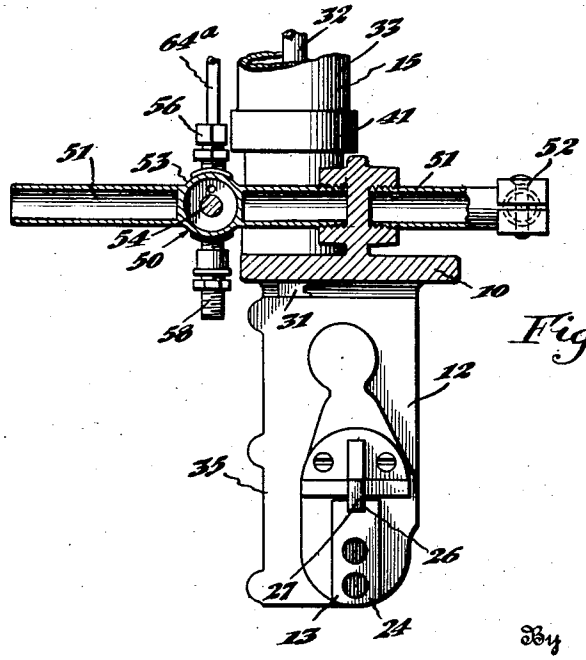


Fig. 5.

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UNITED STATES PATENT OFFICE

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RIVETING APPARATUS

Application filed October 18, 1928. Serial No. 313,348.

This invention relates to improvements in riveting apparatus and is particularly directed to a portable type of riveter incorporating improved features in the rivet driving transmission and control therefor. The riveter concerned in the present invention has a yoke body providing a pair of jaws, one of which carries a stationary die and the other mounting an active or driving die, power actuated through the medium of a rack and gear combination. With the use of compressed air to drive the mechanisms a control is provided which includes a throttle valve for initially introducing the compressed air into an air motor connected to the rack, and an unloading valve for reversing the throttle valve when a predetermined riveting pressure has been exerted.

It is an object of this invention to provide a transmission for the riveter which transmits the drive to the extreme tip of the riveting jaw and enables the insertion of the riveting dies into extremely close corners and angles.

Another object is to provide a type of driving mechanism transmitting the drive to the extreme tip of the riveter jaw in which the drive will be positive and efficient with no great loss of initial force, this being accomplished by moving the rivet driving die through a train of gears, having a driving rack connection moved up the train of gears in the corresponding phases of the riveting die movement, so that when the actual riveting force is being exerted the force is more directly transmitted through the gear adjacent the driving die.

Still another object of this invention is to provide a small portable rivet which is extremely light and which incorporates a complete automatic control circuit for reversing the riveting mechanism when a predetermined pressure has been exerted on the rivet, this control being compactly embodied in the riveter.

Still another object relates to the mounting and movement of the riveting point and to the interchangeability of the stationary point.

Still another object relates to the construction of the various elements making up the control circuit, as the throttle valve and the unloading valve.

Further objects and advantages will be more fully set forth in the description of the accompanying drawings forming a part of this specification, in which:

Figure 1 is a general perspective view of the riveter.

Figure 2 is a sectional view taken longitudinally and transversely of the riveter through the air motor and the driving transmission.

Figure 3 is a sectional view taken on line 3—3, Figure 2, illustrating in detail the throttle or control valve, and the driving mechanism from the piston rack to the laterally actuated riveting die.

Figure 4 is a sectional view taken longitudinally and centrally of the unloader valve.

Figure 5 is a sectional view taken on line 5—5, Figure 3, illustrating the mounting of the throttle valve relative to the handle of the riveter.

Figure 6 is a diagrammatic view illustrating the air control circuit for the riveter.

Figure 7 is a sectional view taken through the lower end of the cylinder showing its connection to the body and the air connection thereto.

Referring to the drawings, the yoke-shaped body of the riveter is indicated at 10 and provides a jaw 11 carrying a stationary die or dolly and a jaw 12 mounting a movable riveting die and housing a transmission for the movable die.

The jaw 12 has a transverse bore in its lower end housing a screw plunger 13 carrying the movable die 14. The plunger is moved by a nut through the medium of a rack and gear transmission actuated by a vertically mounted air motor 15 screwed into the upper face of the body. The nut 16 engaging the plunger is rotatably journalled in a sleeve 17 secured in the transverse bore and rotates against an end thrust ball bearing 18 disposed within the bore at the end thereof opposite the die. The bearing 18 is held in place by a bearing cap 19 screwed into the bore at the outer side of the jaw.

The plunger entering into the opposite end of the nut has a transmission connection with the nut through a ball and groove connection. A semicircular groove 20 is spirally laid in the plunger and a semicircular and adjacently disposed groove 21 is formed in the nut bore, a series of balls 22 filling the formed spiral channel throughout its length. Rotation of the nut moves the plunger longitudinally of the jaw, the nut being rotated through a gear transmission connection with gear teeth 23 formed on the nut.

The riveting die 14 is socketed in an elongated, vertically disposed head 24 as an external part of the plunger. The forward end of the plunger is slidably journalled in a sleeve 25 secured in the transverse bore. The head 24 has a guiding slot 26 in its upper surface in the direction of plunger movement, this slot being in connection with the depending rib of a guide 27 secured to the inner face of the jaw. Any number of sockets may be provided in the head, an upper and lower respectively being shown in this instance, and a set screw 28 is provided relative to each socket for securing the inserted riveting die in place. The die provides a socket end and a head, the head having its tip surfaced to properly mash the end of the particular rivet being acted on.

An angled die or dolly 29 has a square socket end insertable in the lower end of the stationary jaw 11 and held in place therein by a set screw 30. The extending angled end of the removable dolly is aligned with the moving or active die and has its tip formed to fit the head of the particular rivet being maintained in place during driving.

The rack 31 is integrally formed on the lower end of a piston rod 32 extending from the air motor cylinder 33, the upper end of the piston rod carrying a piston indicated at 34. A gear casing into which the rack is disposed is formed within a cover 35 secured against the inner face of the jaw 12 by means of screws. The ends of the shafts carrying the transmission gears 36 are journalled at one side in bearing sleeves 37 secured in the jaw body and at the other side in sleeves 38 secured in the cover 35. As shown in Figure 2, the train of gears 36 is disposed in substantially parallel alignment with the piston, the rack slidably moving relative to the gears at one side thereof and successively meshing with alternate gears of the train, the intermediate driving gear 39 set back out of rack engagement, the relative position of the rack and gears being thus for a purpose which will be hereinafter outlined in the operation and function of the device.

The cylinder 33 is provided with a head 40 and a base 41. The base has an internally and externally threaded sleeve portion 42 screwed into the main body 10 of the riveter. A packing gland 43 is screwed into the internal bore, the packing sealing the piston rod for a sliding fit through the base. The piston comprises a pair of disks 44 clamped together against an intermediate pair of leather cup gaskets 45 having their outer flanges turned in opposite directions and in sealing engagement with the cylinder walls for actuation of the piston in either direction. A nut 46 screwed on the upper end of the piston rod secures the entire piston assembly against a shoulder 47 formed on the rod. Pipe lines 48 and 49, forward feed and reverse feed respectively, extend from a control valve 50, the pipe line 48 entering the cylinder through a screwed connection to the cylinder head, and the pipe line 49 being screwed into a passageway 49^a in the base 41. The control valve 50 provides for a convenient control of the air for alternate feed through these pipe lines and resultant forward and reverse actuation of the piston.

The device is provided with a pair of handles 51—51, screwed in axial alignment into opposite sides of the body transverse thereto, one of these handles having a right angled extension 52 secured thereto. The other handle is straight and has a control valve body 53 formed intermediate thereof and at right angles thereto.

The valve body is cylindrical, extending out from one side of the handle, and has a slide valve 54 longitudinally mounted therein. The valve extends through one end of the valve body and is provided with a grasping hook 55, this member being screwed onto the end of the valve. The pipe lines 48 and 49 are attached to the valve casing 53 by means of coupling elements 56 screw-threaded radially into the valve casing and communicating with radial passageways 57 intersecting the main bore of the casing.

The piston-like valve is provided with three grooves adjacent these radial passageways, the grooves functioning for connection of the main air line 58 alternately with the forward and reverse feed lines 48, 49. The wide intermediate groove 59 is always in registry with the main air line opening 60 entering the valve casing bore radially and between the forward and reverse feed lines to the cylinder. Limit of valve movement in either direction will connect the main air intake with either one of the cylinder feed lines. As shown in Figure 3, the valve is set for introducing air into the forward feed side of the cylinder. The grooves 61 at each side of the groove 59 are for the purpose of exhausting the side of the cylinder toward which the piston is being fed. When the main intake is in communication with one side of the cylinder, one of the grooves 61 registers with the line leading from the opposite side of the cylinder and the exhausting is accomplished through the groove and through a radial aperture 62 therein com-

municating with a central bore 63 extending toward the outer end of the piston or the end opposite the grasping means. This central axial bore communicates with the atmosphere through the unclosed end of the valve casing bore.

As a means for automatically actuating the control valve as a predetermined pressure is reached in the upper or forward feeding side of the cylinder, and thus cutting off the riveting operation at the proper moment, an auxiliary pipe line 64 extends from the upper end of the cylinder being screwed into the head thereof, to an unloading valve 65, and a pipe line 64^a extends from the unloading valve to the control valve. The auxiliary pipe line 64 is screwed into the body of the riveter and communicates with a passageway 64^b extending to the screw-threaded bore into which the unloader valve 65 is inserted.

The unloader valve consists of a cylindrical body made in two sections 66, 67, upper and lower respectively. A ball valve seat 68 is formed internally of the lower end of the valve body section 67, and a ball valve 69 is normally held against said seat by means of a plunger valve 70 slidably mounted within the body and urged downwardly by means of a coil spring 71 under compression between a head or valve seat engaging portion 72 of the piston valve and an adjustment block 73, positioned toward the upper end of a valve body bore. The respective coil spring ends surround a shank 74 of the piston valve and a shank 75 formed on the adjustment block for maintaining the spring in proper axial alignment. The upper valve body element provides a sleeve portion 76 screwed into the lower valve body concentric therewith, the bottom edge of the sleeve providing a valve seat 77 engageable by the shoulder formed on the piston valve. Compression of the coil spring is regulated by means of a set screw 78 screwed into the upper end of the valve body, having a conical dog point end thereon engaging a conical recess in the upper face of the adjustment block. A lock disk or nut 79 is provided on the screw for tightening against the top of the valve casing.

An indicator finger 80 is secured in the adjustment block and extends through a longitudinal slot 81 in the valve casing, the finger being adapted to register with a series of graduations 82 formed parallel with the slot and on the external face of the valve casing. A laterally disposed internally screw-threaded passageway 83 entered by the pipe line 64^a is provided adjacent the plunger valve, the passageway extending from this opening extending two ways.

The upper passageway 84 of largest area extends into the bore of the valve body above the headed portion of the slide valve. The lower or smallest opening 85 is in communication with the intake side of the valve or lower end thereof through longitudinal slots 86 in the bore of the casing which slidably mounts the lower end of the slide valve. The action of this valve is as follows:

When the pressure in the forward side of the cylinder reaches a predetermined degree of pressure or the pressure necessary to drive the rivet, the ball valve 69 is unseated by the air pressure through the line 64 entering the base of the unloader valve. The spring 71 normally seating the plunger valve 70 is adjusted to allow valve unseating at this predetermined pressure and the head or seat engaging portion 72 of the plunger valve is moved upwardly and seated against the valve seat 77 cutting off flow of air to the atmosphere through the longitudinal slot 81, whereupon the air flows through the small opening 85 to the control valve for the purpose of reversing the same. The area of the underside of the plunger valve head 72 exposed to the air coming in through the unseated ball valve 69 is considerable, and the fact that the air may be escaping at this time through the opening 85 does not prevent the plunger valve from being moved to its extreme upper position. The utility of the opening 84 will be apparent from the foregoing description of the means for reversing the control valve.

The control valve has a piston portion 87 formed intermediate of the groove portion and the opposite end, this piston portion 87 being disposed within a cylinder 88 of the valve casing bore, the outer end of the cylinder 88 being closed by means of a bearing sleeve 89 screwed into the end thereof, this bearing sleeve serving to journal the end of the valve. The pipe line leading from the unloader valve to the control valve is in communication with the inner side of the cylinder 88 through a passageway 90 in the valve casing 53, and the cylinder is in communication with the atmosphere through a port 91 in the bearing sleeve 89.

The action of the compressed air being unloaded through the unloader valve as previously described, is to come in through the opening 90 and move the piston from the position shown in Figure 3, which is the forward main piston feeding position of the control valve, to the opposite end of the cylinder, thus reversing the control valve, the port 91 preventing any back pressure in the cylinder 88.

When the forward feeding side of the main driving cylinder is thus exhausted and the air motor piston reversed, the plunger valve in the unloader valve is returned to normal position by the spring. The cylinder 88 in the control valve is in communication with the atmosphere through the pipe line 64^a, the passageway 84, and the slot 81, so that the valve may be hand manipulated to start another cycle. A pressure gauge 92 is inserted in the air line leading to the unloader

valve for the purpose of testing the pressure at which the unloader valve operates.

The cycle operation is as follows: The operator moves the control valve into the position shown in Figure 3. This connects the main air pressure supply line 58 with the forward feeding side of the cylinder of the air motor through the large intermediate annular groove 59 in the control valve, and the rack 31 is moved downwardly, first moving the riveting die through the upper or first gear of the train, and as the riveting die is moved into the work, transferring the drive to the gear of the train which is directly in mesh with the nut 16.

The intermediate gear 39 between the gears 36 and the nut gear are set back in order that the rack will not mesh therewith, since these gears are rotating in a reverse direction. The rack is of such length that when it meshes with the last gear it is passing out of mesh with the first gear of the train. This transfer of the driving mesh provides a more positive drive, with less friction. The rack has a long stroke to permit a movement of the riveting die over considerable space under gear reduction for power. The drive is efficiently transmitted to the extreme end of the jaw through this rack and gear arrangement, and the stroke of the rack is confined to a range of movement within the jaw which does not interfere with the insertion of the dies into close corners.

When the rivet has been suitably driven through this transmission, the pressure in the upper part of the air motor cylinder has reached the point where it will cause the unloading valve to operate, and the control valve will be moved back to normal position in the manner previously described. This reversal of the control valve permits the air from the main air pressure line to enter the lower region of the cylinder through the intermediate annular groove in the control valve, and the piston will then be moved to its normal upper position and the riveting die drawn away from the work.

Having described my invention, I claim:

1. A device of the class described, comprising, a yoke-shaped body providing a pair of spaced jaws, a stationary die secured in one of said jaws, a screw plunger in the other jaw, said plunger carrying a movable die adjacent the first die, a nut in driving connection with said screw plunger, a train of gears meshing at one end with said nut, a power source, and a rack driven from said source, said rack meshing successively from the other end of said train with alternate gears of the train.

2. A device of the class described, comprising, a yoke-shaped body providing a pair of spaced jaws, a stationary die secured in one of said jaws, a movable die mounted in the other jaw adjacent the first die, a train of gears disposed longitudinally of the jaw containing the movable die, a power source, a rack driven from said source meshing successively from one end of said train with alternate gears of the train, and a driving connection between the movable die and the other end of said train of gears for moving the die laterally of the jaw.

3. A device of the class described, comprising, a body providing a pair of jaws, a stationary die in one of said jaws, a screw plunger in the other jaw carrying a movable die, a nut engaging said plunger, a gear formed on said nut, a train of gears having one end gear meshing with the gear on the nut, a rack engaging the other end of the train, an air cylinder, a piston therein in connection with said rack, a throttle valve for alternately connecting a main air line with the drive and reverse ends of the cylinder, said throttle valve having a control pressure chamber therein, and an unloader valve in connection with the driving side of the main air cylinder and with the pressure chamber in the throttle valve, whereby the throttle valve is moved for a reversing of the main driving piston as the unloader valve acts under a predetermined pressure in the driving side of the cylinder.

4. A riveter, including, a body having an extension, a stationary die and a movable die adjacently mounted in said body, a screw plunger journalled in the extreme end of the body extension and carrying said movable die, a nut in connection with said screw plunger, a driving means in said body, and a train of gears disposed longitudinally of the extension and connecting said driving means and said nut.

5. A riveting machine, comprising, a body having a pair of jaws extending therefrom, a die removably secured in the outer end of one of said jaws, a companion die disposed in the outer end of the other jaw adjacent the first die for movement toward and from said first die, and a rack and gear transmission disposed longitudinally of the last mentioned jaw and connected to said companion die for actuating the same.

6. A riveter, including, a body having an extension, a stationary die and a movable die adjacently mounted in said body, said movable die disposed in the outer end of the body extension, a plunger journalled in the end of the extension and carrying the movable die for movement toward and from the stationary die, a nut in screw connection with said plunger, a rack disposed longitudinally within said extension, means for translating said rack, and a gear transmission between the rack and nut.

7. A device of the class described, comprising, a yoke shaped body, a stationary die and a movable die mounted in the respective adjacently disposed ends of said body, said mova-

ble die slidably journalled for movement toward and from said stationary die, a rack extending longitudinally through an arm of the yoke shaped body journalling the movable die, means for translating said rack, a gear transmission in connection with the rack, and a driving connection between the gear transmission and the movable die.

8. A device of the class described, comprising, a body providing a work receiving throat, opposing dies mounted in said body, a train of gears rotatively connecting with one of said dies for moving the same toward the other, a rack extending longitudinally of the train of gears meshing successively with gears of the train, and means for translating said rack.

In witness whereof, I hereunto subscribe my name.

RAYMOND S. OSBORNE.