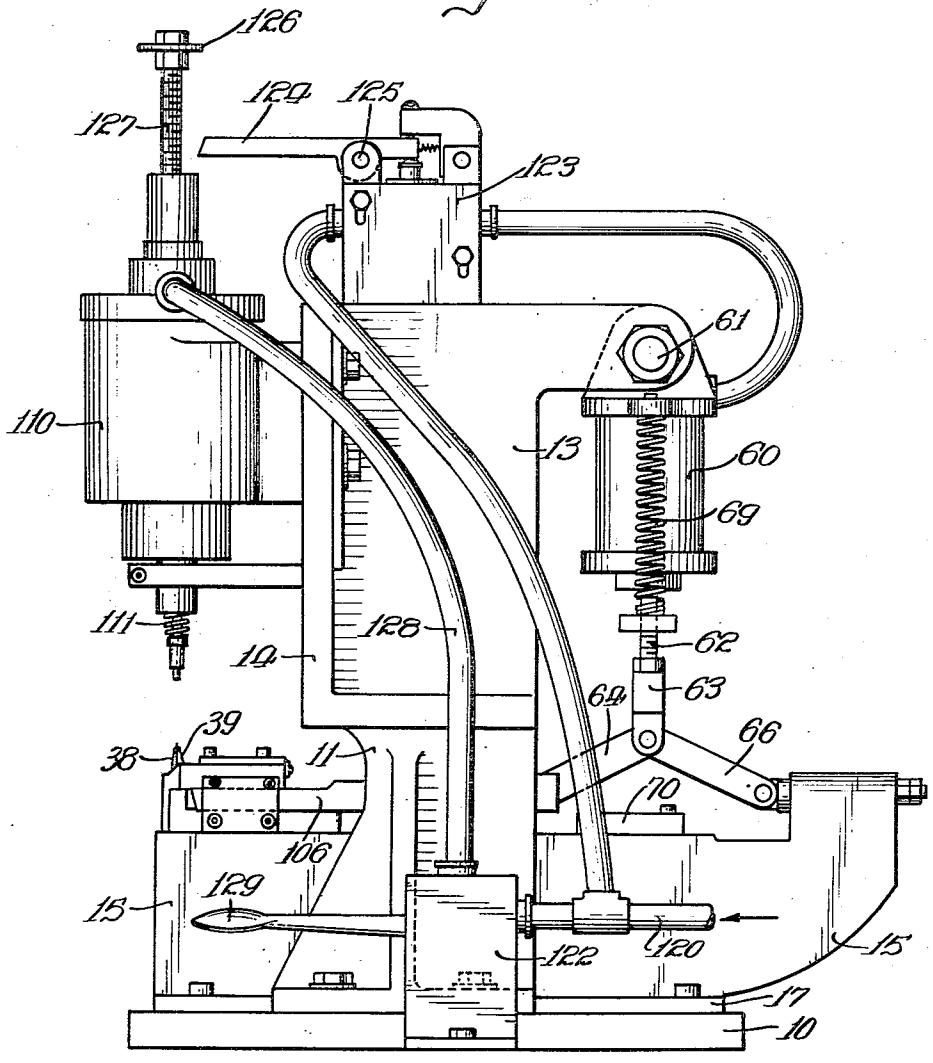
Feb. 12, 1957 K. C. ALLISON 2,781,144

RIVETING APPARATUS

Filed April 11, 1950 4 Sheets-Sheet 1

Fig. 1.




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RIVETING APPARATUS

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Fig. 2.

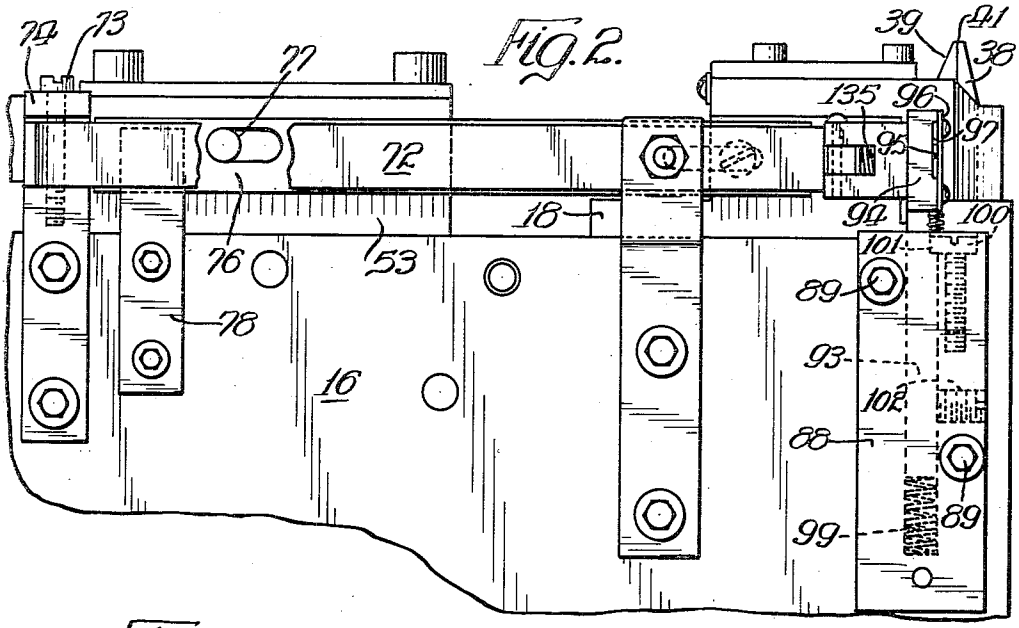
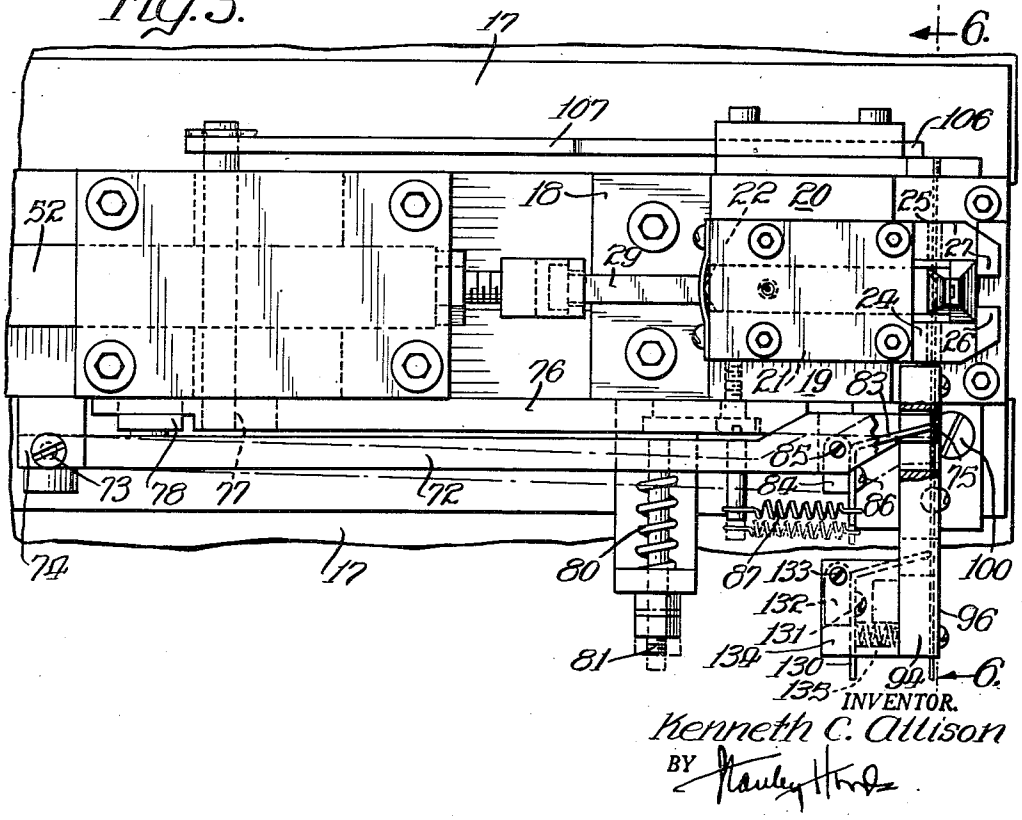



Fig. 3.




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RIVETING APPARATUS

Filed April 11, 1950 4 Sheets-Sheet 3

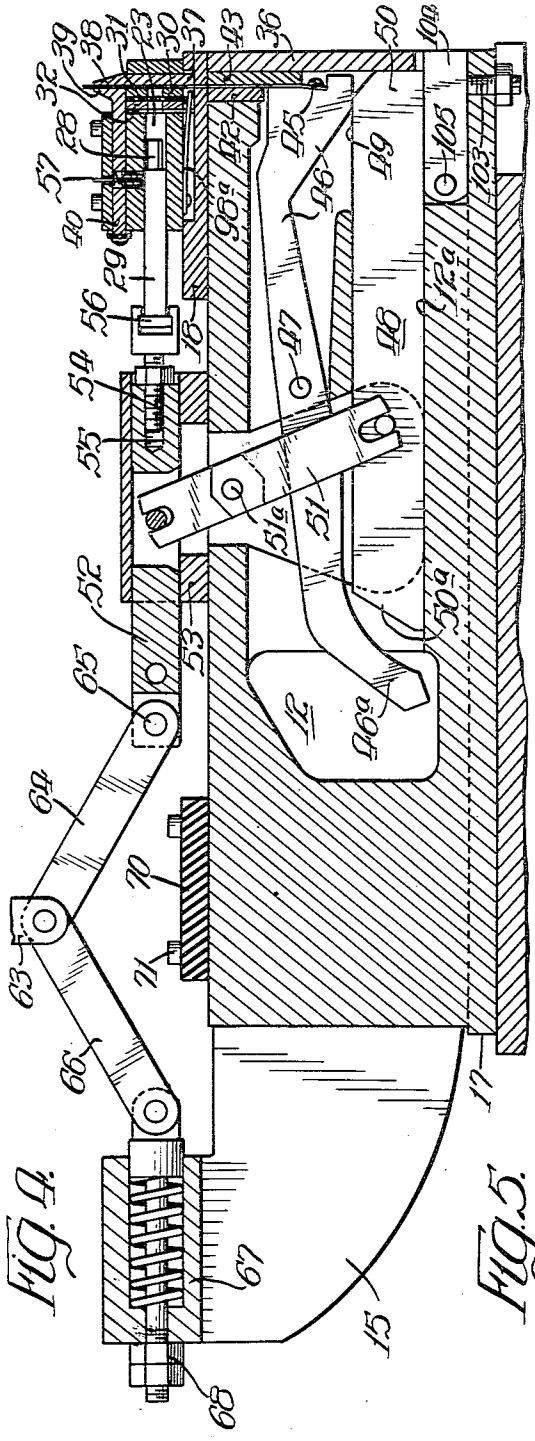


Fig. 4.

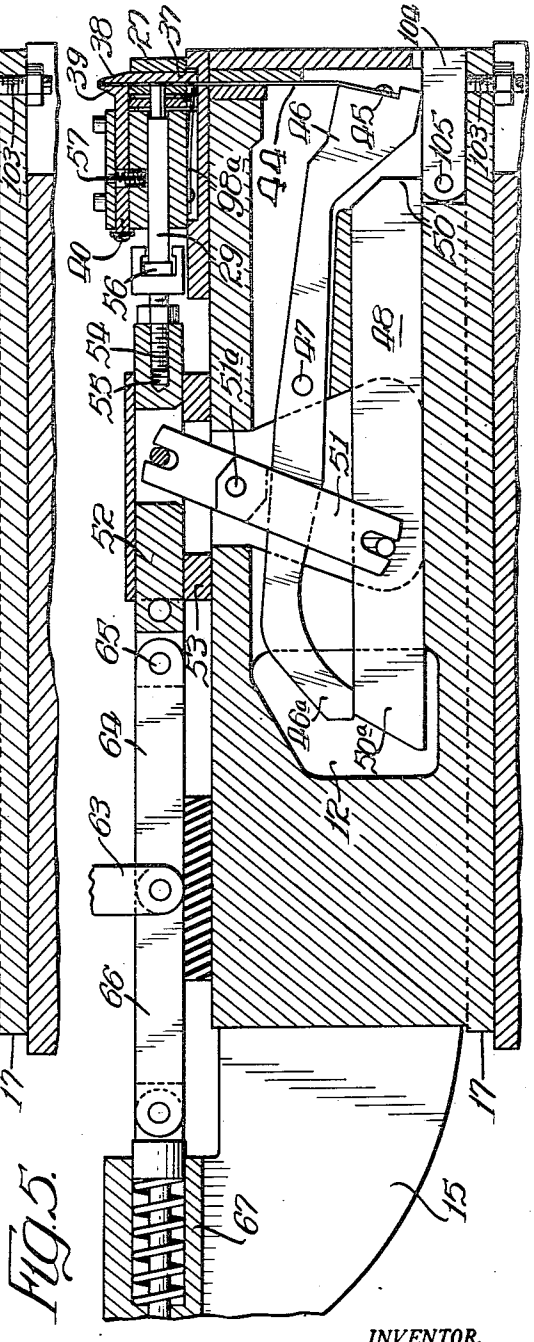


Fig. 5.

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Feb. 12, 1957 K. C. ALLISON 2,781,144

RIVETING APPARATUS

Filed April 11, 1950 4 Sheets-Sheet 4

Fig. 6.

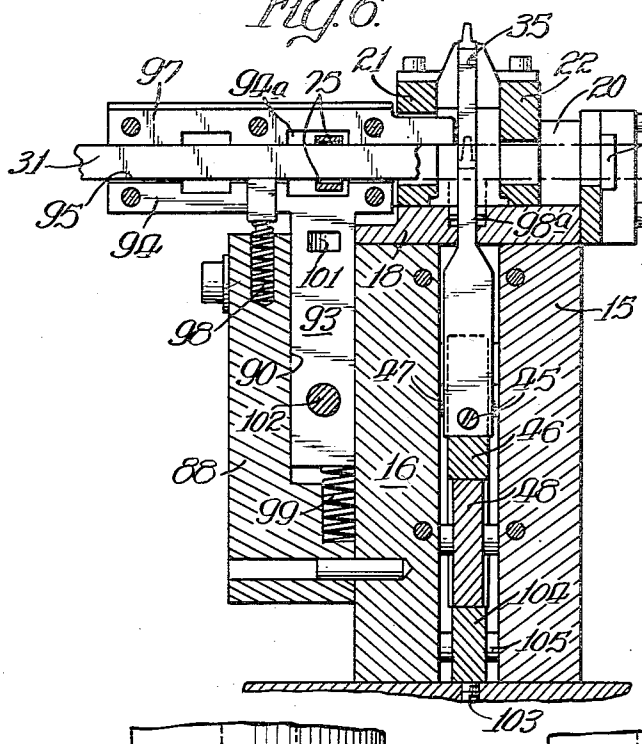
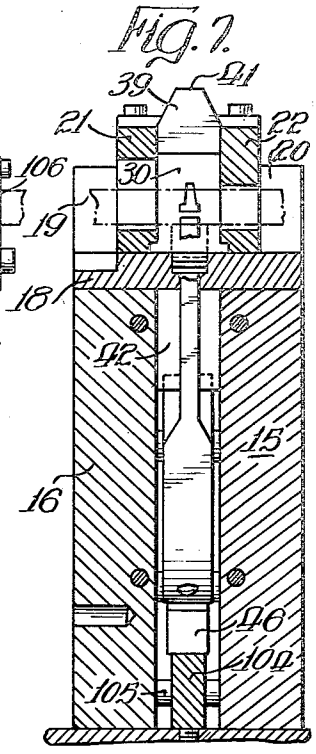



Fig. 7.



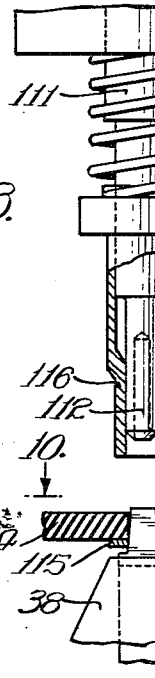
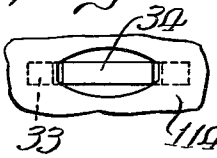




Fig. 8.

Fig. 10.



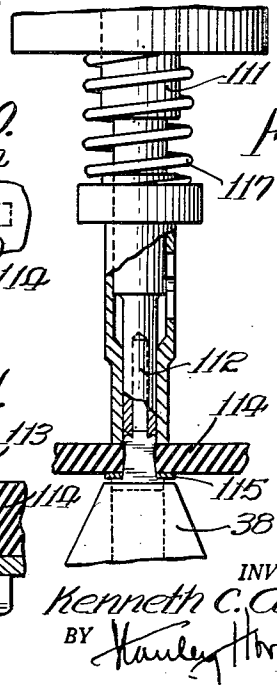
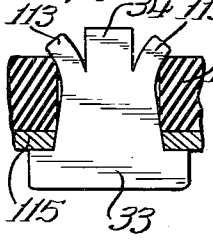




Fig. 9.

Fig. 11.




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United States Patent Office 2,781,144 Patented Feb. 12, 1957



2,781,144

# RIVETING APPARATUS

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Application April 11, 1950, Serial No. 155,335

6 Claims. (Cl. 218—1)

This invention relates to apparatus for producing an assembly of juxtaposed members or parts by means of a riveted joint.

One of the objects of this invention is to provide such an apparatus wherein the rivet itself serves as a guide for the assembly of juxtaposed work members or parts having preformed matching openings for receiving the shank of the rivet.

Another object of this invention is the provision of means for supporting the rivet in a fixed position with its shank portion so arranged that the assembly of the work members or parts thereon may be performed by lowering the latter about said shank portion.

A further object of this invention is the provision of means for so supporting the rivet in a fixed position at the delivery end of apparatus operable to sever a rivet blank from a strip of rivet blank stock supplied to said apparatus.

Still another object of this invention is the provision of rivet clenching means which upon movement from a position operative to clench a rivet so supported at the delivery end of the rivet blank forming apparatus to a retracted position is effective to initiate operation of the rivet blank forming apparatus for delivery of a successively formed rivet blank in a fixed position at said delivery end of the rivet blank forming apparatus.

Another important object of the present invention is the provision in such apparatus of means for positively locating and holding a rivet of the type having a non-circular shank for insertion thereof into non-circular holes of the juxtaposed members to be joined thereby for the purpose of eliminating relative rotation.

Other objects and advantages will be apparent from the following description wherein reference is made to the accompanying drawings illustrating preferred embodiments of the present invention, and wherein similar reference numerals designate similar parts throughout the several views.

Fig. 1 is a side elevational view of an apparatus incorporating and adapted to carry out the principles of this invention and illustrated with its working parts in position and ready for assembly of a rivet with the parts to be joined thereby by lowering the edges of the openings in said parts about the exposed portion of the rivet shank at its station directly below the rivet clenching device.

Fig. 2 is an enlarged fragmentary side elevational view of the apparatus as it appears from the side opposite to that shown in Fig. 1, with the rivet forming and delivery mechanism in retracted position.

Fig. 3 is a top plan view of that portion of the apparatus shown in Fig. 2.

Fig. 4 is an enlarged vertical sectional view, with parts in elevation, showing the arrangement of the rivet blank forming mechanism and rivet blank delivery mechanism when a rivet blank is positioned below the rivet clenching device in accordance with the position shown in Fig. 1.

Fig. 5 is a similar view showing the rivet blank forming mechanism in advanced position and the rivet blank delivery mechanism in readiness to transfer the rivet blank from a position opposite the rivet blank forming mechanism to the position shown in Fig. 4.



Fig. 6 is an enlarged vertical sectional view, with parts in elevation, taken on line 6—6 of Fig. 3, showing details of the rivet blank delivery mechanism as well as the rivet stock feeding mechanism, in accordance with the position thereof as in Fig. 1 and Fig. 4.

Fig. 7 is a similar view showing the rivet blank delivery mechanism when positioned as in Fig. 3.

Fig. 8 is an enlarged detail vertical section, with parts in elevation, illustrating the rivet clenching device in retracted position in readiness to be lowered for action on the rivet blank supported therebelow with the parts to be joined thereby lowered over the exposed portion of the shank of said rivet blank.

Fig. 9 is a similar view illustrating the rivet clenching device in advanced position wherein the riveted joint is shown in completed condition.

Fig. 10 is an end elevation of the assembled parts as viewed from the shank end of the rivet in Fig. 8.

Fig. 11 is an enlarged detail view of the riveted joint as shown in Fig. 9.

Referring more particularly to the drawings, the apparatus forming the subject of this invention is shown as assembled upon a horizontal bed or table **10**. A bridging structure connecting the upper ends of upright legs **11** presents an upright wall **13** extending fore and aft of the bed **10** in a plane approximately centrally of the legs **11** and a front upright wall **14** at right angles to the wall **13**.

Reference numerals **15** and **16** designate a pair of elongated housing members secured to the bed by suitable fastening means entering flanges **17** at the base of the housing members, the latter extending in opposite directions from the space between the legs **11** in spaced vertical alignment with the upright wall **13**. The top and bottom portions of the housing member **16** are separated by a cavity **12** extending inwardly from the front end of the frame. A bracket or casing comprising a base **18** secured to the top of the housing members **15** and **16** and protruding forwardly of the front end of the latter has a pair of arms **19** and **20** at opposite sides of the base **18** which provide an upwardly open channel in which a pair of plates **21** and **22** have portions confined and secured in face to face relation parallel with the longitudinal axis of the housing members. The interfacing surfaces of the plates **21** and **22** have longitudinal grooves formed therein which combine to form a bearing opening **23** of uniform rectangular cross-sectional contour throughout the length of the interfacing surfaces of said plates **21** and **22**. Extensions **24** and **25** of said plates **21** and **22** respectively are spaced apart to present opposite inwardly facing surfaces in laterally outward offset relation to the interfacing surfaces of the plates **21** and **22** and terminate forwardly of the front end of the bearing opening **23** in inwardly angular end sections **26** and **27**, respectively. These end sections, in conjunction with the faces of the plates **21** and **22** about the front end of the bearing opening **23**, define the inner faces of an upright socket of uniform rectangular cross-sectional contour throughout its height. A punch **28** at the forward end of a tool shank **29** reciprocable in the bearing opening **23** cooperates with a die member **30** to sever a rivet blank from a flat strip of stock **31** fed across the path of the punch **28** in a passageway separating the die member **30** and a stripper member **32** positioned between the die member and the inner face of the upright socket defined by the plates **21** and **22**, about the front end of the bearing opening **23**. As noted in Fig. 7, the opening in the die member and stripper member is of inverted T-shaped formation matching that of the punch **28**

whereby the strip of stock acted upon by the punch and die member produces a rivet blank having a head portion 33 in downward relation to its shank portion 34, said shank preferably having side edges which taper inwardly from the head toward its opposite end. The rivet blank so formed by the punch and die members is pushed forwardly into a vertical guideway 35 defined by a vertical recess formed in the rearward face of an upright plate 37 confined at its lower end between the die member 30 and the end sections 24 and 25 forming the forward inner wall of the socket. The plate 37 has an end portion 38 projecting above the upper limits of the socket and the corresponding edges of an upwardly projecting extension 39 at the front end of a horizontal plate 40 secured between the plates 21 and 22 above the bearing opening 23 cooperate to provide an upwardly open muzzle having a flat horizontal rim 41 at the upper limits of the guideway 35.

A pair of interfacing members 42 and 43 confined between the front end of the housing member 16 and a cover plate 36 bridging the front ends of the housing members 15 and 16 and an opening in the base portion 18 of the bracket secured to the top of the housing members 15 and 16 cooperate to provide a downward continuation of the guideway 35. Thus a rivet blank feeding blade 44 having one end thereof fastened as at 45 to the forward swinging end of a lever 46 mounted for vertical rocking movement within the cavity 12 of the housing 16 about a pivot 47, has vertically sliding fit in the guideway 35, as shown in Figs. 4 and 5. The rivet blank, upon being delivered to the portion of the guideway 35 opposite the die member 30 by the punch 28, is engaged along the downwardly facing edge of its head portion 33 by the upper edge of the blade 44, as shown in Fig. 7, wherein the lever 46 is operative to locate the upper edge of the blade 44 at its lowermost position as shown in Fig. 5. A cam member 48 slidable lengthwise of the housing 16 on an upwardly facing flat bearing surface or shoulder $12^a$ defining the lower wall of the cavity 12, has a front portion 50 engageable with the lower forward edge portion of the lever 46, when the cam member 48 is in its forwardmost position as shown in Fig. 4 so as to rock the forward end of the lever 46 upwardly causing the blade 44 to travel to its uppermost position in the guideway 35 where the blade 44 supports the rivet blank at the muzzle end of the guideway. As shown in Fig. 6, the rivet blank is so confined by the walls of the guideway 35 as to have unrestricted vertical sliding movement therein but positively held against rotation therein. When the blade is located at its uppermost position in the guideway, as shown in Fig. 8, the rivet blank is accordingly supported in exposed position above the muzzle end of the guideway except for a lower portion of the rivet head 33 which is confined below the rim 41 of the muzzle end of the guideway so as to be held thereby against movement relative to the guideway. When the cam member is in its rearwardly moved position, as shown in Fig. 5, the rear portion $50^a$ thereof engages the lower rear extremity $46^a$ of the lever 46 to rock to forward end of the lever downwardly into a position wherein the upper edge of the blade 44 is slightly below the lower limits of the opening in the die member to assure engagement with the lower edge of a succeeding rivet blank delivered to the guideway 35 by the punch 28.

Movement of the cam member 48 is controlled by a crank arm 51 which rocks about a horizontal pivot $51^a$ under power of a ram 52 slidable fore and aft of the housing members 15 and 16 in a suitable bearing block 53 secured to the top of said members 15 and 16 rearwardly of the punch 28. A screw 54 having threaded connection with and extending forwardly of the ram 52 is provided with a forwardly open socket head 55. A lost motion connection between the ram 52 and the punch 28 is established by means of a head 56 at the rear end of the tool shank 29 confined in the socket head 55 of the screw 54 whereby the punch 28 may have a slight lag pending such travel of the blade 44 as needed to start upward travel of the rivet blank from its initially delivered position in the guideway 35. A spring pressed friction pin 57 arranged in aligned openings in the horizontal plate 40 and the plates 31 and 22 intersecting the bearing opening 23 acts between the side surface of the tool shank 29 and a cover plate fastened over the plate 40 to prevent the punch 28 from moving during such lag.

Power for actuating the ram 52 in a direction to operate the punch 28 to sever a rivet blank from the strip of stock 31 is supplied by an air cylinder 60 connected as at 61 to the rearward edge of the upright wall 13. A vertically operating rod 62 projecting downwardly from the cylinder 60 and driven thereby acts through a coupling 63 connecting a toggle link 64 joined to the ram 52 as at 65 and a toggle link 66 anchored at its outer end on an extension 67 of the housing member 15 by means of a spring biased adjustment screw 68, forms the driving connection between the ram 52 and the air cylinder 60. A spring 69 cooperating with the rod 62 urges the latter upwardly to move the ram 52 from its forward position as in Fig. 5 to its rearward position as in Fig. 4. Accordingly, forward movement of the ram 52 acts through the crank arm 51 and cam 48 to position the lever 46 and blade 44 in their lowermost positions while opposite movement of the ram 52 operates to position the lever 46 and blade 44 in their uppermost position. A rubber cushion 70 secured as at 71 on the housing member 15 provides an abutment cushion for the links 64 and 66 when the latter are in a downward position to operate the ram 52 toward its forward position as in Fig. 5.

A stock feed arm 72 hinged at one end as at 73 on a bracket 74 fixed to the housing 16 for horizontal swinging movement is provided with a forward position in the form of a loop or eye 75 through which the strip of stock 31 is threaded. As shown in Fig. 3, the forward portion of the arm 72 is offset into the path of a cam bar 76 operative through a pin and slot connection 77 with the ram 52 to slide fore and aft of the housing member 16 on a bracket 78. Thus forward motion of the ram acts on the forward portion of the arm 72 against the resistance of a spring 80 surrounding an adjustable pin 81 projecting into an opening in the arm 72 to crowd the latter in a direction away from the housing member 16 and reverse motion of the ram operates to release the arm 72 for movement toward the housing members under pressure of the spring 80. As the arm 72 is thus moved toward the housing member 16, the inner surface of the eye 75 opposite the forwardly facing side of the strip of stock, in cooperation with a stock gripping blade 83 pressing against the opposite side of the stock, seizes and pulls the latter in the direction of the housing member 16. A bearing block 84, hinged as at 85 on the arm 72, and to which the blade 83 is secured at its inner end as at 86, provides for limited horizontal swinging movement of the blade 83 relative to the eye 75 in a direction toward and a direction away from the strip 31 so as to free the strip during movement of the eye 75 and arm 62 in a direction away from the housing member 16. However, the line of engagement between the blade 73 and the strip of stock 31 confined within the eye 75 is located at such a distance ahead of a vertical plane through the hinge 85 and at right angles to the path of the strip as to assure positive wedging action between the blade and the eye when the arm 72 is moved toward the housing member 16. A tension spring 87 acting on the bearing block 84 urges the blade 83 to maintain contact with the stock 31.

An upright bracket 88 fixed on the housing 15 by bolts 89 is recessed as at 90 to provide, in cooperation with the side wall of the housing member 16, an upwardly open cavity into which the vertical shank portion 93 of a feed guide member is mounted. As shown in Figs. 2,

3 and 6, the guide member includes a horizontal head portion 94, formed with a channel 95 in its forward face, which is bridged by a cover plate 96 fastened as shown on the head portion 94. Thus the guide blade 97 forming the upper edge of the channel, and cover plate 96, cooperate with the channel 95 to define a guideway in alignment with the path of the strip 31 across the opening in the die member 30. The strip 31 may be supplied from a reel or other suitable source (not shown) and accordingly supported for feeding movement by the stock feed arm 72 across the opening in the die member 30 by way of the channel 95. An opening 94a provided in the head portion 94 and the cover plate 96 provides clearance about the path of the strip 31 to accommodate swinging movement of the eye toward and away from the housing member 16 as described hereinabove. The lower edge of the strip of stock 31 is engageable with a leaf spring 98a confined within a recess in the base portion 18 in vertical alignment with the path of the punch 28 and a coil spring 98 seated in a recess in the bracket 88 acting through a suitable strip engaging member against the lower edge of the strip of stock 31 outwardly of the opening 94a in the head portion 94 provide means operative to urge the strip upwardly into engagement with a stock guide blade 97 confined in the channel 95, said blade 97 presenting a downwardly facing edge engageable by the upper edge of the strip 31.

As shown in Fig. 6, a compression spring 99 acting between the lower edge of the shank 93 and the bottom of the recess containing the shank, urges the guide member 94 upwardly. An adjustment screw 100 accessible at the upper surface of the bracket 88 has its head portion partially confined in a notch 101 formed in the forward face of the shank 93 to effect raising or lowering of the guide member by turning said screw 100 in selected directions. A set screw 102 penetrating the forward wall of the bracket 88 acts against the shank 93 to lock the guide member in selected adjusted positions. Thus the strip 31 may be raised or lowered relative to the opening in the die member 30 to obtain variations in the length of the shank of the rivet to be blanked therefrom.

Adjustment of the upper end of the blank feeding blade 44 carried by the lever 46 to control its position at a selected distance below the rim 41 is effected by an adjustment screw 103 engageable upwardly against the bearing member 104 mounted for vertical swinging motion about a pivot 105, which bearing member presents an uppper edge on which the lower forward edge of the lever 46 rests when in lowered position as shown in Fig. 5.

A shear blade 106 at the forward end of an arm 107 supported on the side of the housing member 15 opposite to that of the guide member for fore and aft sliding movement across the path of the strip 31, and operated by the ram 52 to which the rear end of the arm 107 is connected, severs the strip 31 as the blanked portion of the strip is moved past the exit end of the passage containing the strip. Accordingly, with each movement of the punch 28 to sever a rivet blank from the strip of stock opposite the opening of the die member 30, the blade 106 simultaneously cuts off an end portion of the remnant of the strip.

An air cylinder 110 supported on the front wall 14 of the apparatus supplies power to operate a plunger 111 in a vertical path in alignment with a rivet supported at the upper end of the guideway 35. In its lowered position, as shown in Fig. 9, a sharpened annular blade 112 at the lower end of the plunger acts on the upwardly exposed edge of the rivet shank causing the latter to split and form laterally spread prongs 113 which cut or bite into the margin of the rivet confining hole in the uppermost of the parts 114 and 115. When the plunger 111 is in raised position, as shown in Fig. 8, a sleeve or spring pad 116 surrounding the blade 112 is acted on by a spring 117 to occupy a position in leading relation to the blade 112. Thus the pad 116 upon its descent, engages the uppermost part 114 and applies pressure to force the parts 114 and 115 downwardly on the shank of the rivet and into tight engagement with the head of the rivet, held in elevated position by opposition of the bearing member 104 by way of cam member 48, the lever 46 and the upper edge of the blade 44 engaging the lower edge portion of the rivet head (Fig. 4), before the blade 112 engages the rivet shank to split and form laterally spread prongs 113 in said shank. Consequently, the pad 116 insures full and firm installation of the rivet in the openings in the parts 114 and 115 before the rivet clenching operation is begun. It will, of course, be realized that the spring pad 116 also strips the work from the blade 112 as the plunger 111 is returned to its raised position as in Fig. 8.

Before being acted upon by the pad 116, as shown in Fig. 8, the parts 114 and 115 have the edges of the rivet openings thereof in wedging engagement with the longitudinal corners of the rivet shank with part 115 spaced from the head of the rivet, Fig. 8. Accordingly the margin of the opening in the part 115 is cut by the corners of the shank of the rivet as the part 115 is pressed into home position against the rivet head by the pad 116 acting on the part 114, to accommodate itself to the widened dimension of the shank at its head end.

Entry of air from a main feed pipe 120 to the cylinder 60 for actuating the punch and die mechanism is controlled by a valve 123. An operating lever 124, pivoted as at 125, acts to open the valve 123 when its outer swinging end is moved upwardly from a horizontal position while permitting movement of said swinging end in a downward direction without opening the valve 123. A lug 126 projecting laterally from the upper end of a stem 127 forming an upward extension of the plunger 111 moves in a path obstructed by the outer swinging end of the lever 124. The latter is accordingly moved into upwardly swung position to open the valve when the plunger 111 is returning to a raised position as shown in Fig. 1 and is moved into a downwardly swung position without affecting operation of the valve when the plunger 111 is moved downwardly. A valve 122 operating between the main feed pipe 120 and a pipe 128 is opened by depression of a pedal 129 to admit air to the cylinder 110. Thus the pedal 129 is operative to initiate the cycle of operation of the plunger 111 from a raised to a lowered position to perform a clenching operation on a rivet supported at the upper end of the guideway 35, and the means for operating the ram 52 to complete the cycle of feeding the rivet stock, forming the rivet blank, delivering the rivet blank to the upper end of the guideway 35 and cutting off the end of the remnant of the strip by means of the shear blade incident to the delivery of a succeeding rivet for action by the rivet clenching mechanism is not rendered operative until the plunger 111 has returned to an idle position as shown in Fig. 1.

In order to avoid backward travel of the strip 31 in the guide member during motion of the stock feed arm 72 in a direction away from the path of the punch and die mechanism, a blade 130 secured at its inner end as at 131 on a bearing block 132 hinged as at 133 on a bracket 134 fixed to and extending rearwardly from the outer end of the guide head portion 94, is urged by a spring 135 to press against the rearward face of the strip 31 exposed through an opening in the head portion 94 and the cover plate 96.

What is claimed is:

1. Apparatus for making rivets from a strip of flat stock, said apparatus comprising means for intermittently feeding the strip in a path defined by strip supporting means, means for severing the strip into rivet blanks with the shank of the rivet extending cross-wise of the edges of the strip, said latter means including punch and die mechanism between which the strip is movable in said path, the shank producing portion of said punch and die mechanism extending in a direction at right angles to

said path, said strip supporting means being adjustable in a direction parallel to the shank producing portion of the punch and die mechanism to vary the location of the path of said strip between said punch and die mechanism.

2. Apparatus for making T-shaped rivets from a strip of flat stock, said apparatus comprising means to intermittently feed the strip, horizontally movable punch cooperable with die mechanisms, said punch and die mechanism being operable to sever the strip into T-shaped rivet blanks with the shank of the rivet extending upwardly, said punch and die mechanism having the shank producing portion thereof extending in a direction at right angles to the path of movement of said strip, a vertical guideway in which each rivet blank is deposited by the punch as said rivet blank is severed from said strip, and in which guideway each rivet blank has sliding movement between a position in which the rivet blank is deposited by the punch and a second position, said guideway having a discharge end at the upper limits thereof from which the shank of the rivet blank and a portion of the head end thereof adjoining the lower end of the shank protrudes when the rivet blank is in said second position, a propelling device having sliding movement in said guideway between a lowered position and a raised position and with which said rivet blank is engageable to cause the rivet blank to be moved between a position in which the rivet blank is deposited by the punch and said second position, and acting for supporting said rivet blank in said second position in response to movement of said propelling device from said lowered position to said raised position, driving means for said propelling device and said punch being operable under control of means with which said driving means for said propelling device has interconnection whereby said propelling device is moved from said lowered position to said raised position while the punch is withdrawn from a position to sever a rivet blank.

3. Apparatus as described in claim 2 wherein said strip feeding means is operable to feed the strip under control of actuating means with which the punch operating means has interconnection whereby said strip feeding means is actuated to feed the strip when said punch is withdrawn from a position to sever a rivet blank from said strip.

4. Apparatus as described in claim 2 wherein said driving means for said propelling device includes a movable cam engageable with said propelling device and wherein said strip feeding means is operable to feed the strip under control of actuating means with which the punch operating means has interconnection whereby said strip feeding means is actuated to feed the strip when said punch is withdrawn from a position to sever a rivet blank from said strip.

5. Apparatus for joining juxtaposed work members by a rivet extended through preformed coordinated openings in said work members with the shank of the rivet positioned in upwardly projecting relation to its head end to provide for assembly of the rivet in the openings in the work members after lowering the edges of the openings about the shank of the rivet while so positioned, said apparatus including a rivet clenching device movable between raised and lowered positions, means for successively delivering substantially flat T-shaped rivet blanks to a fixed position in the path of said clenching device, said means including the discharge end of a guideway extending downwardly from said rivet clenching device, a propelling device movable in said guideway from a lowered to a raised position to move a rivet blank deposited above said propelling device to said fixed position, and punch and die mechanism operable to sever a rivet blank from a strip of rivet blank stock supplied to said apparatus and to deposit a rivet blank severed thereby above said propelling device when said propelling device is in lowered position, said punch and die mechanism being operable under control of means responsive to movement of the rivet clenching device from a lowered position to a raised position to so sever said rivet blank, and said propelling device being movable from said lowered to said raised position under control of means responsive to movement of the punch in a direction away from the die mechanism.

6. Apparatus for joining juxtaposed work members by a rivet extended through preformed coordinated openings in said work members with the shank of the rivet positioned in upwardly projecting relation to its head end to provide for assembly of the rivet in the openings in the work members after lowering the edges of the openings about the shank of the rivet while so positioned, said apparatus including a rivet clenching device movable between raised and lowered positions, means for successively delivering substantially flat T-shaped rivet blanks to a fixed position in the path of said clenching device, said means including the discharge end of a guideway extending downwardly from said rivet clenching device, a propelling device movable in said guideway from a lowered to a raised position to move a rivet blank deposited above said propelling device to said fixed position, and punch and die mechanism operable to sever a rivet blank from a strip of rivet blank stock supplied to said apparatus and to deposit a rivet blank severed thereby above said propelling device when the latter is in lowered position, said strip of rivet blank stock having feeding mechanism cooperating therewith to advance the stock between the punch and die mechanism under control of means responsive to movement of the punch in a direction away from the die mechanism, said punch and die mechanism being operable to sever a rivet blank therefrom under control of means responsive to movement of the rivet clenching device from a lowered position to a raised position, and said propelling device being movable from said lowered to said raised position simultaneously with stock advance movement of the stock feeding mechanism.

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