March 19, 1946. A. H. HABERSTUMP 2,396,649

RIVETING DEVICE

Filed Oct. 6, 1941 4 Sheets-Sheet 1

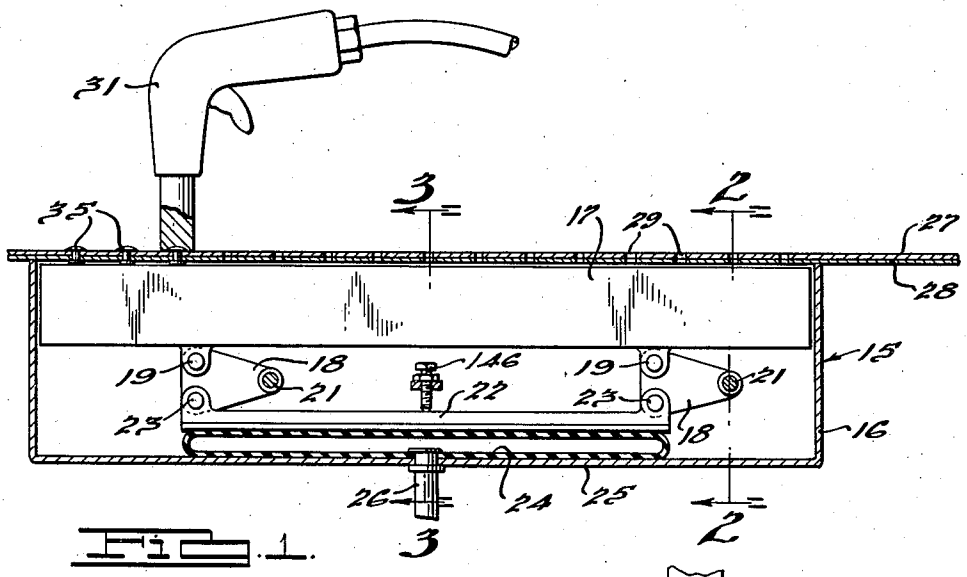


Fig. 1.

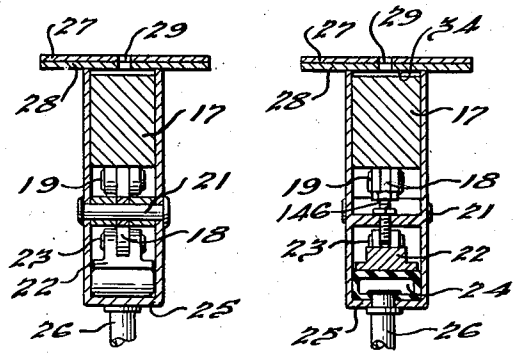


Fig. 2.

Fig. 3.

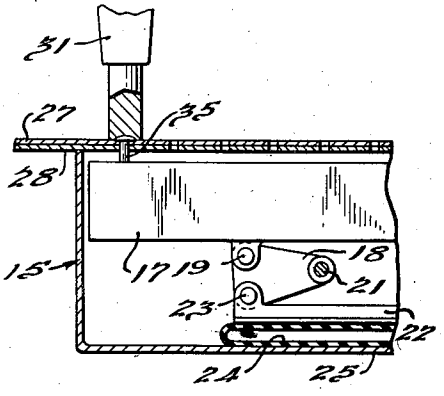


Fig. 4.

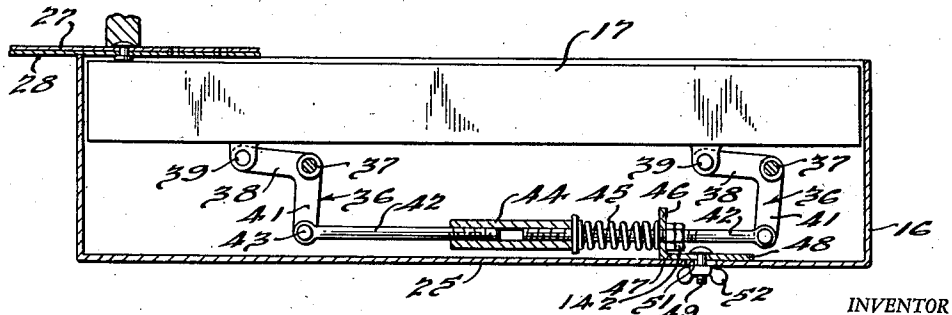


Fig. 5.

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RIVETING DEVICE

Filed Oct. 6, 1941 4 Sheets-Sheet 2

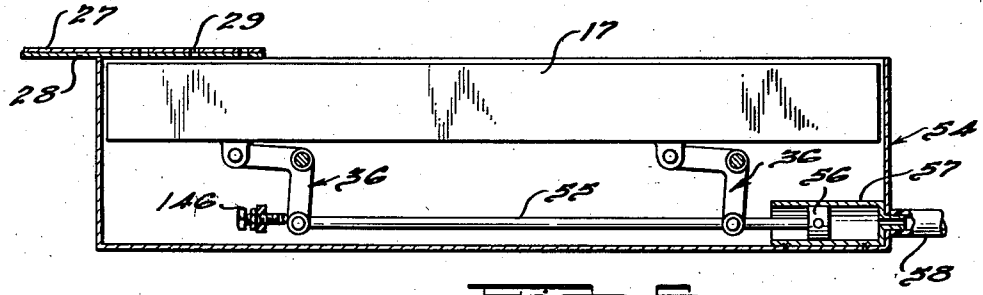


FIG. 6.

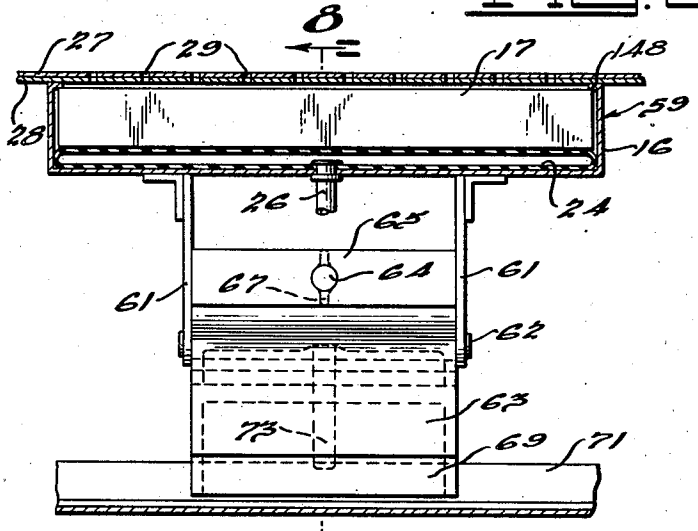


FIG. 7.

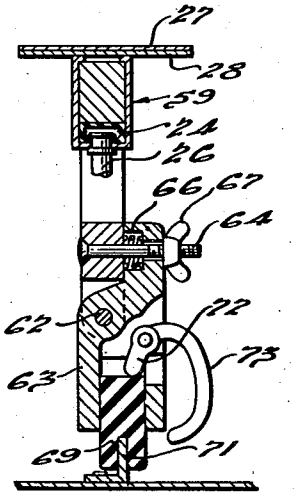


FIG. 8.

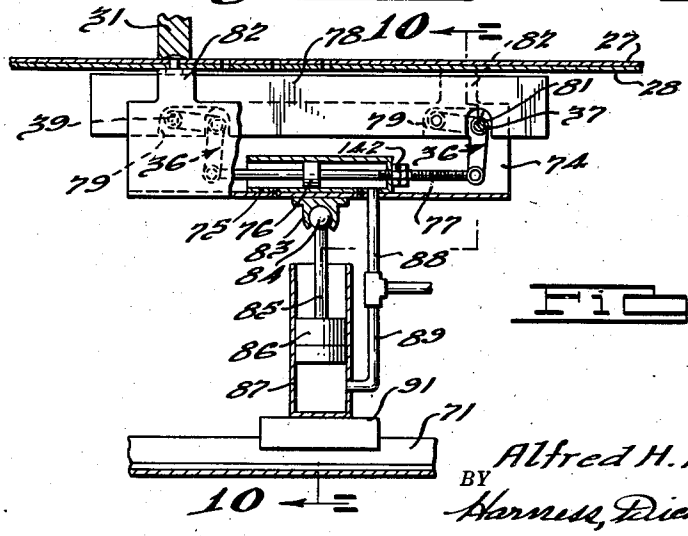


FIG. 9.

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RIVETING DEVICE

Filed Oct. 6, 1941 4 Sheets-Sheet 3

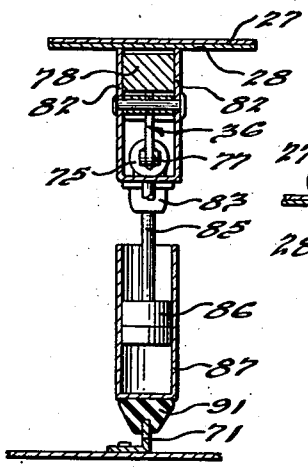


FIG. 10.

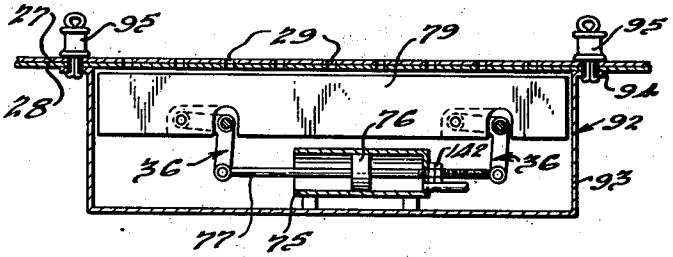


FIG. 11.

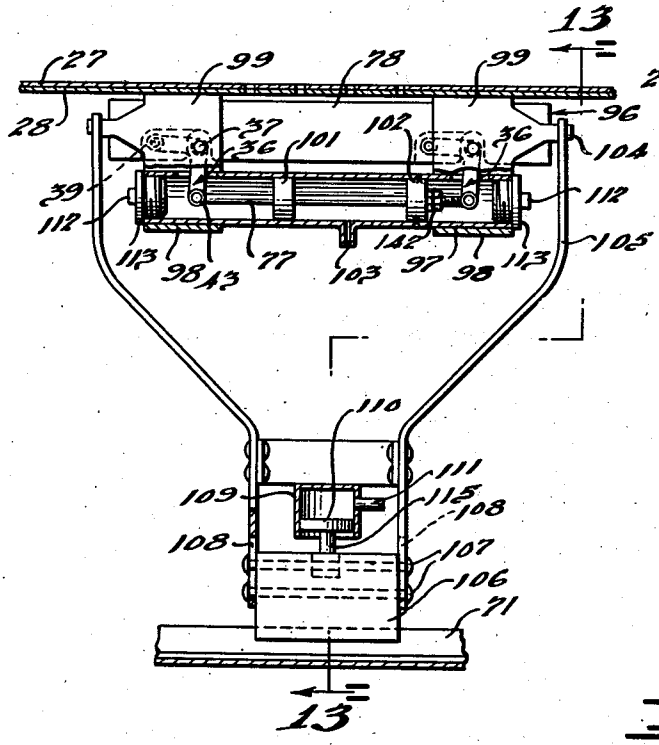


FIG. 12.

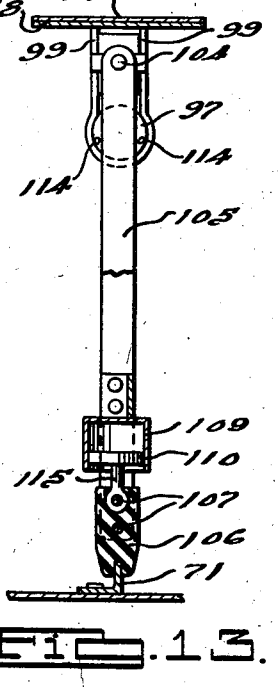


FIG. 13.

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RIVETING DEVICE

Filed Oct. 6, 1941 4 Sheets-Sheet 4

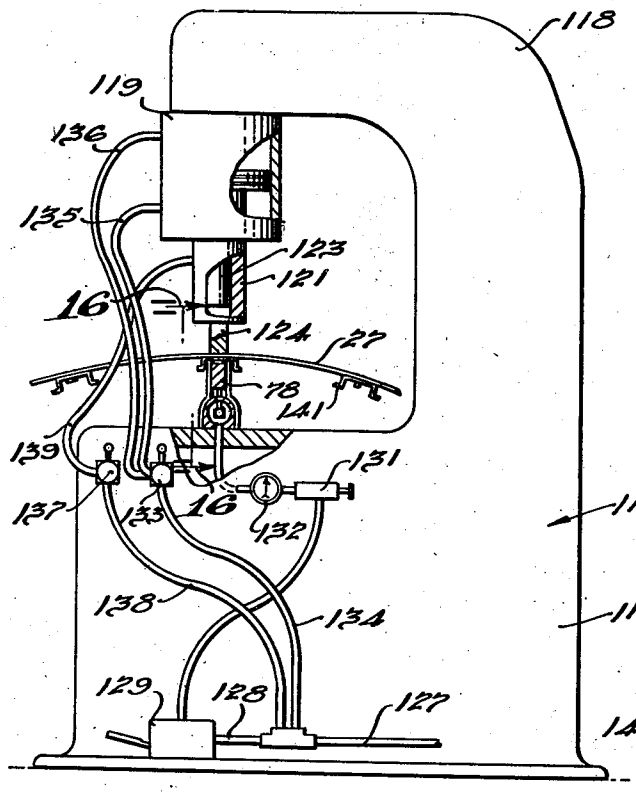


FIG. 14.

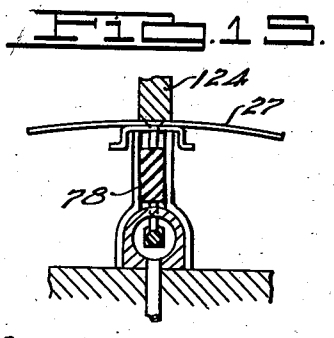


FIG. 15.

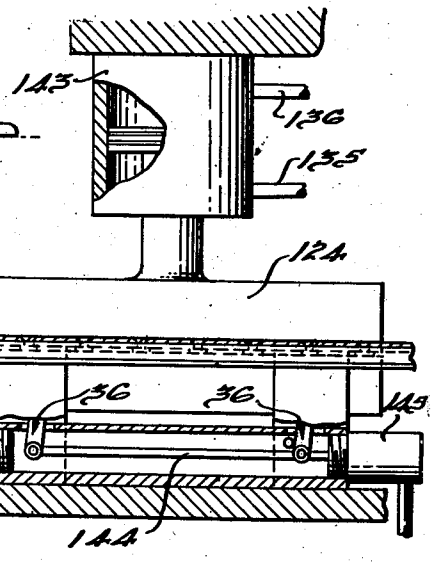


FIG. 17.

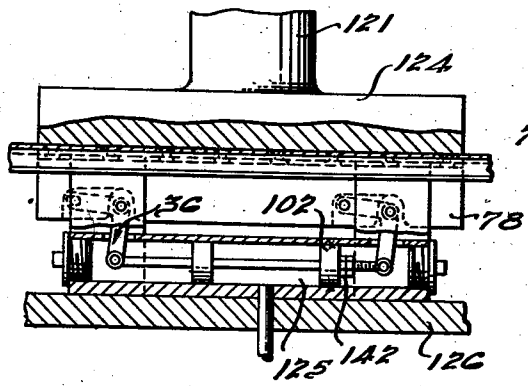


FIG. 16.

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Patented Mar. 19, 1946 2,396,649

UNITED STATES PATENT OFFICE

2,396,649

RIVETING DEVICE

Alfred H. Haberstump, Detroit, Mich., assignor to The Murray Corporation of America, Detroit, Mich., a corporation of Delaware

Application October 6, 1941, Serial No. 413,764

8 Claims. (Cl. 78—53.5)

My invention relates to riveting devices, and particularly to a riveting dolly which is effective to back up a series of rivets of the same or variable spacing which are individually swaged by the device.

The structure of the present application is an extension of the invention which has been set forth and claimed in the copending application of Charles R. Stevenson, et al., Serial No. 408,614, filed August 28, 1941, and assigned to the assignee of the present invention.

In the latter application, a riveting device is employed in which individual pistons are aligned with the rivets and function independently of each other. In the present invention, a single bar is employed, of a length to span a plurality of apertures through which rivets are to be stuck and swaged. In this construction corner rivets are engaged by the end of the bar and the device may be employed without consideration of the spacing of the rivets. The bar is supported on links at each end so as to retain a parallel position to the sheets to be riveted together and to prevent the bar from tilting when rivets are swaged at one end thereof. The links are supported in a suitable manner by pivots while being joined together by an element which is preferably parallel to the riveting bar and to which a resilient pressure is provided. This resilient pressure may be produced by a resilient block of material, by an inflated sack, by one or more springs, by a fluid operated piston within a cylinder, or by other suitable resilient means.

A rectangular casing may be provided in which the links, bars and resilient element are encased and supported. The cylinder may constitute the supporting means to which flanges are attached in which the bar is cradled and which is supported on suitable attaching means. Such attaching means may be similar to those shown in the above-mentioned copending application, or may be in the nature of a bridging structure which urges the device against the sheets to be riveted from a structural element spaced therefrom. Means are provided for permitting the device to adjust itself or be adjusted against the sheets so as to be disposed normal thereto to have the swaging blows applied normal to the rivet axis.

Accordingly, the main objects of my invention are; to provide a bar which is prevented from tilting when resiliently mounted adjacent to a series of holes in sheets of material which are to be riveted together; to pivotally mount a bar on pivotal links which are interconnected by means which has a resilient pressure applied thereto; to provide a casing for housing a bar and resilient supporting means, with means for supporting the casing adjacent to sheets to be riveted together; to provide a resiliently mounted bar which is supported adjacent to sheets to be welded together having a plurality of apertures which may be spaced in any manner relative to each other through which rivets are to be inserted and swaged; to provide a cylinder having flanged projections in which a riveting bar is cradled and supported by bell cranks attached to a piston rod within the cylinder, the piston of which has pressure applied thereto for producing an oscillatory movement to the bar when blows are applied to the head of a rivet on the opposite side of the sheet; to provide supporting means for a resiliently mounted bar which positions it adjacent to sheets to be riveted while permitting the bar to adjust itself to a position normal to the axis of the rivets to be swaged; and in general, to provide a riveting bar for a plurality of rivets which are to be stuck and swaged seriatim, which is simple in construction, positive in operation and economical of manufacture.

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

Figure 1 is a sectional view of a riveting device embodying features of my invention, after a rivet has been swaged;

Fig. 2 is a sectional view of the structure illustrated in Fig. 1, taken on the line 2—2 thereof;

Fig. 3 is a sectional view of the structure illustrated in Fig. 1, taken on the line 3—3 thereof;

Fig. 4 is a broken view of the structure illustrated in Fig. 1, after the rivet has been stuck and before the end thereof has been swaged;

Fig. 5 is a view of structure similar to that illustrated in Fig. 1, showing a modified form of the invention;

Fig. 6 is a view of structure similar to that illustrated in Fig. 1, showing a further form which my invention may assume;

Fig. 7 is a view of bridging structure which may be employed with the riveting device embodied in my invention;

Fig. 8 is a sectional view of the structure illustrated in Fig. 7, taken on the line 8—8 thereof;

Fig. 9 is a view of structure similar to that il-

lustrated in Fig. 7, showing a still further form which my invention may assume;

Fig. 10 is an enlarged sectional view of the structure illustrated in Fig. 9, taken on the line 10—10 thereof;

Fig. 11 is a view of structure similar to that illustrated in Fig. 6, showing a further form which my invention may assume;

Fig. 12 is a view of structure similar to that illustrated in Fig. 11, showing a still further form of my invention;

Fig. 13 is a sectional view of the structure illustrated in Fig. 12, taken on the line 13—13 thereof;

Fig. 14 is a broken view in elevation of a riveting machine showing a further form which my invention may assume;

Fig. 15 is an enlarged broken view of the structure illustrated in Fig. 14, after the rivet heads have been forced against an element to be riveted;

Fig. 16 is a broken sectional view of the structure illustrated in Fig. 14, as viewed from the front side thereof, after the swaging operation; and,

Fig. 17 is a view of structure, similar to that illustrated in Fig. 14, showing a further form which a machine for practicing my invention may assume.

In Figs. 1 to 4, I have illustrated a riveting device 15 embodying a casing 16 and a riveting bar 17 which is pivoted to triangular links 18. The triangular links 18 are secured by pivots 19 and 21 to the walls of the casing. A bar 22 is secured by pivots 23 to the triangular links 18 to form a parallelogram connection between the bars 22 and 17 and the links 18. A flexible sack 24 is mounted between the bottom wall 25 of the casing 16 and the bar 22 and is inflated through a tube 26 which is sealed to the sack.

The casing 16 is provided with suitable means, such as that illustrated in the above-mentioned copending application, or as hereinafter described for supporting it against a pair of sheets 27 and 28 which are to be riveted together. A plurality of apertures 29 are provided in the sheets, spaced the same or different distances apart since, in the present invention, the bar 17 is capable of swaging the rivets at any point throughout its length.

When a rivet 35 is to be swaged it is placed in one of the apertures 29 and a riveting gun 31 engages the rivet head with sufficient pressure to deflect the bar 17 against the pressure provided by the sack 24 when the rivet head engages the sheet 27. Upon the application of blows by the gun 31 to the head of the rivet, the bar 17 oscillates normal to the sheets and produces a striking force for swaging the rivet end. The bar 17 may be limited in its upward movement so as to provide a space 24 beneath the sheets 27 and 28 to regulate the thickness of the swaged end on the rivet.

In Fig. 4, I have illustrated the rivet 35 after being forced by the riveting gun 31 through the aperture 29 with the head in contact with the sheet 27 and the bar 17 deflected. In view of the fact that the bar 17 is maintained in parallel position to the sheet 28 the riveting effect produced at both ends of the bars will be the same as that occurring in the middle. The parallel relation is maintained through the parallelogram formed between the links 18 and 19 and the bars 17 and 22.

In Fig. 5, I have illustrated a further form which my invention may assume that wherein a pair of bell cranks 36 are supported on the walls of the casing 16 by pins 37. One arm 38 of the bell crank is secured by a pin 39 to the bar 17 while the other arm 41 of the bell crank is joined to a pair of rods 42 by pivots 43. The ends of the rods 42 are provided with right and left hand threads joined by an internally threaded sleeve 44 by which the effective length of the rods may be adjusted. A spring 45 is mounted about one of the rods abutted against a flange 46 of an angle member 47, the opposite flange 48 of which is secured to a bolt 49 which operates in a slot 51 in the base wall 25 of the casing. A thumb nut 52 clamps the angle member 47 to the base after being adjusted to produce the proper tension in the spring 45. In this manner, a predetermined tension may be set on the spring 45 which provides a proper bias to the bar 17. It will be noted in this arrangement that a parallelogram is formed between the rod 42 and bar 17 and the bell cranks 36. The bar 17 is maintained parallel to the sheets 27 and 28 at all times, so as to be capable of swaging the end rivets as well as those near the middle portion of the bar.

In Fig. 6, I have illustrated a riveting device 54, which is similar to that shown in Fig. 5, with the exception that a single rod 55 joins the bell cranks 36 with one end of the rod secured to a piston 56. The piston operates within a cylinder 57 into which air or other fluid is introduced through a conduit 58. A parallelogram arrangement is provided between the rod 55, bar 17, and the bell cranks 36 which maintains the bar 17 parallel at all times to the sheets 27 and 28. The fluid back of the piston 56 provides the resilient pressure for oscillating the bar 17 when struck. One advantage of employing the cylinder of this type is that which permits the pressure on the piston to be readily regulated to have the movement of the bar 17 conform to the strength of the blow struck by the hammers 31.

In Fig. 7, I have illustrated a riveting device 59, having a casing 16 in which the riveting bar 17 is mounted against a rubber sack 24. The sack is inflated through the connection 26 to apply a resilient pressure to the lower edge of the bar. While in ordinary operation this particular arrangement is not as satisfactory as that employing a parallelogram connection of parts, the bar backed by the rubber sack as illustrated in Fig. 7 produces satisfactory swaging of the rivet ends of thin, soft rivets.

The casing 16 is mounted on a pair of links 61 which are supported by a pivot 62 on a casting 63. A bolt 64 extends through a cross brace 65 between the links 61 and through the casting 63. A spring 66 urges the cross brace 65 outwardly from the casting about the pivot 62, the position of which is controlled by a thumb screw 67 which adjusts the position of the links 61 relative to the casting 63. In this manner the riveting device 59 is positioned relative to the sheets 27 and 28 being riveted together.

For supporting the casing 16 against the face of the sheet 28, a block 69 of fiber, or other material, is slidably mounted within the casting 63 for engaging a brace 71 or other element which is spaced from the sheets to be riveted. A cam 72 operated by a handle 73 forces the block 69 outwardly from the casting 63. The links, casting, and the block 69 function as an extensible brace for forcing the casing 16 against the sheets. By adjustment of the handle 73 and the thumb nut 67 the riveting device 59 is located lengthwise of a series of apertures in the sheets 27 and 28 and normal to a series of rivets which may

be driven without relocating the riveting device for each rivet.

In Fig. 9, I have shown a further form which my riveting device may assume; that wherein a cradle 74 of U-shape supports a cylinder 75 on the base web thereof. A piston 76 is mounted on a rod 77 pivoted to bell cranks 36 which are supported on pivots 37 which extend through the side of the cradle 74. A riveting bar 78 is provided with a slot 79 for receiving the other arms of the bell cranks which are secured thereon by pivots 39. Slots 81 are provided in the wall of the bar 78 for spanning the pivots 37 of the bell cranks. The sides of the cradle 74 are extended at 82 for engaging the underside of the sheet 28 to be riveted.

A socket 83 is mounted on the lower web of the cradle 74, engaged by a ball 84 on a rod 85 which is connected to a piston 86 within a cylinder 87. The air or other fluid introduced to the cylinder 75 through a flexible conduit 88, is also conducted to the lower end of the cylinder 87 through a flexible conduit 89. The piston 86 is larger than the piston 76 so that a greater pressure is exerted on the cradle 74 than on the bell cranks to assure the oscillating movement application to the riveting bar 78 instead of to the piston 86. The lower end of the cylinder supports a block 91 of fiber or other material which engages a strut or other element 71 spaced from the sheet 28. The ball 84 in the socket 83 permits universal movement of the riveting device which may adjust itself relative to the face of the sheet 28 to be riveted. Fluid is applied to the cylinders through the conduits 88 and 89 which moves the riveting device away from the block 91 and forces the device against the sheets. The bar 78 is spaced from the sheets and is further deflected by the rivet when the gun 31 forces the head of the rivet against the outer surface of the sheet 27. This construction permits the end of the bar 78 to be located directly in the corner beneath the sheets being riveted so that the corner rivet may be engaged by the bar.

In Fig. 11, I have illustrated a riveting device 92 having a casing 93 provided with end flanges 94 which are supported against the sheet by expanding pins 95. The riveting bar 79, bell cranks 36, rod 77, piston 76, and cylinder 75 are similar to those hereinabove described. In this particular arrangement, the casing 93 is supported directly on the sheets by the expanding pins which are utilized when no strut or other element is present against which the expansible structure could abut.

In Figs. 12 and 13, I have illustrated a still further form of riveting device 96, wherein a cylinder 97 has stirrups 98 attached to each end, the sides of which form spaced flanges 99, the ends of which engage the underface of the sheet 28 to be riveted. Bell cranks 36 are supported on the projecting flanges 99 by pins 37, one arm being connected by a pin 39 to the riveting bar 78, the other end being connected by pivots 43 to a rod 77. The rod has a piston 101 secured thereto while a cylinder head 102 is secured to the cylinder wall and sealed on the rod 77. Fluid is introduced into a cylinder between the head 102 and piston 101 through a tubular opening 103 in the cylinder wall.

The projecting flanges 99 of the stirrups 98 support trunnions 104 at each end which extend through an aperture in the end of a V-shaped yoke 105. The yoke is mounted on a block 106 of fiber or other suitable material, which engages a strut or other element 71 which is spaced from the sheets 27 and 28 which are to be riveted. Rivets 107 extend through the block 106 and through slots 108 in the ends of the yoke. The slots in the yoke permit relative movement between the block 106 and the yoke, affected by a cylinder 109 having a piston 110 on a rod 115 which is secured to the block. Fluid is introduced to the cylinder through the flexible conduit 111 which moves the piston and the block 106 outwardly to thereby clamp the riveting device 96 against the sheets from the strut 71. By providing the trunnions 104 on the projecting flanges 99 of the collar 98 the weight of the device is centered below the trunnion and the bar 78 is always supported in a vertical position. This simplifies the adjustment of the bar relative to the sheets to be riveted when the device is clamped into position.

It is to be understood that while I have illustrated different mounting mean for the various types of devices illustrated, the mounting means are interchangeable so that any of the devices may have employed therewith any of the mounting means of other devices illustrated. The various devices and mounting means were shown for the purpose of illustration and it is to be understood that various shapes, forms and lengths of riveting bar will be required for the various shapes, and lengths of the sheets to be assembled together. In some instances the extensible device may be employed with the riveting device capable of swaging corner rivets, while at other times the expanding pins 95 satisfactorily support the riveting device to a central portion of the sheets being riveted.

It is to be understood that the yoke 105 illustrated in Figs. 12 and 13 may be attached to trunnions 112 mounted on plugs 113 provided on the end of the cylinder 97. In this arrangement the projecting portions of the flanges 99 will be eliminated so that the bar 78 may abut a corner of the structure being riveted so that the corner rivets may be swaged thereby. Limit stops 114 are provided on the plugs 113 for limiting the swinging movement of the riveting device on the yoke.

In all the structures illustrated, it will be noted that support is provided for the device against the sheet while the riveting bar is spaced therefrom. This spacing may be accurately set to regulate the amount of swaging performed on the heads of the rivets, or it may be selected so as to permit the bar to be deflected when a rivet is forced through an aperture in the sheets. When the casing about the riveting bar is eliminated, the bar may be disposed against a corner sheet so as to be able to swage the end of the corner rivet. The parallel arrangement of the riveting bar, the links, and the rod eliminates the chance of the bar tilting when swaging the ends of the endmost rivets. When maintaining the bar parallel to the sheets to be riveted, with all parts of the bar balanced against a resilient element, all points of the bar will react to swage the rivet end in exactly the same manner. By using the bar, the spacing of the rivets becomes inconsequential and they may be spaced a greater or lesser amount in different or the same rows. It is within the purview of my invention to curve the bar to follow rows of rivets which are disposed on a curve on flat or arcuate surfaces to engage and swage the ends of the rivets in the same manner as the flat straight bars herein illustrated and described.

In Figs. 14 to 17 inclusive, I have illustrated a machine which may be constructed to practice

the method embodies in my invention and illustrated in the structure of Figures 1 to 13 inclusive.

Referring more specifically to Figs. 14, 15, and 16, a machine 116 is illustrated, having a base 117 and a standard 118. The standard 118 supports an hydraulic ram 119 on the ram portion of which a riveting gun 121 is included. The gun embodies a striking piston 123 and suitable ports and passageways conventionally employed but not herein illustrated. The riveting gun portion 121 has a riveting head 124 on the end which is of material length to engage a plurality of rivet heads simultaneously. The backing up device is similar to that illustrated in Figs. 12 and 13 with the exception that a pressure cylinder 125 is mounted on the top plate 126 of the bed.

Fluid is provided by a conduit 127 through a conduit 128 to a foot operated valve 129, a pressure regulating valve 131, a gauge 132, and to the cylinder 125. The use of the gauge 132 and the regulating valve 131 was found to be of importance since the correct operation of the riveting bar 78 depended upon the amount of striking force provided by the riveting gun 121. It was found when swaging individual rivets that fourteen pound pressure produced very slow swaging effect and that twelve pound pressure produced rapid swaging of the rivet ends. The two pounds difference in pressure produced a wide variation in the time of the riveting operations and the control of the pressure in the cylinder 125 permits the pressure on the bar 78 to be adjusted relative to the force of the blows struck by the riveting gun.

A four-way valve 133 is connected to the supply conduit 127 by a conduit 134. A pair of conduits 135 and 136 connect the valve to the ends of the ram 119. Similarly a conduit 138 is connected to the supply conduit 127 and to a valve 137 from which a supply conduit 139 leads to the riveting gun 121. The sheet 27 to be riveted to the angle members 141 is disposed within the machine after the rivets have been inserted in the apertures through the sheet and members. The heads of the rivets are aligned with the riveting head 124 of the gun 121 and with the bar 78. Pressure is applied to the ram 119 when the valve 133 is operated to move the riveting head 124 downward to engage the rivets as the foot valve 129 is operated to move the riveting bar 78 upwardly. The ends of the rivets are in pressure engagement with the top surface of the bar 78 when the heads of the rivets engage the surface of the sheet 27. The valve 137 is then operated to reciprocate the piston 123 of the gun 121 which provides striking blows to the heads of the rivets. The blows oscillate the riveting bar 78 which simultaneously swages the ends of the rivets as illustrated in Figs. 14 and 16. In Fig. 15, I have illustrated the position of the rivets after the heads are forced against the sheet 27 by the riveting head 124 and the riveting bar 78 has been deflected by the rivet ends.

After the rivets have been swaged, the valves 137 and 133 are returned to their original position and pressure may then be released from the bar 78 by the release of the foot valve 129. It is to be understood that the foot valve 129 may be eliminated and a valve similar to valve 137 substituted therefor. This substitute valve may be retained in "on" position between riveting operations since the bar 78 is limited in its upward movement by a pair of locking nuts 142 which abut against the cylinder head 102 and thereby limit the upward movement of the bar. The pressure of the ram 119 is sufficient to have the rivet ends deflect the bar 78 when the ram is moved downwardly against the sheet.

In Fig. 17, I have illustrated a ram 143 which is directly connected to a riveting head 124. The riveting bar 78 is supported on a pair of bell cranks 36 which are interconnected by a rod 144 which projects within a hammer 145. The ram 143 forces the riveting head 124 and the rivets into contact with the sheet 127 and the gun 145 forces the bar 78 against the rivet ends and applies hammer blows to the rivet ends which swages the rivets. The machines illustrated in Figs. 14 to 17 were shown by way of examples and it is to be understood that the shapes of the rams, gun, and riveting bar, as well as the supporting structure therefor will vary from that illustrated and conform to the shape of the elements to be riveted together. In such machines one row of rivets after another may be swaged as the sheet and elements are advanced to the riveting position.

It will be noted in the various types of guns illustrated that provisions have been made for limiting the movement of the various riveting bars to prevent the bars from projecting above the supporting structure for the sheet. In Fig. 1, an adjustable screw 146 is employed for engaging the interconnecting element 22 of the links 18. In Fig. 5, I have illustrated the pair of clamping nuts 142 which abut against the angle member 47 to thereby limit the upward movement of the bar 17. In Fig. 6, I have illustrated the adjusting screw 146 supported in a position to engage the bell crank 36. These adjustable stop elements are illustrated by way of example and it is to be understood that other means may be employed for limiting the upward movement of the bar, such as the flange 148 on the casing 16 illustrated in Fig. 7.

What I claim is:

1. In a riveting device, a cylinder, flanges projecting upwardly from said cylinder and spaced from each other, a riveting bar disposed between said flanges, links interconnecting the bar to said flanges, a piston rod in said cylinder, means for connecting the piston rod to said links, and means for supporting the assembly in position to have the flanges abut a sheet having apertures through which rivets are to be stuck and swaged.

2. In a riveting device, a cylinder, upwardly projecting spaced flanges on said cylinder, a riveting bar disposed between said flanges, a piston within the cylinder, a piston rod on said piston, bell cranks pivoted on said flanges and to said bar and rod, and means for conducting fluid to said cylinder for applying a pressure to said bar.

3. In a riveting device, a cylinder, upwardly projecting spaced flanges on said cylinder, a riveting bar disposed between said flanges, a piston within the cylinder, a piston rod on said piston, bell cranks pivoted on said flanges and to said bar and rod, means for conducting fluid to said cylinder for applying a pressure to said bar, and means for limiting the movement of the bar relative to the projecting ends of the flanges to have the surface of the bar spaced from the surface of the sheet to be riveted.

4. In a riveting device, a cylinder, upwardly projecting spaced flanges on said cylinder, a riveting bar disposed between said flanges, a piston within the cylinder, a piston rod on said piston, bell cranks pivoted on said flanges and to said bar and rod, means for conducting fluid to said cylinder for applying a pressure to said bar, means for limiting the movement of the bar relative to the projecting ends of the flanges to have the surface

of the bar spaced from the surface of the sheet to be riveted, and means for adjusting said limiting means for regulating the thickness of the swaged rivet end.

5. In a riveting device, a riveting bar, a pair of bell cranks pivoted to the bar, means for pivotally supporting said bell cranks, an element also pivoted to the bell cranks and disposed in parallel relation to the bar, and resilient means reacting on said element for applying a resilient pressure to said bar.

6. In a riveting device, a riveting bar, a pair of bell cranks having angularly disposed arms, pivots for joining the ends of one set of arms to said bar, an element disposed in parallel relation to the bar, pivots for joining said element to the ends of the other set of arms, resilient means reacting on said element for applying a resilient pressure to said bar, means for pivotally supporting said bell cranks near the angle portion of said arms, and means for adjusting the pressure applied by said resilient means.

7. A riveting device including, in combination, spaced supporting means, bell cranks having their medial portions pivoted on said supporting means, a riveting bar pivoted on said bell cranks near one end thereof, an interconnecting bar parallel to said riveting bar and pivoted to said bell cranks near the other end thereof, and resilient means applying pressure to said bars which permits relative movement therebetween while they are retained in parallel relation.

8. In a device for backing up a plurality of rivets including, in combination, a movable bar for spanning a plurality of apertures in a sheet to be riveted, a movable element spaced from said bar, spaced bell cranks pivotally joining said element and bar for retaining them in parallel relation in all positions, means for applying a resilient force to said bar, and means to which said bell cranks are pivoted for supporting the bar in position to engage said sheet.

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