ABSTRACT

A device providing automated riveting service, in the operation of which the rivet is engaged, transported to a riveting station, and has its plain end hammered into a head shape, the only manual operations being required being the placement of the plates or the like to be riveted together over said rivet and the removal thereof after completion of the riveting procedure.

6 Claims, 9 Drawing Figures
RIVETING DEVICE

The present invention relates generally to an improved riveting mechanism or device, and more particularly to a device in which manual rivet-handling operations are eliminated to significantly facilitate the riveting procedure.

The mechanized system of riveting contemplated herein requires engagement of the rivet and the delivery thereof to a work or riveting station where the plain end of the rivet is hammered into a head shape to complete the connecting function of the rivet. To achieve the foregoing without malfunction, it is further required that the means engaging the rivet be disengaged therefrom prior to the formation of the head shape, or else said means will be inadvertently caught by the rivet. However, while permitting the aforesaid disengagement of the rivet, said rivet must nevertheless be at all times under proper control for fulfillment of its positioning and other such requirements of the within automated procedure.

Broadly, it is an object of the present invention to provide an improved automatic riveting device embodying the foregoing requirements, and otherwise overcoming such and other contradictory aspects of automated riveting service heretofore not completely satisfactorily achieved by prior art devices. Specifically, it is an object to provide a device in which the elongation in the plain end of the rivet, prior to its being hammered into a head shape, is advantageously used in the functioning thereof; said elongated rivet being engaged by the hammer and initially useful in providing clearance for a camming stroke which clears the rivet of its holding means, and only thereafter being hammered into its head shape.

An automatic operating riveting device demonstrating objects and advantages of the present invention includes a cooperating pair of rivet holders which are closed in holding relation about a rivet delivered therebetween and carry the same to a riveting station at which a hammer drives the rivet into contact with an anvil and starts to shape the plain end thereof into an appropriate head shape. This shaping causes descending movement in the rivet holders against a camming surface which cam the same apart and thus out of engagement with the rivet, thereby permitting further unimpeded head-shaping movement in the hammer. When the rivet holders disengage from the sides of the rivet, the rivet is then firmly engaged at its opposite ends between the hammer and anvil and thus is under proper control.

The above brief description, as well as further objects, features and advantages of the present invention, will be more fully appreciated by reference to the following detailed description of a presently preferred, but nonetheless illustrative embodiment in accordance with the present invention, when taken in conjunction with the accompanying drawings, wherein:

FIG. 1 is a perspective view of the riveting device hereof showing the general relationship of the parts thereof;

FIG. 2 is a side elevational view, on an enlarged scale, showing details of the construction of the device;

FIG. 3 is an isolated side elevational view, in section taken on line 3-3 of FIG. 1, illustrating details of the rivet holders of the device hereof;

FIG. 4 is an isolated front elevational view, projected from FIG. 1, showing further details of the rivet holders; and

FIGS. 5A-E, respectively, are partial front elevational views, partly in section, progressively illustrating a typical riveting operation.

Reference is now made to the drawings, and in particular to FIGS. 1-4, wherein there is shown a device, generally designated 10, which effectively automates the riveting process. That is, in the operation of device 10, a rivet 12 is individually fed from a hopper 14 or other supply source to a rivet-dispensing or work station 16. In a manner which will be described in detail subsequently, the rivet 12 is engaged at station 16 in an appropriate position which orients its elongated body vertically and thus in a manner to be advantageously inserted through openings in two or more plates that are to be riveted together. First, however, the rivet 12 is transported to a riveting station 18 at which two or more plates 20, 22 (see, for example, FIG. 2) are placed over the upstanding elongated body of the rivet 12. Next, the plain end of the rivet is shaped or hammered into a head by a hammer 24, thereby completing the riveting together of the plates 20 and 22. During all of the foregoing, there are no manual operations required, except for the placement of the plates 20, 22 over the rivet 12.

The foregoing mechanismized system of riveting achieved by the device 10, as just generally described, requires engagement of the rivet at a dispensing station, such as station 16, and the delivery of such rivet while it is still engaged to the riveting station, such as station 18. Before the riveting operation is completed, it is of course necessary that the rivet engaging means be disengaged from the rivet, or else there will be interference with the riveting operation. Incorporated in device 10, as will now be described in detail, are unique means for engaging and holding the rivet 12 preparatory to the riveting operation, which means are then effectively disengaged and moved to an out-of-the-way clearance position before they can be damaged by the power stroke of the hammer 24 which completes the riveting operation.

As best illustrated in FIG. 4 in conjunction with FIGS. 1-3, device 10 includes an elevated guide member 26 on which there is slidably disposed for reciprocating movement between the stations 16 and 18, as along horizontal track grooves 27, a U-shaped body including opposite leaf springs 28 and 30 connected at locations 31 so as to extend on opposite sides of the guide member 26. The leaf springs 28 and 30 support a cooperating pair of rivet holders 34 and 36 which are normally biased by said springs 28, 30 into a normally closed relationship with each other. When the holders 34 and 36 are in position at station 16, as illustrated in FIGS. 1, 3, 4 and 5A, there is an opening 40 which is then in alignment with the end opening 42 of a rivet delivery tube 44 whose opposite end is connected to the rivet hopper 14. In response to an air pulse delivered via conduit 46 connected to the tube 44, a single rivet 12 is effectively propelled through the tube 44 and ejected from the tube opening 42 so that the body 48 of rivet 12 projects through the opening 40 and the head 50 thereof seats behind the opening 40. A conical cam surface 45 on the upper end of the tube 44 is effective in slightly camming apart the holders 34, 36 so that the rivet 12, supported by the pressure air forced
through the tube 44, fits between said holders. However, when the holders 34, 36 are eased off the cam surface 45, said holders close upon the rivet body 48.

At this point in the description, it is convenient to note that, for brevity's sake, there has been omitted a detailed description of the construction and mode of operation of an appropriate feeder 52 which operates in a well understood manner to separate individual rivets from the source of supply being stored in the hopper 14 and which orients these rivets with their bodies 48 as the leading end preparatory to the transportation thereof through the tube 44 to the station 16. A preferred feeder 52 for achieving this is one utilizing the "Scason System" manufactured by Scason of Stockholm, Sweden.

Following the positioning of a rivet 12 for engagement by the rivet holders 34 and 36 at station 16, air cylinder 54 is operated to cause sliding movement 56 in holders 34, 36 along the tracks 27 to the riveting or work station 18, the extent of such sliding movement being appropriately controlled by a mechanical stop or the like in the path of movement 56. At station 18, the rivet holders 34, 36 position the engaged rivet 12 therebetween over an anvil 58 disposed on guide member 26, and having an upper conical camming surface 59, the significance of which will soon be apparent. Arranged in facing relation to the anvil cam surface 59 are cooperating camming surfaces 66 on each of the holders 34 and 36. Thus, descending movement 60 of the holders 34, 36 is, in effect, a camming stroke, during which the camming surfaces 59 and 66 come into camming relation with each other with the result that each of the leaf spring bodies 28 and 30 are bent apart, so that the holders 34, 36 are correspondingly spread apart, or urged through opening movement 68. In this manner, the holders 34 and 36 are retracted clear of the vertical plane of the power stroke 70 of the hammer 24 prior to completion of the riveting operation, and thus there cannot be any inadvertent engagement of the edges of the holders 34 and 36 between the bottom plate 22 and the rivet head 50. Further, although the holders 34 and 36 are cleared during the initial portion of the hammer power stroke 70, the rivet 12 nevertheless is at all times under proper engagement and control. This can be best appreciated by progressive reference to FIGS. 5A, 5B, 5C, 5D and 5E, in which it is most clearly illustrated that there is considerable length in the rivet body 48 since the plain or upper end thereof provides the mass out of which a head shape 72 (see FIG. 5E) is hammered to cooperate with the formed head 50 to complete the riveting together of the plates 20 and 22. This elongation of the rivet body 48 is used to advantage in that it permits effective use to be made of the rivet 12 in so far as being pushed into contact against the anvil 58 during the initial portion of the power stroke 70 and thus in establishing holding contact at opposite ends of the rivet before release of the same, and also in so far as proving clearance for withdrawing movement of the holders 34, 36. That is, when hammer 24 first contacts rivet body 48, this initial contact results in descending movement in rivet 12 until rivet head 50 contacts the top of anvil 58, all as is progressively illustrated in FIGS. 5B and 5C. At this point, continued movement of the hammer 24 results in descending movement 60 in the plates 20, 22 as the plain rivet end starts to collapse within the head shaping cavity 61. This descending movement produces corresponding descending movement 60 in the holders 34 and 36 along vertical tracks 63 (see FIG. 4) provided between the structures mounting the leaf springs 28, 30 and the structures 65 which are horizontally slidable on the guide 26. Thus the middle portion of the hammer stroke 70 causes descending movement in the holders 34, 36 and thus in the camming stroke thereof. As already explained, the result of this camming stroke is the camming contact of the cam surfaces 59 and 66 with each other and thus the opening movement 68 of holders 34 and 36, thereby causing release of the rivet 12 and the movement of the holders into out-of-the-way clearance positions. As this crucial time, however, the rivet 12 is firmly in engagement between the anvil 58 and the striking end 74 of the hammer 24. Ultimately, the holders 34 and 36 are squeezed from beneath the plates 20, 22 to the extent illustrated in FIG. 5E. Thus the holders 34, 36 do not impede or otherwise interfere with the continued power stroke 70 of the hammer 24 which results in the hammering or forming of the plain end 48 of the rivet into the previously noted head shape 72, thereby completing the riveting together of the plates 20 and 22. Hammer 24 is then raised into its ready position permitting withdrawal of the riveted together plates 20 and 22 and the riveting procedure, as described herein, is then repeated. Preparatory thereto, springs 67 (FIG. 4) raise the holders 34, 36 to their normal elevated position above the anvil cam surface so that the urgency in their leaf spring bodies 28, 30 can again close the rivet engaging portions thereof.

It is contemplated that the hammer 24 be urged through its power stroke 70 by a unique force transmitting mechanism, as illustrated in FIGS. 1 and 2. Specifically, hammer 24 is operated by an air pressure cylinder 76, the piston rod 78 of which, as clearly shown in FIG. 2, being connected via an intermediate power transmitting link 80 to the free end 82 of the hammer 24 which is pivotally mounted, as at 84, on an integral upstanding post 86 of the guide member or body 26 of the device 10. When the hammer 24 is in its raised ready position, rod 78 is in its fully extended position from the cylinder 76 and the link 80 is in a corresponding angular orientation as illustrated in phantom perspective in FIG. 2. A support roller 88 is appropriately journalled for rotation at the juncture of the interconnection of the rod 78 with the link 80, and such roller is in rolling contact with a rolling surface 90 formed along the guide member 26 rearwardly of the post 86. Thus, when air cylinder 76 is operated and the rod 78 thereof is retracted through its power stroke, there is movement of roller 88 along the surface 90 and the angularly oriented link 80 is thrust into an upright position thereby causing pivotal clockwise movement in the hammer operative end 82 which, in turn, causes the striking end 74 of hammer 24 to be urged through closing movement 70 upon the anvil 58. In this manner, support surface 90 provides support for the force load that is applied by the hammer end 74 against the rivet body 48, which force load will be understood to be adequate to result in the formation of a head shape 72 on the plain rivet end 48. After the plates 20 and 22 are riveted together, air cylinder rod 78 is extended from the air cylinder 76 resulting in opening movement of the hammer 24 from about the plates, and the device 10 is then in condition for repetition of the riveting service as just described.
From the foregoing, it should be readily appreciated that device 10 is capable of mechanized or automatic handling of rivets 12 in rapid cyclical operation with the only manual requirement being the placement of the plates 20 and 22 over the upstanding rivet body 48 and the removal of these plates after they have been riveted together.

A latitude of modification, change and substitution is intended in the foregoing disclosure, and in some instances some features of the invention will be employed without a corresponding use of other features. Accordingly, it is appropriate that the appended claims be construed broadly and in a manner consistent with the spirit and scope of the invention herein.

What is claimed is:

1. A riveting device comprising means forming an elevated guide member for the operable moving parts thereof, a rivet-dispensing station formed adjacent one end of said guide member including a conduit connected to a supply source of rivets, an upstanding anvil disposed on said elevated guide member having a camming surface arranged thereon, a hammer in striking relation to said anvil operatively arranged to be urged through a power stroke from a clearance position into adjacent position with said anvil, and rivet-holding means slidably disposed on said elevated guide member for reciprocating sliding movement between said rivet-dispensing station and said anvil and also disposed for limited descending movement relative to said anvil, said rivet-holding means comprising a body slidably mounted on said elevated guide member, a cooperating pair of leaf springs and rivet holders on said body operatively arranged to be normally closed in holding relation about a rivet delivered therebetween at said rivet-dispensing station, and a camming surface on said rivet holders adapted to be contacted by said anvil camming surface incident to descending movement of said rivet holders as caused by said hammer during said power stroke thereof, whereby said rivet holders are correspondingly urged through opening movement releasing said rivet, but only after said rivet is engaged between said hammer and said anvil.

2. A riveting device as claimed in claim 1 wherein said hammer is pivotally mounted on said guide member at a point intermediate its opposite operative and striking ends and has its said operative end connected to an angularly oriented link interposed between said hammer and an air cylinder piston rod, whereby the power stroke movement of said piston rod thrusts said angularly oriented link into a vertical orientation causing pivotal movement in said hammer.

3. A riveting device as claimed in claim 2 including a roller at the interconnection of said air cylinder piston rod and said link and wherein said guide member has a rolling surface in supporting relation beneath said roller.

4. A riveting device comprising means forming an elevated guide member for the operable moving parts thereof, a rivet-dispensing station formed adjacent one end of said guide member including a conduit connected to a supply source of rivets, an upstanding anvil disposed on said elevated guide member, a hammer in striking relation to said anvil pivotally mounted on said guide member at a point intermediate its opposite operative and striking ends so as to be urged through a power stroke from a clearance position into riveting relation with said anvil, an air cylinder having a piston rod and an angularly oriented link interposed between said hammer and said air cylinder piston rod, whereby the power stroke movement of said piston rod thrusts said angularly oriented link into a vertical orientation causing pivotal movement in said hammer.

5. A riveting device as claimed in claim 4 including a roller at the interconnection of said air cylinder piston rod and said link and wherein said guide member has a rolling surface in supporting relation beneath said roller.

6. A riveting device as claimed in claim 4 including a camming surface on said anvil and rivet-holding means slidably disposed on said elevated guide member for reciprocating sliding movement between said rivet-dispensing station and said anvil and also disposed for limited descending movement relative to said anvil, said rivet-holding means comprising a body slidably mounted on said elevated guide member, a cooperating pair of leaf springs and rivet holders on said body operatively arranged to be normally closed in holding relation about a rivet delivered therebetween at said rivet-dispensing station, and a camming surface on said rivet holders adapted to be contacted by said anvil camming surface incident to descending movement of said rivet holders as caused by said hammer during said power stroke thereof, whereby said rivet holders are correspondingly urged through opening movement releasing said rivet, but only after said rivet is engaged between said hammer and said anvil.