

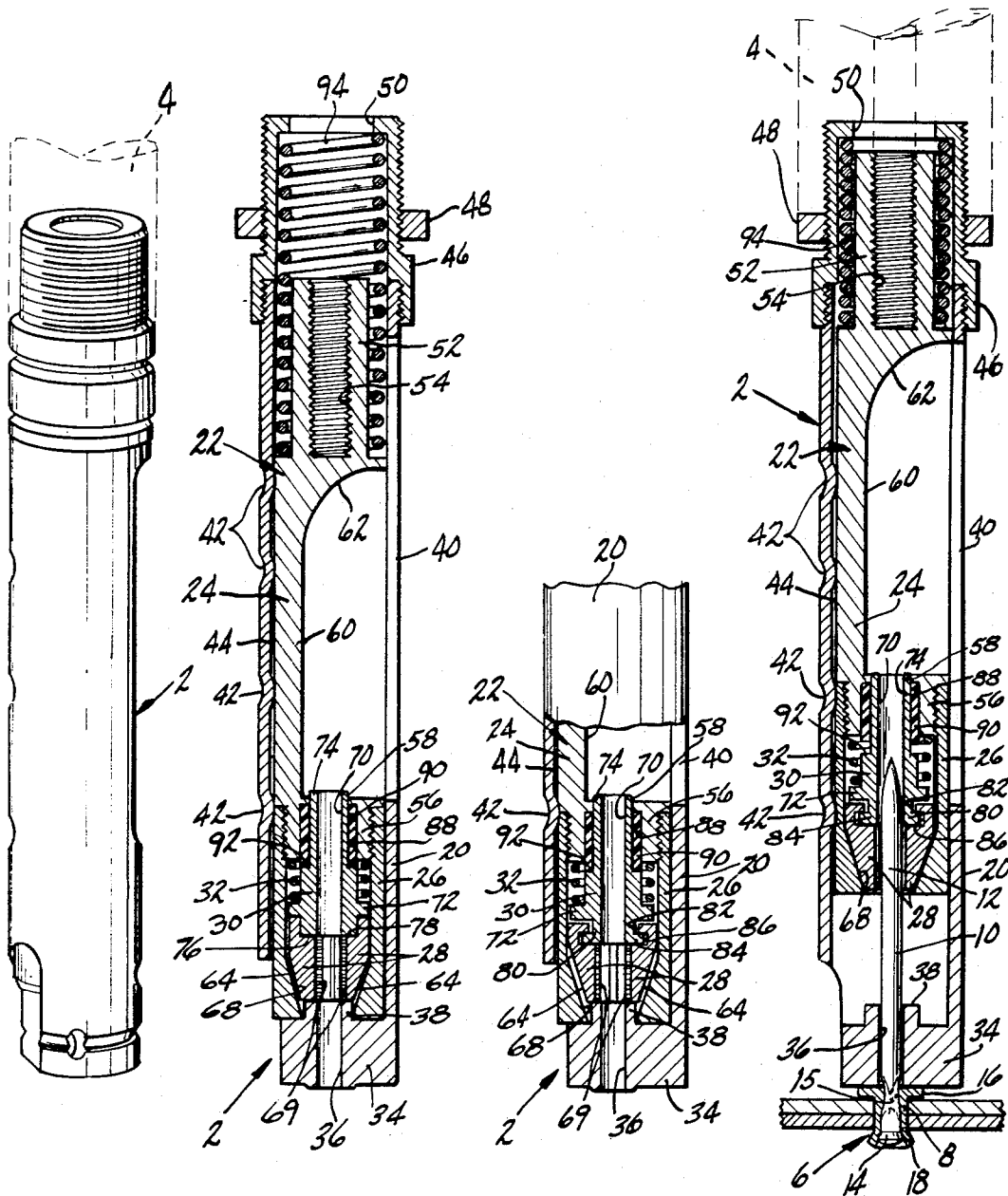
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RIVET TOOL

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RIVET TOOL

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This invention relates generally to a riveting tool, and more particularly to a riveting tool of the type employed for setting blind rivet assemblies wherein the riveting forces are all applied from one side of the work.

Tools of the above type are used to set a rivet assembly which includes an elongated mandrel having an enlarged head portion at one end and a gripping portion at the other. A rivet is positioned on the mandrel with its tail portion adjacent the head of the mandrel and its head positioned adjacent the gripping portion. Such tools and rivet assemblies are used in many different operations wherein it is desired to fasten two members together. Needless to say, the number of rivet setting operations performed by a tool over a period of time is quite large. Accordingly, the industry demands that such tools be capable of withstanding a large number of rivet setting cycles without failure.

Tools of the above type may include a pulling head adapted to be attached to an actuator which is energized pneumatically, hydraulically, electrically, or otherwise. The pulling head of one particular design includes a housing member having a drawbolt with an attached collet positioned therein for axial movement by the actuator. A plurality of jaw members are floatingly positioned within the collet with a spring biased follower urging them into their gripping position.

In connection with pulling heads of the type described above, it has been found that such pulling heads are unusable after a relatively few number of cycles. In particular, it has been found that the jaw follower and jaw members are subject to failure. In addition, severe peening has occurred at certain places on the drawbolt rendering it unsuitable for additional use. After extensive investigation, it has been found that these occurrences are due to the impact of the jaw follower on the drawbolt occurring immediately after the mandrel of the rivet assembly breaks.

Accordingly, it is an object of this invention to provide a riveting tool wherein the rate of failure of the various elements is reduced.

Yet another object of this invention is to provide a riveting tool having an increased service life.

More specifically, it is an object of this invention to eliminate the foregoing problems of prior riveting tools by providing a tool wherein the impact between the drawbolt and jaw follower is buffered.

These and other objects of the present invention may be accomplished by the provision of a rivet tool including tubular housing means having drawbolt means axially movable therein.

Floating jaw means are provided within the drawbolt means. A jaw follower is positioned rearwardly of the jaw members and spring biased forwardly. Resilient buffer means are disposed between the drawbolt means and the jaw follower to prevent impact of the jaw follower against the drawbolt in an axial rearward direction.

The above objects may be more readily understood by

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reference to the following description and to the accompanying drawings in which:

FIGURE 1 is a perspective view of a riveting or pulling head of the riveting tool of this invention;

FIGURE 2 is an enlarged sectional view of a pulling head showing one embodiment of the follower and jaw members;

FIGURE 3 is an enlarged sectional view of a pulling head showing a second embodiment of the follower and jaw members; and

FIGURE 4 is a view similar to FIGURE 3, but showing the tool acting upon a rivet assembly with the component parts shown in their respective positions immediately before the mandrel of the rivet assembly breaks.

Referring to the drawings, the numeral 2 designates a riveting tool of the present invention which is operable by an actuator 4 (outlined in phantom) of any suitable type which may be energized pneumatically, hydraulically, electrically, or otherwise. As shown in FIGURE 4, the riveting tool 2 may be used in conjunction with a rivet assembly 6 which includes a tubular rivet 8 mounted on a mandrel 10. The mandrel 10 includes a gripping portion 12 and an enlarged head portion 14 separated by a weakened portion 15. The tubular rivet 8 includes an enlarged head portion 16 which is positioned adjacent the gripping portion 12 of the mandrel 10, and an elongated tail portion 18 terminating at the head portion 14 of the mandrel 10.

Considering the rivet tool itself, it includes an outer tubular housing 20 having drawbolt means 22 disposed within for axial movement. The drawbolt means 22 include a drawbolt 24 having a collet 26 attached to the forward end thereof. Jaw members 28 are positioned within the collet 26 and are urged forwardly and into their gripping position by the jaw follower 30 which is biased by spring 32.

The outer tubular housing 20 includes a forward end portion 34 having a bore 36 therethrough for the reception of the mandrel 10 of the rivet assembly 6. A boss 38 projects axially inwardly from the internal surface of portion 34 in concentric alignment with the bore 36. An axially extending slot 40 is provided in the wall of housing 20 to provide an escape for the mandrel 10 after it breaks. A plurality of axially spaced detents 42 extend inwardly from the wall of the housing 20 in opposed relation to the slot 40. The drawbolt 24 and collet 26 are provided with an axially extending groove 44 whereby relative rotation between the drawbolt means 22 and the housing 20 is prevented.

A retaining cap 46 is threadably secured to the rearward end of the housing 20. The outer surface of the retaining cap is threaded to provide means for connecting the tool to a suitable actuator. A locknut 48 is provided to maintain the proper connection. An aperture 50 in the cap provides an opening for the pulling rod of the actuator.

The drawbolt 24 includes a reduced tubular rearward end portion 52 which is internally threaded as indicated at 54 for connection to an externally threaded pulling rod of the actuator 4. The forward end 56 of the drawbolt 24 is reduced and externally threaded for connection with the collet member 26. A bore 58 extends through forward end 56. An axially extending slot 60, communicating with the bore 58, is provided in the drawbolt 24 and is held in alignment with the slot 40 in the

housing 20 by detents 42. The rearward end 62 of the slot is curved to facilitate the removal of the mandrel 10 after it breaks.

The jaw members 28 are floatingly positioned within the collet member 26. The outer surface 64 of each of the jaw members 28 includes a tapering portion 66 having a taper corresponding to the taper of the forward internal surface 68 of the collet member 26. The inner surface of each of the jaw members 28 is provided with mandrel gripping teeth 67.

The jaw follower 30 includes an axial bore 70 and a circumferential flange 72. The jaw follower 30 is positioned rearwardly of the jaw members 28 within the collet member 26 with its rearward extension 74 extending through the bore 58 in the forward end of the drawbolt 24. The follower spring 32 is positioned between the forward face of the drawbolt 24 and the flange 72 of the jaw follower 30 to urge the jaw follower, as well as the jaw members, forwardly within the collet member 26.

In the embodiment shown in FIGURE 2, the forward face 76 of the jaw follower acts directly upon the rearward face 78 of the jaw members 28.

In accordance with the embodiment shown in FIGURE 3, the jaw follower 30 includes a forward extension 80 having a circumferential groove 82 spaced from its forward end to provide a flange 84. Each of the jaw members 28 are provided with a circumferentially extending groove 86. The jaw members are so positioned that the flange 84 of the jaw follower 30 is received within the grooves 86. The width of the groove 86 should be slightly greater than the thickness of the flange 84 of the jaw follower 30 to permit some rocking motion of the jaw members 28. By virtue of this arrangement, proper centering of the jaw members 28 is insured.

The forward end 56 of the drawbolt 24 is provided with a counterbore 88. Buffer member 90 is positioned in the counterbore 88 and extends slightly forward from the drawbolt 24. The buffer member is preferably of elastomeric material and in accordance with the preferred embodiment, it comprises a cylinder of urethane having a Shore A durometer hardness of 95 as measured by A.S.T.M. method D-2240. The jaw follower 30 in both embodiments is provided with a shoulder 92 for abutment with the forward face of the buffer 90 upon rearward movement thereof.

A spring member 94 extends between the top of the retaining cap 46 and shoulder 96 on the drawbolt 24 to urge the drawbolt means forwardly in the housing 20. In the normal position of the tool, the spring 94 forces the forward face 98 of the drawbolt means 22 into engagement with the internal surface of end portion 34 of the housing 20. The boss 38 extends into the collet 26 and holds the jaw members rearwardly therein and in an expanded condition so that the mandrel 10 can be conveniently inserted through bore 36.

In operation, after the gripping portion 12 of the mandrel 10 is inserted through bore 36 up into the cavity between the jaw members, the tail portion 18 of the rivet is inserted through the work pieces. The forward face of the housing member 20 is positioned against the head 16 of the rivet to exert pressure thereon. The rod member of the actuator 4 pulls the drawbolt means 22 rearwardly in the housing 20. This rearward movement causes the tapered surface 68 of the collet 26 to press the jaw members radially inward in gripping engagement with the mandrel 10. Continued rearward movement of the drawbolt means 22 pulls the head portion 14 of the mandrel 10 into the tail portion 18 of the rivet 8 causing the tail to expand as shown in FIGURE 3. The expansion continues until the mandrel 10 breaks at the weakened portion 15. At this point, due to the sudden release of the load, the inertia of the jaw members 28 and jaw follower 30 causes them to move rearward relative to the collet member 26 whereupon the buffer member 90

will absorb impact between the jaw follower and forward face of the drawbolt 24.

After the actuator 4 has completed its stroke, spring 94 returns the drawbolt means 22 to their forward or normal position shown in FIGURES 2 and 3. The boss 38 causes the jaw members 28 to open whereupon the mandrel can pass into slot 60 in the drawbolt 24 and out through the slot 40 in the housing.

To illustrate the advantages of the present invention, the embodiments of FIGURES 1 and 2 were tested both with and without the urethane buffer. The testing consisted of snapping 1/8-inch steel and 3/16-inch aluminum mandrels using a tool having the appropriate bore in the forward end of the housing. In the case of the embodiment of FIGURE 1, but without a buffer member, there was failure after 3,900 cycles. In the case of the embodiment of FIGURE 2, but without a buffer, there was failure in the area of the grooves in the jaw members after 2,100 cycles. However, in the case of both embodiments utilizing a urethane buffer of 95 durometer hardness, after 10,000 cycles there was no sign of failure. A total of 20,000 cycles produced some wear on the buffer, but the tool was still usable.

Various other modifications and alterations will suggest themselves readily to persons skilled in the art. It is intended, therefore, that the foregoing description be considered as exemplary only, and that the scope of the invention be ascertained from the following claims.

What is claimed is:

1. In a rivet tool for use with a rivet assembly including a breakable mandrel having axially spaced tail flaring means and grippable means and which includes a tubular rivet on said mandrel having a tail portion adjacent the tail flaring means and a head portion adjacent the grippable means, the combination of housing means, drawbolt means within said housing means, floating jaw means within said drawbolt means, a jaw follower for urging said jaw means into gripping engagement with a mandrel, and resilient buffer means disposed between said drawbolt means and said jaw follower to absorb the impact of said jaw follower on said drawbolt upon relative rearward movement of said jaw follower after said mandrel breaks.

2. The tool of claim 1 wherein said buffer means is an elastomeric material.

3. The tool of claim 2 wherein said elastomeric material is urethane having a Shore A durometer hardness of 95.

4. In a rivet tool for use with a rivet assembly including a breakable mandrel having axially spaced tail flaring means and grippable means and which includes a tubular rivet on said mandrel having a tail portion adjacent the tail flaring means and a head portion adjacent the grippable means, the combination of housing means, drawbolt means within said housing means including a drawbolt member having a collet member attached to one end thereof, said collet member having a tapered internal surface at its forward end, a plurality of jaw members within said collet member having tapered outer surfaces adapted to engage said tapered internal surface, a jaw follower within said collet having an extension portion extending into a bore in the forward end of said drawbolt member, spring means urging said jaw follower into engagement with said jaw member and said jaw members into engagement with said tapered internal surface to move said jaw members into gripping engagement with a mandrel, a counterbore in the forward end of said drawbolt member, a buffer member positioned in said counterbore, an abutment shoulder on jaw follower for abutment with said buffer member upon rearward movement of said jaw follower relative to said drawbolt member to absorb the impact therebetween.

5. The tool of claim 4 wherein said buffer means is a cylinder of elastomeric material.

6. The tool of claim 5 wherein said elastomeric ma-

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terial is urethane having a Shore A durometer hardness of 95.

7. The tool of claim 5 wherein said jaw follower includes a forward surface for engaging a rearward face on each of said jaw members.

8. The tool of claim 5 wherein said jaw follower includes a circumferential flange and said jaw members have grooves on their internal surface, said flange extending into said grooves.

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