United States Patent [19]

James

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[54] **PLIERS TYPE BLIND RIVETING TOOL**

[75] Inventor: **Peter A. James,** Walsall, England

[73] Assignee: **USM Corporation,** Boston, Mass.

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[52] **U.S. Cl.** **72/391,** 72/452

[51] **Int. Cl.** **B21j 15/34**

[58] **Field of Search** 72/391, 114, 452

[56] **References Cited**

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Primary Examiner—Charles W. Lanham
Assistant Examiner—Gene P. Crosby
Attorney, Agent, or Firm—Carl E. Johnson; Vincent A. White; Richard B. Megley

[57] **ABSTRACT**

A blind-riveting pliers tool has an intermediate member pivoted by an operating handle to act on a jaw case in tensioning a mandrel. The arrangement is such that as the tool is operated by pulling the handle away from the workpiece which is to receive the rivet, mechanical advantage increases and there is a reduced tendency for the tool to "jump" when the stem of the mandrel breaks.

8 Claims, 4 Drawing Figures

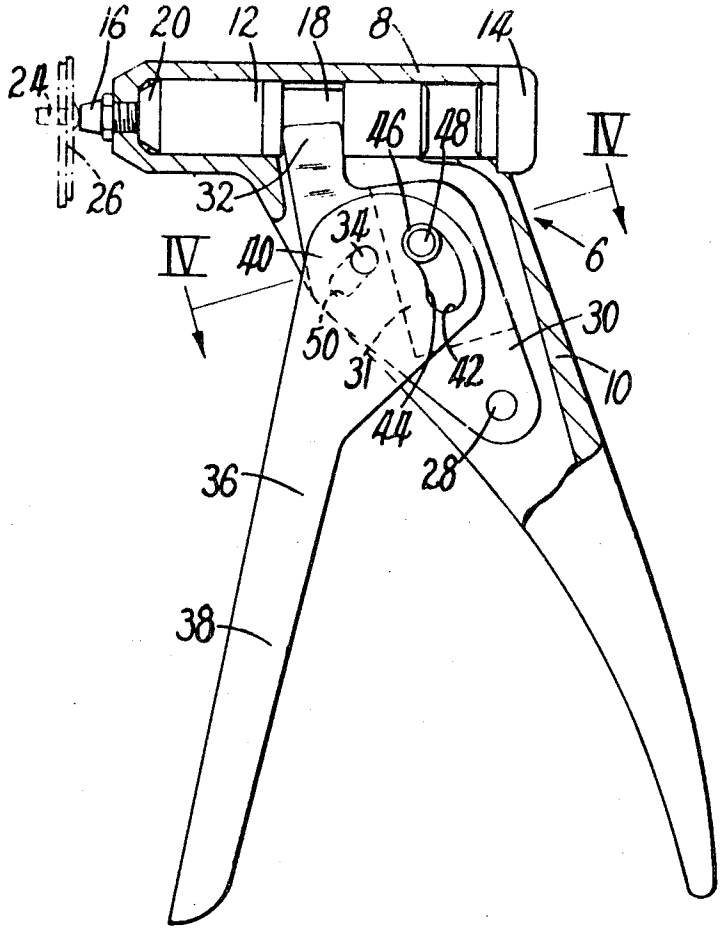


FIG. 1

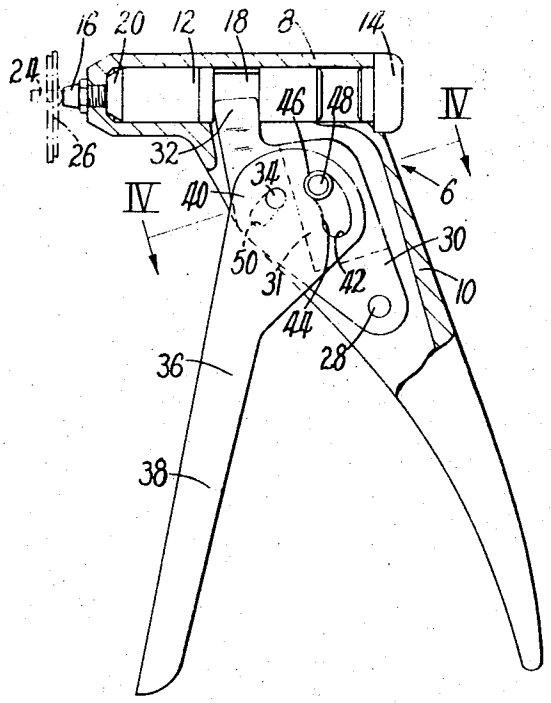

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FIG. 2

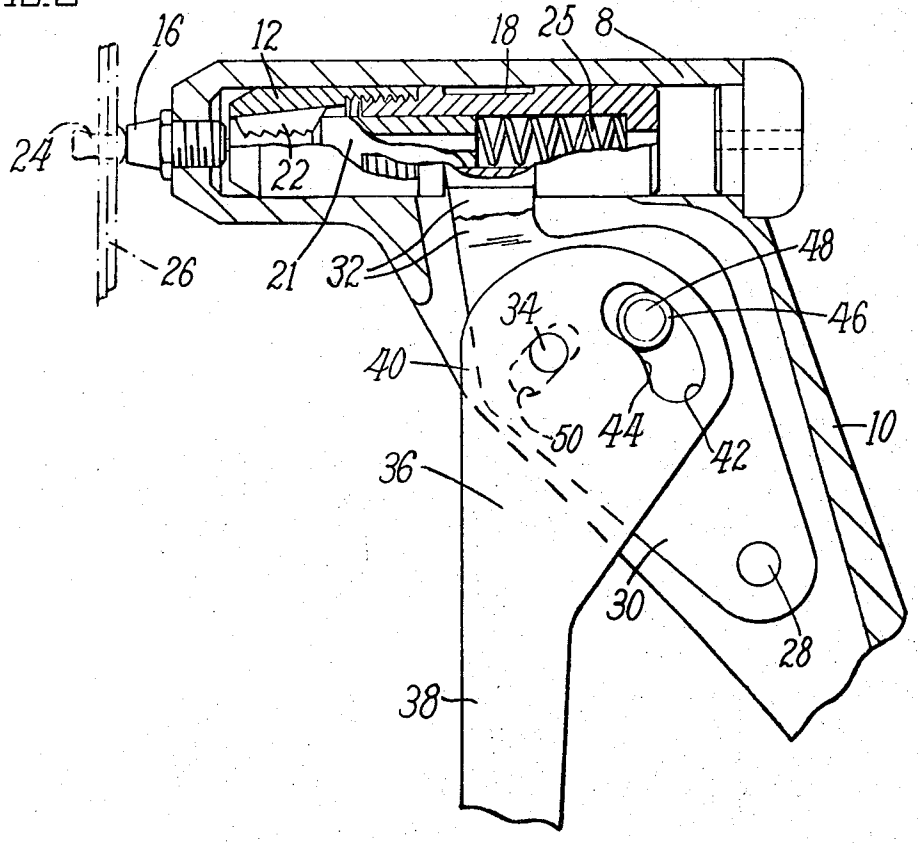

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FIG. 3

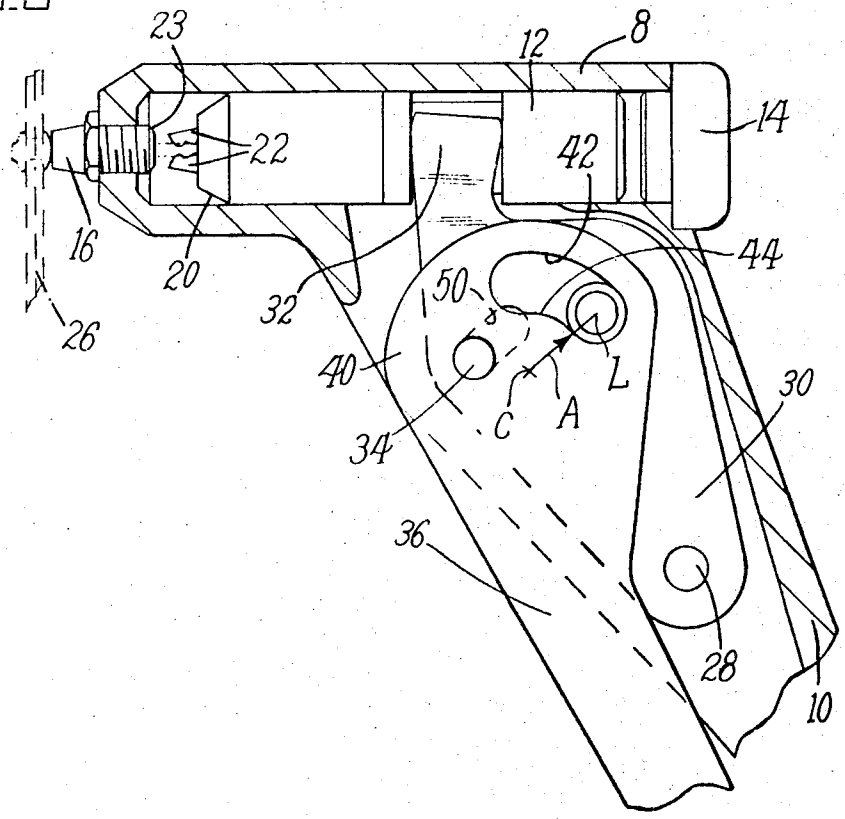
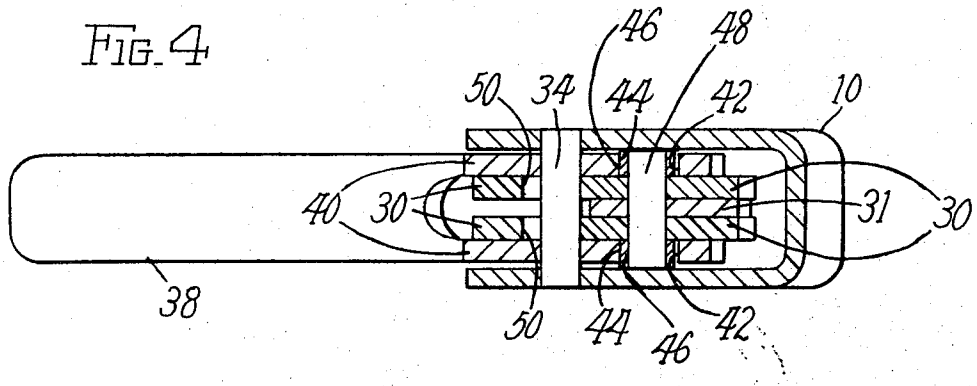

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FIG. 4


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PLIERS TYPE BLIND RIVETING TOOL

BACKGROUND OF THE INVENTION

This invention is concerned with improvements in hand-operated riveting tools, especially tools of the type for installing blind rivets by tensioning their mandrels. In such fastener assemblies a tubular rivet axially receives a headed mandrel, and the stem of the mandrel is pulled axially relatively to retract the mandrel head, the latter thereby upsetting or radially deforming the blind end of the rivet when the latter is held against bodily movement with respect to a receiving workpiece.

Considerable force is required to tension the mandrel during rivet-setting, the force usually being exerted additionally to break the mandrel stem after rivet-setting. Both mechanical and power-operated tools have been provided with nosepieces for receiving the stem while abutting a head flange of the rivet, and stem pulling mechanism commonly including a pair of cooperative jaws for gripping and tensioning the mandrel.

One known mechanical riveting tool is of the so-called lazy-tongs type, and while it develops considerable pulling force, it occupies considerable space and is not operable with one hand as is often desirable. Another known mechanical tool is of the pliers type and operable with one hand, but the operator must squeeze one handle towards the workpiece and toward that portion of the tool supporting the nosepiece. Accordingly the tool, which is in effect then anchored to the workpiece by the rivet assembly until the moment of application of maximum force to the mandrel, is suddenly free to move or "jump" when the mandrel breaks. An operator may consequently lose control of such a tool and it may damage the workpiece upon unintended engagement therewith.

SUMMARY OF THE INVENTION

In view of the foregoing, it is an object of this invention to provide an improved manually operable tool for setting blind mandrel rivet assemblies, which tool shall be simple and have adequate mechanical advantage yet have a reduced tendency to "jump" upon mandrel breakage.

To this end, and in accordance with a feature of the invention, a blind-riveting tool comprises a handle member supporting a nosepiece and providing a slideway for a reciprocable jaw case, a pulling handle pivoted to the handle member, and a force transmitting member operatively connected to the jaw case and pivotally connected to the supporting member. The arrangement is such that movement of the pulling handle, preferably away from a workpiece, toward the supporting handle causes the transmitting member to apply a force on the jaw case whereby it is moved in the slideway to cause the jaws therein to grip and then pull the stem of a mandrel of a rivet to be set in the workpiece. The transmitting member is preferably formed with two arcuate slots, the walls of which serve as cam surfaces respectively engageable by followers mounted on the transmitting member. During the riveting stroke the line of action of the force exerted by the pulling handle on the transmitting member moves toward the pivot point of the pulling handle thus to increase the mechanical advantage of the tool.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other objects and features of the invention will now be more particularly described in connection with an illustrative embodiment, and with reference to the accompanying drawings thereof, in which:

FIG. **1** is a side elevation view, partly in section, showing the tool at the beginning of its rivet-setting stroke;

FIG. **2** is a view similar to FIG. **1** but on a larger scale and with parts broken away and at an intermediate stage of the rivet-setting stroke;

FIG. **3** is a view similar to FIG. **2** showing the tool at completion of its rivet-setting stroke; and

FIG. **4** is a sectional view taken on the line IV—IV of FIG. **1.**

The illustrative tool comprises a supporting member generally designated **6** which has a generally cylindrical portion **8** and a handle portion **10** which depends from the cylindrical portion **8.** The cylindrical portion **8** is hollow and provides a slideway in which a jaw case **12** is reciprocal between an end cap **14,** removal of which provides entry into the slideway, at one end of the slideway and a nosepiece **16** at the other end thereof. The nosepiece **16** has a bore to receive the projecting part of the mandrel stem of a pull-type blind-riveting assembly **24,** the rivet of which is to be set in a hole in a workpiece **26,** and provides an abutment to engage the head of the rivet and hold it against bodily movement relative to the workpiece **26** during setting.

The jaw case **12** of the illustrative tool is cylindrical but with a portion **18** of reduced diameter intermediate its ends and a tapering forward end portion **20.** The jaw case **12** contains two serrated jaws **22** which are urged towards the forward end portion **20** by a tubular pusher **21** and a spring **25;** the interior wall of the jaw case **12** tapers towards the forward end portion **20** so that as the jaws **22** move towards the end portion **20** they are forced together and the arrangement is such that, when the jaw case **12** is moved to the end of the slideway adjacent the nosepiece **16,** an inwardly tapering portion **23** of the nosepiece **16** enters the jaw case **12** pushing the jaws **22** against the spring **25** and the jaws **22** are thereby separated.

The handle portion of the supporting member **6** of the illustrative tool is generally U-shaped in cross-section (see FIG. **4**) and between its limbs supports a pivot pin **28** on which is pivotally mounted a transmitting member **30** of the tool. The transmitting member **30** comprises two side plates separated by a spacer **31** (see FIG. **4**). An ear portion **32** extends upwardly from each of the side plates of the transmitting member **30** and is bent out of the plane of the remainder of the side plate so as to embrace the portion **18** of the jaw case **12;** the ear portions **32** provide a yoke which bears on the shoulders at each end of the portion **18.** The spacer **31** does not extend throughout the whole area of the transmitting member **30,** its extent being indicated by the dotted line in FIG. **1.** Pivoting of the transmitting member **30** about the pin **28** causes the ear portions **32** to move the jaw case **12** in its slideway.

A second pivot pin **34** extends between the limbs of the handle portion **10** and has pivotally mounted thereon a pulling handle **36** of the illustrative tool. The pulling handle **36** has a lower portion **38,** which the operator of the tool pulls with his fingers, and a forked

upper portion 40 which embraces the transmitting member 30 (see FIG. 4). An arcuate slot 42 is formed in each arm of the split upper portion 40 so that one slot 42 is on each side of the transmitting member 30 and each slot 42 provides an arcuate camming surface 44 of the tool on each of which a roller 46 bears. The rollers 46 are coaxially mounted on a pin 48 which is seated in and passes through the transmitting member 30. A slot 50 passes through each of the side plates of the transmitting member 30 and accommodates the pivot pin 34 so that the transmitting member 30 is able to pivot about the pin 28.

A convenient manner of operation of the illustrative tool will now be described. An operator of the tool first moves the pulling handle 36 away from the handle portion 10 (clockwise in FIG. 1) until the tool reaches the condition shown in FIG. 1 in which the jaws 22 have been separated by being urged against the pusher 21 and the spring 25 contained in the jaw case 12 by contact with the portion 23 of the nosepiece 16. The tool is now ready to commence its rivet-setting stroke and the operator inserts the stem of the mandrel of the blind-riveting assembly 24 through the bore in the nosepiece 16 so that the stem enters between the jaws 22. He then pulls the handle 36 slightly towards the hand portion 10 (counter-clockwise in FIG. 1) so that the jaw case 12 moves slightly in its slideway and the jaws 22 (under the influence of the spring 25) contact and grip the stem of the mandrel. The operator next moves the tool until the rivet of the blind-riveting assembly 24 enters a hole in the workpiece 26 into which the fastener is to be set. Holding the handle portion 10 in the palm of his hand, he next "squeezes," i.e., pulls the the handle 36 towards the handle portion 10 and away from the workpiece 26 with his fingers (pivoting the handle 36 counter-clockwise in the drawings); this causes the camming surfaces 44 to press against the rollers 46 and thereby causes the transmitting members 30 to pivot about the pin 28 (clockwise in the drawings), the movement being allowed for by the slots 50 which accommodate the pin 34, the ears 32 to act on the jaw case 12 moving it away from the nosepiece 16, and the stem of the mandrel to be pulled relative to the rivet.

FIG. 2 shows an intermediate stage of the rivet-setting stroke of the illustrative tool at which the rivet of the blind-riveting assembly 24 is partly set and the rollers 46 have moved part of the way along the slots 42. FIG. 3 shows the illustrative tool at the completion of its rivet-setting stroke at which stage the rivet of the blind-riveting assembly is set, the mandrel stem has broken, and the rollers 46 have reached the end of slots 42.

In the operation of the illustrative tool the pulling handle 36 acts as a lever and the force applied to the transmitting member 30 thereby is greater than the operating force applied to the pulling handle 36. Furthermore, the mechanical advantage of the tool increases during its rivet-setting stroke; this is due to the fact that the motion of the rollers 46 in the slots 42 moves the line of action of the force applied to the tramsmitting member 30 by the pulling handle 36 towards the pivot pin 34 (and away from the pin 28) as the tool goes through its rivet-setting stroke, the mechanical advantage between the force applied to the pulling handle 36 and the force applied thereby to the transmitting member 30 increases during the rivet-setting stroke and, as the transmitting member 30 applies an approximately constant proportion of the force applied thereto by the pulling handle 36 to the jaw case 12, the mechanical advantage of the tool increases.

The mechanical advantage of the tool depends on the perpendicular distance from the line of action of the force applied to the transmitting member 30, indicated by arrow A in FIG. 3, to the pivot pin 34 and this decreases as the tool moves from the beginning to the completion of its rivet-setting stroke. The arrow A passes through the center or axis line L of the rollers 46 and the center of curvature C of the camming surfaces 44, and the position of C is selected by the condition that the mechanical advantage of the tool shall increase during the rivet-setting stroke thereof.

The fact that the mechanical advantage of the illustrative tool increases during the rivet-setting stroke thereof means that the force which the operator has to apply to the pulling handle 36 in order to break the stem of the mandrel of the blind-riveting assembly 24 is less than would have been necessary with a blind-riveting tool having the same initial mechanical advantage as the illustrative tool but with constant mechanical advantage (the breaking of the stem of the mandrel in normal circumstances requires a greater force to be applied to the jaw case 12 than does the setting of the rivet) and this plus the fact that the operator is pulling away from the workpiece 26 means that the illustrative tool has less tendency to "jump" and thereby damage the workpiece when the stem of the mandrel breaks than is the case with some previous tools, since the operator has less force to control and as any such "jump" is likely to be away from the workpiece.

Broken-off mandrel stems may be removed from the jaw case 12 of the illustrative tool either forwardly or rearwardly. When the stems are to be removed rearwardly aligned axial passageways are provided, as shown in FIG. 2, through the jaw case 12 and the end cap 14 for this purpose.

Having thus described my invention, what I claim as new and desire to secure by letters Patent of the United States is:

1. A pliers-type blind riveting tool comprising a handle member supporting a nosepiece engageable with a rivet of a mandrel rivet to be set, a jaw case movable in the handle member to carry cooperative mandrel gripping jaws toward and from the nosepiece, a force transmitting member pivoted to the handle member and operatively connected to the jaw case, and a pulling handle pivoted to the handle member and formed with a cam surface for causing the force transmitting member to pivot on the handle member and thereby, in a rivet-setting stroke, forceably retract the jaw case from the nosepiece with increasing mechanical advantage.

2. A pliers-type blind riveting tool as in claim 1 wherein said force transmitting member carries at least one roller, and said cam surface is arcuately shaped to bear on said roller, the center of curvature of the cam surface being selected so that the distance between the pivotal connection of the pulling handle and the line of action of the force applied through said surface to the roller decreases during rivet-setting.

3. A hand tool for feeding mandrel-rivets comprising a pair of handles pivotally connected together, one of said handles carrying at one end a nosepiece adapted to receive a mandrel while abutting its rivet, said one

handle slidably supporting a jaw case and mandrel gripping jaws therein in alignment with the nosepiece, a force transmitting member pivoted at one end to said one handle and operatively connected at the other end of said member to said jaw case, the other of said handles having a cam and follower connection to said force transmitting member, the arrangement being such that relative movement together of said handles causes said member to move the jaws to effect a mandrel tensioning stroke with increasing mechanical advantage.

4. A tool as in claim **3** wherein the cam of said cam and follower connection is a wall of a convex slot formed in said other handle, and said follower is a roller adapted to be received in said slot, the roller being carried by a pin in said member.

5. A tool as in claim **4** wherein the center of curvature of said cam wall is selected to define a line of action of the force applied to said roller, which line moves closer to the pivot connection of the pair of handles as said other handle is pulled toward said one handle.

6. A pliers-type tool for setting mandrel-rivets comprising a pair of pivotally connected handles, one of said handles having a tubular portion providing a rivet abutting end and another portion adapted to be engaged by the palm of one hand of an operator, a slidable jaw case in said tubular portion carrying cooperative jaws adapted to grip the stem of a rivet to be set, a force transmitting member pivoted to said one handle and operatively connected to the jaw case, the other of said handles being adapted at its free end portion to be pulled by the fingers of the operator's hand and formed at its other end portion with an arcuate slot, and said member carrying a roller adapted to ride in said slot, the arrangement being such that movement of said other handle toward said one handle and away from a structure in which the rivet is to be set causes a wall of said slot to bear with increasing mechanical advantage on said roller as the mandrel gripping jaws are thereby retracted from the structure.

7. A tool as in claim **6** wherein said other handle has its slotted end portion forked to straddle said force transmitting member, and a pin transversely extending through the member supports a pair of rollers respectively nested in aligned slots of said forked handle portion.

8. A tool as in claim **6** wherein the jaw case includes spring means and a tubular pusher for urging the jaws into mandrel gripping relation, and the end of said handle tubular portion remote from said rivet abutting end is open to allow passage therethrough of broken-off mandrel stems.

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