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MANUALLY OPERABLE TOOL FOR SETTING TUBULAR RIVETS

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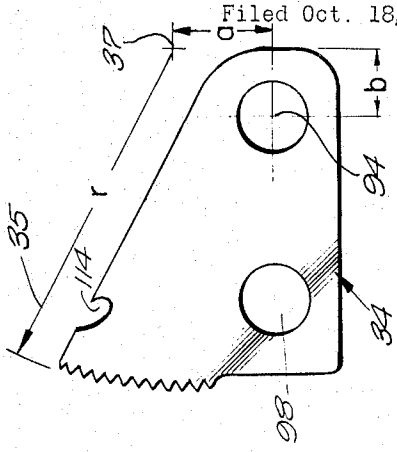

FIG. 4

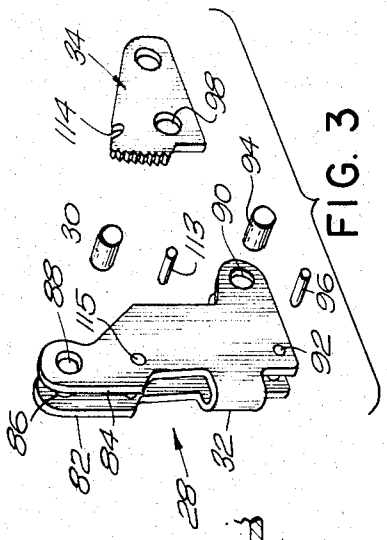

FIG. 3

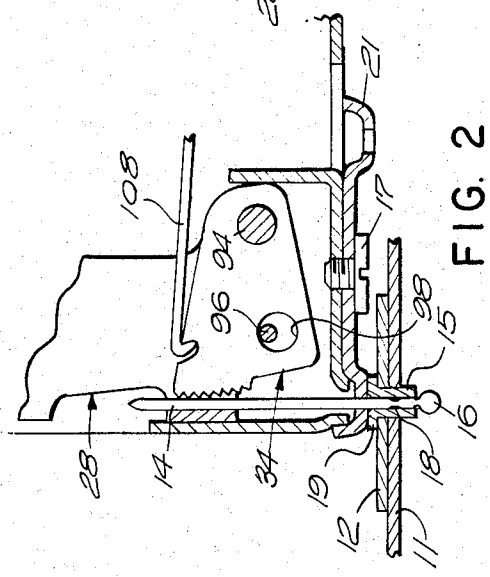

FIG. 2

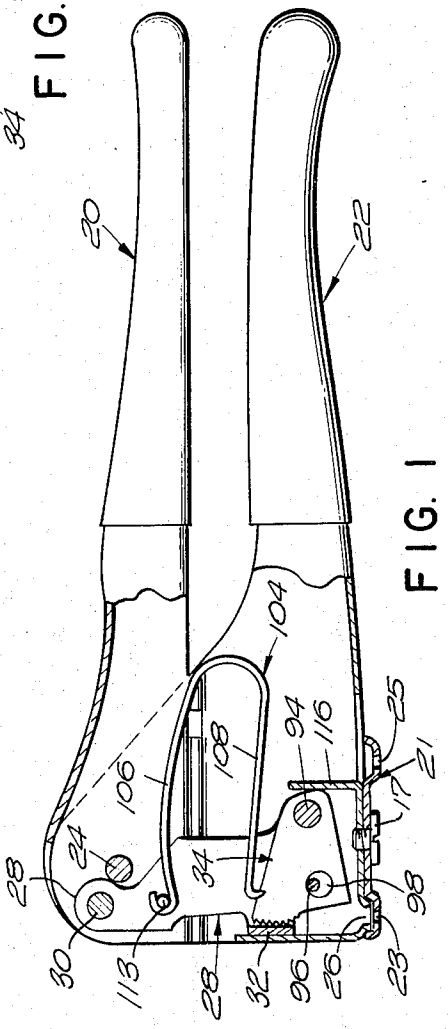

FIG. 1

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MANUALLY OPERABLE TOOL FOR SETTING TUBULAR RIVETS

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The present invention relates to fastener setting tools and, more particularly, to tools of the type adapted to set tubular rivets into an apertured structure that may be accessible from one side only. Such a tubular rivet, for example, comprises: an external tubular member of relatively ductile material having a preformed flange at the rearward end of the rivet; and an internal mandril member having a head engaging the tubular member at the forward end of the rivet and a stem projecting through the rearward end. In operation, first the forward end of the rivet is inserted through the aligned holes of a pair of work pieces to be joined with the preformed flange abutting against the outer face of one of the workpieces. Next the stem is gripped by a tool and retracted through the rearward end in such a way that the head deforms the tubular member at the forward end of the rivet to provide a new formed flange abutting against the outer face of the other of the workpieces. Finally continued retraction of the mandril member, when the new formed flange sufficiently resists further endwise movement, causes a rupture within the tubular member of an expendable portion of the mandril member from the remainder, thereby leaving the rivet set into position and free of the tool. The present invention contemplates a novel operable rivet setting tool characterized by an arrangement by which certain mandril gripping elements and certain manually actuated elements are isolated from each other for efficacious operation. The present invention further contemplates a particular construction that permits the use of varied sizes of mandrels so that the rivet setting tool may be used to apply rivets of more than one size without change of internal parts.

The primary object of the present invention is to provide a rivet setting tool comprising a pair of handles pivoted to each other at a first center, a slider bracket that is pivoted to one of the handles at a second center and that presents an integral jaw, and a rocking jaw that pivots in the slider bracket between a position of engagement with the integral jaw when the handles are closed and a position of disengagement with the integral jaw when the handles are opened, an important feature of the invention being a particular construction of the rocking jaw, which may be biased toward engagement with the integral jaw in such a manner as to operate effectively with mandrels of various diameters.

Other objects of the present invention will in part be obvious and will in part appear hereinafter.

The invention accordingly comprises the device involving the components and relationships exemplified in the following detailed disclosure, the scope of which will be indicated in the appended claims. For a fuller understanding of the nature and objects of the present invention, reference should be had to the following detailed description, taken in connection with the accompanying drawings, wherein:

FIG. 1 is a broken away view of operative components of a preferred rivet setting tool of the present invention;

FIG. 2 is a fragmentary detail of the rivet setting tool at the beginning of a typical riveting operation;

FIG. 3 is an exploded view of certain components of the rivet setting tool; and

FIG. 4 is a side elevation of the rocking jaw of the rivet setting tool.

Generally, as best shown in FIG. 1, the illustrated rivet setting tool comprises: a manual control and encasing support assembly in the form of a pair of handles **20**, **22**, which are pivoted about a main center **24** to each other. Handles **20** and **22** both are of sheet metal fold construction in the form of channel-like portions that extend forwardly to house and support the mandrel actuating parts. One of the handles provides an anvil bore **26** through which the mandril of the rivet (to be described below) may be inserted, and a mandril gripping and rupturing assembly in the form of a slider bracket **28**, which is pivoted about an eccentric center **30** at its upper extremity and provides an integral jaw **32** that is fixed with respect thereto, and a rocking jaw **34** that is pivotable with respect thereto. Attached to the lower handle and pivotally connected thereto by a thumb screw **19** is a turret **21** with two holes **23** and **25** capable of alignment with anvil base **26** for piloting a mandrel into operating position. The turret shown in FIG. 1 is in the form of a flat plate with cups at the extremities thereof in which holes **23** and **25** are provided.

A fragmentary detail view of the rivet setting tool at the beginning of a typical riveting operation is shown in FIG. 2. A typical rivet for use with the tool of the present invention is shown for use in connecting a pair of workpieces **11**, **12** that are apertured by aligned holes. The rivet is shown as including a mandril **14** surrounded by a tube **15**. Tube **15** is composed of a relatively soft metal such as soft steel, and mandril **14** is composed of a relatively hard metal such as hard steel. Mandril **14** is provided at one extremity with a head **16** that abuts against the forward part of tube **15** and is provided at the other extremity with a stem portion that extends rearwardly from tube **15**. The stem portion is separated from head **15** by a constriction **18** which constitutes a weakened point at which the mandril ruptures when a predetermined tensile force is exceeded.

FIG. 3 is an exploded view of the slider bracket, the rocking jaw, and the pins and shafts appurtenant thereto. Slider bracket **28** is shown as including a pair of spaced channel sections **82**, **84**, which are integrally connected at a connecting bite constituting integral jaw **32**. The upper narrower extremities of sections **82**, **84** are provided with bearing holes **86**, **88**. The lower, wider extremities of sections **82**, **84** are provided with pairs of pin holes **90**, **92**. Extending through and between pairs of pin holes **90**, **92** are a pair of pins **94**, **96**. Rocking jaw **34** is positioned within and between channel sections **82**, **84**, being provided with a journal hole snugly receiving pin **94** and a limit hole **98** through which pin **96** projects. Limit hole **98** is considerably larger in diameter than pin **96** in order to permit rocking of rocking jaw **34**. As will be observed in FIG. 1, a shaped leaf spring **104**, having opposed sections **106**, **108** and hook extremities, operates between a notch **114** in rocking jaw **34** and an abutment **113** formed by bosses biased inwardly and in line in the pair of channel sections **82** and **84**. Bracket **28** is guided for reciprocal motion by a lug **116** struck from the bight of handle **22**.

FIG. 4 is a side elevation showing the unique construction of rocking jaw **34**. The pitch of the teeth is on a radius **35** taken from a point **37** higher and more rearwardly than the pivot point of the rocking jaw which is at the center of pin **94** in its normal operation. By way of example, in the present rocking jaw **34** shown in FIG. 4, the center point **37** of the radius **35** is in a more rearwardly position than the center of pin **94** by an amount equivilant to approximately one-fifth of the length of the radius. Also, the center point **37** is in a more upwardly

position than the center of pin **94** by an amount equivalent to approximately one-third the length of the radius. As a result, this forms a larger arc of effective bite. The teeth of the rocking jaw can therefore engage a wider range of diameters of mandrels, while it pivots on the same axis of pin **94**.

The detail view of FIG. 4 emphasizes certain important features of rocking jaw **34**, which as indicated above is pivoted about a center **94**. The teeth of rocking jaw **34** are generated along an arc that is eccentric with respect to center **94** in order to effect a bite with integral jaw **32** when mandrel **14** is to be pulled. It has been found that if this arc has too much eccentricity the teeth will cut through the mandril when pulled. On the other hand if this arc has too little eccentricity, the teeth will not hold the mandrel after it has separated from its stem, and the mandril will tend to be propelled from between the jaws in a dangerous manner. Rocking jaw **34** is shown as having dimensions for accommodating three typical hard steel mandrils having approximately the following diameters; diameter of first mandril=approximately .096 to .097; diameter of second mandril=.114 to .115; and diameter of third rivet=.076 to .077. Hole **23** of turret **26** accommodates the mandril of the third rivet. Hole **25** of turret **26** accommodates the mandrils of the first and second rivets. In FIG. 4, the center of the radius of curvature of the toothed arc of rocking jaw **34** is shown at **37**. Center **37** is shown as being spaced from center **94** by a distance and at an orientation defined by two perpendicular lines segments *a* and *b*. The radius of the toothed arc is designated *r*. These dimensions, which are critical are as follows; a=.250 to .500″; b=.125 to .375″; and r=1.100 to 1.300″. The example shown: a=.375″; b=.250″; and r=1.175″.

In operation, normally spring **104** serves to cause rocking jaw **34** to abut against the profile boundary in the vicinity of anvil bore **26**. When a rivet mandril is inserted into position between integral jaw **32** and rocking jaw **34** it is maintained in that position by light pressure exerted by spring **104** in such a way as to prevent its dropping out of anvil bore **26**. Nevertheless this tubular rivet may be manually pulled from anvil bore **26**. When the handles are moved to their outermost position, the insertion of a new mandril stem forces the old previous mandril stem out from between the jaws for ejection from within the tool through the opening adjacent to the slider bracket and the forwardly portion of the rivet setting tool. When handles **20**, **22** are manually closed into position shown in FIG. 1, slider bracket **28** is lifted by the eccentirc action of centers **24**, **30** in such a way as to cause the mandril stem to be securely gripped between integral jaw **32** and rocking jaw **34**.

The present invention thus provides a novel rivet setting tool which conveniently holds several diameters of mandril stems in position before, during and after setting of the rivet. Since certain changes may be made in the foregoing disclosure without departing from the scope of the invention herein, it is intended that all matter described in the foregoing specification and shown in the accompanying drawings be interpreted in an illustrative and not in a limiting sense.

What is claimed is:

1. A rivet setting tool capable of setting rivets of a plurality of diameters, each rivet having an external tubular element and an internal rupturable mandrel element, said rivet setting tool comprising a pair of handles pivoted to each other about a main handle center, a slider bracket pivoted to one of said handles about an eccentric handle center spaced from said main handle center, a housing on the other of said handles providing an anvil aperture, a turret pivotally attached to said housing providing a plurality of apertures any one of which may be moved into alignment with said anvil aperture, said slider bracket providing an integral jaw, a rocking jaw pivotally moveable about a main jaw center between positions remote from and adjacent to said integral jaw, said rocking jaw having a set of teeth arranged in an arc about an eccentric jaw center and biased toward said stationary jaw, said eccentric jaw center being spaced from and oriented to said main jaw center by two line segments at right angles to each other, the first line segment extending from said main jaw center a distance of approximately .250 to .500″, the second line segment extending from said eccentric jaw center a distance of approximately .125 to .375″, the radius of said arc being approximately from 1.100 to 1.300″, a spring urging said rocking jaw into the position adjacent to said integral jaw, an abutment on said other of said handles limiting movement of said rocking jaw toward said integral jaw when said handles are opened, said rocking jaw being free of said abutment when said handles are closed, said rocking jaw and said stationary jaw being operative in alignment with said anvil aperture, said slider bracket including parallel channel sections, a pair of stationary pins extending between the channel sections, the bite between the channel sections constituting said stationary jaw, a journal hole in said rocking jaw pivotally receiving one of said pins, a limit hole of larger diameter than the other of said pins receiving said other of said pins.

2. A rivet setting tool capable of setting rivets of a plurality of diameters, each rivet having an external tubular element and an internal rupturable mandril element, said rivet setting tool comprising a pair of handles pivoted to each other about a main handle center, a slider bracket pivoted to one of said handles about an eccentric handle spaced from said main handle center, a housing on the other of said handles providing an anvil aperture, a turret pivotally attached to said housing providing a plurality of apertures any one of which may be moved into alignment with said anvil aperture, said slider bracket providing an integral jaw, a rocking jaw pivotally moveable about a main jaw center between positions remote from and adjacent to said integral jaw, said rocking jaw having a set of teeth arranged in an arc about an eccentric jaw center and biased toward said stationary jaw, said eccentric jaw center being spaced from and oriented with respect to said main jaw center by two line segments at right angles to each other, a spring urging said rocking jaw into the position adjacent to said integral jaw, said rocking jaw and said stationary jaw being operative in alignment with said anvil aperture, said slider bracket including parallel channel sections, the bite between the channel sections constituting said stationary jaw, means along the first line segment extending from said main jaw center and means along the second line segment extending from said eccentric jaw center cooperating with said turret to enable proper gripping of any mandril elements operationally fitting into any of said plurality of apertures.

References Cited

UNITED STATES PATENTS

3,154,210	10/1964	Elliott	72—391

FOREIGN PATENTS

1,116,324	1/1956	France.
542,382	1/1942	Great Britain.

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