

March 26, 1968

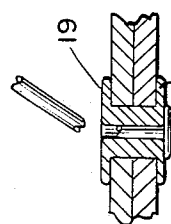
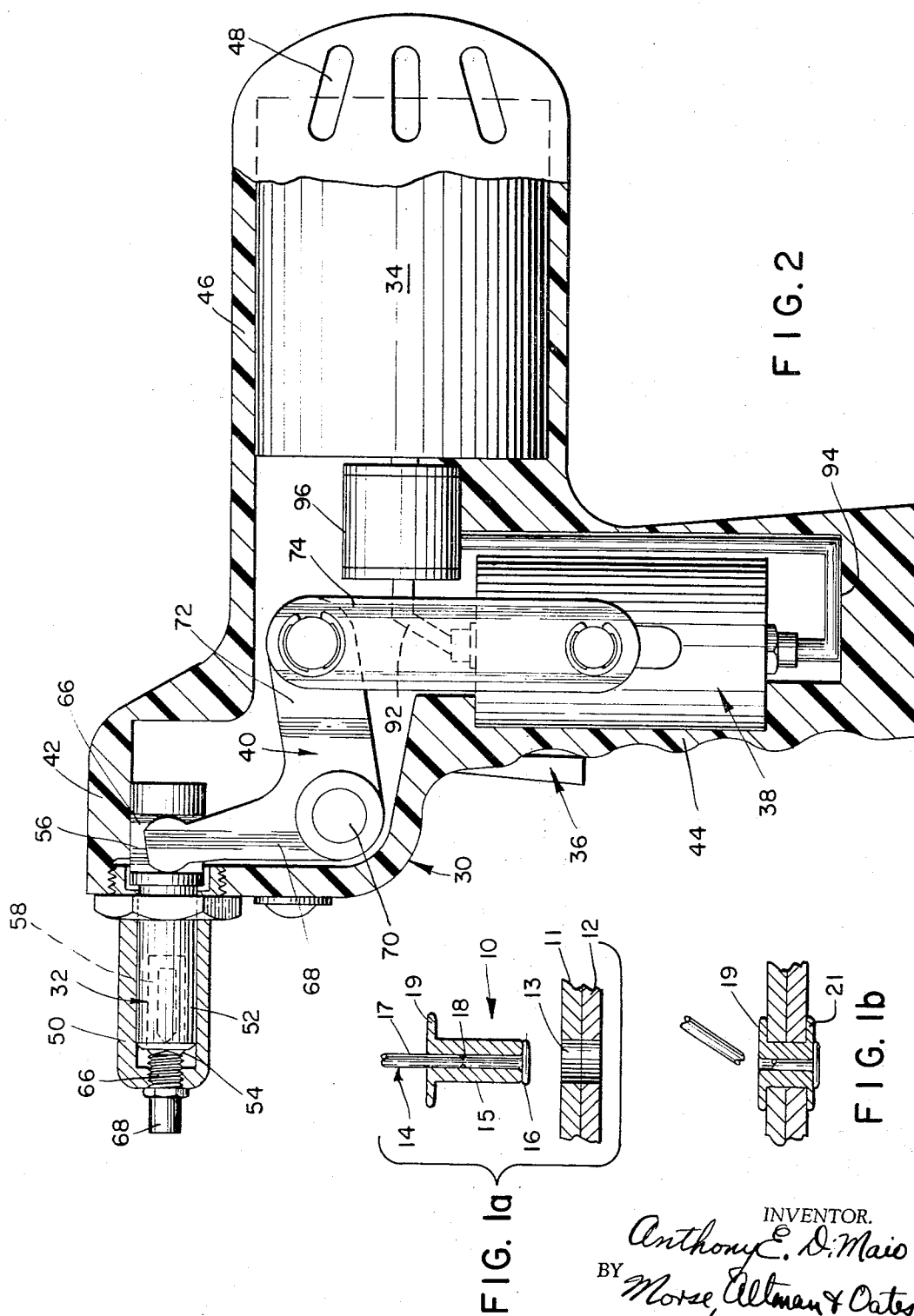
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3,374,656

TOOL FOR SETTING TUBULAR RIVETS

Filed Jan. 25, 1966

3 Sheets-Sheet 1



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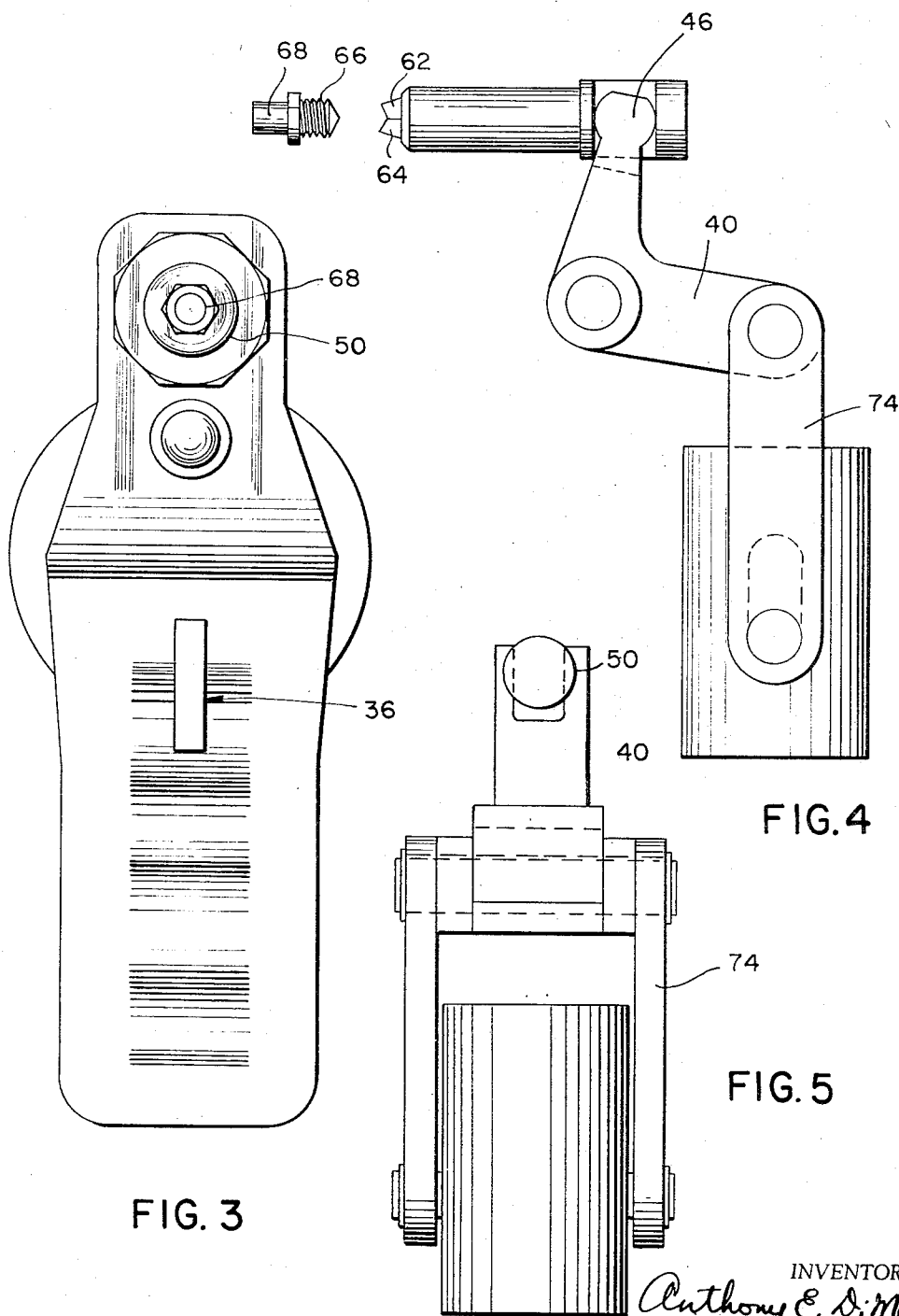


FIG. 4

FIG. 5

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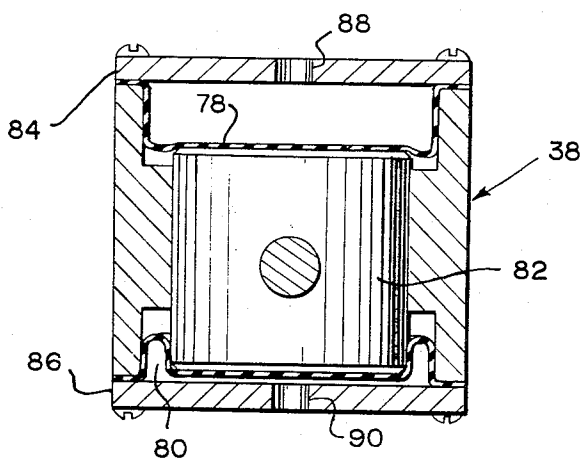


FIG. 6

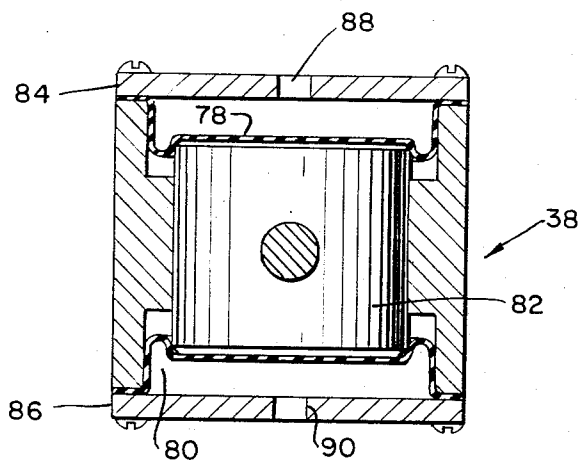


FIG. 7

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TOOL FOR SETTING TUBULAR RIVETS

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5 Claims. (Cl. 72-391)

The present invention relates to fastener setting tools and, more particularly, to tools of the type adapted to set a tubular rivet 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 workpieces to be joined with the preformed flange abutting against the outer face of one of the work pieces. 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 work pieces. Finally, continued retraction of the mandril member, when the new formed flange sufficiently resists further 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 automatically operable rivet setting tool characterized by an arrangement by which certain mandril gripping elements are automatically actuated in a simple manner by an unusually efficacious but compact power train.

The primary object of the present invention is to provide a rivet setting tool comprising a mandril gripping and releasing collet, which is actuated and de-actuated by a motor driven, hydraulic cylinder, the entire structure being within the format of a manually triggered gun. It has been found that the foregoing arrangement enables the prompt application of power but the smooth avoidance of shock.

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:

FIGS. 1(a) and (b) illustrate the operation of an exemplary rivet, for which the rivet tool of the present invention is designed;

FIG. 2 is a side view, with parts broken away, of a tool embodying the present invention, certain components being shown in one stage of a riveting cycle;

FIG. 3 is a front view of the tool of FIG. 2;

FIG. 4 is a view of certain components of the tool of FIG. 2 in another stage of the riveting cycle;

FIG. 5 is a rear view of the components of FIG. 4;

FIG. 6 is a schematic detail view of a component of the tool of FIG. 1 in a first position; and

FIG. 7 is a detail view of the component of FIG. 6 in a second position.

A typical rivet for use with the tool of the present invention is shown at 10 for use in connecting a pair of work pieces 11, 12 that are apertured at 13 by aligned holes. The rivet is shown as including a mandril 14 surrounded

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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 17 that extends rearwardly from tube 15. Stem 17 is separated from head 16 by a constriction 18, which constitutes a weakened point at which the mandril ruptures when a predetermined tensile force is exceeded. As shown in FIG. 1(b), after tube 15 is inserted through aperture 13 in such a way that the flanged portion 19 of tube 15 abuts against the work pieces, mandril 17 when withdrawn, effects a deformation of the head extremity of tube 15 in order to provide a flange 21 which cooperates with flange 19 in order to grip the work pieces therebetween.

The general assembly of the illustrated tool is shown in FIG. 2 as comprising a housing 30 generally in the form of a gun, a collet 32 for gripping, retracting and releasing the mandril of a rivet of the above described type, a motor 34 that is actuated by a trigger 36 to operate a hydraulic cylinder 38 and a linkage 40 by which the cylinder is operatively connected to collet 32.

Housing 30 has a forward nose portion 42 to which collet 32 is affixed, a manually grippable handle portion 44 in which hydraulic cylinder 38 is located, and a rearwardly projecting casing portion 46 in which electric motor 34 is located. Rearward casing 46 has at its rearward extremity a plurality of slots 48 by which motor 34 is air cooled.

Collet 32 includes a mounting shell 50, the rearward extremity of which is shouldered and threaded into a corresponding opening in nose portion 42 of the housing. Slidable within shell 50 is a reciprocable collet case 52 the forward end of which is open as at 54 and the rearward end of which provides a bearing 56. Within collet case 52 is a collet 58 and a spring, not shown, which resiliently presses collet 58 outwardly through opening 54. Collet 58 includes a pair of jaws 62, 64 which are spread by an anvil 66 into open condition when the collet in it is in its foremost position. Anvil 66 is the rearwardly projecting tubular extremity of a head 68 through which the mandril of a rivet of the foregoing type is inserted prior to the riveting cycle. The rearward end of tubular extremity 66 is tapered so as to wedge the tapered extremities of the spring jaw 62, 64 of collet 58 into open position when in contact therewith. When the collet is removed to its rearward position, collet 58 is urged forwardly by spring 60 within collet case 52, which is shaped to urge jaws 62, 64 together, thereby gripping the mandril with which they are contiguous.

The forward and rearward motion of collet 32 is under the control of a follower 66 within bearing 56. Follower 66 constitutes the extremity of a rocker arm 68, which is pivoted in the nose portion of housing at 70 and which has a crank arm 72. Crank arm 72 is pivoted to one extremity of a link 74, the other extremity of which is controlled by hydraulic cylinder 38. As shown in FIGS. 6 and 7, hydraulic cylinder 38 includes a cylinder portion 76 which presents cylinder chambers 78, 80 at its opposite extremities. Reciprocable within cylinder portion 76 is a piston portion 82, the opposite extremities of which project into cylinders 78, 80. Affixed to the walls of chambers 78, 80 and to the faces of cylinder 82 are a pair of elastomeric diaphragms 84, 86, composed for example of neoprene, which conveniently seal chambers 78, 80. Projecting into the ports 88, 90 of chambers 78, 80 are tubes 92, 94 which communicate with the opposite mouths of a hydraulic pump 96. Hydraulic pump 96, when powered in actuating direction by motor 34, drives hydraulic cylinder piston 82 upwardly and when powered in de-actuating direction by motor 34 drives hydraulic

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cylinder piston 82 downwardly. A suitable hydraulic fluid, for example, a hydrocarbon oil, fills the cylinders, conduits and pump. Motor 34 contains a simple control which rotates the motor in the actuating direction when energized by the trigger 36 and which rotates the motor in de-actuating direction when trigger 36 is released.

In operation, first the mandril of a rivet of the foregoing type is inserted through anvil 66 into collet 32 at the beginning of a cycle with collet 32 in its foremost position. Thereafter the tubular portion of the rivet is inserted through the aligned openings of a pair of work pieces to be assembled. Next trigger 36 is squeezed while the gun is held in the hand of an operator. Actuation of trigger 36 causes motor 34 to power pump 96 and to cause the fluid in the system to flow from chamber 80 to chamber 78 thereby causing piston 82 to move downwardly and causing collet 32 to move rearwardly by the action of linkage 40. Next, the rearward part of the mandril is separated from the forward part of the mandril at the constriction in the mandril following deformation of the rivet as in FIG. 1(b). Release of trigger 36 causes reverse rotation of motor 34 and pump 96, by which the hydraulic fluid flows from chamber 78 to chamber 80, thereby completing the riveting cycle.

The present invention thus provides an extremely convenient and shock free rivet setting tool characterized by a particular arrangement of electric and hydraulic components. Since certain changes may be made in the device hereof without departing from the scope of the present invention, it is intended that all matter described in the foregoing specification or shown in the accompanying drawing be interpreted in an illustrative and not in a limiting sense.

What is claimed is:

1. A tool for setting tubular rivets of the type having an outer barrel portion and an inner mandril portion, said outer barrel portion having a rearward flange, said mandril portion having a head at the forward end of said

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outer barrel portion and a stem extending rearwardly from said head and from said outer barrel portion, said tool comprising a housing having a nose portion and a grip portion, a collet case affixed to said nose portion, an electric motor in said housing, a hydraulic pump operatively connected to said electric motor, hydraulic cylinder means communicating with said hydraulic pump, a collet reciprocable in said collet case between a forward position and a rearward position, said collet when in said forward position being open to receive said stem and when in said rearward position being closed to retract said stem, said hydraulic cylinder being operatively connected to said collet case.

2. The tool of claim 1 wherein said cylinder is positioned in said grip portion and said motor is positioned substantially between said grip portion and said nose portion.

3. The tool of claim 1 wherein said hydraulic cylinder means provides two compartments and a piston therebetween, said hydraulic pump forcing said hydraulic fluid through conduits from one compartment to the other when said motor is actuated.

4. The tool of claim 1 wherein a linkage connects said hydraulic cylinder to said collet.

5. The tool of claim 1 wherein said compartments are defined in part by elastomeric diaphragms connected to said cylinder.

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