Dec. 14, 1971 R. F. RICHARDSON ET AL 3,626,745

RIVET GUN ACCESSORY

Filed Dec. 1, 1969 2 Sheets-Sheet 1

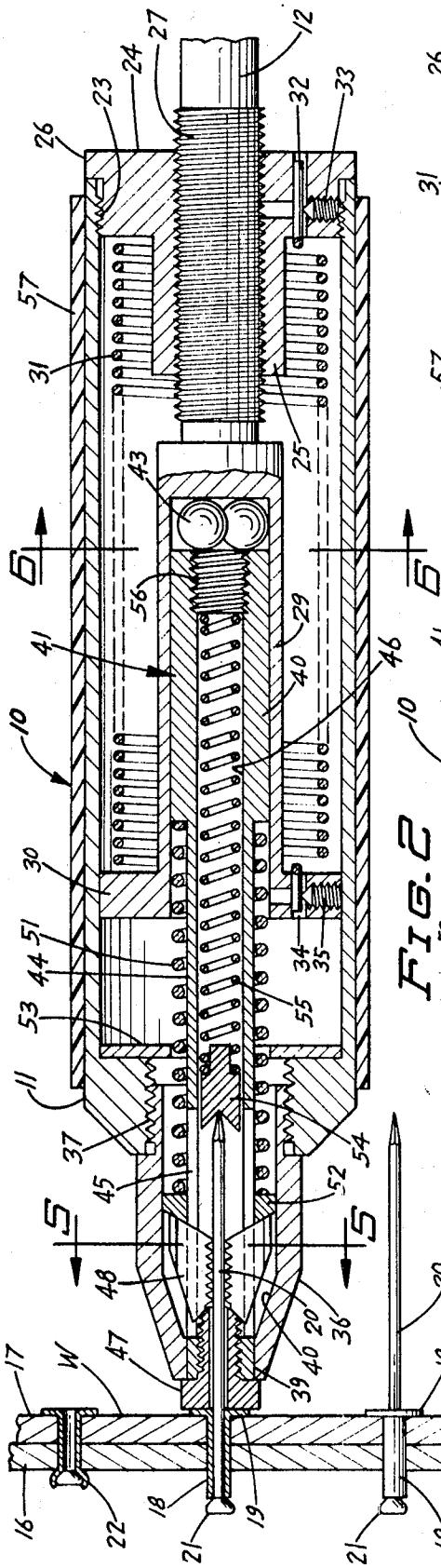


FIG. 2

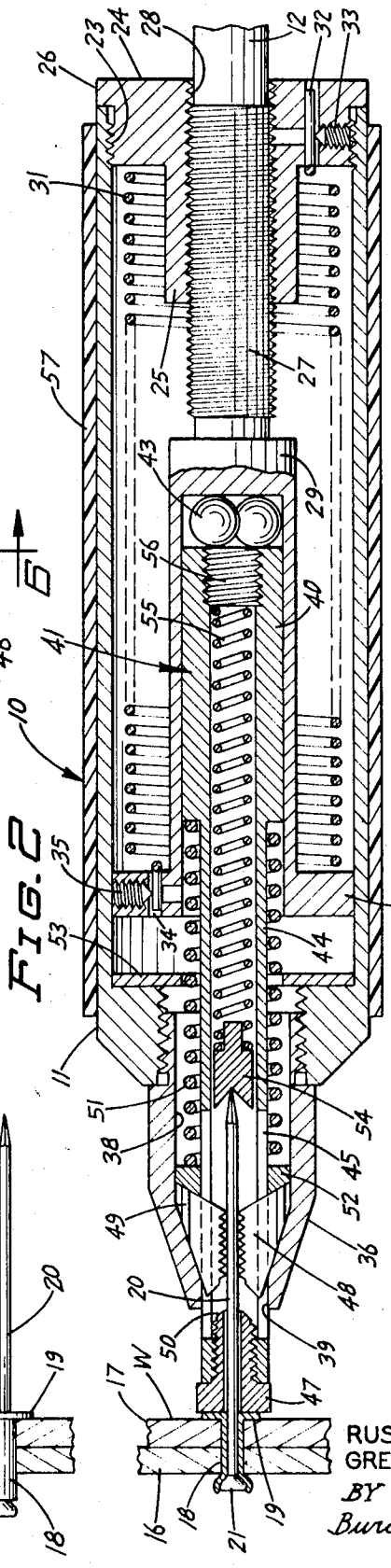


FIG. 3

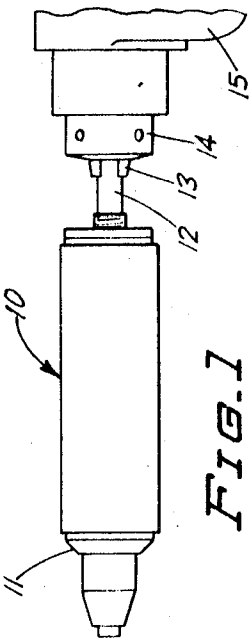


FIG. 1

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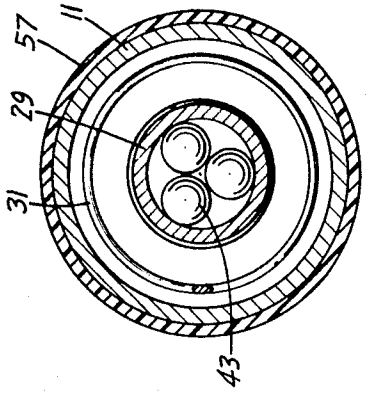


FIG. 6

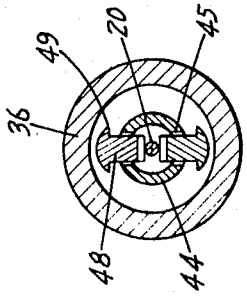


FIG. 5

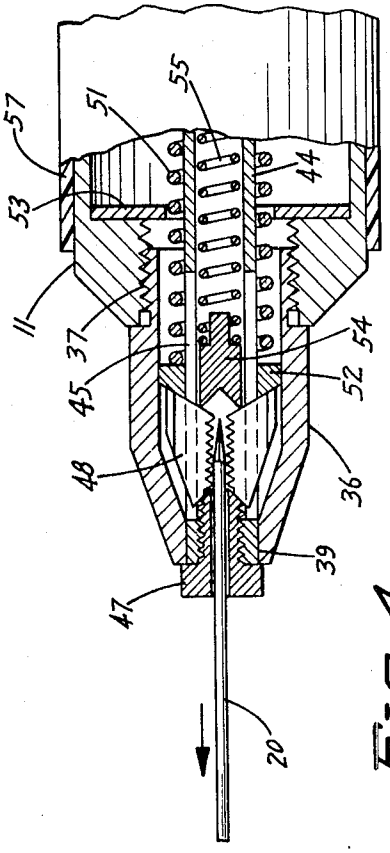


FIG. 4

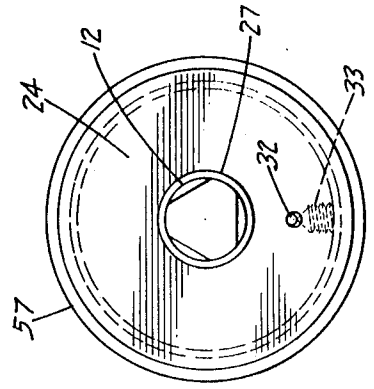


FIG. 8

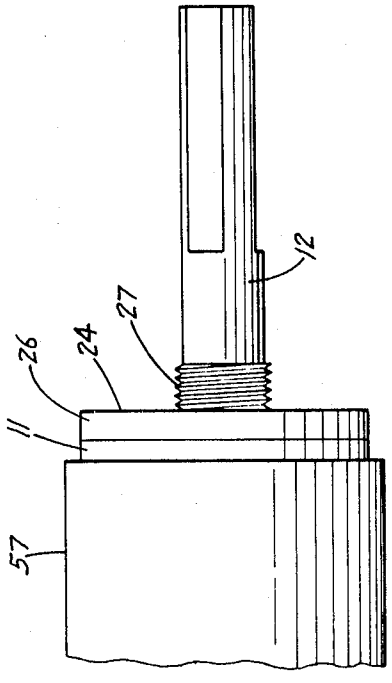


FIG. 7

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3,626,745

RIVET GUN ACCESSORY

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U.S. Cl. 72—391 8 Claims

ABSTRACT OF THE DISCLOSURE

A rivet setting accessory for the setting of blind rivets for use in conjunction with a standard power unit, such as an electric drill. The operator's hand gripping the barrel of the rivet setting gun functions as a clutch holding the barrel stationary while the rotary motion supplied by the power drill advances a plunger causing jaws to grip the mandrel of a rivet, set the rivet, detach the mandrel from the set rivet and eject the spent mandrel.

This invention relates to an accessory for use in conjunction with an electric or other power unit, such as a standard electric drill, for setting rivets. The rivet gun accessory is for setting "blind" rivets, that is, the rivet is both inserted into the work and secured therein from the same side, without access to both sides of the work. Rivets for this purpose and guns for setting such rivets are well known.

Guns for setting blind rivets tend to be of two general types, hand and powered. Exemplary of one type of hand rivet gun is that shown in United States Patent No. 3,280,615 issued Oct. 25, 1966, of which the present applicant was co-inventor. Such guns are well suited for their intended purpose but for relatively high speed work, such as on assembly lines, and for work over a long duration, the operation of such guns is tiring to the operator. Powered rivet guns whether operated electrically, hydraulically or pneumatically, tend to be capable of greater production and reduce the fatigue of the operator, but they are most generally cumbersome and expensive.

It is the principal object of the present invention to provide a rivet gun accessory for an electric or other power unit, such as a standard power drill. Virtually every manufacturing plant and fabricating and repair shop using blind rivets is well equipped with electric or other power drills. Most handymen and hobbyists also have electric drills. The rivet gun accessory, according to the present invention, is adapted to be used with standard electric or other power drills simply by insertion therein in the manner of a drill bit or similar tool.

The invention is illustrated in the accompanying drawings in which corresponding parts are identified by the same numerals and in which:

FIG. 1 is an elevation of the rivet gun accessory shown in conjunction with a power drill;

FIG. 2 is an enlarged elevation in section showing the working parts of the rivet gun accessory with a rivet inserted into a work piece before application of force to set the rivet therein;

FIG. 3 is a similar elevation in section showing the working parts in position when the rivet is expanded and the head of the rivet supporting mandrel about to be snapped off;

FIG. 4 is a similar enlarged fragmentary elevation in section showing the parts in position after the rivet supporting mandrel has been separated from its head to free the rivet gun from the set rivet and work piece and showing the muzzle ejection of the mandrel;

FIG. 5 is a transverse section on the line 5—5 of FIG. 2 and in the direction of the arrows;

FIG. 6 is a transverse section on the line 6—6 of FIG. 2 and in the direction of the arrows;

FIG. 7 is a fragmentary elevation showing the shank of the rivet gun accessory which is engaged by the chuck of the power drill; and

FIG. 8 is an end elevation of the shank end of the rivet gun accessory.

Referring now to the drawings, the rivet gun accessory according to the present invention, indicated generally at 10, includes a generally hollow cylindrical body 11, from one end of which extends a shank 12 adapted to be held within the jaws 13 of a chuck 14 of a standard powered drill 15. The rivet gun accessory 10 is shown in use in conjunction with a work piece W composed of two plates 16 and 17 to be riveted together. There is shown a conventional blind rivet of the type having a hollow tubular shank or body 18 which extends through the work to be riveted and having an annular flanged head 19, which may be flat or domed or countersunk. A mandrel 20 is inserted through the rivet in the reverse direction, that is, from the operator's side with the head 21 of the mandrel at the opposite end from the head 19 of the rivet. In FIG. 2, the blind rivet is shown standing free in the work piece, engaged by the rivet gun accessory and finally at 22 as expanded and set.

As best seen in FIGS. 2 and 3, body 11 is hollow and tubular open at one end and internally threaded at 23. An externally threaded end cap 24 having an internally extending boss 25 is threaded into the end of body 11 engaging internal threads 23. End cap 24 is provided with external flange 26, the edge of which in the assembled unit is substantially flush with the outside walls of body 11. Shank 12 is threaded at 27 over a substantial portion of its length and engages the central threaded bore 28 of the end cap 24.

An inner tubular body 29 is carried by the inner end of shank 12, preferably integral therewith. The free end of inner tubular body 29 is provided with an outwardly extending annular flange 30 whose edge fits with a close fit within tubular body 11, which functions as a bushing for the flange, for both rotary and reciprocal movement. The inner tubular body 29 and flange 30 function as a plunger to operate the gun. A helical torsion spring 31 is housed within tubular body 11 surrounding the inner end of shank 12, boss 25 and inner tubular housing 29. One end of torsion spring 31 is anchored in a longitudinally extending hole 32 in end cap 24 held therein by means of a set screw 33. The opposite end of spring 31 is anchored in flange 30 of inner tubular body 29 in a longitudinally extending hole 34 secured therein by means of a set screw 35.

A knurled threaded hollow head 36 engages internal threads 37 at the end of body 11 opposite from end cap 24. Head 36 has a central cylindrical bore 38 and a central muzzle bore 39 of lesser diameter connected together by an interior tapered wall 40.

An elongated sleeve member, indicated generally at 41, is positioned within head 36 extending to inner tubular body 29 for longitudinal movement with the inner tubular plunger body and relative to head 36. Sleeve 41 is provided with a relatively short head portion 42 which is of a larger diameter to fit with a slide fit within the bore of the inner tubular body 29 for rotary movement of the inner body relative to the head portion 42. The base of head portion 42 rests against a plurality of ball bearings 43 disposed in the bottom of the bore of inner tubular body 29. Sleeve 41 is also provided with a relatively elongated stem portion 44 of lesser diameter adapted to fit with a slide fit within the muzzle bore 39 of head 36. The stem portion 44 of the sleeve is provided with a transverse slot 45 which extends through the stem portion of the

sleeve for a portion of its length adjacent to, but spaced inwardly from, the muzzle end of the sleeve.

The sleeve is provided with a longitudinal bore **46**. The muzzle end of bore **46** is threaded to receive a bushing **47**. Bushing **47** functions as a nozzle and has an adapter to receive mandrels of different sizes from rivets of different sizes. That is, bushings of different sizes are readily interchangeable with the head in order to adapt the rivet gun accessory to the setting of rivets of various sizes.

A pair of toothed jaw members **48** are positioned partially within the transverse slot **45** of the stem portion **44** of sleeve **41**. Each of the jaw members **48** is desirably provided with an outer flanged end **49** (FIG. 5) extending into the longitudinal bore of the head opposite from, and generally parallel to, the toothed edge. This flange functions to restrict the movement of the jaws inwardly and insure their proper alignment at all times. Each jaw member also has an inclined edge portion extending away from the flanged edge and adapted to engage the inside tapered surface **40** of the head **36**.

In the assembled rivet gun accessory, the inclined edges of the jaw members **48** are maintained in contact with the inner end of bushing **47** and held away from the tapered bore surfaces **40**, until such time as the rivet gun accessory is put into operation, by means of a compression spring **51**. Spring **51** extends around the stem portion **44** of sleeve member **41** and is seated against the enlarged head **42** at one end and against a washer **52** extending around the stem to exert the force of the spring against the jaw members. Loose fitting split washer **53** within the head end of tubular housing **11** serves as a resilient bumper for the flanged head of the actuating plunger.

A mandrel ejector **54** secured at one end to, and spring loaded by, compression spring **55** is positioned within the central bore **46** of sleeve **41**. The ejector and its spring are retained in the central bore by means of set screw **56**. As seen in FIG. 2, spring **55** is partially compressed by the end of the mandrel pressing against ejector means **54**. As seen in FIG. 4, when the mandrel is released from its head after the rivet is set, the spent mandrel is ejected through the muzzle.

The outer surface of tubular housing **11** is desirably provided with a resilient covering **57**. As explained in further detail hereinafter, the operator's hand functions as a clutch in the operation of the rivet gun accessory. The resilient covering **57** is an aid to the operator in gripping the housing and lessens hand fatigue from the use of the accessory device.

In the operation of the device, the gun is loaded by inserting the mandrel **20** of the rivet through the nozzle bushing **47**, either before or after the shank **18** of the rivet has been inserted into an appropriately sized hole in the work W to be riveted together. The gun and rivet are then in the positions shown in FIG. 2, the accessory being held in the chuck of a power drill.

While holding the gun in place by firmly grasping the handle of the power drill and by loosely holding the body **11** of the rivet gun accessory, the operator squeezes the actuating trigger of the power drill. This causes the entire rivet gun accessory to spin in the operator's hand. The operator then actuates the manual clutch by gripping the body **11** firmly with his hand to hold its against rotation. This causes the body and the head to be drawn toward the drill chuck as a result of end cap **24** screwing down on the threaded portion **28** of shank **12**. As seen in FIG. 3, this has the result that the actuating plunger comprised of inner tubular body **29** and flange **30** and the sleeve **41** carried within the inner body and the accessory elements associated with the sleeve are moved relative to the body and head so as to extend out farther from the muzzle bore **39** of the head and to bring the inclined edge portions of jaw members **48** into engagement with the inside tapered surface **40** of the head.

Because the body **11** is held against rotation by the operator's hand, the plunger both rotates and moves longitudinally relative to the body **11**. Because both ends of torsion spring **31** are anchored, one in the rotating plunger and the other in the non-rotating body, torsion spring **31** is both opened as a result of the convolutions being spread farther apart and unwound as a result of the end anchored in flange **30** being moved in a circular path.

As the relative longitudinal movement of the plunger **29–30** and sleeve member **41** continues, the assembly comprised of sleeve **41**, jaws **48**, spring **51** and washer **52** is moved into further engagement between the inclined surfaces of the jaws and the tapered bore **40** of the head. This relative movement causes the jaws to move inward toward one another in the slot **45** and tightly grip the mandrel **20**. As the relative movement continues, the pulling force of the jaws working against the force of bushing **47** bearing against the head of the rivet and the work piece pulls the rivet mandrel **20** through the tubular shank **18**. This action causes the head **21** of the mandrel to spread apart the portion of the tubular shank **18** of the rivet which extends through the opposite side of the work piece. Further relative movement of the jaws causes the head of the mandrel to become firmly seated in the spread apart tubular shank of the rivet.

Still further relative movement of the jaws exerting further longitudinal force on the rivet mandrel after the head of the mandrel has become firmly seated in the spread apart shank of the rivet causes the mandrel to be snapped free from the head. This then releases the gun accessory from the rivet which is now firmly set in the work piece. At this point, the operator may both release the grip of his hand clutch from the body **11** and release the trigger to de-energize the power drill. As seen in FIG. 4, the spent mandrel is ejected through the muzzle through bushing **47** as the result of spring **55** expanding and pushing ejector **54** against the end of the spent mandrel.

Upon release of the hand clutch, torsion spring **31** contracts and rewinds itself causing plunger **29–30** to be rotated in the opposite direction and causing threaded end cap **24** to partially unscrew itself off of the threaded shank **12** as the plunger **29–30** is retracted relative to the housing. Sleeve member **41** is likewise retracted as the result of action of spring **51**. As jaws **48** are retracted from the tapered bore **40** of the head, the inner end **50** of bushing **47** tends to separate the jaws for receiving the mandrel of the next rivet to be set. The entire operation as described, from loading of the rivet gun, setting the rivet and discharge of the spent mandrel takes only a matter of seconds and the tool is ready for reloading.

The rivet gun accessory, according to the present invention, is compact and durable. It is adapted for use with power sources already available in the plants and shops where such guns are commonly used. When the rivet gun accessory is not in use, the power unit is available for other uses. Great economies are achieved relative to rivet guns with self-contained power units. The rivet gun is easily assembled and maintained for trouble-free operation. It is easily operated over long periods of time without fatigue. It is useful for setting rivets in a wide variety of applications such as in sheet metal assembly, duct work, attachment of body panels, window channels, sign work, assembly of a great many different parts of all kinds, and the like. It is adapted to setting rivets of a variety of sizes and materials such as aluminum rivets with aluminum mandrels, aluminum rivets with steel mandrels, steel rivets with steel mandrels, and the like.

It is apparent that many modifications and variations of this invention as hereinbefore set forth may be made without departing from the spirit and scope thereof.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A rivet setting accessory tool for use with a separable power unit, said tool comprising:

(A) an elongated tubular body;

(B) a relatively short head portion at one end of said body in axial alignment therewith, said head having a longitudinal bore therein;

(C) means within said head for engaging the mandrel of a rivet inserted therein, said mandrel engaging means comprising:

(1) a longitudinally extending sleeve assembly having a longitudinal bore and at least one transverse slot intersecting said longitudinal bore; and

(2) at least two toothed jaw members in said transverse slot, said jaws being movable in said slot to engage and grip a mandrel;

(D) shank means extending from the opposite end of said body and adapted for engagement in the chuck of a rotary power unit;

(E) actuating means within said body connected to said shank means for actuating said mandrel engaging means.

2. A rivet setting accessory tool for use with a separable power unit, said tool comprising:

(A) an elongated tubular body adapted for gripping by the hand;

(B) a relatively short head portion at one end of said body in axial alignment therewith, said head having a longitudinal bore therein;

(C) means within said head for engaging the mandrel of a rivet inserted therein;

(D) shank means extending from the opposite end of said body and adapted for engagement in the chuck of a rotary power unit, said shank means being threaded throughout part of its length and in threaded engagement with said body;

(E) actuating means within said body connected to said shank means for actuating said mandrel engaging means, said actuating means being rotatable with the shank means and reciprocable relative to the body when the body is held stationary and comprising:

(1) a flanged plunger in axial alignment with said shank means, one end of said plunger being connected to said shank means, and

(2) helical torsion spring means within said body around said shank means and plunger, one end of said spring means being anchored in the end of said body and the other end of said spring means being anchored in the flange of said plunger.

3. An accessory tool according to claim **1** further characterized in that:

(A) the longitudinal bore of said head portion has a tapered restriction adjacent its muzzle end;

(B) a portion of said jaw members extends outwardly from said slots into the longitudinal bore; and

(C) upon engagement of said extending portions of the jaw members with said tapered restriction the jaw members are urged inwardly to grip said mandrel.

4. An accessory tool according to claim **1** further characterized in that:

(A) helical coil spring loaded longitudinally movable mandrel ejector means are disposed within said sleeve assembly,

(B) the helical coil spring of said ejector means being compressed by said mandrel upon insertion of a rivet in the tool.

5. A rivet setting accessory tool for use with a separable power unit said tool comprising:

(A) an elongated tubular body;

(B) hand gripping means on said body;

(C) a relatively short head portion at one end of said body in axial alignment therewith, said head having a longitudinal bore therein;

(D) means within said head for engaging the mandrel of a rivet inserted therein;

(E) shank means extending from the opposite end of said body, said shank means adapted for engagement in the chuck of a rotary power unit;

(F) said shank means being threaded throughout part of its length and in threaded engagement with said body; and

(G) actuating means within said body connected to said shank means for rotary movement therewith, and reciprocable movement relative to the body to actuate said mandrel engaging means when said body is held stationary, said actuating means comprising:

(1) a flanged plunger having a tubular body in axial alignment with said shank means, one end of said plunger body being connected to said shank means; and

(2) helical torsion spring means within said tool body around said shank means and plunger body, one end of said spring means being anchored in the end of said body and the other end of said spring means being anchored in the flange of said plunger.

6. An accessory tool according to claim **5** further characterized in that said mandrel engaging means comprises:

(A) a longitudinally extending sleeve assembly having a longitudinal bore and at least one transverse slot intersecting said longitudinal bore, one end of said sleeve assembly extending into the bore of said head portion and the other end extending into the body of said plunger, and

(B) at least two toothed jaw members in said transverse slot of the sleeve, said jaws being movable in said slot to engage and grip a mandrel.

7. An accessory tool according to claim **6** further characterized in that:

(A) the longitudinal bore of said head portion has a tapered restriction adjacent its muzzle end;

(B) a portion of said jaw members extends outwardly from said slots into the longitudinal bore; and

(C) upon engagement of said extending portions of the jaw members with said tapered restriction the jaw members are urged inwardly to grip said mandrel.

8. An accessory tool according to claim **6** further characterized in that:

(A) helical coil spring loaded longitudinally movable mandrel ejector means are disposed within said sleeve assembly,

(B) the helical coil spring of said ejector means being compressed by said mandrel upon insertion of a rivet in the tool.

References Cited

UNITED STATES PATENTS

2,941,687	6/1960	Simmons	72—391
2,473,913	6/1949	Shaff	72—114
2,075,162	3/1937	Begg	72—454
3,144,158	8/1964	Nouvelet	72—391
3,309,911	3/1967	Simmons	72—391
3,399,561	9/1968	Martin	72—391
3,423,986	1/1969	Young	72—391
3,504,519	4/1970	Hornung	72—391

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