

[54] RIVET GUN
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 [73] Assignee: **The Richline Company, Incorporated**, St. Paul, Minn.
 [22] Filed: **Dec. 13, 1971**
 [21] Appl. No.: **207,406**

3,280,615 10/1966 Molitor..... 72/391
 3,548,627 12/1970 Henshaw..... 72/391

Primary Examiner—Charles W. Lanham
Assistant Examiner—Gene P. Crosby
Attorney—L. Paul Burd et al.

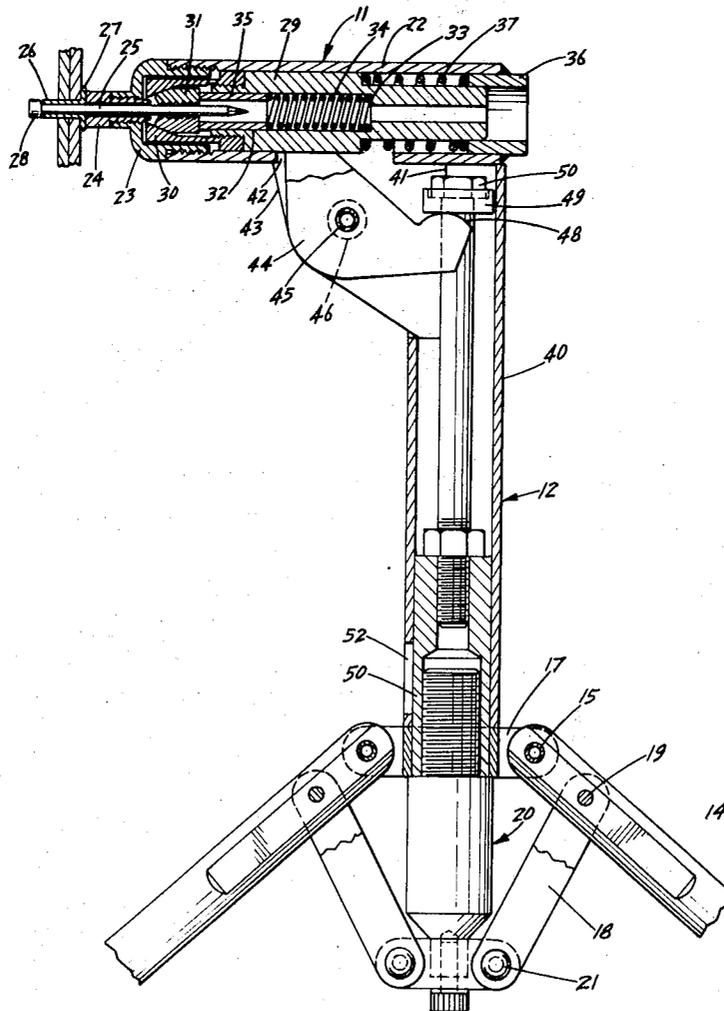
[52] U.S. Cl. 72/391
 [51] Int. Cl. B21j 15/16
 [58] Field of Search..... 72/391, 114, 453, 72/450

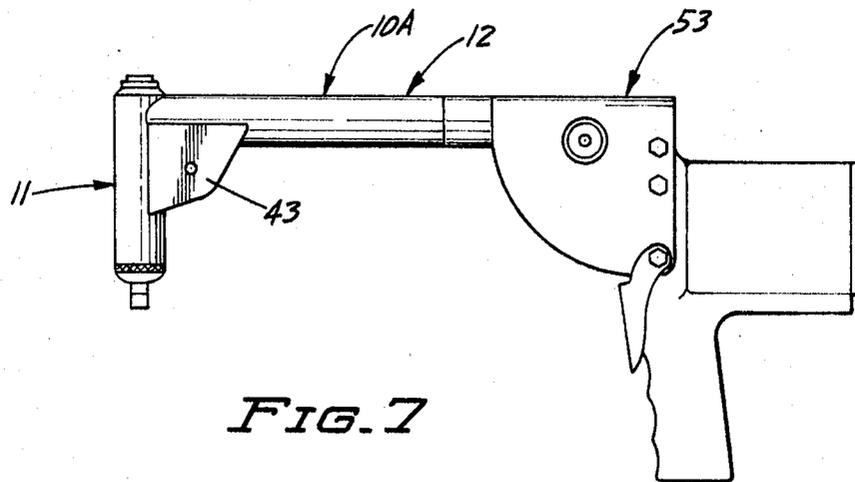
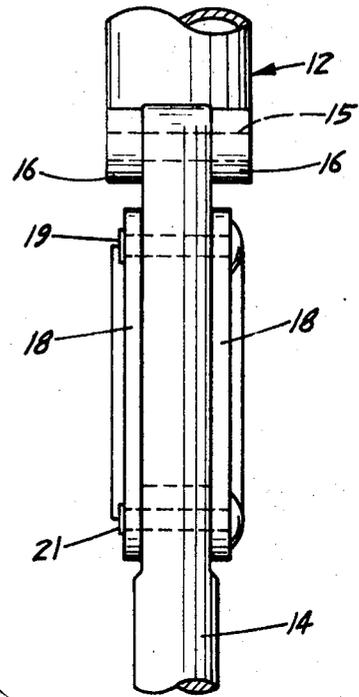
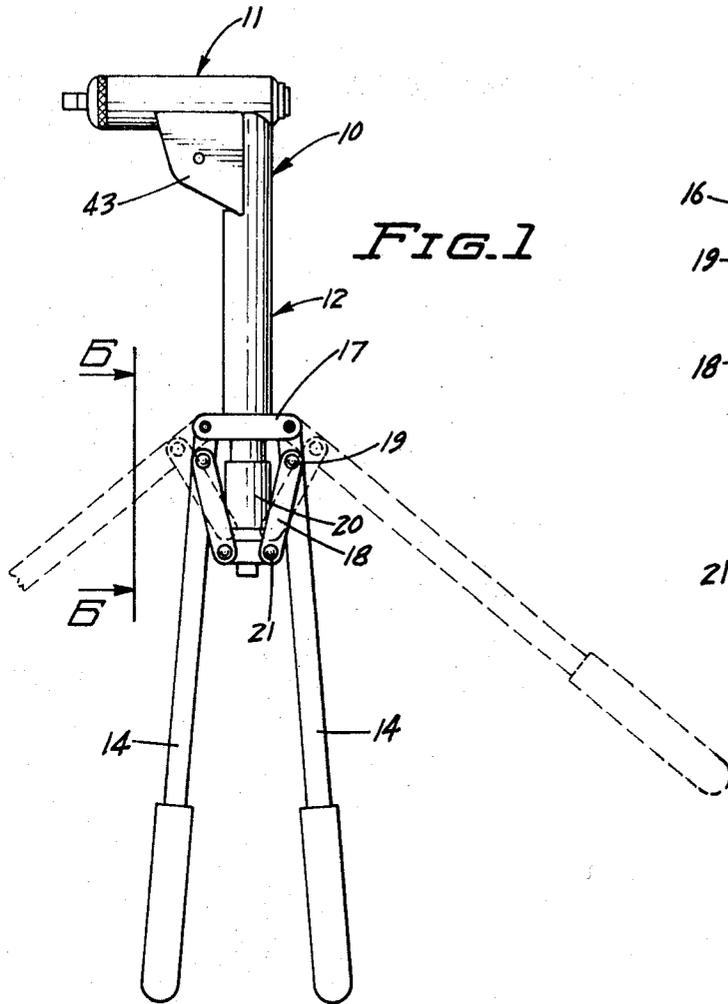
[56] **References Cited**
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3,374,656 3/1968 Di Maio..... 72/391
 2,396,001 3/1946 Fischer 72/391

[57] **ABSTRACT**
 A rivet gun for the setting of blind rivets characterized by a 90° angle head to permit use of the gun in otherwise inaccessible places. The longitudinal axis of the rivet setting head is disposed at a 90° angle relative to the longitudinal axis of the force applying mechanism by which the head is operated. The 90° angle head may be swiveled through 360° to further facilitate use of the gun for setting rivets in otherwise inaccessible locations. The rivet gun may be operated manually or from a power source.

9 Claims, 7 Drawing Figures





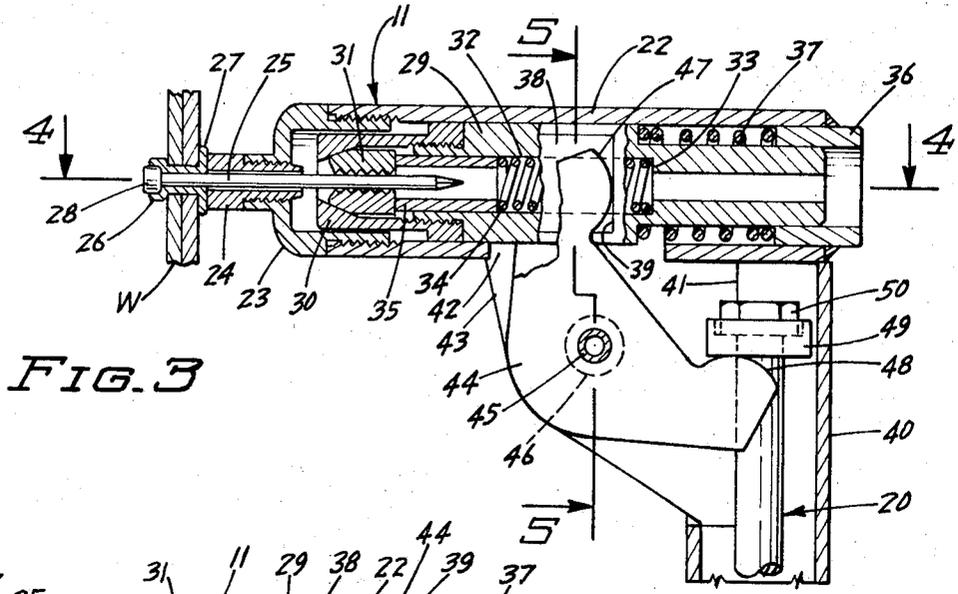


FIG. 3

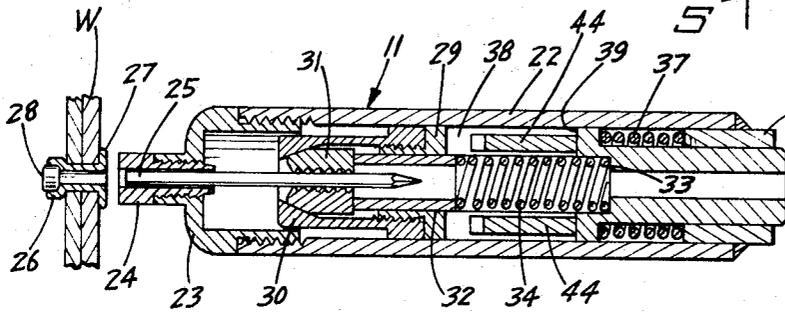


FIG. 4

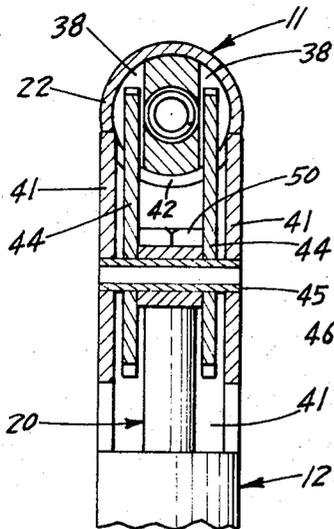


FIG. 5

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RIVET GUN

This invention relates to a gun for setting rivets. The rivet gun is for setting "blind" rivets, that is, the rivet is both inserted into the work and secured therein from the same side, without access by the operator to both sides of the work. Rivets for this purpose and guns for setting such rivets are well known. However, such rivet guns generally involve application of force "in line" along a common longitudinal axis. A pulling or pushing force is applied longitudinally to the mechanism of the rivet setting head which translates the force into a pulling action against the mandrel of the rivet to set the same. Because of this "in line" construction and operation, the use of blind rivet setting guns is limited to readily accessible sites.

One form of hand operated rivet gun designed for use in cramped and relatively inaccessible locations is shown in U. S. Pat. No. 3,280,615. Greater accessibility is provided through a relatively short head. However, the mechanism of that rivet gun is "in line" and, being manually operated, the force applied, and consequently the size and strength of the rivet, is limited by the manual strength of the operator.

The rivet gun according to the present invention is adapted for heavy duty work in relatively inaccessible places. The longitudinal axis of the setting head is disposed at right angles relative to the longitudinal axis of the direction of force applied by the force applying mechanism and the head may be swiveled in a full circle. By this means, many otherwise inaccessible places may be reached. Heavy duty manual or power force applying means permit use of the device to set heavy duty rivets. Although especially adapted for the maintenance and repair of snowmobiles, the tool is obviously of general utility.

The invention is illustrated in the accompanying drawings in which the same numerals are used to identify corresponding parts and in which:

FIG. 1 is an elevation of one form of manually operable rivet gun according to the present invention;

FIG. 2 is a fragmentary elevation on an enlarged scale and in section showing the rivet setting head and force applying means applied to a work piece with a rivet inserted through an aperture provided therein, the parts being shown in the positions they occupy just prior to application of force to set the rivet;

FIG. 3 is a fragmentary section similar to FIG. 2 showing the parts in the positions which they occupy when the rivet has been expanded and just before the head of the rivet supporting mandrel is about to be snapped off;

FIG. 4 is a longitudinal section along the line 4—4 of FIG. 3 showing the parts in the position they occupy just after the rivet supporting mandrel has been separated from its head to free the rivet gun from the work piece;

FIG. 5 is a fragmentary section on the line 5—5 of FIG. 3 and in the direction of the arrows;

FIG. 6 is a fragmentary side elevation on an enlarged scale generally along the line 6—6 of FIG. 1 and in the direction of the arrows; and

FIG. 7 is an elevation of another form of rivet setting gun according to the present invention adapted for operation by power means.

Referring to the drawings and particularly to FIGS. 1 to 5, the rivet gun, indicated generally at 10, comprises a rivet setting head, indicated generally at 11, se-

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cured at right angles to a body, indicated generally at 12. This form of rivet gun is manually operated. As illustrated, a compound lever operating mechanism is provided. A pair of arms 14 are pivotally mounted at 15 between the spaced apart parallel arms 16 at the opposite ends of a bracket member 17 mounted at the end of body 12 remote from the setting head 11. Each of arms 14 is connected by a spaced apart parallel pair of links 18 pivotally connected to the arms at 19, to the end of a pulling shaft 20, the links 18 being pivotally connected to a fitting 21 carried by the end of the shaft. As best seen in FIG. 1, and as explained in greater detail hereinafter, when arms 14 are moved inwardly from the broken line positions to the full line positions, pulling force is exerted on shaft 20 by means of links 18 permitting the exertion of great force up to about 3,000 pounds.

The rivet setting head 11 comprises a hollow tubular body 22 internally threaded at one end to receive a nozzle 23 having a restricted bore which is likewise internally threaded to receive a nozzle bushing 24. Bushing 24 as a central bore in which to receive the mandrel 25 of a conventional blind rivet. Such a rivet has a hollow tubular shank or body 26 which extends through the work piece W to be riveted (here shown as composed of two plates to be riveted together) and an annular flanged head 27, which may be flat or domed or counter-sunk and engages the operator's side of the work. The mandrel 25 is inserted through the rivet in the reverse direction, that is, from the operator's side with the head 28 of the mandrel at the opposite end from the head 27 of the rivet. Bushings 24 of different sizes are readily interchangeable with the nozzle 23 in order to adapt the rivet gun to the setting of rivets of various sizes.

A pulling head 29 reciprocates within the hollow body 22. The forward end of pulling head 29 is externally threaded and adapted to receive a chuck 30 whose bore is tapered to receive a pair of tapered jaws 31 which function to engage the shank of mandrel 25. Pulling head 29 has a central bore 32 extending axially through its length. Bore 32 is of reduced diameter at its rearward end providing a shoulder 33 against which one end of a coil spring 34 bears. A tubular sleeve 35 within bore 32 functions as a jaw actuating member, one end of sleeve 35 bearing against jaws 31 and the opposite end bearing against spring 34 to maintain the jaws in constant gripping engagement with the mandrel.

The rearward end of pulling head 29 is of reduced diameter and reciprocates in a short sleeve 36 fixed in the rearward end of tubular housing 22 opposite from the nozzle. A heavy coil spring 37 surrounds the end of reduced diameter of pulling head 29, one end of spring 37 bearing against a shoulder formed on the pulling head and the other end bearing against the inner end of sleeve 36. The opposite sides of pulling head 29 are flattened to provide a pair of recesses 38, each having a rearward shoulder 39.

Body 12 includes a tubular housing 40, the upper end of which is affixed to the rearward end of the rivet setting head 11. The upper forwardly facing portion of housing 40 is cut away to provide an opening 41. The inner portion of head housing 22 is cut away to provide an opening 42 about midway between the ends of the housing. A pair of parallel spaced apart gusset plates

are secured to the housings adjacent openings 41 and 42 at the connection between the body and head.

A pair of parallel spaced apart crank arm levers 44 are pivotally supported within the gusset plates 43 on a pin 45 being held spaced apart by a spacer sleeve 46. The inside edges of crank levers 44 have a pair of inwardly facing arcuate cam surfaces 47 and 48 which extend through the openings 42 in head housing 22 and opening 44 in body housing 40, respectively. Cams 47 embrace the opposite sides of pulling head 29 within the recesses 38 and bear against shoulders 39. Cams 48 embrace the end of pulling shaft 20 and bear against a shaft collar 49 secured to the end of the shaft by nut 50.

The entire rivet setting head, levers 44 and body housing 40 are freely rotatable about shaft 20, the bearing surfaces being the interface between cams 48 and collar 49, between the bottom end of housing 40 and the upper surface of bracket 17, and between the lower inside surface of housing 40 and the outer surface of the enlarged diameter portion 51 of pulling shaft 20. An opening 52 in housing 40 permits lubrication of this latter interface.

The descriptive words "upper," "bottom," and the like, used herein are in reference to the tool in the positions as illustrated. It will be readily understood that the tool may be used in any position dependent upon the location of the work to be performed.

In FIG. 7, there is shown a modified form of rivet gun according to the present invention, indicated generally at 10A. The rivet setting head 11, body 12 and mechanisms contained therein are in all material respects as already described in detail with reference to the manually operated rivet gun of FIGS. 1 through 6. In this modified form of rivet gun, a power means 53, in this instance an air gun, is provided to supply the pulling force. Alternatively, the power source might be electrically or hydraulically driven. This form of gun has the rivet setting head disposed at a right angle to the longitudinal axis of the force applying means and is fully rotatable through 360°.

In the operation of the rivet gun of FIGS. 1 through 6, the mandrel 25 of a rivet is first inserted into the nozzle of the setting head and the shank 26 of the rivet is inserted into the work piece W. Force is applied by bringing together arms 14. Force is transmitted through links 18 to the bottom end of shaft 20 pulling that shaft outwardly from housing 40, collar 49 bearing against cams 48 causing the crank levers 44 to move in unison on their pivot causing cams 47 to bear against shoulders 39 to reciprocate pulling head 29 against the pressure of coil spring 37. Constant tension is maintained on jaws 31 by virtue of coil spring 34 bearing against sleeve 35. As pulling head 29 is retracted, chuck 30 bearing against the tapered faces of jaws 31, forces those jaws into tight clamping relation with mandrel 25 and the mandrel is pulled through the rivet. As continued force is applied, the mandrel head 28 expands the outer end of rivet tubular shank 26 to set the rivet and finally head 28 separates to free the rivet gun and the mandrel from the work piece. As pressure on arms 14 is relaxed, spring 37 functions to return the parts to their original starting position. The spent mandrel may be discharged through the rearward end of bore 32 through the pulling head 29. The operation of the power gun is similar except that the pulling force is applied by the power means.

Although the setting head is described and illustrated as being disposed at a right angle relative to the axis of the pulling force, the head may be disposed at an angle other than 90° with only minor modification of the levers 44 and their supporting structure.

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 specific embodiments described are given by way of example only and the invention is limited only by the terms of the appended claims.

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

1. A rivet gun for setting blind rivets, said gun comprising:
 - A. a setting head for engaging and pulling the mandrel of a blind rivet,
 - B. a body including force exerting means for applying pulling force to said setting head, the direction of said force being generally longitudinal of said body,
 - C. said setting head being secured to said body with the longitudinal axis of said setting head disposed at an angle relative to the longitudinal axis of said body and the direction of force applied by said force exerting means, and
 - D. said setting head being rotatable through 360° relative to the longitudinal axis of the body.
2. A rivet gun according to claim 1 further characterized in that said setting head is disposed with its longitudinal axis at a 90° angle relative to the longitudinal axis of the body and the direction of force applied by said force exerting means.
3. A rivet gun according to claim 1 further characterized in that said force exerting means includes means for translating force exerted in one direction to another direction disposed at an angle to the first direction.
4. A rivet gun according to claim 3 further characterized in that:
 - A. said setting head comprises a tubular housing, a reciprocable pulling head within said housing and mandrel gripping means within said pulling head,
 - B. said body includes a tubular housing and a reciprocable pulling shaft within said housing,
 - C. said force translating means comprises a bell crank lever, one arm of said lever engaging said pulling head and the other arm of said lever engaging said pulling shaft.
5. A rivet gun for setting blind rivets, said gun comprising:
 - A. a setting head for engaging and pulling the mandrel of a blind rivet, said setting head including a tubular housing, a reciprocable pulling head within said housing and mandrel gripping means within said pulling head,
 - B. a body including force exerting means for applying pulling force to said setting head, the direction of said force being generally longitudinal of said body, said body being secured at one end to said setting head and including a housing and a reciprocable pulling shaft within the housing,
 - C. the longitudinal axis of said setting head being at an angle relative to the longitudinal axis of the body and the direction of force applied by said force exerting means,
 - D. an opening in each of said housings adjacent to their point of attachment,

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- E. means for translating force exerted in one direction by said pulling shaft into another direction for reciprocating said pulling head, including a bell crank lever, one arm of said lever extending through one of said openings and engaging said pulling head and the other arm of said lever extending through the other of said openings and engaging said pulling shaft,
- F. means outside of said housings adjacent to said openings for mounting said crank arm for pivotal rotation, and
- G. means outside of said body at the end opposite from said setting head for exerting pulling force on said pulling shaft.

6. A rivet gun according to claim 5 further characterized in that the axis of said setting head is disposed at a 90° angle relative to the axis of said body.

7. A rivet gun according to claim 5 further characterized in that means are provided whereby said setting head is rotatable through 360° relative to the longitudinal axis of the body.

8. A rivet gun according to claim 5 further characterized in that said means for exerting pulling force is manually operated.

9. A rivet gun according to claim 5 further characterized in that said means for exerting pulling force is power operated.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,760,627 Dated September 25, 1973

Inventor(s) Russell F. Richardson et al

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 2, line 44, "tubu'ar" should be --tubular--;

line 56, "thee" should be --the--;

line 57, "aare" should be --are--.

Column 3, line 10, "th" should be --the--;

line 15 after "are", --all-- is omitted

Claim 1, line 5, "fo" should be --for--.

Claim 5, line 22, "inlcuding" should be --including--.

line 31, "boby" should be --body--.

Signed and sealed this 25th day of December 1973.

(SEAL)

Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

RENE D. TEGTMEYER
Acting Commissioner of Patents