July 26, 1949. S. L. GOOKIN 2,477,056

RIVETING IMPLEMENT

Filed Jan. 5, 1946

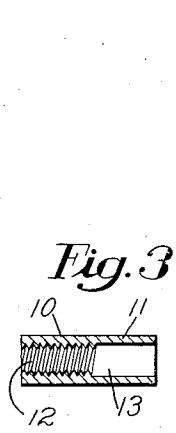


Fig. 3

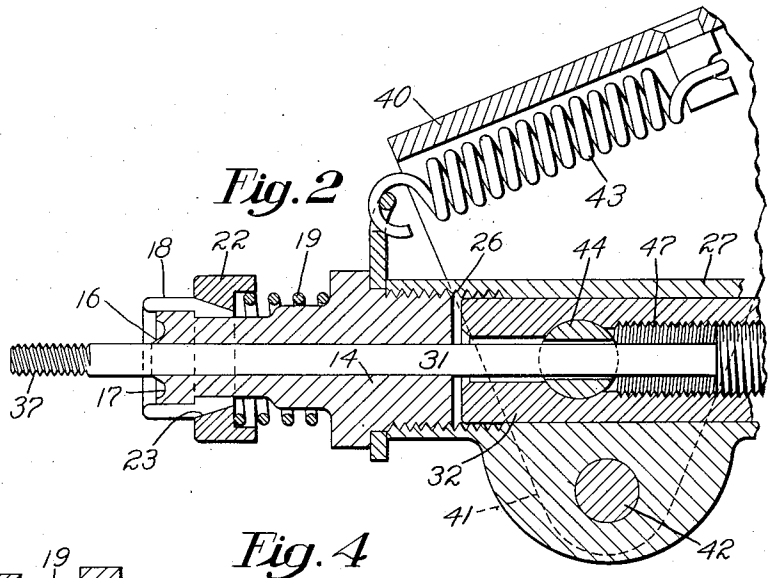


Fig. 2

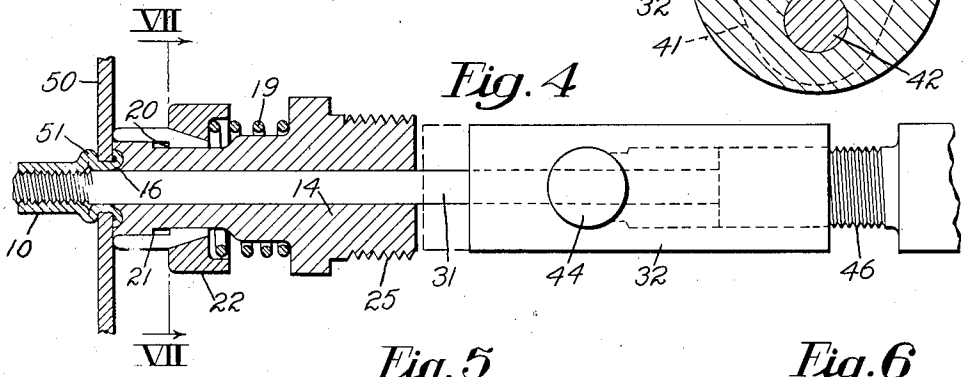


Fig. 4

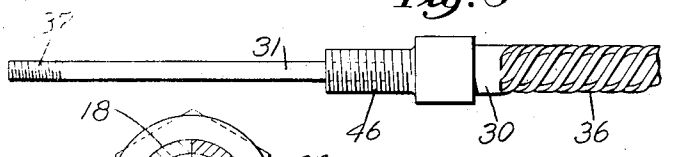


Fig. 5

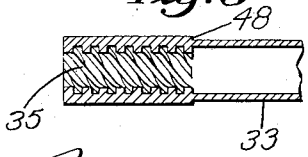


Fig. 6

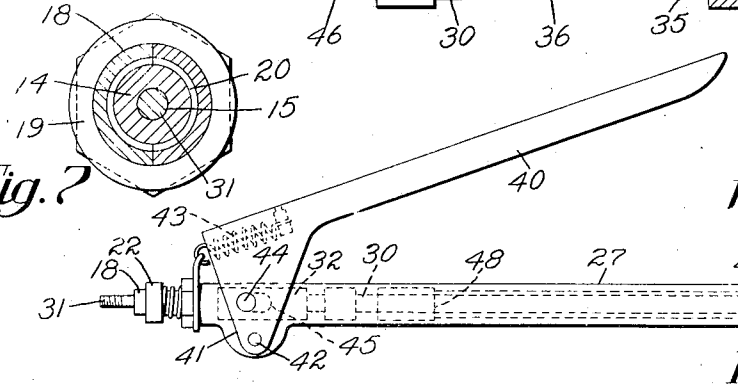


Fig. 7

Fig. 1

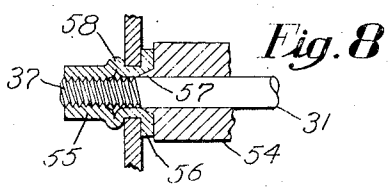


Fig. 8

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UNITED STATES PATENT OFFICE

2,477,056

RIVETING IMPLEMENT

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Application January 5, 1946, Serial No. 639,354

3 Claims. (Cl. 218—19)

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The purpose of the present invention is to provide improvements in implements for installing hollow rivets according to the blind riveting methods set forth in my application for United States Letters Patent Serial No. 639,355, filed January 5, 1946, now abandoned. One of those methods provides for installing a headless rivet and transforming one end of the rivet into a head during the installing process but prior to upsetting or enlarging another portion of the rivet to form a retaining flange or shoulder.

The implement illustrated herein embodies the same general organization as that illustrated in United States Letters Patent No. 2,358,703, granted September 19, 1944 on an application filed in my name, but the present development includes novel features related to the methods above mentioned. One of these novel features is a riveting anvil designed to dilate one end of a headless hollow rivet and thereafter transform the dilated end into a head as the rivet and the anvil are pulled one against the other by a rod extending through both of them.

Another novel feature is a spring-loaded member carried by the anvil to abut the structure being riveted and thereby locate the anvil and the rivet initially in positions that will insure projection from the structure of a predetermined quantity of rivet metal required to form a head. The spring-loaded member, after performing that duty, will yield to permit the anvil to advance toward the structure in response to the upsetting stress applied to the pull-rod.

If the implement is to be used to install a rivet having a preformed head as illustrated in the aforesaid Patent No. 2,358,703, the anvil need not be provided with a spring-loaded locating member, nor with a head-forming surface, but it may be provided with a tapered pilot surrounding the pull-rod. In that event the pilot will enlarge the shank of the rivet and dilate its throat, thereby tightening it with respect to the riveted structure but loosening it with respect to the pull-rod.

Referring to the drawings,

Fig. 1 is a side elevation of a riveting implement embodying the invention;

Fig. 2 is a longitudinal section of the forward portion thereof on a larger scale;

Fig. 3 is a longitudinal section of a headless rivet having an internal screw-thread;

Fig. 4 is a sectional view representing the implement in the final stage of installing a headless rivet;

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Fig. 5 is a side view including the pull-rod and a portion of a shaft to which it is affixed;

Fig. 6 is a longitudinal section of a portion of an internally threaded sleeve for rotating the shaft;

Fig. 7 is a cross section of the parts in the plane of line VII—VII in Fig. 4; and

Fig. 8 is a sectional view in which an alternative type of anvil is in the act of installing a rivet having a preformed head.

The headless hollow rivet shown in Fig. 3 is a cylinder of ductile metal having a thick-walled zone 10, a thin-walled zone 11, an internal screw-thread 12 in the zone 10, and a counterbored throat 13 in the zone 11.

The implement illustrated in Figs. 1, 2 and 4 is provided with an anvil 14 designed to install a headless rivet. A smooth bore 15 (Fig. 7) extending through the anvil is concentrically surrounded at one end thereof by an annular rivet-engaging surface or channel 17 of curved section and a tapered pilot 16 projecting therefrom. The outer margin of the anvil projects less than the pilot 16. The smaller end of the pilot is of the same size as the bore 15, and is therefore small enough to be forced into a rivet having a throat of that size. The anvil is surrounded by a sliding sleeve 18 normally pressed ahead by a compression spring 19. A stop shoulder 20 of the sleeve is thus normally held against a stop shoulder 21 of the anvil as shown in Fig. 2, and the forward end of the sleeve then projects a short predetermined distance beyond the anvil and surrounds the rivet zone. This factor of projection determines the amount of metal of the zone 11 to be transformed into a head.

For assembling purposes the spring-loaded sleeve 18 is divided in a diametrical plane (Fig. 7) to provide two equal segmental sections, and the rear portions thereof are tapered to fit into an internally coned collar 22. When the parts are assembled the collar receives the thrust of the spring 19, and the sections of the sleeve are maintained in their assembled relation by the conical surface 23 of the collar. The sleeve is then free to slide on the anvil, and the collar is carried by the sleeve.

A screw-thread 25 (Fig. 4) on the rear end of the anvil is screwed into a thread 26 inside the tubular body 27 of the implement to provide a rigid connection. The features now to be described may be the same as corresponding features of the implement illustrated in the aforesaid Patent No. 2,358,703.

The cylindrical internal surface of the tubu-

lar body 27 provides a bearing for an axially movable assemblage including a screw-shaft 30 (Fig. 5), a pull-rod 31 affixed thereto, a thrust-sleeve 32 and a tubular plunger 33, all telescopically related to the body. The plunger 33 is individually movable and its purpose is to rotate the pull-rod 31. For this purpose the plunger projects from the rear end of the body 27 and is provided with a knob 34 by which it may be pulled and pushed endwise. The forward portion of the plunger is provided with a coarse steep screw-thread 35 that cooperates with a mating thread 36 on the shaft 30 to rotate the latter and the pull-rod affixed thereto. The rear end of the pull-rod is screwed into the shaft and may be otherwise secured thereto by a setscrew (not shown). The pull-rod fills and extends freely through the bore 15 of the anvil, and its forward end is provided with a fine thread 37 that will mate the thread 12 in a rivet but slide freely through the counterbored throat 13 of the rivet. These elements provide for coupling the pull-rod and a rivet prior to placing the latter in a hole in the structure to be riveted.

The motion for pulling the rivet against the anvil is obtained from a manually operable lever 40 (Fig. 1) having a pair of confronting arms 41 that straddle the body 27 and are anchored thereto by a fulcrum pin 42. A tension spring 43 normally holds the lever in the position shown. The thrust-sleeve 32 and the arms 41 are coupled by a cross pin 44 that extends through slots 45 in the body 27. This pin is bored to enable the pull-rod to extend through it (Fig. 2). The thrust-sleeve and the shaft 30 are coupled by a thrust connection that permits rotation of the shaft without rotation of the sleeve. This connection is provided by a fine screw-thread 46 on the shaft and a mating screw-thread 47 in the sleeve. The gage of these threads is preferably the same as that of the threads 12 and 37. The connections between the lever 40 and the axially movable assemblage cause the pull-rod to be retracted in consequence of swinging the long arm of the lever toward the body 27, the extent of the travel of the sleeve 32 being indicated in Fig. 4 in which broken lines represent the initial position of the forward end of the sleeve.

To install a headless rivet (Fig. 3) the operator will first hold a rivet between the thumb and a finger of one hand while the anvil portion of the implement rests in the cupped palm of that hand. With the other hand he will retract the knob 34 to place a stop shoulder 48 of the plunger against a bushing 49 fastened in the rear end of the body 27. Now, the shaft 30, having been thereby partially unscrewed from the thrust-sleeve 32 which remained in its forward position locates, due to the pull of spring 43 the forward end of the pull-rod at a distance from the pilot 16 just equal to the length of the counterbored throat 13 of the rivet. The operator may now slide the zone 11 of the rivet along the thread 37 until the rivet touches the pilot 16. Holding the rivet there, he will push the knob 34 forward as far as it will go, thereby rotating the shaft 30 and the pull-rod. As the thread 46 of the shaft advances in the thread 47 of the thrust-sleeve, the thread 37 of the pull-rod advances equally in the thread of the rivet without displacing the rivet from the pilot 16. During this forward travel of the plunger 33 the thrust thereof is sustained entirely by the sleeve 32 and the body 27.

Having assembled the implement and a rivet, the operator will thrust the rivet into a hole in the structure to be riveted. In Fig. 4 the plate 50 represents such a structure and it is hereinafter assumed for purposes of explanation to be stationary although it will be understood that it may be movable without altering the manner of operation of the tool. The spring-loaded sleeve 18 will at this stage abut the plate and the rivet will be located endwise with a portion of its thin zone 11 projecting from both the external and the inaccessible sides of the plate 50. It will be understood that the spring 19 is then under no compression from forces acting externally of the tool, its strength being sufficient to hold the sleeve 18 extended beyond the anvil with the stop shoulders 20 and 21 in engagement. At this time the amount of the extension of the sleeve beyond the anvil corresponds with, and predetermines or measures, the amount of the zone 11 rivet material extending in front of the plate and contacting the pilot 16. It is this measured portion of the headless hollow rivet which is about to be curled into an external head.

While keeping the sleeve 18 in contact with the plate 50 by slight forward pressure insufficient further to compress the spring 19, the operator will grasp the lever 40 and the body 27 in one hand and squeeze them to overcome the resistance offered by the springs 19 and 43. The slight forward pressure referred to is maintained to retain contact between the sleeve 18 and the plate 50. The body, because of the hand grip action, is thereby forced forward as the thrust sleeve 32, the shaft 30 and the pull rod 31 tend to be retracted. It should be noted that the rivet, as a body, being acted on by forces of equal and opposite direction, does not move endwise of the plate 50 and hence its endwise location relative to the plate remains as it was first determined by the yieldable sleeve 18, i. e., the rivet (considered as a whole) and plate do not thereafter slide with respect to each other. The relative movement of the rivet and pull rod with respect to the anvil affixed to the body 27 is believed to meet with cumulative resistance as head forming progresses. Thus, the external rivet end is first expanded by the pilot 16 (and thereby tightened) and then the measured portion is further curled by the channel 17 to form a head. When this head is formed, it together with the anvil 14 abuts the plate 50 and further rolling back of the rivet is prevented probably because of this accumulation of resistance. The sleeve 18, while still engaging the plate due to the aforesaid light forward pressure, will consequently have been permitted to recede relatively to the anvil so that the latter at this stage also abuts the plate. The cavity defined by the channel 17, the plate 50 and the pull rod 31 having been packed with thin-zone rivet material, no further head curling of the rivet occurs. Presumably this is because the force which is thereafter applied in operating the lever 40 is expended more easily in buckling the thin zone rivet material still extending behind the plate, as at 51, than in doubling the external rivet end further back along its barrel. Since the formed head confined by the anvil and the plate 50 now has a resistance to further deformation in the channel 17, further retraction of the pull rod by operating the lever 40 will pull the thick zone 10 of the rivet toward the anvil. The effect of this is to compress the rivet endwise on the inaccessible side of the plate, and consequently, an unconfined portion of the thin zone 11 behind the plate

50 and adjoining the zone 10 will be collapsed endwise and bulged radially to form the flange 51. The advance of the anvil to abut the plate, will thus be seen to have left an adequate and a definite amount of rivet material from which the internal retaining flange is formed. The operator's final squeeze of the tool clenches the plate 50 by reason of the outside head and inside flange being pressed toward each other to complete a tight-fitting installation.

The installing of the rivet being now completed, the operator will release the lever 40 and retract the knob 34. As the plunger 33 is pulled back it will rotate the shaft 30 in the direction to unscrew the pull-rod from the rivet. Since the tapered pilot 16 maintains radial expansion of the counterbored throat of the rivet throughout the upsetting operation, the pull-rod will rotate freely when the knob is finally retracted.

If the implement is to be used to install rivets having preformed heads, the anvil 14 may be detached from the body 27 and replaced by an anvil 54 (Fig. 8) of the same length but of different design. The rivet 55 included in this view is the same, prior to being installed, as the rivet represented in Fig. 3 except that it has a preformed head 56. Large numbers of rivets of this type are now being used, despite the fact that many of them, when collapsed with too much force against anvils heretofore provided for them, grip the pull-rod so tightly that the final unscrewing thereof is difficult.

The anvil 54 is designed to prevent such gripping. For this purpose it is provided with a tapered pilot 57 similar to the pilot 16. When this anvil and the head end of a rivet 55 are forced one against the other by retracting the pull-rod the pilot 57 is forced into the throat of the rivet where it remains while the rivet is being collapsed endwise to bulge the portion 58. The portion expanded by the pilot becomes tight with respect to the riveted structure but remains loose with respect to the pull-rod.

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

1. An implement for blind riveting of a headless hollow rivet to a structure, comprising a main body, a riveting anvil fixed to said body having an axial bore and one end provided with an annular concave groove concentric with said bore and adjacent thereto, a member initially projecting a predetermined amount beyond the grooved end of said anvil to abut the structure, said member being yieldingly mounted on the anvil to recede a distance equivalent to said predetermined amount, a pull rod slidably mounted in said bore having means exterior to said anvil for attachment of the rivet, and a lever with a pivot fixed to said main body and a second pivot movable with respect to the main body and affixed to said pull rod, the arrangement being

such that operation of the lever forces the anvil relatively toward the forward end of the pull rod to upset a length of one end of the rivet equivalent to said predetermined amount.

2. An implement for blind riveting of a hollow rivet to a structure, comprising a main body, a riveting anvil fixed thereto having an axial bore and an annular concave groove concentric with said bore and adjacent thereto, a pull rod slidable through the bore of said anvil having means remote therefrom which may be detachably secured to a hollow rivet, a spring-loaded sleeve yieldingly carried by the anvil and normally in advance thereof for abutment with the structure, cooperative stops on the anvil and the sleeve for limiting the advance of said sleeve forwardly of the anvil and consequently predetermining the amount of rivet material initially projecting from the structure to the anvil, and means associated with said body for retracting the pull rod whereby said predetermined quantity of rivet material is collapsed and confined against the groove of the anvil.

3. An implement for riveting of a headless hollow rivet to a structure, comprising a main body, a riveting anvil affixed thereto having an axial bore extending centrally therethrough and one end provided with an annular concave channel concentric with said bore for upsetting a rivet, a pull-rod slidable in the bore and having means for attachment thereto of said rivet forwardly of the anvil, a member supported by the anvil and normally held yieldingly a predetermined amount beyond the upsetting end of the anvil to abut the structure, the projection of said member thereby serving to equate the amount of rivet material to be upset with the volume of said channel, and means associated with the body for retracting the pull-rod to move the anvil relatively toward the forward end of the pull rod whereby said measured rivet projection material is upset by said channel.

SYLVESTER L. GOOKIN.

REFERENCES CITED

The following references are of record in the file of this patent:

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2,358,703	Gookin	Sept. 19, 1944
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Certificate of Correction

Patent No. 2,477,056 July 26, 1949

SYLVESTER L. GOOKIN

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows:

Column 6, line 41, strike out the word "projection";

and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 28th day of February, A. D. 1950.

[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.