

May 14, 1946.

J. JENSEN

2,400,354

RIVET SETTING TOOL

Filed Sept. 28, 1942

3 Sheets-Sheet 1

Fig. 1.

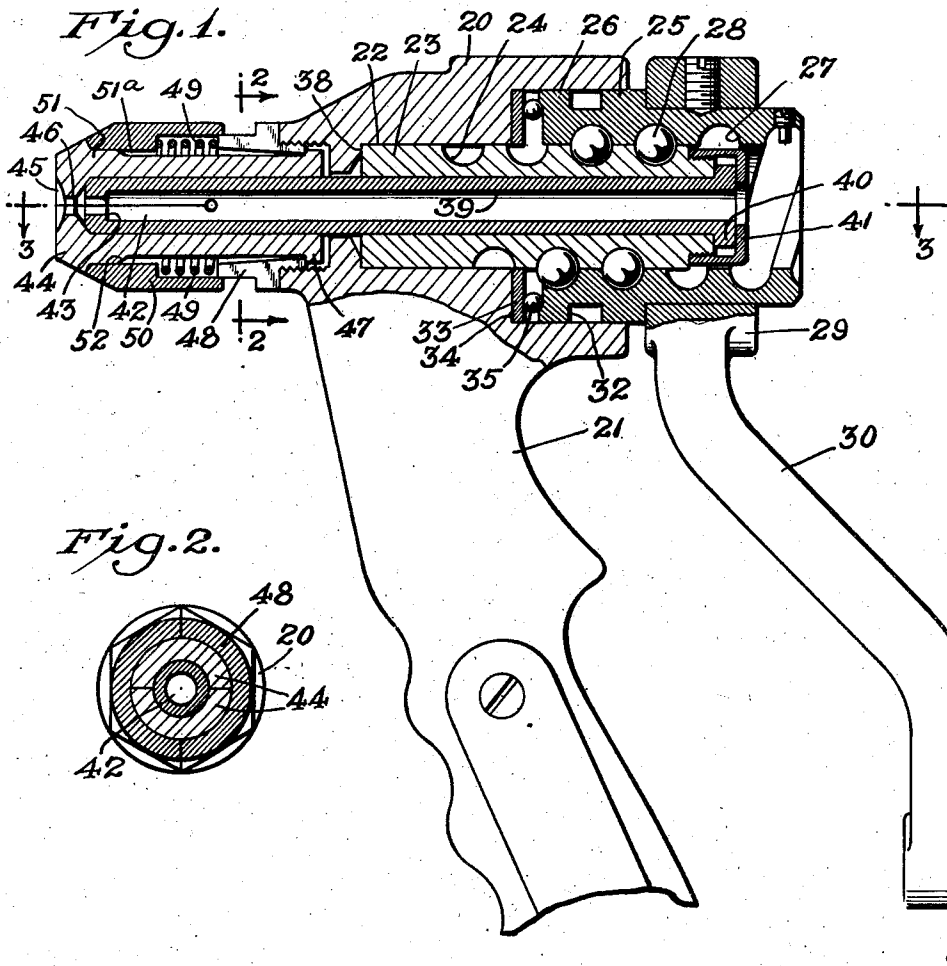


Fig. 2.

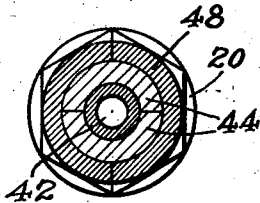
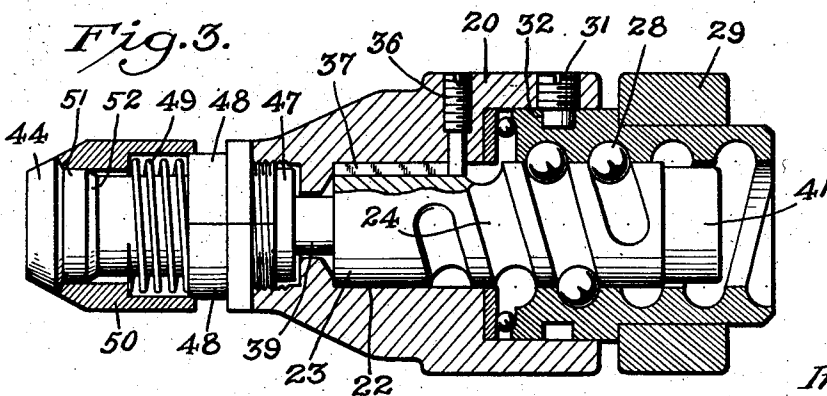


Fig. 3.



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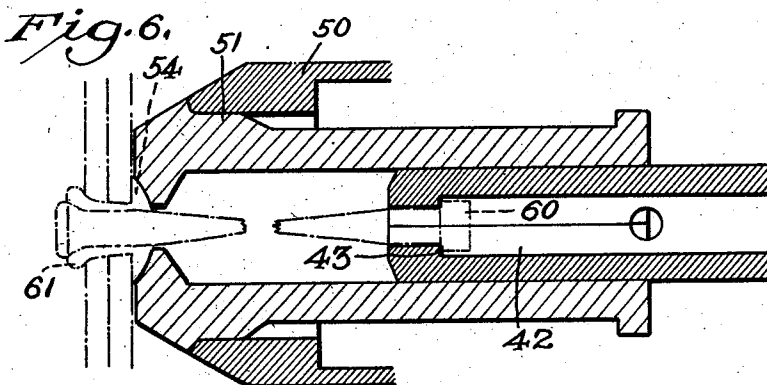
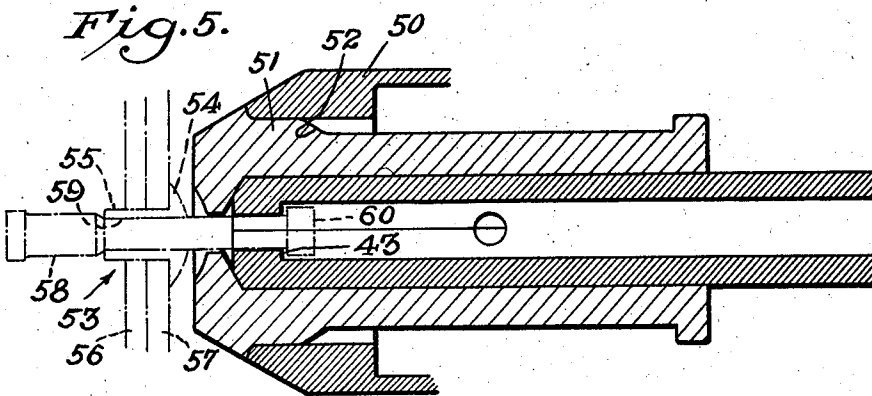
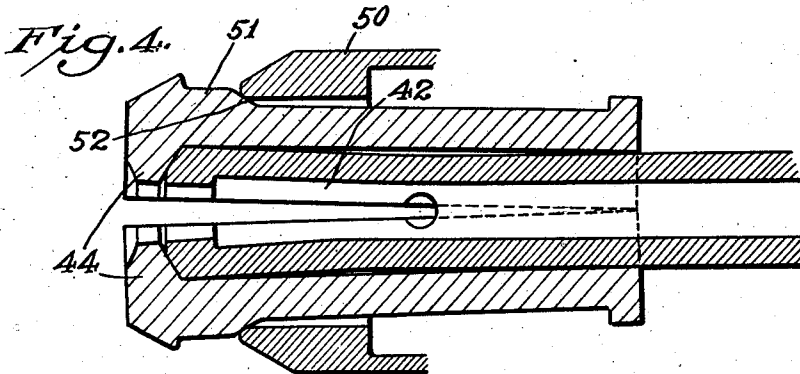
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RIVET SETTING TOOL

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3 Sheets-Sheet 2



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RIVET SETTING TOOL

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3 Sheets-Sheet 3

Fig. 7.

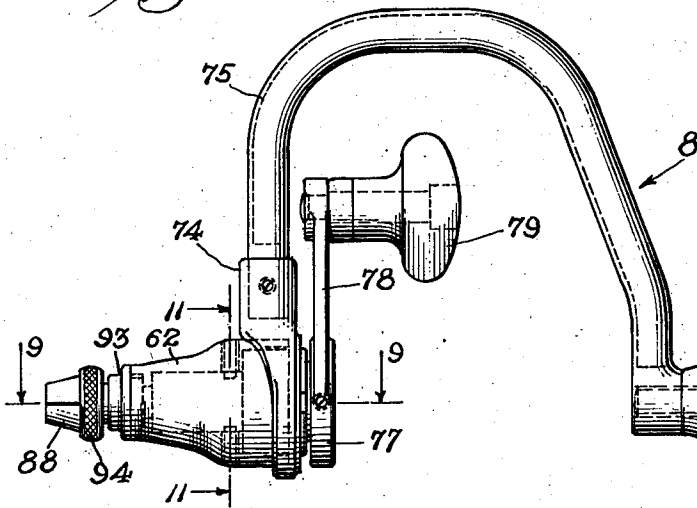


Fig. 8.

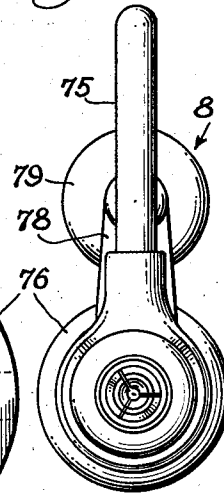


Fig. 9.

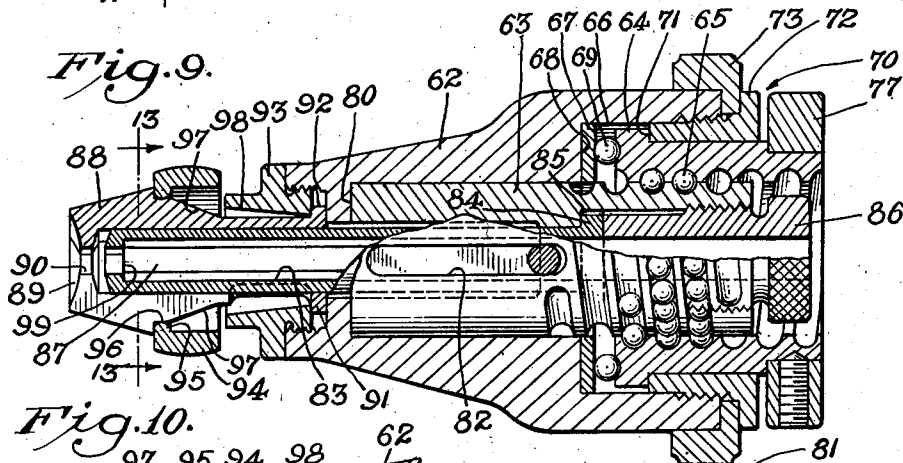


Fig. 10.

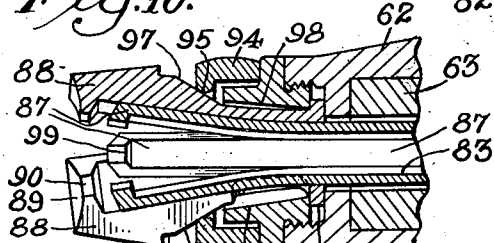


Fig. 11.

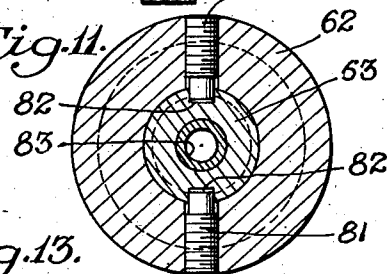


Fig. 12.

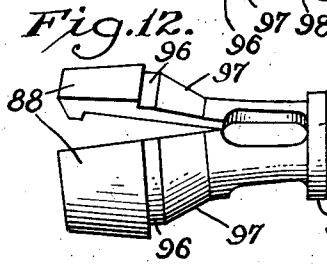
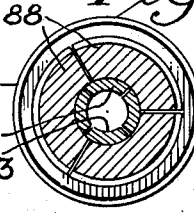


Fig. 13.



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UNITED STATES PATENT OFFICE

2,400,354

RIVET SETTING TOOL

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Application September 28, 1942, Serial No. 459,945

16 Claims. (Cl. 218—19)

My invention relates to a rivet setting tool and is concerned more particularly with a tool utilizable in the mechanical setting of that type of rivet which is positioned and secured in place from one side of the parts to be connected together.

Generally speaking, such a fastening means, which may be in the form of a rivet, bolt, stay or similar member, and which for purposes of description will be considered as a rivet, comprises a head and shank arranged similar to a standard solid rivet, but differs therefrom in respect of an axial passage extending completely through the head and shank. A typical rivet of this class is disclosed in United States Letters Patent No. 2,183,543 and it is secured in position by spreading or expanding the shank end of the rivet by means of an upsetting or former member which engages the shank end, extends through the rivet passage and is pulled by a tool on the head side of the unit while the rivet head is held firmly against one of the parts being fastened together. Uniformity of setting is intended to be accomplished by employing former members of uniform strength for any given size of rivet which are tensionally ruptured during pulling at any predetermined strength of pull.

Tools heretofore employed for setting the above type of rivet have not proven entirely satisfactory for a number of reasons, including a tendency to cock the rivet during setting by a pull misaligned relative to the axis of the rivet and awkwardness in holding the tool to the rivet and in applying the oppositely acting forces to the rivet head and former member.

It is therefore one object of my invention to provide a tool for the purpose stated which is characterized by a capacity for securing substantially a full circumferential bearing on the rivet head and substantially a full circumferential grip on the former member, or, generally, a bearing and grip which is symmetric with the axis of the rivet.

A further object is to devise a tool as indicated in which the rivet head bearing and grip on the former member are coaxially related and so maintained during the upsetting operation whereby the rivet is upset in a symmetrical fashion relative to the apertures through the parts fastened together.

A further object is to provide a rivet setting tool having means for holding the tool to the work that is substantially aligned with the axis of the tool.

A further object is to devise a tool which is characterized by a steady, easy pull on the mem-

ber which deforms one end of the rivet, thus insuring uniformity and precision in the setting operation and uniformity of stress distribution in the rivet, and rapidity of action in engaging with and disengaging from the rivet.

These and further objects of my invention will be set forth in the following specification, reference being had to the accompanying drawings, and the novel means by which said objects are effectuated will be definitely pointed out in the claims.

In the drawings:

Figure 1 is an elevation partly in section of one form of my improved rivet setting tool.

Figs. 2 and 3 are sections along the lines 2—2 and 3—3, respectively, in Fig. 1.

Figs. 4 to 6, inclusive, are enlarged, sectional elevations of the working end of the tool showing successive stages of operation with respect to the rivet being set.

Fig. 7 is an elevation of a modified form of the tool.

Fig. 8 is a view looking in the direction of the area 8 in Fig. 7.

Fig. 9 is a section along the line 9—9 in Fig. 7.

Fig. 10 is a fragmentary section of the working end of the tool showing the same in condition to receive a portion of the rivet to be set.

Fig. 11 is a section along the line 11—11 in Fig. 7.

Fig. 12 is a side elevation of the collet showing the normal expanded condition of this part when free from restraint.

Fig. 13 is a transverse section taken in the plane of line 13—13 in Fig. 9.

By way of example, my improved setting tool will be illustrated in connection with the type of rivet assembly disclosed in the above patent, but it will be understood that this association is merely descriptive in nature, as the tool is intended to be utilized in connection with any type of hollow rivet assembly which is set from one side of the parts being fastened together and which includes a former member that extends through the rivet for engagement with the tool. In a generic sense, the tool sets the rivet by symmetrically bearing on the rivet head while symmetrically gripping the former member and pulling the same through the rivet. The bearing and gripping forces are essentially balanced, respectively, around the axis of the rivet, but are not necessarily continuous around the head and member.

Referring to Figs. 1 to 6, inclusive, and directing attention more particularly to Fig. 1, the nu-

meral 20 designates a casing which has extending from one side a hand grip 21 by means of which the tool is held to the work in the manner hereinafter described. The casing 20 is centrally bored as at 22 to receive a hollow screw 23 having a helical groove 24 disposed around its peripheral surface. This screw cooperates with a nut 25 which rotates within a counterbore 26 coaxial with the bore 22. A similar helical groove 27 is formed internally of the nut 25 and a plurality of balls 28 operating in the indicated grooves provide the required connection between the nut 25 and the screw 23. The nut 25 is rotated by a collar 29 secured thereto and from which extends an operating handle 30 that may carry a rotary hand grip 30a. The nut is held against axial movement (see Fig. 3) by means of a set screw 31 mounted in the casing 20 and whose inner end extends into a circumferential groove 32 provided in the nut. Thrusting action of the nut 25 towards the left, as viewed in Fig. 1, is accommodated by a thrust plate 33 which seats against a shoulder 35 that defines the junction of the bores 22 and 26 and interposed between this plate and the adjacent end of the nut 25 is a plurality of balls 35. The screw 23 is restrained against rotary movement, but arranged for an axial movement through the medium of a set screw 36 also threaded through the casing 20 and whose inner end operates in a longitudinal groove 37 provided in the peripheral surface of the screw. Endwise movement of the screw 23 toward the left is limited by an internal shoulder 38 provided at the end of the bore 22.

Coaxial with the screw 23 and extending there-through is a hollow pull tube 39 whose right end is flanged as at 40 and seats against the right end of the screw, the tube being held in this position by a cap 41 which is threaded on the indicated end of the screw 23. The left end of the tube 39 is split to form a multiple jaw collet. Thus the tube for a predetermined distance along the tube from the left end is provided with a plurality of fingers 42. When this tube is first formed, these fingers are bent radially outward and spring tempered so that when free to do so they occupy the outwardly extended position shown in Fig. 4. When the fingers are closed on each other, as illustrated in Fig. 1, an annular internal shoulder 43 is formed in the finger end of the tube.

The end of the tube 39 which projects beyond the left end of the casing 20 is surrounded by a collet sleeve composed of the separable jaws 44. The left end of each of these jaws is so shaped that, when contracted as illustrated in Fig. 1, the complementary shapings form a parti-spherical recess 45 which is intended to bear on the head of the rivet as hereinafter described. Each jaw 44 also includes a recess which cooperates with similar recesses in the other jaws to form a passage 46 which is coaxial with the recess 45 and with the tube 39. The right end of each jaw 44 is outwardly shouldered as at 47 and abutting these shoulders and threaded internally of the casing 20 is a nut 48 by means of which the jaws are held to the casing 20, the nut being split for purposes of assembly. A helical spring 49 surrounds the jaws 44 and has its opposite ends respectively abutting the adjacent end of the nut 48 and an internal shoulder provided on a collet structure in the form of a collar 50 whose forward inner surface, when the parts occupy the positions illustrated in Fig. 1, encircles and bears against an annular surface 51 provided on the

jaws 44. Accordingly, the spring 49 tends to maintain the collar 50 in the advanced position shown, i. e., in a position closing the jaws 44 and also the fingers 42. As noted in Fig. 1, the surface 51a around the main body of the sleeve collet possesses a smaller diameter than the surface 51 and these surfaces are connected by an inclined surface 52 (see Figs. 1 and 4).

Referring to Figs. 4 to 6, inclusive, which show the several stages involved in conditioning the tool to be placed in operative relation to a rivet and the setting of this rivet, it will be noted that one of the principal advantages of the tool resides in the capacity for receiving endwise the former member for the rivet. This result is obtained by retracting the collar 50 to the position illustrated in Fig. 4. When the nose of the collar 50 reaches the inclined surface 52, the confining restraint on the spring fingers 42 is released so that these fingers move radially outward and correspondingly move the jaws 44, all as illustrated in Fig. 4. In this connection, it will be understood that the split nut 48 is internally tapered so as to permit the jaws to be shifted with a slight pivotal action relative to the nut.

In Fig. 5 is illustrated in dotted outline a rivet assembly 53 which comprises a rivet having a rounded head 54, a hollow shank 55 which extends through the parts 56 and 57 that are to be fastened together, and a former member 58 which engages the tail end of the shank 55 and is provided with a stem 59 that extends through the shank 55 and terminates in a head 60. This rivet assembly is inserted through the apertures in the parts 56 and 57, after which the tool is conditioned by manually retracting the collar 50 to permit radial spreading of the fingers 42 and jaws 44 as shown in Fig. 4. Thereupon, the tool can be moved into the position generally indicated in Fig. 5 relative to the rivet, i. e., with the head 60 located within the tube 39 and in proximity to the shoulder 43 and the collar 50 advanced by spring 49 to close the fingers and jaws. The recessed end of the collet is then seated on the rivet head 54 and the tool is held in this position by means of the hand grip 21. Thereafter, the handle 30 is rotated in a clockwise direction, looking at the right-hand end of Figs. 1 and 3. This turns nut 25 clockwise. The nut is held against axial movement by pins 31 and groove 32, and bushing 23 is held against rotating movement by pin 36 and groove 37. As a result balls 28, moving in grooves 24, cause an axial shift of bushing 23 which in turn causes an axial shift of the tube 39 toward the right and an engagement of the shoulder 43 with the head 60, thus causing an axial movement of the former member 58 towards the right to outwardly expand the tail of the rivet into the shape indicated by the numeral 61 in Fig. 6. In the arrangement illustrated, the shoulder 43 has a full, circumferential engagement with the head 60. The pull on the stem 59 is continued until it is tensionally ruptured as illustrated in Fig. 6. By making the stems 59 of uniform strength it is possible to secure a uniform setting of the rivets. Afterwards, the portion of the former member left in the rivet shank may be sawed off and left in position or removed and the opening through the rivet filled with an appropriate cement.

The tool is readily changed to accommodate different size rivets by unscrewing the cap 41 and withdrawing and inserting an appropriate size pull tube 39, while a different sleeve collet may be inserted after unscrewing the nut 48.

The modification disclosed above might be

termed the gun type of tool while the modification illustrated in Figs. 7 to 11 might be regarded as of the "brace and bit" type. In the latter modification, the screw and nut relation is generally similar to that discussed above. This particular arrangement, therefore, comprises a casing 62 which is axially bored to receive a hollow screw 63 which cooperates with a nut 64 through the medium of a plurality of balls 65 that are respectively received within appropriate helical grooves provided in the screw and nut. The nut rotates within a counterbore 66 and end thrusts of the nut toward the left are accommodated by a thrust ring plate 67 which abuts against a shoulder 68 at the left end of the counterbore and between the plate and the adjacent end of the nut is provided a plurality of balls 69. The nut is held against axial movement toward the right by means of a sleeve 70 in which the nut is journaled and which is threaded in the counterbore 66 and abuts against a shoulder 71 provided on the nut. The right end of the sleeve 70 is outwardly flanged as at 72 and between this flange and the adjacent end of the casing 62 is clamped a collar 73 having a radial arm 74 that may be socketed to receive one end of a handle 75. This handle extends radially outward of the casing 62, is then bent substantially parallel to the axis of the casing and then inwardly toward the axis of the casing and in spaced relation to the right end thereof (see Fig. 7) and on its free end is rotarily mounted a hand grip 76. For a purpose presently explained, the hand grip 76 is coaxial with the axis of the casing 62.

As noted in Fig. 9, the nut 64 extends beyond the flange 72 and has secured thereto a collar 77 from which extends a radial arm 78 having on its outer end a rotary hand grip 79. As illustrated in Fig. 7, the hand grip 79 operates within the partial enclosure defined by the arm 75.

Movement of the screw 63 towards the left is limited by a shoulder 80 within the casing 62 and the screw is restrained to an axial movement of translation only by means of set screws 81 which are threaded through the wall of the casing 62 and have their inner ends received within elongated grooves 82 provided in the peripheral surface of the screw. A pull tube 83 is mounted within the screw 63 in coaxial relation thereto and has its right end outwardly flanged as at 84 to seat against a shoulder 85 provided on the screw 63 by means of a plug 86 which is threaded internally of the screw. The right end of the plug 86 may be knurled or otherwise shaped for easy finger gripping so as to permit of its ready withdrawal and the insertion of tubes for accommodating different size rivets.

The left end of the tube 83 is split inwardly for a predetermined distance to provide a plurality of spring fingers 87 which are formed in the same manner as the fingers 42 and which always tend to move radially outward when free from restraint. Surrounding the fingers 87 is a collet composed of a plurality of spring jaws 88 which have their work ends complementally shaped to provide when closed a rivet head receiving recess 89 which communicates with the interior of the tube 83 through a passage 90 that is composed of complementally shaped grooves or depressions formed in the jaws 88. The right ends of the jaws are united by a continuous ring 91 which is outwardly shouldered as at 92 and maintained in operative relation to the casing 62 by a nut 93 threaded internally of the casing.

The jaws 88 and accordingly the spring fingers 87 are held in the closed position illustrated by a collar 94 having an internal bead 95 that bears against an annular surface 96 on the collet and composed of the several arcs around the jaws 88.

Like the spring fingers 87, the collet jaws 88 also tend to move radially when free to do so, as illustrated in Fig. 12. Accordingly, this tool is transposed quickly from the closed position shown in Fig. 9 to the open position shown in Fig. 10 by merely retracting the collar 94. The number of jaws 88 and fingers 87 may be varied as desired, three of the former and four of the latter being illustrated in Fig. 13.

The operation of this tool is generally similar to that described above in that the collar 94 is moved toward the right to thereby enable the fingers 87 and jaws 88 to move radially as permitted by the frusto-conical surface 97 on each jaw. To further facilitate the indicated movement, the internal surface of the nut 93 is tapered as indicated by the numeral 98. The several parts of the left end of the tool then occupy the position illustrated in Fig. 10 whereupon the head 60 (see Fig. 5) of the rivet assembly may be inserted within the pull tube 83 and collar 94 moved to the position shown in Fig. 9 to thereby close the jaws 88 and the spring fingers 87. The collar 94 is held in the latter position by the friction grip between the bead 95 and surface 96 arising from the outward spring pressure of the spring fingers 87 and jaws 88, but this grip may be readily broken by the operator. Thereafter, the tool is positioned relative to the rivet assembly as illustrated in Fig. 5 and true axial bearing of the recess 89 on the rivet head is insured by the coaxial relation of the hand grip 76 relative to the axis of the casing 62 and also of the rivet assembly. Accordingly, when the handle 78 is operated in the appropriate direction, the head 60 of the rivet assembly is engaged by the shoulder 99 of the pull tube 83 and the ensuing action is identical with that already described for the gun type of tool. One of the primary advantages in the use of either of the above modifications resides in the fact that it is possible to hold the tool to the work with one hand while operating the pull tube to set the rivet with the other. A further advantage consists in the full bearing on the rivet head and the balanced grip on the head 60 which avoids any tendency to cock the rivet during setting.

I claim as my invention:

1. A tool for setting a hollow rivet having a head and a former member engaging the tail and extending through the rivet comprising head bearing means for holding the rivet during setting, and pulling means for engaging and drawing the member through the rivet to spread the tail, the bearing and pulling means being telescopically related and each comprising parts radially movable to receive the member endwise.

2. A tool for setting a hollow rivet having a head and a former member engaging the tail and extending through the rivet comprising head bearing means for holding the rivet during setting, pulling means for engaging and drawing the member through the rivet to spread the tail, the pulling means being located inwardly of and in telescopic relation to the bearing means and each comprising parts radially movable to receive the member endwise, and a collar advanceable to contract the bearing and pulling means into working

engagement with the rivet and member, respectively, and retractable to release the parts.

3. A tool for setting a hollow rivet having a head and a former member engaging the tail and extending through the rivet comprising a split collet having one end recessed to bear on the rivet head, a pull tube within the collet for engaging and drawing the member through the rivet to spread the tail, the member engaging end of the tube being split whereby said tube end and collet may be expanded radially to receive the member endwise, and means for contracting the collet and said tube end into working engagement with the rivet and member.

4. A tool for setting a hollow rivet having a head and a former member engaging the tail and extending through the rivet comprising a split collet having one end recessed to bear on the rivet head, a pull tube within the collet for engaging and drawing the member through the rivet to spread the tail, the member engaging end of the tube having outwardly biased parts engageable with and radially moving the split portions of the collet to receive the member endwise, and means for contracting the collet and said tube end into working engagement with the rivet and member.

5. A tool for setting a hollow rivet having a head and a former member engaging the tail and extending through the rivet comprising a split collet having one end recessed to bear on the rivet head, a pull tube within the collet for engaging and drawing the member through the rivet to spread the tail, the member engaging end of the tube being split and spring tempered and tending to bend radially outward of the tube to thereby radially expand the collet and receive the member endwise, and means for contracting the collet and said tube end into working engagement with the rivet and member.

6. A tool for setting a hollow rivet having a head and a former member engaging the tail and extending through the rivet comprising a split collet having one end recessed to bear on the rivet head, a pull tube within the collet for engaging and drawing the member through the rivet to spread the tail, the member engaging end of the tube having outward biased parts engageable with and radially moving the split portions of the collet to receive the member endwise, and a collar surrounding the collet advanceable to contract the collet and tube into working engagement with the rivet and member, respectively, and retractable to permit release of the parts.

7. A tool for setting a hollow rivet having a head and a former member engaging the tail and extending through the rivet comprising a split collet having one end recessed to bear on the rivet head, a pull tube within the collet for engaging and drawing the member through the rivet to spread the tail, the member engaging end of the tube having outward biased parts engageable with and radially moving the split portions of the collet to receive the member endwise, and a collar surrounding the collet spring actuated to contract the collet and tube into working engagement with the rivet and member, respectively, and retractable against the spring to permit release of the parts.

8. A tool for setting a hollow rivet having a head and a former member engaging the tail and extending through the rivet comprising a split collet having one end recessed to bear on the rivet head, a pull tube within the collet for

engaging and drawing the member through the rivet to spread the tail, the member engaging end of the tube having resilient parts engageable with and radially moving the split portions of the collet to receive the member endwise, and a collar surrounding the collet advanceable to contract the collet and tube into working engagement with the rivet and member, respectively, and retractable to permit release of the parts, the collar and collet having co-acting surfaces for frictionally holding the collar in advanced position under the impulse of the resilient parts.

9. A tool for setting a hollow rivet having a head and a former member engaging the tail and extending through the rivet comprising means for symmetrically bearing on the head to hold the rivet during setting, and pulling means for symmetrically engaging and drawing the member through the rivet to spread the tail, the bearing and pulling means being telescopically related and each comprising parts radially movable to receive the member endwise.

10. A tool for setting a hollow rivet having a head and a former member engaging the tail and extending through the rivet comprising head bearing means for holding the rivet during setting, pulling means for engaging and drawing the member through the rivet to spread the tail, the pulling means being located inwardly of and in telescopic relation to the bearing means and each comprising parts radially movable to receive the member endwise, and a collar advanceable to contract the bearing and pulling means into working engagement with the rivet and member, respectively, and retractable to release the parts.

11. A tool for setting a hollow rivet having a head and a former member engaging the tail and extending through the rivet comprising a collet having a plurality of jaws complementally shaped at one end to bear on the rivet head, a pull tube within and coaxial with the collet having a plurality of fingers for engaging and drawing the member through the rivet to spread the tail, the jaws and fingers being spring tempered and tending to bend radially outward to receive the member endwise, and means for contracting the collet and fingers into working engagement with the rivet and member.

12. A pulling mechanism for rivets equipped with pulling heads, comprising: a multiple-jaw collet adapted to fit over and engage the pulling head of a rivet, a multiple-jaw collet-constrictor fitted around said collet, said constrictor including radially movable anvil segments adapted when in their radially inner positions to receive slidably the stem of said pulling head and bear against said rivet.

13. A pulling mechanism for rivets equipped with pulling heads, comprising: a multiple-jaw collet including segmental gripping elements tending to spread radially to receive the pulling head of a rivet, a multiple-jaw collet sleeve fitted over said collet and urged radially outward thereby, said sleeve including segmental anvil elements protruding forward of said collet to receive slidably the shank of said pulling head and bear against an end of said rivet, means for constricting said collet sleeve to close said anvil elements and gripping elements about said shank and pulling head, and means for moving said collet longitudinally to exert traction on said pulling head.

14. A pulling mechanism for rivets equipped with pulling heads, comprising: a spring jaw

collet having a normally open position adapted to receive the pulling head of a rivet, and a closed position engaging said head; a segmental constrictor-sleeve around said collet, said constrictor-sleeve including complementary anvil segments overhanging said collet and adapted to be spread radially thereby, said anvil segments being adapted to receive slidably the shank of said pulling head and bear against an end of said rivet, means for constricting said constrictor, thereby constricting said collet, and means for moving said collet longitudinally when constricted to exert traction on said rivet.

15. A pulling mechanism for rivets equipped with pulling heads, comprising: complementary anvil segments adapted to fit slidably around the shank of the said pulling head of a rivet and bear against the end of said rivet from which said shank protrudes; a segmental collet within said

anvil segments, said collet tending to spread said anvil segments whereby said collet and anvil segments may slip over said pulling head, means for constricting said anvil elements and collet to cause engagement of said pulling head by said collet, and means for exerting traction on said collet and pulling head, while said anvil segments restrain said rivet.

16. A pulling mechanism for rivets equipped with pulling heads, comprising: complementary segmental anvil jaws adapted to fit around the shank of the pulling head of a rivet and bear against an end of said rivet, complementary segmental collet jaws adapted to fit over and grip said pulling head, yieldable means tending to spread said collet and anvil jaws, means for constricting said collet and anvil jaws, and means for exerting traction on said collet jaws.

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