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RIVET SETTING MACHINE

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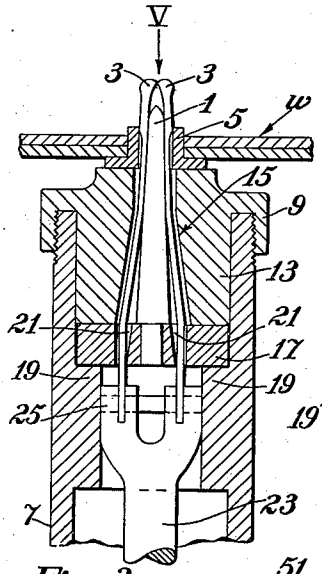

Fig. 3

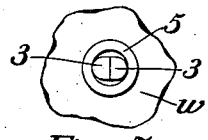

Fig. 5

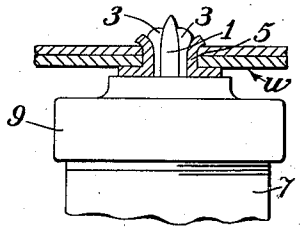

Fig. 4

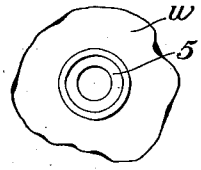

Fig. 6

Fig. 1

Fig. 2

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RIVET SETTING MACHINE

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10 Claims. (Cl. 218—19)

The purpose of the present invention is to provide an improved machine for setting tubular rivets of the type in which the throat extends all the way through a rivet. The invention provides rivet upsetting means adapted to be inserted through the throat of a rivet from the head end thereof and retracted to upset the clenching end, as when the latter is not otherwise accessible because of the structure in which the rivet is to be clenched.

The upsetting means includes a pair of separable rivet engaging members and a stem located between them, all arranged to extend through a rivet, the rivet engaging members being designed to upset two diametrically opposite segments of the clenching end in consequence of being forced apart radially of the rivet with a wedging effect by the stem. For this purpose the illustrated machine is designed to maintain the stem in one position while an operating mechanism retracts the rivet engaging members with a movement of translation. Considering the results thus obtained, the radial displacement of the rivet engaging members upsets two segments of a rivet while the translational component renders the upsetting progressive along the length of the rivet and packs the finally upset metal of the two segments tightly against the riveted structure.

The illustrated machine is portable and designed to be operated by hand. It comprises a novel combination of mechanisms, one for operating the rivet engaging members as above set forth and the other for turning them through a partial revolution about the axis of the rivet to place them on another diameter thereof after the first two rivet segments have been upset and clenched. Moreover, the mechanism first mentioned pushes the rivet engaging members ahead after each upsetting stroke to release them from the upset segments before they are turned to the next position by the other mechanism, thus relieving them from torsional stress. This combination of mechanisms provides for clenching two pairs of segments successively without turning the body of the machine.

In the drawing,

Fig. 1 is a side elevation of the illustrative apparatus;

Fig. 2 is a view mainly in section of the illustrative apparatus, taken in the direction of the arrow II in Fig. 1;

Fig. 3 is a sectional elevation to a larger scale than Fig. 1, showing rivet engaging elements with which the illustrative apparatus is provided;

Fig. 4 is a view to the same scale as Fig. 3 showing the action of the rivet engaging elements upon a rivet when an axial pull is imparted to them;

Fig. 5 is a view of a rivet and rivet engaging elements as they would appear when viewed in the direction of the arrow V in Fig. 3; and,

Fig. 6 is a view of the rivet seen in Fig. 5 after having been operated upon by the rivet engaging elements of the illustrative apparatus.

The illustrative apparatus (which is a portable apparatus intended to be held in the hands of the operator) comprises rivet-entering means which consists of a central stem 1 which tapers to a point at its forward end and two rivet-engaging elements 3 which engage the stem 1 at diametrically opposed localities thereof and are slidable longitudinally with respect to the stem 1. The rivet-engaging elements 3 are similar to each other. Each is a resilient steel strip throughout the major portion of its length but its rivet-engaging end portion has a bulb of hemispherical shape, the inner surface of the bulb being slidable along the stem and concave to produce the radial displacement above mentioned as it runs on the tapering end portion of the stem. When the stem 1 and the two rivet-engaging elements 3 are about to be inserted into a rivet 5 the bulbed end portions of the two said elements 3 project beyond the forward end of the stem and touch each other. This relation enables them to be inserted through the throat of the rivet 5 together with the stem 1. When the parts are fully inserted the said bulbed end portions will lie some distance beyond the setting end of the rivet 5 while the stem 1 will project a shorter distance beyond the setting end of the rivet. When, by means hereinafter described, the two said rivet-engaging elements 3 are pulled back while the stem 1 remains stationary, the said elements 3 will slide along the stem and be thereby cammed apart as ther bulbed end portions enter the setting end of the rivet 5. The flanged end of the rivet will meantime be held firmly up against the front face of the workpiece *w* by an anvil. The radial movement of the members 3 dilates two opposite segments of the rivet while the axial movement packs them tightly against the back face of the work.

The illustrative apparatus is so constructed and arranged that on rotation of a single operating member 55 the said rivet-engaging elements 3 are pulled back to effect spreading as described of two diametrically opposite segments of the setting end portion of the rivet 5, then pushed

ahead to free them from the rivet, then automatically turned 90° about the axis of the rivet, then again pulled back to spread two other segments of the rivet, and again pushed ahead to permit their removal from the rivet. The arrangement of parts to achieve this sequence of motions will now be described.

The body of the apparatus includes a cylindrical tubular casing 7 (which may conveniently be some 14 inches in length) on the forward end of which there is secured a cap 9 and on the rearward end of which is secured a rest 11 against which the operator may exert pressure by his arm or body to hold the apparatus firmly up to the work, the said cap 9 acting as an anvil to buttress the flange of a rivet 5 against the workpiece *w*. The cap 9 has a boss 13 inside the casing 7, and a throat 15 of circular section extending therethrough. The stem 1 and the two rivet-engaging elements 3 extend loosely through the throat 15 and may turn therein. A circular plate 17 is located inside the casing 7 just behind the boss 13 of the cap 9. This plate 17 is constrained against axial movement by the boss 13 and a shoulder 19 formed on the interior of the casing. Sufficient play is, however, allowed to permit the plate 17 to turn in its own plane about the axis of the casing 7. The rearward end portion of the said stem 1 is fixed in a hole in the plate 17 but the rivet-engaging elements 3 extend loosely through two slots 21 in the plate.

Located inside the casing 7 is a rod 23 which is movable axially thereof. The forward end portion of the rod 23 has a bearing in a bore in the shoulder 19. In this end portion of the rod 23 are two slots in which the rear end portions of the rivet-engaging elements 3 are fixed by means of a pin 25. The rod 23 at some distance from its rearward end has fixed to it a collar 27 which is slidable in the interior of the casing 7. The said rod 23 is formed in two separate portions joined near the middle of the rod by a telescopic connection 29 including a strong compression spring 31. This spring 31 may yield to prevent applying excessive stress to the rod 23 in a rivet-setting operation. The arrangement is, however, such that the two parts of the rod 23 may not turn with respect to each other about the axis of the rod. The provision of such a spring yield also provides tolerance for rivets of different lengths.

Toggle means is provided for causing axial movement of the collar 27 and the rod 23 in the casing 7. This means comprises a forward toggle link 33 which is pivoted at its forward end portion on a pin 35 fixed in the casing 7 and at its rearward end portion to the forward end portion of a rearward toggle link 37 which at its rearward end portion carries a pin 39 which is slidable in a slot 41 in the casing 7. The slot 41 is parallel to the axis of the casing 7. The pin 39 projects through the slot 41 and into a circumferential groove 43 formed in the said collar 27. At the knee of the toggle (i. e. where the two said links 33, 37 are pivoted together) is a pin 45 on which is mounted a cam roll 47. The roll lies in a cam groove 49 in a disk 51 affixed to a shaft 53. The shaft is journaled in a bracket formed on the casing 7. The walls of the cam groove 49 shift the knee of the toggle across and to opposite sides of its dead center position, the latter being midway between the limits of travel, thereby producing two cycles of reciprocation of the rod 23 for each cycle of rotation of the cam.

The disk 51 has a handle 55 secured to it whereby the operator may rotate it. On rotation of the disk 51 through 360° the toggle shifts the collar 27 first to the rear, then ahead to its initial position, again to the rear, and finally ahead to its initial position. These movements of the collar 27 are imparted by the rod 23 to the two rivet-engaging elements 3, though not, of course, to the stem 1.

The following means is provided for turning the rivet-engaging elements 90° about the axis of the rivet 5 after each setting stroke. The shaft 53 also carries a cam member 57 the peripheral surface of which is engaged by a roll 59 carried by one end of a lever 61. The lever is connected to the casing 7 by a fulcrum stud 65 and its other end has a pivotal connection with a bar 63. A pin 67 affixed to the rear end of the bar projects through a guiding slot 69 in the casing 7 and into a helical groove 71 in the periphery of a cylinder 73 rotatably installed inside the casing 7 but constrained against axial movement by pins 72 and a circumferential groove 74. The coaction of the pin 67, the slot 69 and the helical groove 71 produces oscillation of the cylinder 73 through an arc of 90°. The rearward end portion of the rod 23 and the cylinder 73 have interengaged spline formations 75 by which the rod, the rivet engaging members 3 and the plate 17 are oscillated with respect to the casing 7. A tension spring 83 connecting the lever 61 and the casing 7 maintains the roll 59 against the cam 57.

The cam 57 is so designed as to turn the rivet engaging members only when they are in the advanced portion of their range of axial travel, when they are free from a rivet. Assuming that the cam assemblage is in its initial position, as shown in Figs. 1 and 2, and about to be rotated counterclockwise (Fig. 1), the spring 83 and the falling portion 81 of the cam 57 will complete the last turning of the members 3 while they are being pulled back but before they are wedged apart by the stem 1. The low part of the cam is concentric through about 110° and postpones the next turning until the members 3 have been pushed forward far enough to free them from the rivet after the first upsetting stroke. During the remainder of their advancing stroke and the beginning of their second pulling stroke they are turned by the rising portion 77 of the cam, but again their turning is completed before they are wedged apart by the stem 1. At this point the high concentric segment 77 of the cam postpones further turning of the members 3 until they have been pushed ahead far enough after their second upsetting stroke to be closed and withdrawn from the rivet. The final turning of the members 3 due to the spring 83 and the falling portion 81 of the cam, though usually less than 90° at the completion of a cycle, is of no consequence.

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

1. A machine for upsetting a tubular rivet having a throat extending from end to end, the machine comprising an anvil arranged to buttress the head end of the rivet, a pair of rivet engaging members projecting from the anvil to extend through said throat to and beyond the clinching end of the rivet, a rotary cam assemblage, mechanism operable by said assemblage to impart successive pulling strokes and reverse strokes to said rivet engaging members, means arranged to force

said rivet engaging members apart during each pulling stroke to displace two diametrically opposite segments of the clenching end of the rivet, and means operable by the cam assemblage for turning the rivet engaging members through a partial revolution about the axis of the rivet in alternation with said pulling strokes.

2. A machine for upsetting a tubular rivet having a throat extending from end to end, the machine comprising an anvil arranged to buttress the head end of the rivet, a pair of rivet engaging members projecting from the anvil to extend through said throat to and beyond the clinching end of the rivet, a rotary cam assemblage, mechanism operable by said assemblage to impart successive pulling strokes and reverse strokes to said rivet engaging members, a stem located between said rivet engaging members and braced against end thrust to force them apart in consequence of said pulling strokes, and means operable by said cam assemblage for turning the rivet engaging members through a partial revolution about the axis of the rivet in alternation with said pulling strokes.

3. A machine for upsetting a tubular rivet having a throat extending from end to end, the machine comprising a stationary assemblage including an anvil and a stem projecting therefrom to extend through the throat of the rivet from the head end thereof, a linearly movable assemblage carried by the stationary assemblage and including a pair of rivet engaging members extending through and beyond the anvil to lie between said stem and two diametrically opposite segments of the rivet, operating means carried by the stationary assemblage for reciprocating the linearly movable assemblage lengthwise of the rivet, and operating means carried by the stationary assemblage for turning said linearly movable assemblage through a partial revolution about the axis of the rivet, said stem being braced against end thrust to force said rivet engaging members apart in consequence of pulling them along the stem.

4. A machine for upsetting a tubular rivet having a throat extending from end to end, the machine comprising a stationary assemblage including an anvil and a stem projecting therefrom to extend through the throat of the rivet from the head end thereof, a linearly movable assemblage carried by the stationary assemblage and including a pair of rivet engaging members extending through and beyond the anvil to lie between said stem and two diametrically opposite segments of the rivet, a toggle connecting said assemblages, a rotary operating assemblage carried by said stationary assemblage and including means by which the knee of the toggle is shifted across and to opposite sides of its dead center position, and means operable by said rotary assemblage for oscillating said linearly movable assemblage through a partial revolution about the axis of the rivet, said stem being arranged to force the rivet engaging members apart as the knee of said toggle moves toward its dead center position from either side thereof.

5. A machine for upsetting a tubular rivet having a throat extending from end to end, the machine comprising an anvil, a stem projecting therefrom to extend through the throat of a rivet, a tubular member by which the anvil and the stem are carried and braced against end thrust, a rod movably installed inside said tubular member, a pair of rivet engaging members extending along opposite sides of said stem and connected to said rod to be moved thereby along said stem and rotated, a rotary operating assemblage carried by said tubular member outside the latter, means operable by said rotary assemblage for reciprocating said rod endwise, and means also operable by said rotary assemblage for turning said rod intermittently about its axis, said stem being arranged to force the rivet engaging members apart as they traverse it lengthwise in one direction.

6. A machine as defined in claim 5 in which said rod comprises relatively movable parts and resilient means connecting them to relieve the rivet engaging members and the rotary operating assemblage from excessive stress due to rivet upsetting movement.

7. A machine for upsetting a tubular rivet having a throat extending from end to end, the machine comprising an anvil, a stem projecting therefrom to extend through the throat of a rivet, a tubular body member by which the anvil and the stem are carried, a rod movably installed inside said tubular body member, a pair of rivet engaging members extending along opposite sides of said stem and connected to said rod to be reciprocated thereby along said stem and rotated, a rotary operating assemblage carried by said tubular body member outside the latter, means operable by said rotary assemblage for reciprocating said rod endwise, said stem being braced against end thrust to force the rivet engaging members apart as they traverse it lengthwise in one direction, a rotatable member inside said tubular body member and having rotary driving connection with said rod but permitting relative endwise movement of the latter, and means operated by said operating assemblage for turning said rotatable member intermittently through a partial revolution.

8. A machine for upsetting a tubular rivet having a throat extending from end to end, the machine comprising a tubular body having an anvil at one end to buttress the head end of a rivet, a rod inside the tubular body and slidable lengthwise thereof, a pair of separable rivet engaging members secured to one end of said rod and extending through the anvil to project through the throat of a rivet, a stem projecting from the anvil between said rivet engaging members to force them apart as their outer ends are drawn toward the anvil, the stem and the tubular body having a connection by which relative endwise movement of the stem is prevented, an actuator carried by the tubular member and attached to one side thereof, and means forming an operating connection of said actuator and said rod for reciprocating the latter endwise.

9. A machine for upsetting a tubular rivet having a throat extending from end to end, the machine comprising a body having an anvil for buttressing the head end of a rivet, a plurality of rivet engaging members forming a group and arranged to extend through the anvil and the throat of a rivet, operating means carried by said body and connected to said rivet engaging members for moving them back and forth through the anvil, and a stem projecting from the anvil in the center of the group of rivet engaging members to force the latter radially away from each other as they are drawn towards said body, the stem and the body having a connection by which relative endwise movement of the stem is prevented.

10. A machine for upsetting a tubular rivet having a throat extending from end to end, the

machine comprising a body having an anvil portion and a stem projecting from the latter to extend through a rivet, an assemblage including a rod and a plurality of separable rivet engaging members carried thereby and extending along said stem, said rod having a bearing in the body and being movable relatively thereto about the axis of the stem and lengthwise of said axis, operating means mounted on the body for reciprocating said rod lengthwise, and means for turning the rod about said axis.

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