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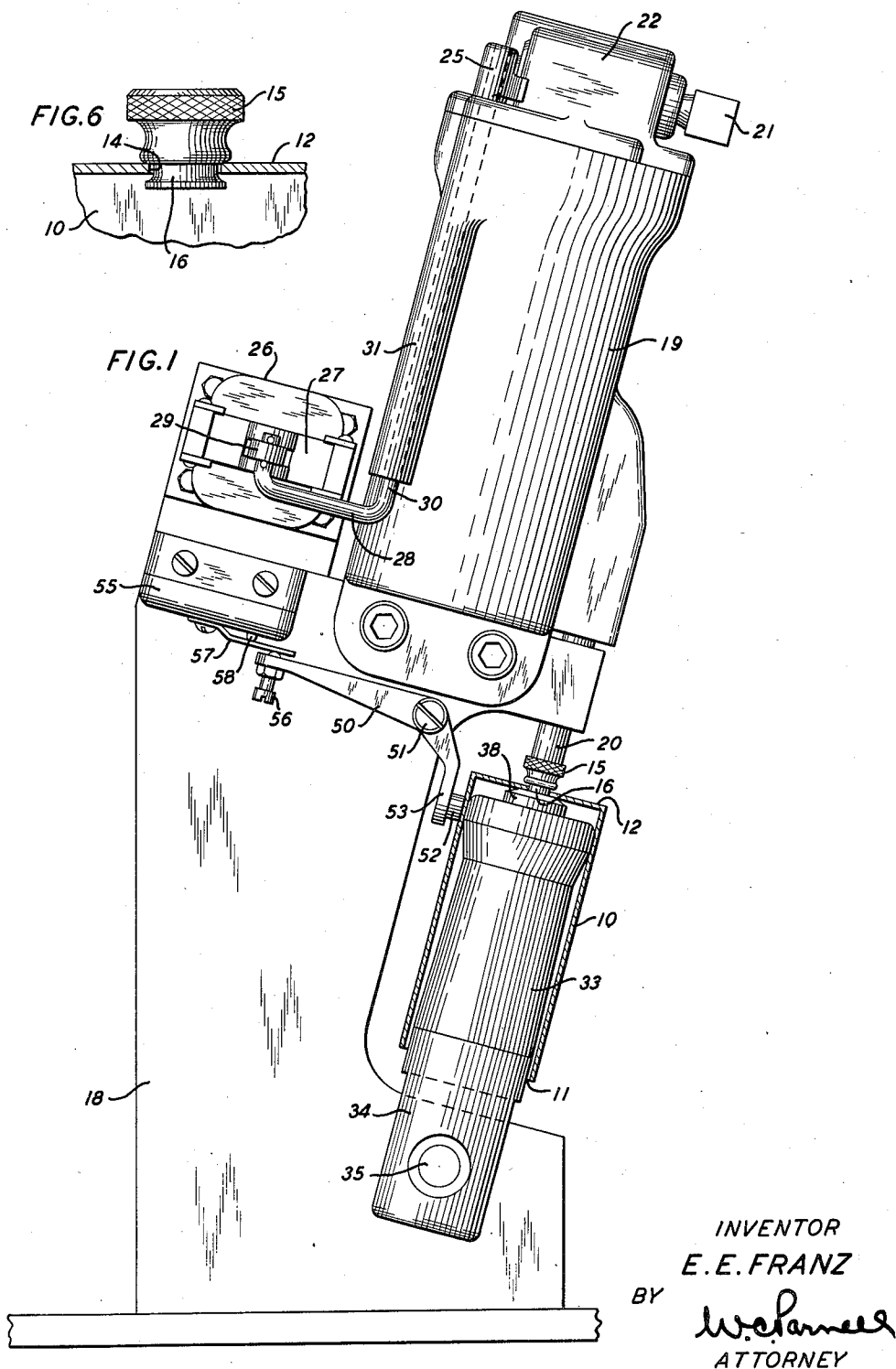
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STAKING APPARATUS WITH MOVABLE WORK HOLDER

Filed March 20, 1948

2 Sheets-Sheet 1



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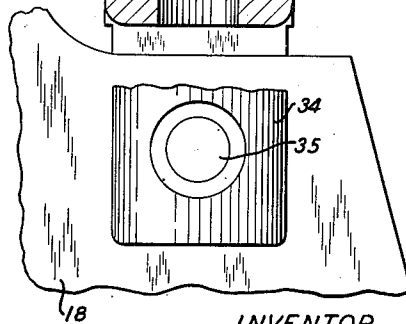
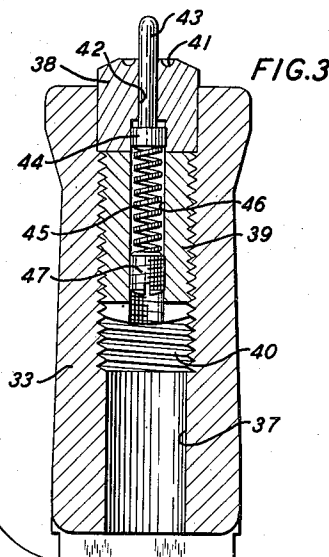
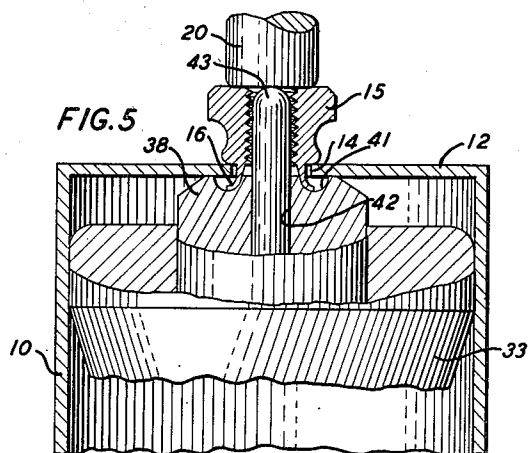
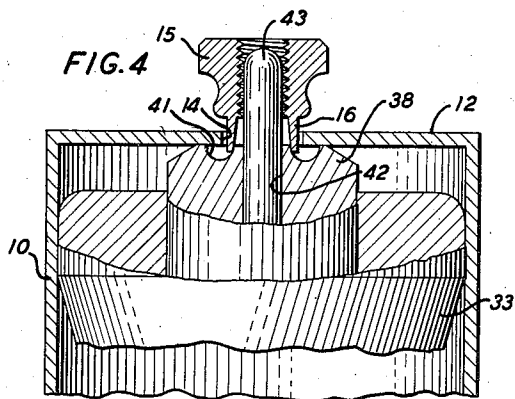
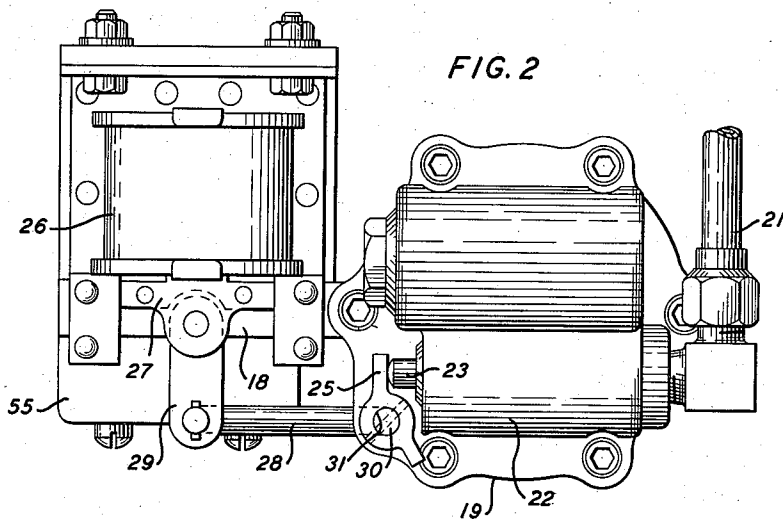
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STAKING APPARATUS WITH MOVABLE WORK HOLDER

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2 Sheets-Sheet 2



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## UNITED STATES PATENT OFFICE

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## STAKING APPARATUS WITH MOVABLE WORK HOLDER

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2 Claims. (Cl. 218--1)

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This invention relates to staking apparatus with movable work holder, and more particularly to apparatus for securing one article to another by staking the first article within an apparatus of the second article.

In the manufacture of electrical equipment for the communication arts, metallic housings are required for certain of the electrical units. Some of the housings become permanent parts of the electrical units in that the units are embedded in a sealing compound within the container or housings, while with other units, it is a requirement that the housings be removable. In such instances, it has been found advantageous to secure a thumb nut or any other suitable internally threaded article to the housings, a portion of the article extending through an aperture in the housing becoming a permanent part of the housings, yet free to rotate in its aperture.

An object of the invention is to provide a staking apparatus which is simple in structure, semi-automatic in operation, and highly efficient in staking an article within an aperture of another article.

With this and other objects in view, the invention comprises a staking apparatus having a frame with a staking unit mounted thereon and including a reciprocable plunger operable through single cycles. A holder for an article is movably mounted on the frame for movement between a loading position and an operating position to hold the articles in their relative positions for assembly, one of the articles having a portion extending through an aperture of the other article. Means is actuated upon movement of the holder with the articles into operating position to cause operation of the unit to actuate the plunger to stake one of the articles within the aperture of the other article.

The holder includes an anvil to support the apertured article and is formed to cause outward flaring of the inner portion of the second article during the staking operation. The anvil is centrally apertured to receive a locating pin to centrally locate the second article within the aperture of the first article and to be forced downwardly against its supporting spring during the swaging operation. In the present embodiment of the invention, the swaging unit is a fluid-operated unit similar to commercially known riveters. It is under the control of a fluid valve actuated by a solenoid which is energized by the closing of a microswitch during movement of the holder with the articles into operating position.

Other objects and advantages will be apparent

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from the following detailed description, when considered in conjunction with the accompanying drawings, wherein

Fig. 1 is a side elevational view of the apparatus in operating position;

Fig. 2 is a top plan view of the apparatus;

Fig. 3 is an enlarged vertical sectional view of the article holder;

Fig. 4 is an enlarged fragmentary sectional view of the upper portion of the article holder showing the positions of the articles prior to the swaging operation;

Fig. 5 is an enlarged fragmentary sectional view of the upper portion of the article holder showing the relationship of the particles at the end of the swaging operation; and

Fig. 6 is an enlarged fragmentary detailed view of the assembled articles.

Referring now to the drawings, attention is first directed to the articles which are to be assembled by the apparatus. The first article 10 is a sheet metal container or housing having an open end 11 and a closed end 12, an aperture 14 being centrally located in the closed end 12 of the article. The second article 15 is in the form of a nut having a relatively thin tubular portion 16 integral with the lower portion of the article to extend freely through the aperture 14 as illustrated in Figs. 4 and 5. The function of the apparatus is to stake the article 15 within the aperture 14 of the article 10 so that it will be a permanent part of the article 10, but free to rotate in the aperture 14 thereof whereby it may be secured to a threaded portion of an electrical unit to be housed in the article 10.

The apparatus includes a main frame 18, supporting a swaging unit 19 which may be of the commercially known fluid-operated type of swaging or riveting unit. The plunger 20 of the unit 19 is normally held upwardly and is moved downwardly by fluid under pressure supplied to the unit 19 from a fluid line 21 when a valve 22 is open. The valve 22 includes a plunger 23 normally closed in a conventional manner by a spring and opened by the actuation of a lever 25 during energization of a solenoid 26. The solenoid 26 is mounted on the main frame 18 as shown in Fig. 1 and has its core 27 connected to an actuating rod 28 through a link 29. The actuating rod 28 has a vertical portion 30 journaled for rocking movement in a bearing 31 of the unit 19. The upper end of the rod extends through the lever 25 and is pinned thereto, whereby energization of the solenoid 26, will rock the lever 25

clockwise to actuate the plunger 23 to open the valve 22.

A holder 33 of the contour shown has a bifurcated lower portion 34 straddling the adjacent portion of the frame 18 and pivotally secured to the frame at 35. The holder 33 is centrally apertured at 37 throughout its upper portion to support an anvil 38 in the upper end thereof, the anvil being supported by a threaded member 39 adjustably positioned in a threaded portion 40 of the aperture 37. The anvil 38 is circular in cross-section having a concaved annular groove 41 to receive the inner end of the tubular portion 16 of the article 15 and cause outward flaring of this portion, as illustrated in Fig. 5, during the swaging operation. The anvil 38 is centrally apertured at 42 to receive a locating pin 43 having a head portion 44 positioned within an enlarged portion of the aperture 42 and backed by a spring 45, normally urging the locating pin outwardly. The spring 45 is disposed in a central aperture 46 of the threaded member 39, a portion of the aperture being threaded to receive a screw 47 which supports the spring and by the aid of which the spring may be compressed as desired to vary the force applied to the locating pin, particularly during the swaging operation.

The holder 33 may be moved clockwise (Fig. 1) into its loading position, away from the plunger 20 where assembled articles may be removed from the holder and new articles 10 and 15 disposed thereon for assembly. A lever 50, pivotally supported at 51 on the frame 18, has an abutting block 52 carried by an arm 53 thereof, to be engaged by the article 10 on the holder 33, when moved into operating position, to function not only in aligning the holder with the articles centrally of the plunger 20, but to cause actuation of a microswitch 55 to energize the solenoid 26. The other arm of the lever 50 carries an adjustable screw 56 positioned to engage a resilient portion 57 of the switch 55, which when flexed inwardly will actuate a plunger 58 to operate the normally open switch into closed position. Adjustment of the screw 56 will vary the point at which the switch will be closed during counterclockwise movement of the holder 33 with the articles 10 and 15 into the operating position.

Considering now the operation of the apparatus, let it be assumed that the holder 33 is in the loading position out of alignment with the plunger 20. The operator may at this time lower an article 10 onto the holder until its closed end comes to rest on the anvil 38. It will be noted that the outwardly flared upper end of the holder partially conforms to the article 10 and this formation, cooperating with the anvil, will position the article 10 centrally on the holder with its centerline, coincident with the centerline of the holder and the anvil. Furthermore, the aperture 14, being centrally positioned within the closed end 12, will be accurately located to receive the tubular portion 16 of the article 15. When the article 15 is placed on the holder, it is accurately located with respect to the article 10 by the locating pin 43 extending substantially through the threaded aperture of the article.

The operator may then move the holder 33 with the articles 10 and 15 thereon in a counterclockwise direction (Fig. 1). During this movement, the article 10 will engage the abutting block 52 and rock the lever 50 clockwise about its pivot 51, causing the screw 56 to flex the member 57 to depress the plunger 58 and operate the switch 55 into closed position. At this time, through the

control of the lever 50, the holder 33, with its articles 10 and 15, will be in alignment with the plunger 20 which is operated through a single cycle as a result of energization of the solenoid 26 and operation of the valve 22. When the solenoid 26 is energized, the actuating rod 28 is rocked in a clockwise direction (Fig. 2) to rock the lever 25, depressing the plunger 23 and opening the valve 22, allowing fluid under pressure to pass through the valve into the unit 19 from the supply line 21 to actuate the plunger 20 through a single cycle. As the plunger 20 moves downwardly, it engages the article 15, forcing it toward the anvil 38, causing the inner end of the tubular portion 16 to flare outwardly where the outer edges thereof will extend beyond the periphery of the aperture 14, permanently securing the article 15 to the article 10, leaving the article 15 free to rotate within the aperture 14. In successive operations of the apparatus the same result will be accomplished owing to the dimensional requirements of the articles. The material of the articles or containers 10 must be of a given thickness or the articles will not be accepted. Certain limitations are also placed on the articles or nuts 15. Their dimensions must be within given limits otherwise they will not be accepted. Therefore, the operation of the apparatus on any accepted article 10 and article 15 will assure permanent connection of the articles, leaving article 15, not only free for rotation, but free for lateral or tilting movements to align the axis of the article with the centerline of the threaded element upon which the article is to be mounted.

When the staking operation has been completed, the operator returns the holder with the assembled articles to the loading position and in doing so, the lever 50 moves by gravity and the force of the member 57 to allow the switch 55 to open to deenergize the solenoid 26 and close the valve 22. The assembled articles may be removed from the holder and two more articles 10 and 15 mounted thereon for the next operation of the apparatus.

It is to be understood that the above described arrangements are simply illustrative of the application of the principles of the invention. Numerous other arrangements may be readily devised by those skilled in the art which will embody the principles of the invention and fall within the spirit and scope thereof.

What is claimed is:

1. An apparatus for connecting a nut, having a projecting portion with a periphery smaller than the main portion of the nut, to an apertured hollow article for rotation of the nut relative to the hollow article at the aperture thereof, the apparatus comprising an anvil having an outer surface and a groove therein of a given depth to cause forming of the projecting portion, an element extending from the anvil to hold the nut in a given position and align the projecting portion with the groove, a holder supporting the anvil and the element at given relative positions and having an outer surface concentric therewith to engage the inner surface of the hollow article to align the aperture of the article with the groove of the anvil and cause the portion of the article adjacent the aperture to rest on the outer surface of the anvil, a frame, means on the frame to support the holder for movement between a loading position and an operating position, an operable unit mounted on the frame and having a ram reciprocable through an operating cycle and adapted to force the nut toward the

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anvil whereby the projecting portion of the nut will be forced outwardly by the groove of the anvil sufficiently to connect the nut against displacement to the article and for free rotation of the nut relative to the article, and means actuated by the loaded holder upon movement thereof into the operating position to cause operation of the unit.

2. An apparatus for connecting a nut, having a projecting portion with a periphery smaller than the main portion of the nut, to an apertured hollow article for rotation of the nut relative to the hollow article at the aperture thereof, the apparatus comprising an anvil having an outer surface and a groove therein of a given depth to cause forming of the projecting portion, an element extending from the anvil to hold the nut in a given position and align the projecting portion with the groove, a holder supporting the anvil and the element at given relative positions and having an outer surface concentric therewith to engage the inner surface of the hollow article to align the aperture of the article with the groove of the anvil and cause the portion of the article adjacent the aperture to rest on the outer surface of the anvil, a frame, means on the frame to support the holder for movement between a loading position and an operating position, an operable unit mounted on the frame and having a ram reciprocable through an operating cycle and adapted to force the nut toward the anvil whereby the projecting portion of the nut will

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be forced outwardly by the groove of the anvil sufficiently to connect the nut against displacement to the article and for free rotation of the nut relative to the article, control means actuable to cause operation of the unit, and an element movably supported by the frame to be engaged by the loaded holder upon movement thereof toward the operating position and to be moved thereby to actuate the control means to cause operation of the unit when the nut and the groove of the anvil are aligned with the ram.

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