March 5, 1957 A. G. HULL 2,783,567

ETCHING APPARATUS ASSEMBLY

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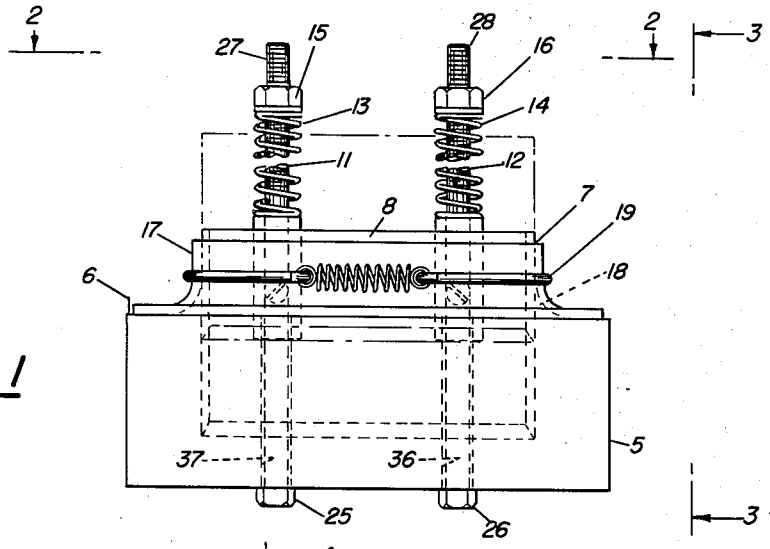


Fig. 1

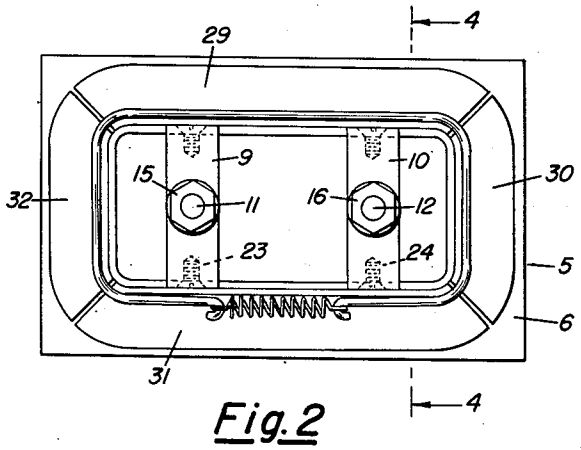


Fig. 2

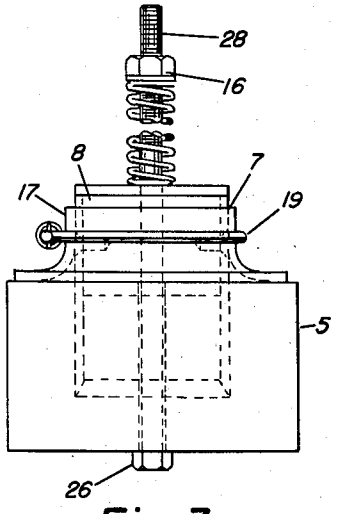


Fig. 3

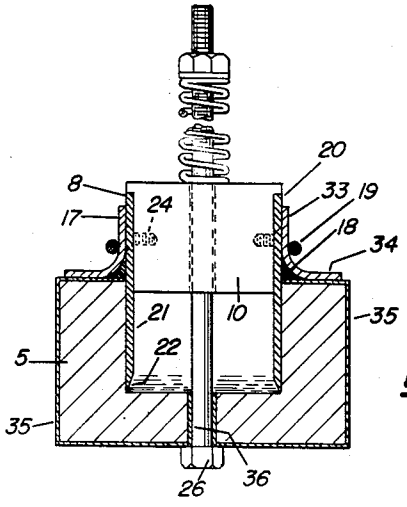


Fig. 4

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ETCHING APPARATUS ASSEMBLY

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6 Claims. (Cl. 41—9)

My invention relates to etching apparatus, particularly as employed for the vertical wall formation progressively of pockets or recesses in metallic work-pieces or basic structures; and its objects are to dispense with the necessity of the use of cutting instruments or other abrasive means now ordinarily employed for such purpose, and in place thereof to utilize in the formation of such pockets or recesses the dissolving action of etching fluids strictly confined to the areas to be treated; to guard effectively against the spreading of the etching fluid to attack the vertical walls of the aperture while the same is being formed; to permit progressively the ready etching of vertically walled pockets cylindrical, triangular, square, rectangular in form or other shapes prismatic in character, and of any depth desired; to render readily accessible the various parts for inspection, adjustment, manipulation, replacement or repair; and in general to provide an etching apparatus which is simple and economical of construction, saving of labor and expense, efficient in action, and of prolonged life and durability. My invention further consists of other novel features of construction, and combinations and arrangements of elements and parts illustrated in the drawing, and hereinafter more particularly described and claimed.

At the present time, it is the general shop practice in airplane plants, automobile plants, and other establishments using metallic parts in the manufacture of commercial products, where it is found necessary to form pockets or recesses in the mass of work-pieces or in basic structures, to employ mechanical cutting instruments, or other abrasive means for such purpose. This involves considerable expense for labor and special machine tools or abrasive materials in making such apertures and, except in the formation of cylindrical openings, it has been found difficult if not impossible correctly to make the cuttings in the exact dimensions required. Attempts to accomplish such results have been made through the process of etching, but because of the difficulty of confining such etching to the exact areas required, without spreading outside of said areas, such attempts, so far as I am aware, have been found to be unsuccessful. With my improved etching apparatus, however, I am enabled to restrict the etching of the material to the precise confirmation progressively of the walls of the recess and to the exact depth required, and to guard the said walls against further etching.

Attention is hereby directed to the accompanying drawing, illustrating a preferred form of my invention, in which drawing similar numerals of designation refer to similar parts throughout the several views, and in which:

Figure 1 is a side elevationary view of an etching apparatus embodying said form of my invention, showing the same mounted upon a metallic work-piece in operative position to effect vertically by etching a pocket therein;

Fig. 2 is a plan view of the etching apparatus shown in Fig. 1, looking downwardly in the direction indicated by the arrows 2—2;

Fig. 3 is an end elevationary view of said apparatus, looking longitudinally in the direction indicated by the arrows 3—3, of Fig. 1; and

Fig. 4 is a section on line 4—4 of Fig. 2, looking in the direction indicated by the arrows.

Referring to the drawing, the work-piece 5 is shown in the form of a rectangular metallic mass of copper, aluminum or other metallic material susceptible to the dissolving action of etching fluid when applied thereto. It may, however, be of any thickness and of any longitudinal or lateral dimensions, sufficient to allow upright pockets or recesses with vertical walls to be formed therein. Its upper face 6 is planar and flat.

Mounted upon said upper face 6 of said work-piece 5 is the etching apparatus 7, comprising the rectangular shaped shell 8, blocks 9 and 10 secured within said shell, upright bolts 11 and 12 extending vertically through said blocks, helical compression springs 13 and 14 mounted upon said bolts between the nuts 15 and 16 thereof and tops of said blocks, an expansible and contractable ring 19 surrounding said collar. All of these parts, except the work-piece 5, are of material resistant to the action of the etching fluid.

The rectangular shaped shell 8 is made with perpendicularly extending wall 20 of substantial thickness, the bottom edge 21 of which is inwardly bevelled to form the continuously extending knife-edge 32. Within the hollow of said shell and secured to the upper portion of the said wall 20 by screws 23 and 24, are the blocks 9 and 10, rectangular in form and having their opposite sides contacting and in abutting registration with the adjacent inner face of the wall 20. Extending upwardly through the said blocks, and passing with sliding contact through passageways provided therefor, are the elongated bolts 11 and 12, having the heads 25 and 26, the threaded end portions 27 and 28 and the nuts 15 and 16. Interposed between the said nuts and blocks 9 and 10, and mounted upon the shanks thereof, are the compression springs 13 and 14, the purpose of which is shortly to be explained.

The collar 17 is preferably constructed in four separate sections 29, 30, 31 and 32, conforming to the four sides of the shell 8, and having adjacent ends, separated by narrow gaps; each of said sections being provided with an upstanding flange 33 positioned to make close sliding contact with the adjacent wall of the shell 8, and each of said parts having a flat horizontally extending base 34 positioned to make close surface contact with the adjacent top face of the work-piece 5. Preferably to guard against leakage between said bases 34 and the work-piece 5, I provide a continuous plastic seal 35 interposed therebetween, said seal being of material resistant to etching fluid, and permitting sliding vertical contact with the shell 8. The ring 19 is preferably an annulus with separated ends formed from a cable of flexible or resilient material resistant to the action of etching fluid; the said ends being connected by an etching resistant tension spring 38, to complete the said ring. As shown, such ring so constituted being of less circumference than the collar 17 will, upon being applied thereto, serve closely to draw together the sections 27, 30, 31 and 34 into spring yielding close engaging contact with the shell 8.

To operate my improved etching apparatus, it is first necessary to bore the work-piece 5, from top to bottom, with two holes 36 and 37 shaped and located to make close engagement with the shanks of the bolts 11 and 12; the walls of said holes being covered with wax or other material resistant to etching fluids. The said apparatus 7 is then mounted upon said work-piece, the nuts 15 and 16 and the springs 13 and 14 removed from the said bolts, and such bolts inserted into the holes 36 and 37 from below and thrust upwardly to contact the heads of said bolts with the bottom of the work-piece, and to pass vertically through the passageways in the blocks 9 and 10, and to protrude therefrom. Whereupon the said springs 13 and 14, and the nuts 15 and 16 are restored to their

original position on said bolts, and screwed down upon the threaded portions 27 and 28 to compress the springs 13 and 14 and to press downwardly and inwardly the knife edge of the shell 8 in continuous contact with the work-piece, in the formation progressively of a rectangularly shaped pocket as the etching proceeds. Then the etching fluid is poured into the hollow of the shell 8 at the top, upon the upper exposed face of the work-piece, and the etching of the same slowly proceeds constantly downwardly slowly and evenly to form the pocket; the sides thereof being protected and guarded from being etched by the shell 8, encompassing collar 17 and etching resistant plastic seal ring 18, the said shell being forced downwardly and progressively into said workpiece through said collar by action of the springs 13 and 14 as the etching proceeds. To determine the depth of the said pocket and the period of time required to etch the same, it is necessary to ascertain the strength and temperature of the etching fluid, and the tension of the springs 13 and 14 through manipulation of the nuts 15 and 16. Once these two factors are ascertained, formulae may be worked out whereby any desired depth of pocket may be readily accomplished.

In place of pouring the etching fluid into the hollow of the shell 8 as above set forth, the entire etching apparatus mounted as aforesaid upon the work-piece 5, may be immersed in a receptacle containing said fluid of sufficient depth to cover the same, the exposed outer faces of the said work-piece being covered by a coating 35 of wax or other material resistant to the dissolving action of the etching fluid.

My invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiment as above set forth is, therefore, to be considered in all respects as illustrative and not restrictive, the scope of my invention being indicated by the appended claims rather than by the foregoing description, and all changes which may come within the meaning and range of equivalency of the claims are, theerfore, intended to be embraced therein.

What I claim and desire to secure by Letters Patent is:

1. An etching apparatus for forming pockets in the mass of a basic structure, the combination of a work-piece, susceptible to the dissolving action of etching fluid; an etching resistant upright shell forming a receptacle for said fluid mounted upon said work-piece and in close contact therewith; means for forcing progressively said shell down upon and into said work-piece while a pocket is being etched therein by said fluid; and sealing means for preventing the spreading of said fluid from attacking the walls of said pocket while and after said walls have been formed.

2. An etching apparatus for forming pockets in the mass of a basic structure, the combination of a work-piece, susceptible to the dissolving action of etching fluid; an etching resistant upright shell forming a receptacle for said fluid mounted upon said work-piece and having a cutting edge at its bottom in close contact therewith; means for resiliently forcing progressively said shell down upon and into said work-piece while a pocket is being etched therein by said fluid; and sealing means encompassing said shell for guarding against the spreading of said fluid from attacking the walls of said pocket while and after said walls have been formed.

3. An etching apparatus assembly, comprising a work-piece susceptible to the dissolving action of etching fluid; an etching resistant upright shell with vertically extending walls mounted upon said work-piece in close contact therewith, said shell so disposed forming a receptacle for said fluid and confining its action to the part of the work-piece in process of being etched; spring actuated means connected with both said shell and work-piece and operating constantly and progressively to force said shell down upon and into said work-piece to cover walls therein while the etching away of said work-piece is taking place to form a pocket.

4. An etching apparatus assembly, comprising a flat top metallic work-piece susceptible to the dissolving action of etching fluid; an etching resistant upright shell with vertically extending walls sharpened to a knife edge at the bottom thereof and mounted upon said work-piece in close contact therewith, said shell so disposed forming a receptacle for said fluid and confining its action to the part of the work-piece in process of being etched; spring actuated means connected with both said shell and work-piece and operating constantly and progressively to force said shell down upon and into said work-piece to form walls therein while the etching away of said work-piece is taking place, said spring actuated means consisting of blocks installed within and secured to said shell, threaded bolts extending upwardly through openings in said work-piece and blocks, nuts mounted to turn upon the upper ends of said bolts, and helical compression springs interposed between said nuts and blocks; and means for sealing off from further contact with said fluid the walls of said socket after formation of the same.

5. An etching apparatus assembly, comprising a flat top metallic work-piece susceptible to the dissolving action of etching fluid; an etching resistant upright shell with vertically extending walls sharpened to a knife edge at the bottom thereof and mounted upon said work-piece in close contact with the top thereof, said shell so disposed forming a receptacle for said fluid and confining its action to the part of the work-piece in process of being etched; spring actuated means connected with both said shell and work-piece and operating constantly and progressively to force said shell down upon and into said work-piece to form walls therein while etching away said work-piece to form a pocket therein; and means for sealing off from further contact with said fluid the walls of said socket after formation of the same, said sealing means consisting of a sectional collar surrounding said shell and in sliding contact therewith, an annular plastic seal interposed between said collar and shell, and a contractable elastic ring encompassing the sections of said collar and compressing the same against said shell.

6. An etching apparatus assembly, comprising a flat top metallic work-piece susceptible to the dissolving action of etching fluid; an etching resistant upright shell with vertically extending walls sharpened to a knife edge at the bottom thereof and mounted upon said work-piece in close contact with the top thereof, said shell so disposed forming a receptacle for said fluid and confining its action to the part of the work-piece in process of being etched; spring actuated means connected with both said shell and work-piece and operating constantly and progressively to force said shell down upon and into said work-piece to form walls therein while the etching away of said work-piece is taking place; said spring actuated means consisting of blocks installed within and secured to said shell, threaded bolts extending upwardly through openings in said work-piece and blocks, nuts mounted to turn upon the upper ends of said bolts, and helical compression springs interposed between said nuts and blocks; and means for sealing off from further contact with said fluid the walls of said socket after formation of the same, said sealing means consisting of a sectional collar surrounding said shell and in sliding contact therewith, an annular plastic seal interposed between said collar and shell, and a contractable elastic ring encompassing the section of said collar and compressing the same against said shell.

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