July 17, 1956 L. T. ZATKO 2,754,785

RIDGED HOUSING STAMPING

Filed Nov. 7, 1951

5 Sheets-Sheet 1

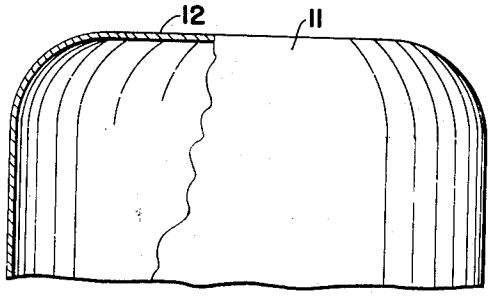


FIG. 1

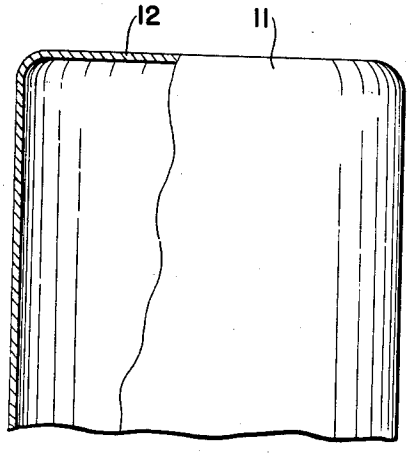


FIG. 2

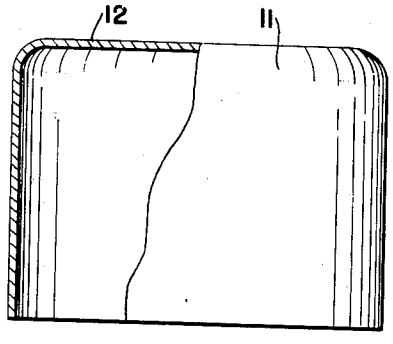


FIG. 3

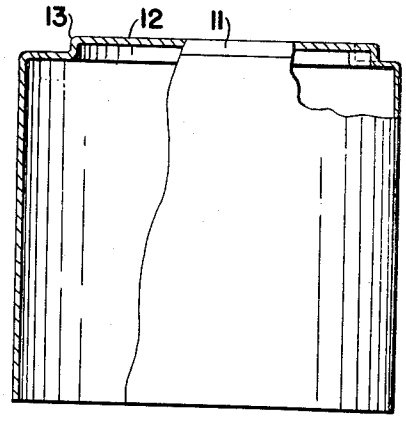


FIG. 4

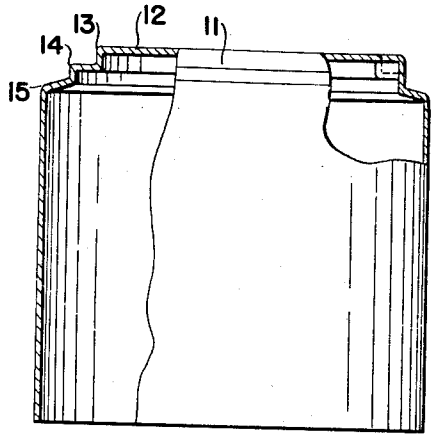


FIG. 5

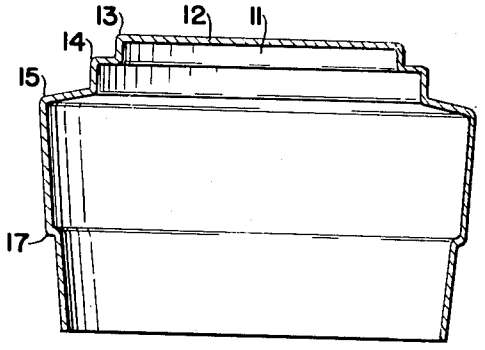


FIG. 6

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5 Sheets-Sheet 2

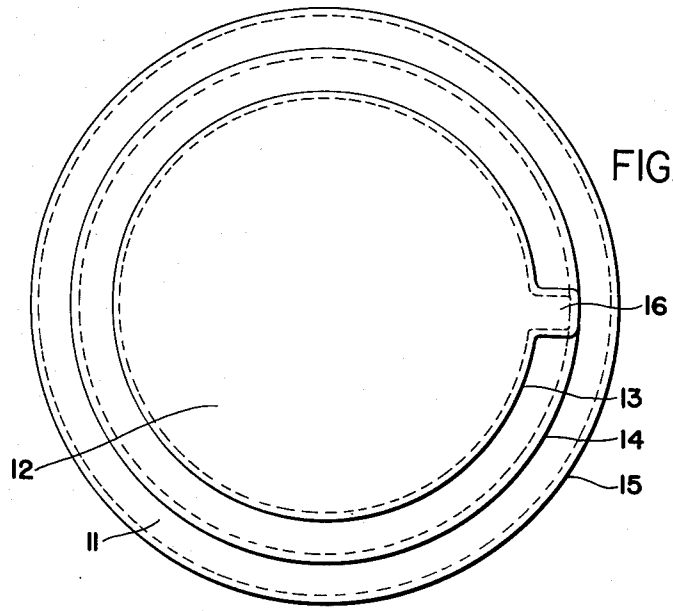


FIG. 5A

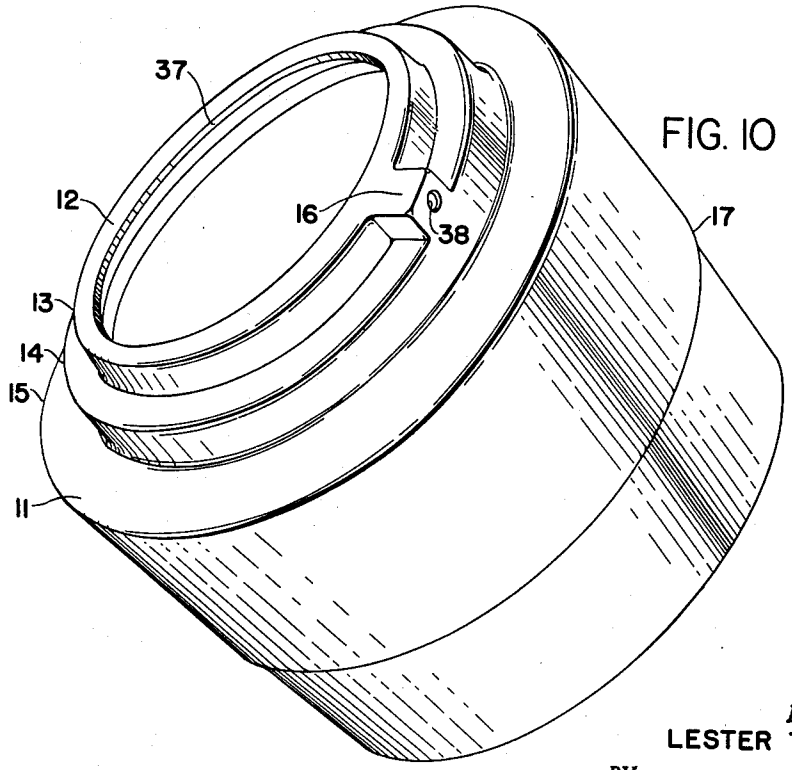


FIG. 10

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5 Sheets-Sheet 3

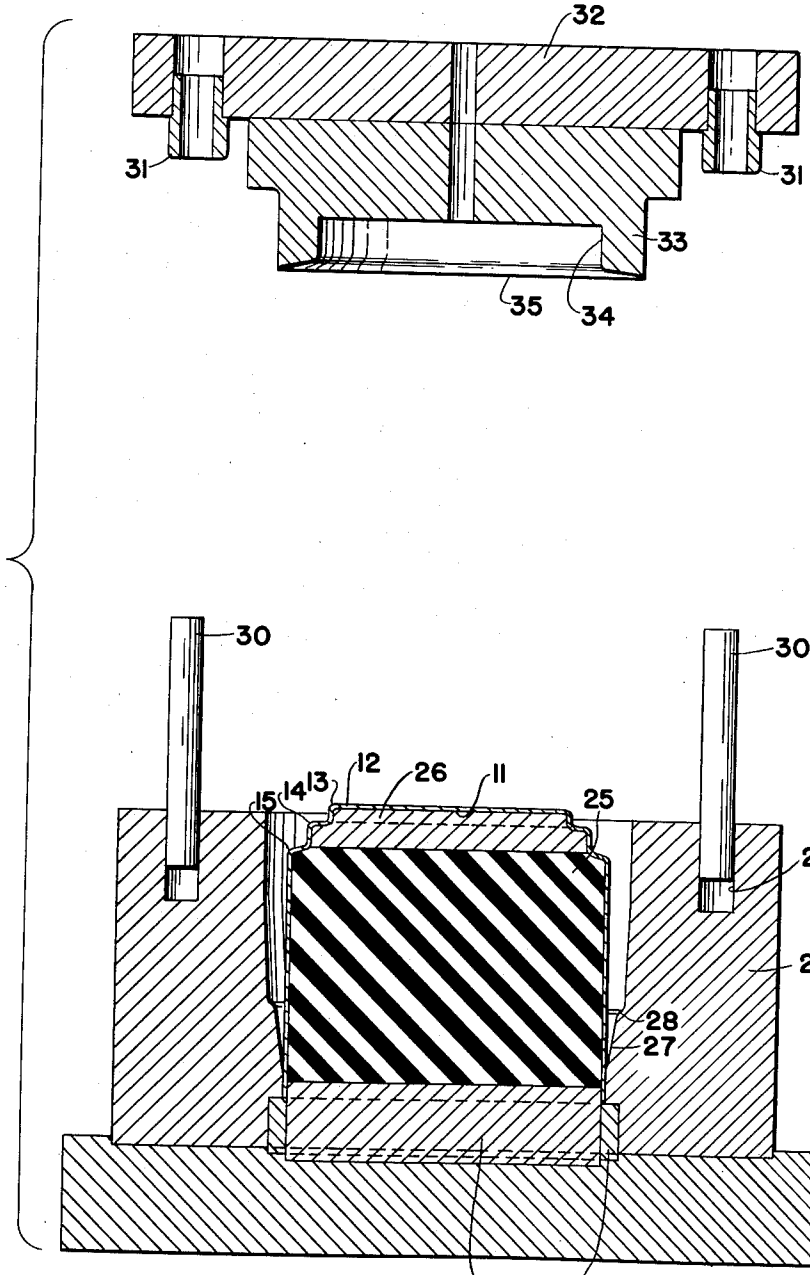


FIG. 7

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5 Sheets-Sheet 4

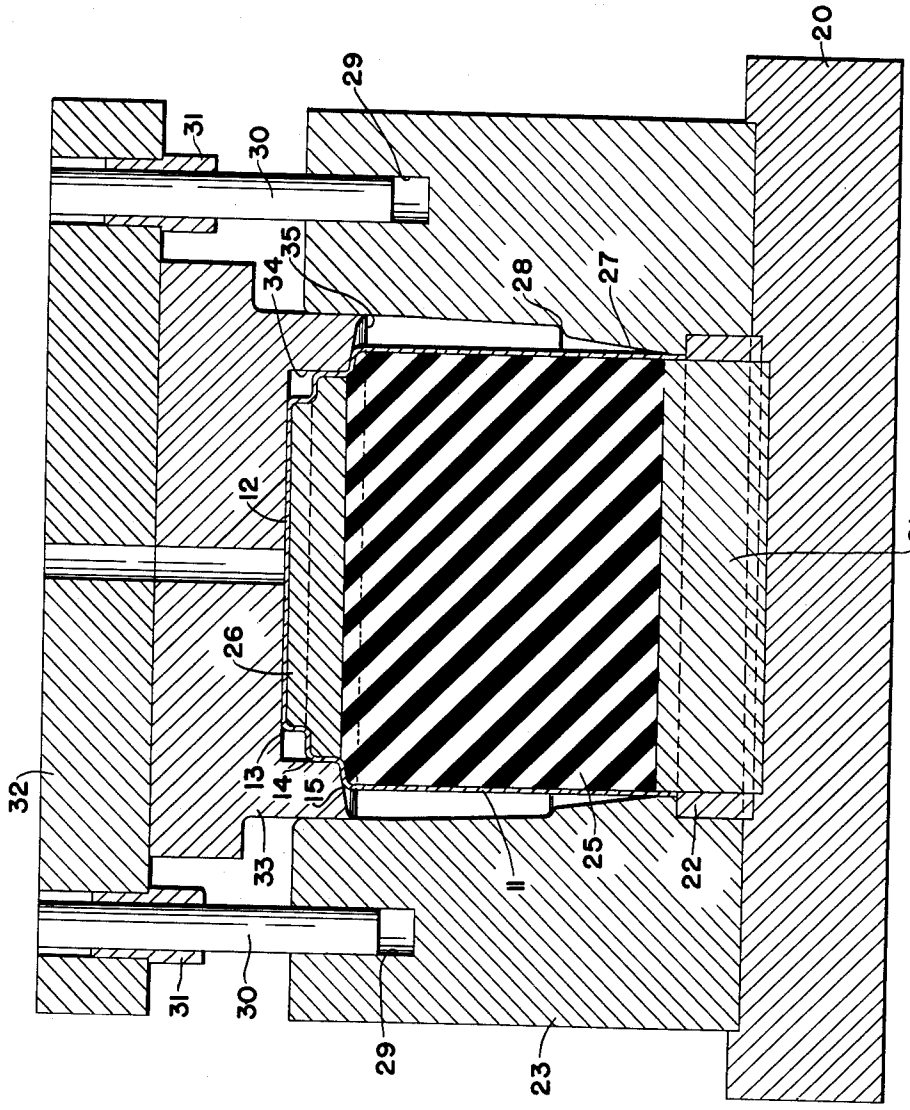


FIG. 8

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5 Sheets-Sheet 5

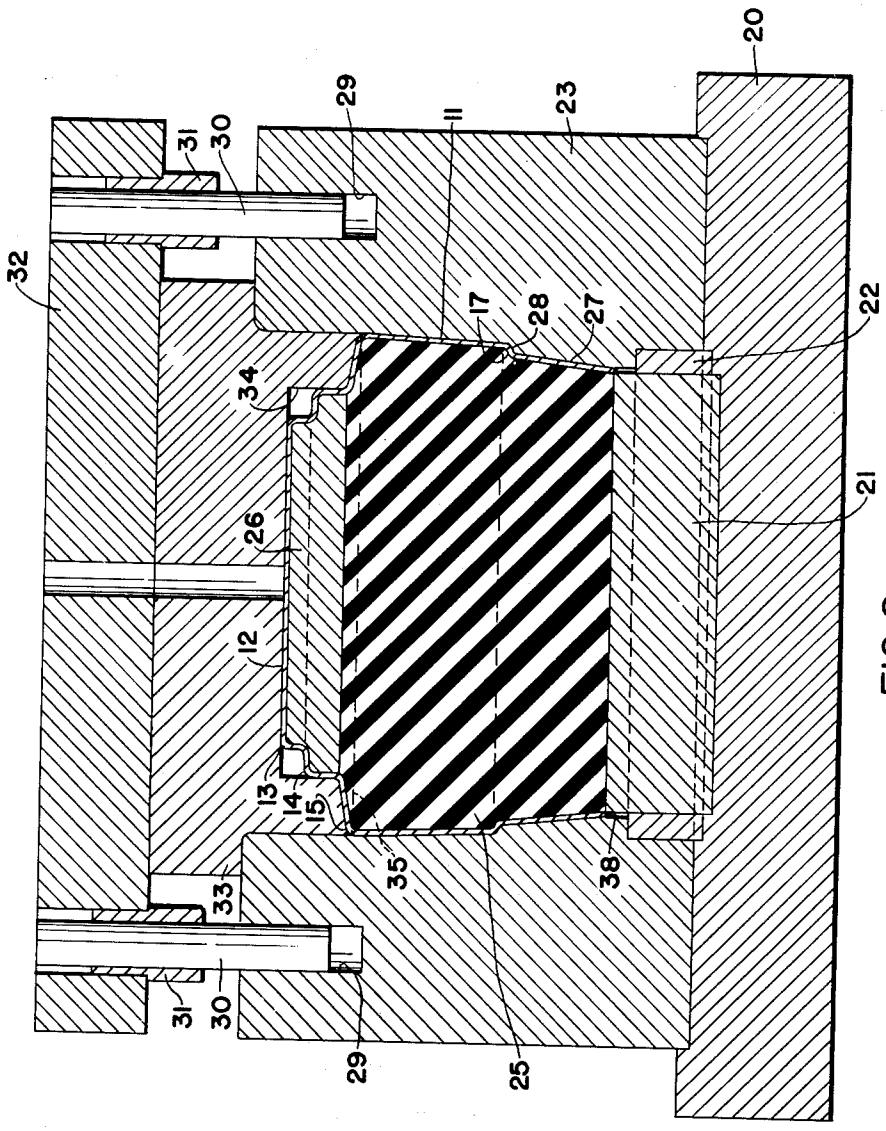


FIG. 9

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United States Patent Office 2,754,785 Patented July 17, 1956

2,754,785

RIDGED HOUSING STAMPING

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Application November 7, 1951, Serial No. 255,187

3 Claims. (Cl. 113—44)

The present invention relates to a device for forming ridged circular housings and more particularly to a device for forming ridged housings from sheet metal by stamping operations alone.

In the past, ridged metal housings having been stamped in separate parts with mating peripheral flanges which were then riveted or welded together to form finished housings. Attempts to form the housing from a single piece of metal were unsuccessful because of the resulting weakness of the housing wall. In efforts at single piece fabrication, no particular difficulties were met in performing conventional preparatory drawing operations but no way was found to employ the expanding die member necessary for final ridge forming operations without subjecting the walls to a prohibitive amount of working. Particularly at the root or inner corners of the ridge the simultaneous bending and longitudinal drawing to which the wall was subjected resulted in the formation of a brittle initially stressed zone which would quickly fail in service.

While a satisfactory housing may be fabricated from two stamped pieces, the necessary welding operations and the componding of stamping operations are expensive and time consuming in terms of both equipment and labor. For these reasons, feasible one-piece manufacture of ridged housings remains a highly desirable goal for sheet metal fabricators.

The present invention successfully accomplishes fabrication of a ridged housing by stamping operations performed on a single piece of sheet metal. The cost of housings produced by the present invention is minimal. Not only do the housings avoid the structural weaknesses previously encountered in single piece fabrication, but they are actually more durable and have a longer service life than two-piece welded housings.

Other objects and advantages of the invention will be apparent from the following detailed description and the accompanying drawings in which:

Figures 1 to 6, inclusive, are side elevations partly in section showing successive stages in stamping a ridged housing from a sheet metal blank. The partial section in Figure 6 is taken on a transverse vertical plane rotatably removed from the plane on which the partial sections in Figures 4 and 5 are taken.

Figure 7 is a vertical cross-section of the open stamping dies just before the stamping operation for forming the housing ridge as shown in Figure 6.

Figure 8 is a vertical cross-section of the stamping dies at an intermediate position between the positions illustrated in Figures 7 and 9 and drawn to a larger scale than Figure 7.

Figure 9 is a vertical cross-section of the stamping dies upon the conclusion of the stamping operation for forming the housing ridge as shown in Figure 6 and drawn to the same scale as Figure 8.

Figure 10 is a perspective view of the ridged housing formed by the present invention.

Figure 5A is a plan view of the stamping shown in Figure 5.

As illustrated in Figures 1 to 5 inclusive, a piece of sheet metal is first stamped to form a cylindrical cup-shaped blank **11** having a base or web **12** as shown in Figure 1. The stamping **11** is then stamped and redrawn to increase its depth and decrease its diameter as shown in Figure 2. The next operation as shown in Figure 3 consists of trimming off the bottom edge of the stamping **11**, preferably through the use of pinch-trim stamping dies. The top shoulder of the stamping **11** is then subjected to two successive indenting stamping operations as shown in Figures 4 and 5 to form the stepped annular shoulders **13**, **14** and **15**. By providing a short notch in the ring die used to stamp the indent as shown in Figure 4, the indent may be only about half as wide radially at portion **16** as it is at the remainder of the annular locations about the top of the stamping **11**. After an additional indenting operation to form the shoulder **15** as shown in Figure 5, the portion **16** will remain upstanding in the indent between the shoulders **13** and **14** to form a power cable receiving lug through which a cable receiving hole may be later pierced in a radially outward direction.

After the stamping has been given the conformation illustrated in Figure 5, it is ready for the ridge forming operation which is accomplished by the press-mounted dies illustrated in Figures 7 to 9. Included in the illustrated assembly are lower shoe **20**, an anchoring base **21**, a liner **22** and a bulge die **23**. Cemented to the base **21** is a block **25** comprising dense rubber of so-called "bumper stock" or its equivalent which has a toughness and resiliency corresponding to the commonly known vulcanized tire-tread stock. Cemented to the top of the rubber block **25** is a steel top pad or plug **26**. Mounted in the holes **29** in the bulge die **23** are the guide pins **30**. Adapted to receive the guide pins **30** are the bushings **31** which are mounted on the top shoe **32**. Pinned to the top shoe **32** is the stake **33**. As may best be seen in Figures 8 and 9, the conformation of the lower surface of the stake **33** is such as to permit it to come into tight clamping engagement with the shoulders **14** and **15** of the stamping **11**. The low inner bore **34** of the stake **33** is of a diameter only great enough to permit the bore to the pressed onto the vertical wall of the shoulder **14** and the bottom edge **35** of the stake is slightly flared to enable it to bear firmly on the radial wall of the shoulder **15** to press this wall against the rubber stock **25**. The long vertical sides of the stamping **11** ride freely on the sides of the block **25** and its bottom edge abuts against the liner **22**.

The stamping **11** is placed on the lower die members when the upper and lower die members are in their fully separated position as shown in Figure 7. As the upper die members move into the position shown in Figure 8, the inner bore **34** of the stake **33** presses over the vertical wall of the shoulder **14** until the bottom stake edge **35** bears on the radial wall of the shoulder **15** to firmly clamp the stamping **11** between the stake **33** and the plug **26** and rubber block **25**. As the dies move from the position shown in Figure 8 to the position shown in Figure 9, the upper portion of the vertical wall of the stamping **11** is bent outwardly to conform to and extend the radial wall of the shoulder **15**. There being no tight gripping engagement of the lower portions of the vertical wall of the stamping **11**, these portions are free to ride up along the block **25** to follow the bent-out upper portion and to be urged by the expanding block **25** against the bulge die **23**. When the dies reach the position shown in Figure 9, the lower edge of the stamping **11** is raised above the liner **22** and is positioned substantially opposite the bottom of the flared portion **27** of the bulge die bore.

The distance of the lower edge of the stamping **11** above the liner **22** represents the amount of upward displacement of the stamping sides to compensate for the sheet material taken up in the formation of the ridge **17**.

The top pad **26** functions as an inner gripping member to cooperate with the stake **33** to tightly grip the stamping **11** at the initiation and throughout the actual ridging operation. Moreover, the top pad **26** of the base **21** cooperate to limit the rubber block **25** to substantially radial expansion against the stamping **11** except at the top outside shoulder of the block where resilient expansion both upwardly and outwardly against the shoulder **15** occurs. Transformation of the upper portion of the long vertical wall of the stamping **11** into an extension of the radial wall of the shoulder **15** is thus accomplished predominately by a bending rather than a drawing action, and the small degree of drawing of sheet material that does occur (in order to accommodate the comparatively small increase in peripheral dimension) is along substantially horizontal peripheral lines of force rather than in the vertical direction.

It will be noted that the base **21**, the liner **22** and the bulge die **23** cooperate to define the small annular groove **38** which initially receives the foot of the stamping **11**. Upward movement of the stamping foot may thus occur free of any pinching or clamping action on the bottom of the stamping **11** so that the metal wall may be displaced toward the upper portions of the die and toward the portion of the housing opposite the bulge die shoulder **28**. By the time the sides of the rubber block **25** move their full distance outwardly to press the stamping **11** against the bore of the bulge die **23**, all necessary upward movement of the stamping walls has taken place.

All the successive stamping operations to and including the final ridge forming step described immediately above may, if desired, be performed on a single stamping press by substituting successive sets of dies for the successive operations. However, it is preferable to have a series of stamping presses, each one adapted to perform a single operation on the blanks.

After giving the housing its final shape illustrated in Figure 6, a large central hole **37** may be pierced in the web **12** and a radial hole **38** drilled in portion **16** to give the housing the conformation illustrated in Figure 10.

Modifications of the disclosed specific embodiment of my invention will suggest themselves to those familiar with the stamping art. Accordingly, the invention is not to be restricted to the embodiment disclosed but is to be defined by the following claims.

What is claimed is:

1. The method of forming a ridged annular housing from sheet metal comprising the steps of forming from a blank of said metal a seamless flanged cup having a first cylindrical wall, striking an annular step around the base of said cup to form a second cylindrical wall of lesser radius than said first cylindrical wall and joined to said first cylindrical wall by an outwardly extending annular web, placing said second cylindrical wall around and in mating relationship with a supporting plug, press-fitting a female die member around said second cylindrical wall and in mating relationship therewith with a lower annular surface of said female die member abutting against and extending radially beyond said outwardly extending annular web whereby said second cylindrical wall will be held in clamping relation between said plug and said female die member and said first cylindrical wall will be free of any clamping constraint, expanding an elastic expandable block within said cup to force said first cylindrical wall outwardly against an annular die surface and the upper portion of said first cylindrical wall outwardly and upwardly against said lower annular surface of said female die member.

2. A stamping assembly comprising a lower bulge die member having a wide bore, an upper annular stake member having a depending circular lip, said lip defining an outer cylindrical surface, an inner cylindrical surface and a bottom face, means to project said stake member into the top portion of said wide bore with said outer cylindrical surface in mating sliding contact with said wide bore and to withdraw said stake member from said bore, an upstanding resilient normally cylindrical expandable block coaxially placed within said wide bore, the bottom of said expandable block being anchored in fixed relation to said bulge die member, a shallow round plug fixed to the top of said expandable block and concentric therewith, said plug having a great diameter less than the diameter of said expandable block to define a cylindrical plug surface and an annular shoulder at the juncture of said plug and said expandable block, said inner cylindrical surface of said lip having a diameter greater than said great diameter of said plug to permit said inner cylindrical surface to fit over said cylindrical plug surface in spaced mating relationship upon initial projection of said stake in said bore, said expandable block being upstanding in said bore to such a height as to effect engagement between said bottom face and a stamping supported on said annular shoulder upon less than full projection of said stake into said bore.

3. A stamping assembly comprising a lower bulge die having formed therein a wide bore, an upper stake member having a depending annular lip, said lip defining an outer cylindrical surface, an inner cylindrical surface and a bottom face, means to project said stake member into the top portion of said wide bore with said outer cylindrical surface in mating sliding contact with said wide bore and to withdraw said stake member from said bore, an upstanding resilient expandable block defining a normally cylindrical resilient surface and coaxially upstanding within said wide bore, a rigid base block supporting and fixed to the bottom of said expandable block, the upper peripheral portion of said base block being spaced from the apposite zone of the surface of said wide bore, all portions of said normally cylindrical resilient surface being spaced from apposite zones of the surface of said wide bore, a shallow round plug fixed to the top of said expandable block and concentric therewith, said plug having a great diameter less than the diameter of said expandable block to define a cylindrical plug surface and an annular shoulder at the juncture of said plug and said expandable block, said inner cylinder surface of said lip having a diameter greater than said great diameter of said plug to permit said inner cylindrical surface to fit over said cylindrical plug surface in mating relationship upon initial projection of said stake in said bore, said expandable block being upstanding in said bore to a height sufficient to effect engagement between said bottom face and a stamping supported on said annular shoulder upon less than full projection of said stake into said bore.

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