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H. S. ACHLER ETAL

3,276,239

PRESS BRAKE DIE RETAINER

Filed April 6, 1964

FIG. 1.

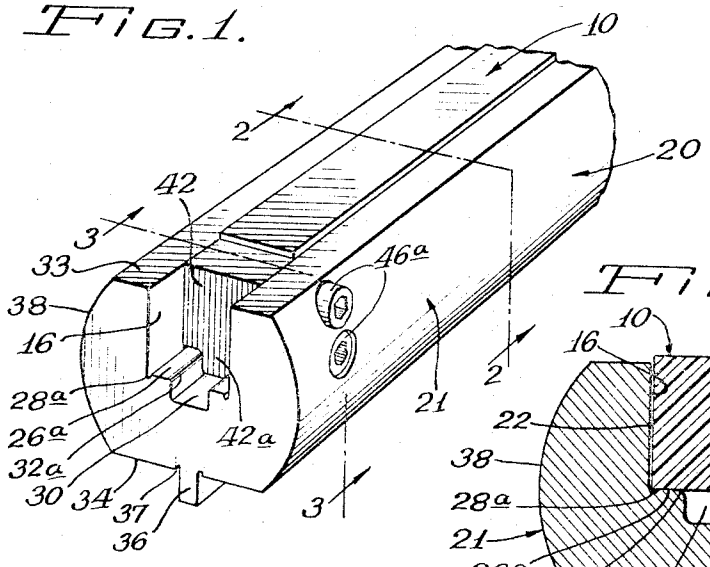


FIG. 2.

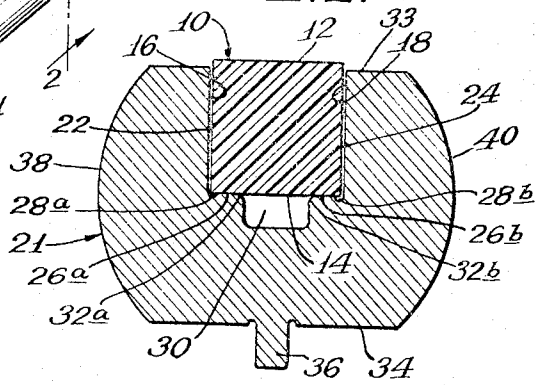


FIG. 3.

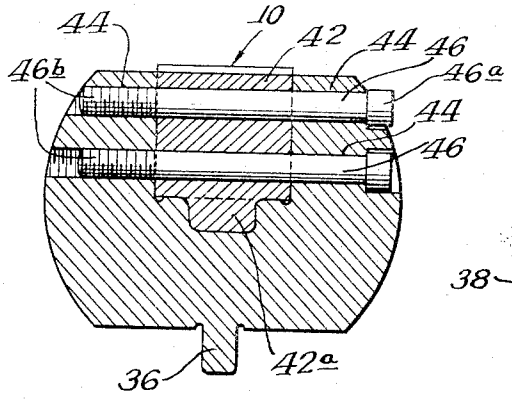
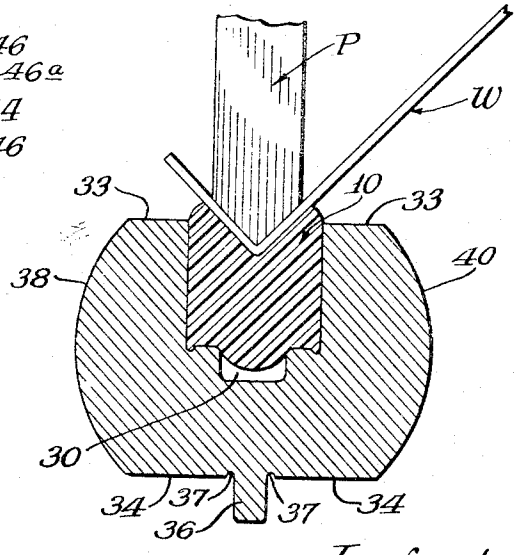


FIG. 4.



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PRESS BRAKE DIE RETAINER

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5 Claims. (Cl. 72—465)

This invention relates to female press brake dies and more particularly relates to a simplified extruded pad retainer for urethane rubber die pads.

Urethane rubber, manufactured and sold by Du Pont under the trademark "Adiprene" has certain desirable characteristics, such as unusually high load bearing capacity, abrasion resistance, and oil resistance. The potential use of urethane rubber for tooling, such as a substitute for the female die in press brakes has been known, and its superiority in versatility, economy and performance, by reducing tooling time, eliminating the need for a machined metal female die, in producing sheet metal parts without scratched or gouged exterior surfaces, practicability for long production runs, and in producing sharper and more precise bends, has been demonstrated.

When loads, such as from hard press brake punch, are applied to a die pad of urethane rubber, the extreme resiliency characteristic of the urethane rubber permits the pad to temporarily deform to a precise female die shape conforming to the shape of the brake punch, while at the same time the material of the pad is temporarily displaced laterally in all directions and oppositely from the press brake punch. The die pad, being confined in a die retainer, develops high bottom and lateral or side pressures. Furthermore, since urethane rubber is non-compressible, as constrasted to being deformable, it has the effect of being a "solid liquid" and performs like a confined hydraulic fluid within the limitations of its deflection rating.

Die retainers have, of course, been used and known where the entire retainer is built up of individual parts defining respectively the bottom, two sides, and two end walls, with the end walls connected to the terminal ends of the bottom and sides. There are a number of drawbacks resulting from such prior constructions, namely: the relatively high labor cost in effecting the assembly of the multiple parts; the fact that the length of the bottom and sides require precise tailoring in size to the length of the die pad to be used, thus requiring large expense of a tailor-made retainer for each die pad of different length; the cost of machining of a bottom or building up a bottom to define a relief space for receiving distortion of the die pad thereinto during a brake punch operation; and the engineering of varying thicknesses of side walls and appropriate bracing therefor to accommodate variations in the maximum bending stresses developed at the lower edges of the side walls and so as to avoid, to as great an extent as possible, any variation during use in the basic shape of the retainer chamber for the die pad, so as to obtain the benefits of the aforenoted characteristics of the urethane rubber.

It is submitted that the versatility and economy of use of urethane rubber die pads would be additionally increased by the provision of a simplified and inexpensive die retainer for such die pads and, accordingly, it is one

object of this invention to provide an improved and simplified form of die retainer for urethane rubber die pads.

Another object of this invention is to provide a die retainer for urethane rubber die pads that provides the necessary strength for lateral and bottom pressures and for bending stresses developed when the die pad is used with a press brake punch, and which die retainer is characterized by its economy and simplicity of construction, and by its versatility in use and in the modification thereof for varying installations.

With these and other objects in view, our invention consists in the construction, arrangement and combination of the various parts of our press brake die retainer, whereby the objects above contemplated are attained, as hereinafter more fully set forth, pointed out in our claims and illustrated in detail on the accompanying drawing, wherein:

FIGURE 1 is a fragmentary isometric view of our invention showing a urethane rubber die pad and its improved retainer therefor;

FIGURE 2 is a cross-section view taken substantially on line 2—2 of FIGURE 1;

FIGURE 3 is a cross-section view of the end plate of the die pad retainer and is taken substantially on line 3—3 of FIGURE 1, and

FIGURE 4 is a cross-section view similar to FIGURE 2 but illustrating a typical use of the device of FIGURES 1–3 with a press brake punch in the forming of a sheet metal part.

Referring now to the drawing, FIGURE 1 shows a flat urethane rubber die pad **10** and the improved die pad retainer generally indicated as **20**. More specifically the die pad is an elongated block of urethane rubber whose cross-section is right rectangular thereby defining top surface **12** and parallel bottom surface **14**, and parallel side surfaces **16** and **18**.

The die pad retainer **20** includes an elongated channel-shaped metal extrusion **21**, preferably of aluminum, which defines an elongated die pad recess that is bounded by pad-engaging side walls **22** and **24**, a pad support wall **26** formed by spaced surfaces **26***a* and **26***b*, corner relief recesses **28***a* and **28***b*, a large central relief space or well **30** and rounded corners **32***a* and **32***b* at the junction between the well **30** and the pad support **26**. The retainer **20** is formed with a flat top **33**, flat bottom **34**, and with a downwardly projecting elongated tail or tang **36** for purposes of alignment or clamping thereof, that extends longitudinally of the retainer and is located in a medial vertical plane of the extrusion. To provide for perfect squareness between bottom **34** and tang **36** in an extrusion, corner reliefs **37** are provided.

The shape of the extrusion is such that the thickness of the material behind, or outwardly, of side walls **22** and **24** gradually and continuously increases in thickness from the least amount of material at the top of the side walls to a greater thickness at the level of the support wall **26**. This gradually and continuously increasing material thickness is achieved by providing arcuate exterior walls **38** and **40**. While the increase in thickness to accommodate increase in bending stresses could be achieved by downwardly and outwardly inclined outer surfaces, exterior walls **38** and **40** are provided in arcuate shape for aesthetic reasons. When the walls **38** and **40** are circular arcs, the center of curvature must be located

in the central vertical plane of extrusion **21** at the plane of support wall **26** or therebelow.

In the forming of the extrusion **21**, the surfaces **26** and bottom **34** are provided precisely parallel, and side walls **22** and **24** are provided precisely parallel and at a spacing slightly larger than the width of the die pad **10** to be used. The plane of surface **26** is precisely square with walls **22** and **24**. The width of relief well **30** is about one-half of the width of the pad **10**, and the depth of well **30** is between 25% to 30% of the thickness of pad **10**. The spacing between the planes of top **33** and support wall **26** is less than the thickness of pad **10**, so that pad **10** normally protrudes slightly above the upper surface **33** of the pad retainer, as best seen in FIGURES 1–3.

The pad retainer **20** is also provided with a pair of similar end walls **42**, only one of which is seen in FIGURE 1. The end wall **42**, as can be seen from FIGURES 1 and 3, is shaped generally to fit closely within the contour of the rectangular recess defined by the intersecting planes of walls **22** and **24** and surfaces **33** and **26**, and additionally includes a tab **42***a* which fits into well **30**. It is preferred that each end wall be spaced axially from the terminal end of the extrusion **21**, as seen in FIGURE 1.

In order to secure the end wall **42** at its desired location and to provide the necessary strength for resistance to forces thereagainst from the urethane rubber pad **10**, elongated apertures **44** are provided extending into and through the material of the extrusion in a plane perpendicular to the longitudinal axis of extrusion **21**. In the specific construction disclosed herein, two elongated bolts **46**, with countersunk heads **46***a* having internal wrench sockets, and with threaded tip **46***b* are screwed into extrusion **21** and extend through walls **22** and **24** and through end wall **42**. In effect, each of the end walls **42** carry lateral extensions in the form of the protruding shank portions of bolts **46** which cooperate with the longitudinal sections of the extrusion **21**, so that forces from pad **10** applied to the end walls **42** are transmitted through bolts **46** to the transversely apertured sections of extrusion **21**.

FIGURE 4 illustrates a typical use of the device of FIGURES 1–3, wherein a press brake punch P is in the process of forming a corner in a sheet metal part W, and the urethane rubber die pad **10** has deformed to form the female die for the work W. It is understood that the flat bottom **34** may be resting on the bed of the press brake machine and that tank **36** extends through a slot in the press brake bed normally provided for purposes, among others, of alignment. It will be seen how, under pressure from punch P, the urethane rubber has deformed to move against and exert pressure along the entire height of walls **22** and **24**, to move into the relief recesses **28***a* and **28***b* and into relief space **30**, to move upwardly along the sides of the work piece W and above the normal level of the pad's top surface **12**. Although not seen in FIGURE 4, the pad **10** also deforms endwise to exert pressure against the end walls **42**.

The usefulness and economy of the construction hereinabove described will now be understood. A tooling shop needs only to carry in stock extrusions **21** of a length sufficient to accommodate a demand for the longest possible press brake female die. A supply of extrusions would be maintained for different size die pads, such as die pads of 1" x 1", 2" x 2", 3" x 2", etc. The end plates **42** are precut for fitting into the longitudinal recesses of the respective extrusions. When an order comes for tooling for a particular job, the shop need only select the desired size of die pad and associated extrusion. Then the pad is cut to a requisite length and the extrusion is cut to sufficient length to receive the die pad and the end walls **42** therein, leaving a few inches of additional length at each end beyond each end wall **42**. The only additional work is the machining necessary to effect connection of the end plates, and the order is completed.

It is understood that the thickness of material in extrusion **21** outwardly of side walls **22** and **24** is designed to accommodate the greatest loadings to which the die pads **10** could be subjected within the range of their design ratings and considering that the die pads exert uniform lateral pressure against the wall as if the pads were a "solid liquid." By providing additional material to resist the increase in bending stress at the lower ends of walls **22** and **24** due to such loadings and to resist variation of the basic shape of the retainer chamber under loadings during use of a die pad, it will be seen that the use of extruded retainers **21** with die pads **10** solves the many problems noted hereinabove as being associated with prior constructions of urethane rubber die retainers.

Some changes may be made in the construction and arrangement of the parts of our press brake die retainer without departing from the real spirit and purpose of our invention, and it is our intention to cover by our claims any modified forms of structure or use of mechanical equivalents which may reasonably be included within their scope.

We claim as our invention:

1. In a die retainer for a urethane rubber die pad where the die retainer provides an elongated die pad chamber having parallel side walls, end walls, support surfaces for the pad and a relief recess centrally of the support surfaces, the improved die retainer characterized by the combination of an elongated body of extruded aluminum defining therein an elongated die-pad recess bounded by elongated upright parallel spaced side walls, elongated support surfaces for a die pad located in a horizontal plane perpendicular to the side walls and spaced below the upper edges of the side walls, a relief space longitudinally of the body located centrally of the support surfaces, and end plates on the extruded body projecting across the die-pad recess to define a die-pad chamber.

2. In a die retainer for a urethane rubber die pad where the die retainer provides an elongated die pad chamber having parallel side walls, end walls, support surfaces for the pad and a relief recess centrally of the support surfaces, the improved die retainer characterized by the combination of an elongated body of extruded aluminum defining therein an elongated die-pad recess bounded by elongated upright parallel spaced side walls, elongated support surfaces for a die pad located in a horizontal plane perpendicular to the side walls and spaced below the upper edges of the side walls, a relief space longitudinally of the body located centrally of the support surfaces, and the thickness of the material of the extruded body outwardly of the side walls increasing in thickness continuously in the direction downwardly from the upper edges of the side walls to the plane of the support surfaces, thereby providing increasing resistance to increasing bending stresses obtained with use of a urethane rubber die pad, and end plates on the extruded body projecting across the die-pad recess to define a die-pad chamber.

3. In a die retainer for a urethane rubber die pad where the die retainer provides an elongated die pad chamber having parallel side walls, end walls, support surfaces for the pad and a relief recess centrally of the support surfaces, the improved die retainer characterized by the combination of an elongated body of extruded aluminum defining therein an elongated die-pad recess bounded by elongated upright parallel spaced side walls, elongated support surfaces for a die pad located in a horizontal plane perpendicular to the side walls and spaced below the upper edges of the side walls, a relief space longitudinally of the body located centrally of the support surfaces, aperture means in said extrusion located in a plane perpendicular to the longitudinal axis of the extrusion and communicating with the die-pad recess of the

extruded body, an end plate for projecting across the die-pad recess to help define the die-pad chamber, and means on the end plate extending into said aperture means for securing the end plate to the extruded body so that forces applied against the end plate are transmitted to the extruded body.

4. An improved die pad retainer as set forth in claim 2 wherein there are aperture means in the extrusion extending through said side walls and into the material outwardly of the side walls, the aperture means being located in a plane perpendicular to the longitudinal axis of the extrusion, and means on an end plate extending laterally of the end plate into said aperture means for securing the end plate to the extruded body.

5. An improved die pad retainer as set forth in claim 3 wherein the extrusion defines longitudinal relief recesses at the projected intersections of the side walls and the support surfaces.

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