

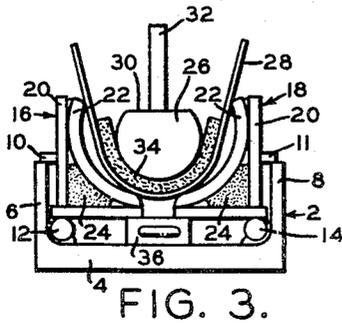
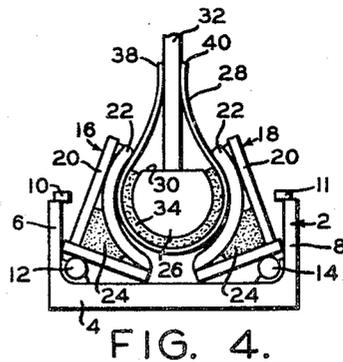
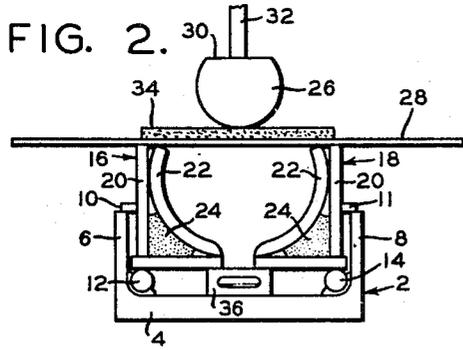
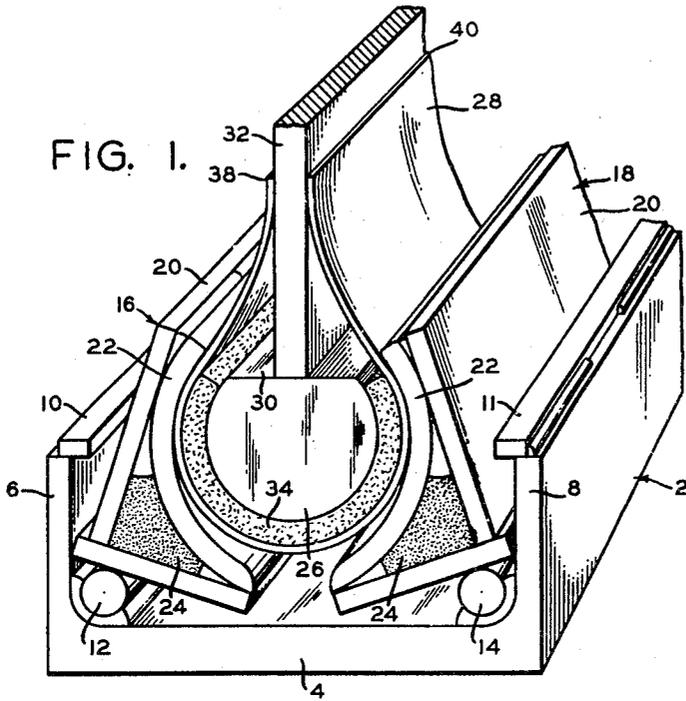
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RECIPROCATING BENDER WITH PIVOTED SIDE SHAPERS

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RECIPROCATING BENDER WITH PIVOTED SIDE SHAPERS

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This invention relates to a device for forming sheet material and is herein illustrated as embodied in a device for bending a workpiece to a streamlined or teardrop cross-section.

Sheet metal sections of teardrop cross-section are employed for certain aircraft parts. Ordinary dies for bending sheet material satisfactorily produce curvatures of 180° or less. Such a curvature can be produced with a simple pair of dies, a female die having a U-shaped cross-section and a male die curved to fit the female die and constructed to grip a workpiece with the female die when the dies are forced together. However, such a pair of dies cannot satisfactorily produce a finished piece having a streamlined or teardrop cross-section since such pieces have a curvature greater than 180°.

Therefore it is an object of this invention to produce a simple forming device which will bend sheet material to a teardrop cross-section.

Accordingly this invention provides a forming device having a pair of female dies rotatably mounted upon a base and constructed and arranged to grip a workpiece in combination with a male die adapted to fit therebetween. The two female dies rotate about the workpiece and the male die to form a finished workpiece having a cross-section of teardrop shape.

With the above and other objects and features in view, the invention will now be described with reference to the accompanying drawings which illustrate a preferred embodiment of the invention and will be pointed out in the claims.

Fig. 1 is a perspective view of a forming device constructed in accordance with this invention showing a finished workpiece ready to be removed from the device.

Fig. 2 is a schematic view which shows the device and a workpiece ready for the first stage of the forming operation with the female dies supported by a block which prevents rotation thereof.

Fig. 3 is a schematic view which shows the device and workpiece at the completion of the first stage of the forming operation with the block ready to be removed for the second stage.

Fig. 4 is a schematic view which shows the device and workpiece after the completion of the final stage of the forming operation.

As illustrated in Fig. 1 the device includes a base 2 of U-shaped cross-section, which may be constructed from an iron channel of the usual type having a horizontal web 4 and upwardly extending flanges 6 and 8. Stop strips 10 and 11

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are welded or otherwise firmly attached to the upper edges of the flanges 6 and 8.

Two steel rods 12 and 14 are welded or otherwise firmly attached in the acute angles or corners of the base 2. The rods 12 and 14 act as supports upon which a pair of female dies 16 and 18 rotate.

Each of the female dies includes a backing section 20, which may be an angle iron. A forming face 22, having a substantially quarter circular cross-section, is attached to the inner surfaces of the flanges of the backing section. The forming face 22 is welded or otherwise firmly attached to the backing section 20. If desired, the space between the forming face 22 and the backing section 20 can be filled with a heavy weighting metal such as zinc as indicated at 24 to give a firm support to the forming face 22.

A male die 26 cooperates with the female dies 16 and 18 to bend and shape a workpiece 28. The male die has a substantially cylindrical transverse cross-section, as shown in the drawing. Part of the male die 26 may be cut away as at 30 to attach a ram 32, which is used to force the male die toward and into association with the female dies.

A sponge rubber pad 34 is placed between the male die 26 and the workpiece 28 during the forming operation in order to protect the surface of the workpiece.

The forming operation is carried out in two stages and can best be understood by reference to the schematic drawings, Figs. 2, 3, and 4. During the first stage of the forming operation, block 36 (Figs. 2 and 3) is inserted beneath the female dies and upon the base 2 to prevent the female dies from rotating. As shown in Fig. 2, the workpiece is laid across the top edges of the female dies 16 and 18. The rubber pad is laid on top of the workpiece and the male die 26 is driven downwardly toward the female dies and into association therewith to bend the workpiece to a substantially U-shaped cross-section as shown in Fig. 3. An hydraulic press (not shown) is used to force the dies together. Then the block 36 is removed from under the female dies and the male die is forced further downwardly to cause the female dies to rock towards each other while continuing to be supported by the rods 12 and 14. By this operation, the workpiece is further bent into a teardrop configuration, the upper ends 38 and 40 of the workpiece being bent into contact with the sides of the ram 32 as shown in Fig. 4. Next, the force on the male die is removed, and the finished workpiece is withdrawn from the dies axially of the male die. The finished work-

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piece has a teardrop shape cross-section as shown in Figs. 1 and 4.

The invention described herein may be manufactured and used by or for the Government of the United States of America for government purposes without the payment of any royalty thereon or therefor.

Having described my invention, what I claim is:

1. A device for bending a workpiece into a tear drop formation comprising, a base of U-shaped cross-section, a movable male die member having a substantially cylindrical cross section and having a ram attached thereto, a pair of oppositely disposed female dies having internally curved surfaces of quarter circular section conforming substantially to the contour of said male die, two rod members rigidly attached at the corners of said base for supporting said female dies for rocking movement thereon, a block removably mounted in said base for arresting said female dies against rocking movement, said female dies coacting with said male die as said male die is advanced against said workpiece to bend said workpiece into substantially U-shaped form, and upon subsequent removal of said arresting block and continued advance of said male die, rock toward each other about their respective supporting rod members to bend the sides of said U-shaped workpiece further about the remainder of said male die into substantially tear drop formation.

2. A device for bending a workpiece into a tear drop formation comprising, a channel shaped base, a movable male die member having a substantially cylindrical cross section and having a ram attached thereto, a pair of oppositely disposed female dies being formed of angle members of a length substantially equal to said base and having forming faces of substantially quarter circular section attached thereto, said forming faces conforming substantially to the contour of said male die, two rod members rigidly attached at the corners of said channel shaped member and extending the length thereof for supporting said female dies for rocking movement thereon, a block between said base and said female dies for arresting rocking movement of said dies, said female dies coacting with said male die as said male die is advanced against said workpiece to bend said workpiece into substantially U-shaped form, and upon subsequent removal of said arresting block and continued advance of said male die, rock toward each other about their respective supporting rod members, to bend the sides of said U-shaped workpiece further about the remainder of said male die into substantially tear drop formation.

3. A device for bending a workpiece into a curve of more than 180° comprising, a channel shaped base, a movable male die member having a substantially cylindrical cross section, a pair of oppositely disposed female dies having quarter-circle arcuate forming faces conforming substan-

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tially to the contour of said male die, two rod members attached to the internal corners of said channel for supporting said female dies for rocking movement thereon and for spacing said female dies from the bottom of said channel, removable means mounted between the bottom of said channel and said female dies for arresting said female dies against rocking movement and for spacing said female dies from the bottom of said channel by an amount equal to the spacing afforded by said rod members, said female dies coacting with said male die as said male die is advanced against said workpiece to bend said workpiece into substantially U-shaped form, and upon subsequent removal of said arresting and spacing means and continued advance of said male die, rock toward each other about their respective supporting rod members to bend the sides of said U-shaped workpiece further about said male die, whereby the workpiece is shaped to a smooth curve of more than 180°.

4. A device for bending a workpiece into a tear drop formation comprising, a base of U-shaped cross-section, a movable male die member adapted to move in a vertical plane equidistant from the sides of said base and having a substantially cylindrical cross-section, a pair of oppositely disposed female dies having quarter-circular arcuate forming faces conforming substantially to the contour of said male die, means disposed along the corners of said base for freely supporting said female dies in spaced relation from the bottom of said base and for providing surfaces on which said female dies are mounted for rocking movement, removable means mounted between the bottom of said base and said female dies for arresting said female dies against rocking movement, said female dies coacting with said male die as said male die is advanced against said workpiece to bend said workpiece into substantially U-shaped form, and upon subsequent removal of said removable means and continued advance of said male die, rock toward each other about their respective spacing and supporting means to bend the sides of said U-shaped workpiece further about said male die into substantially tear drop formation.

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