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2,493,053

METHOD OF MAKING PULLEYS

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4 Sheets-Sheet 1

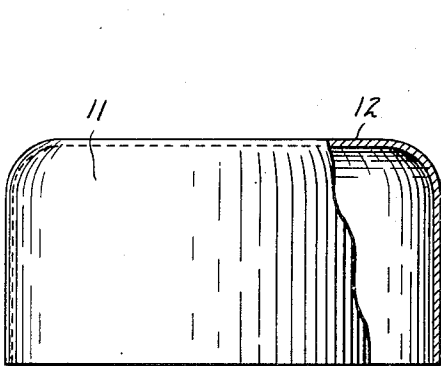


Fig. 1

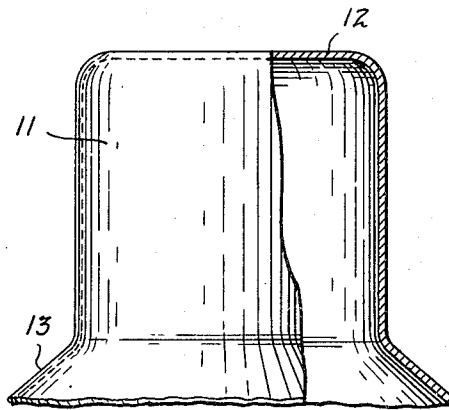


Fig. 2

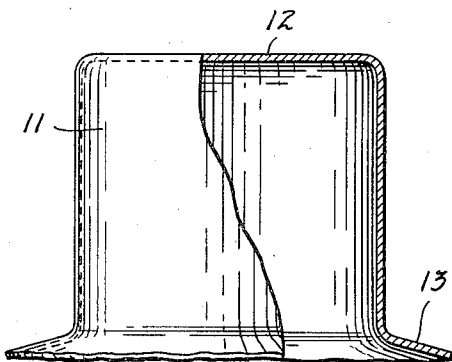


Fig. 3

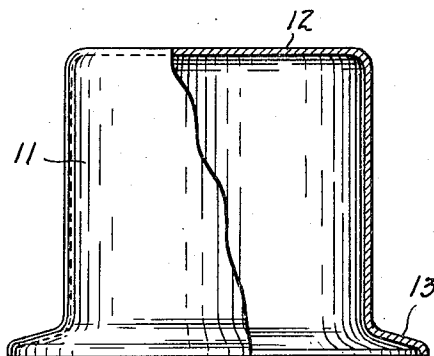


Fig. 4

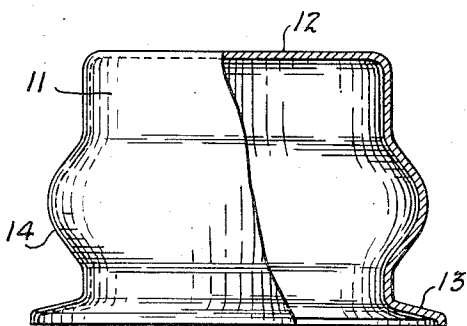


Fig. 5

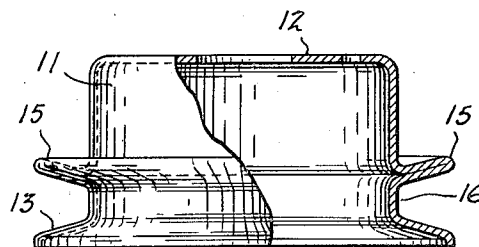


Fig. 6

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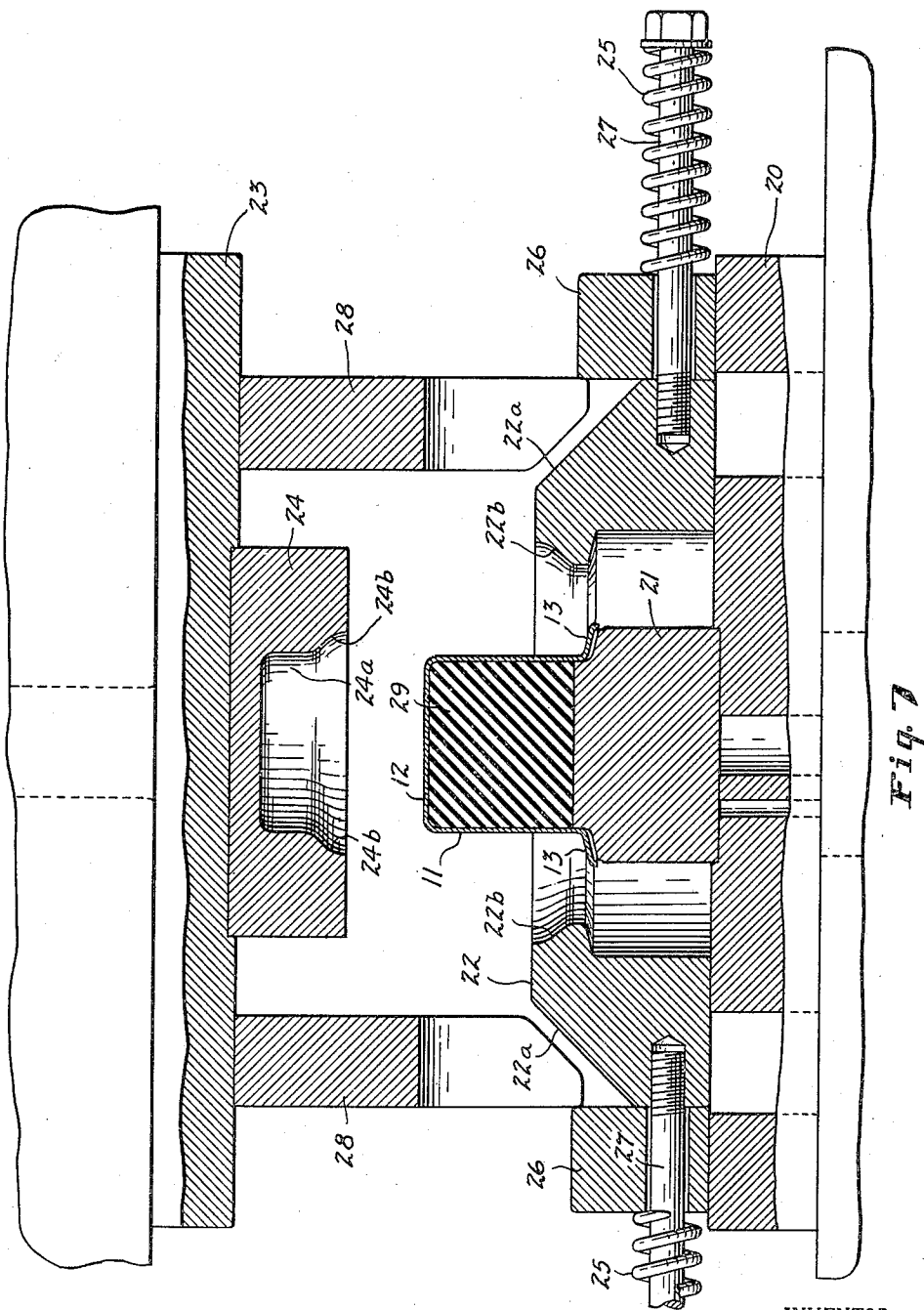


Fig. 7

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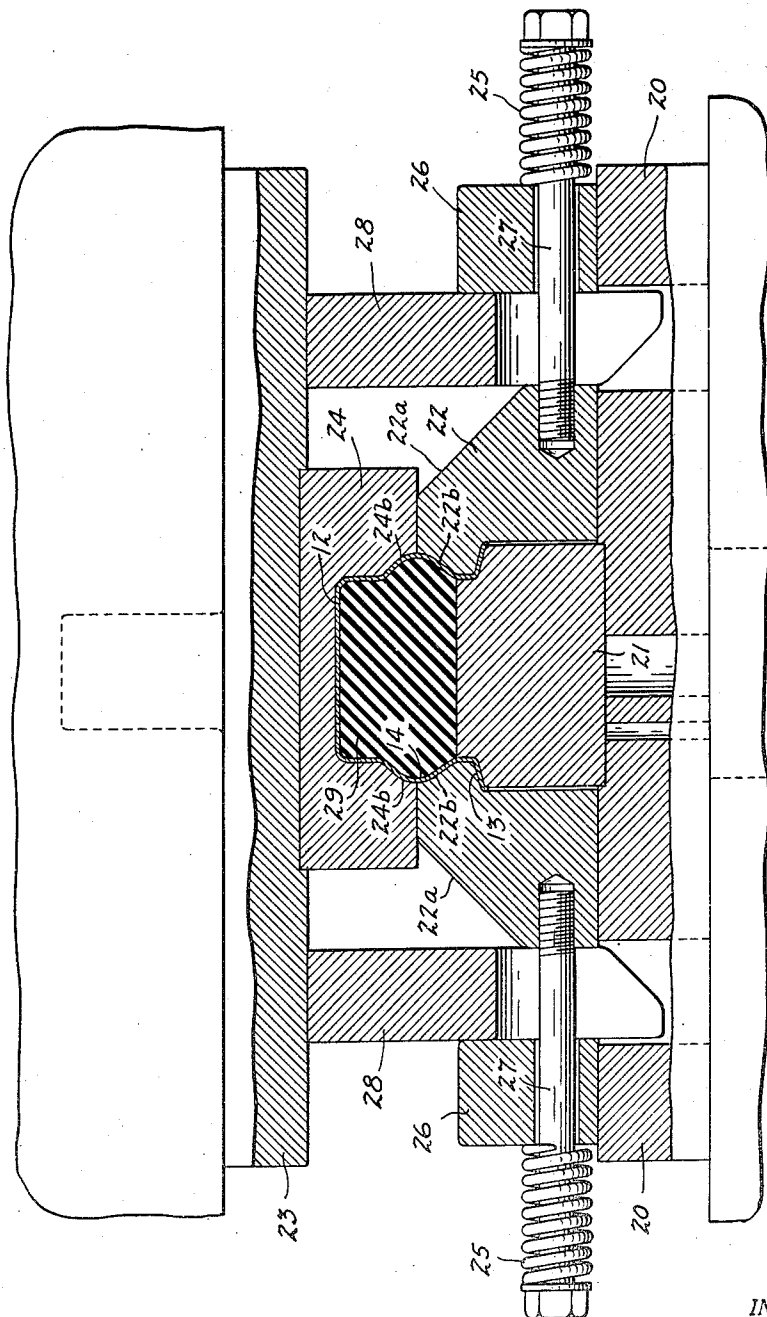
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4 Sheets-Sheet 3



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4 Sheets-Sheet 4

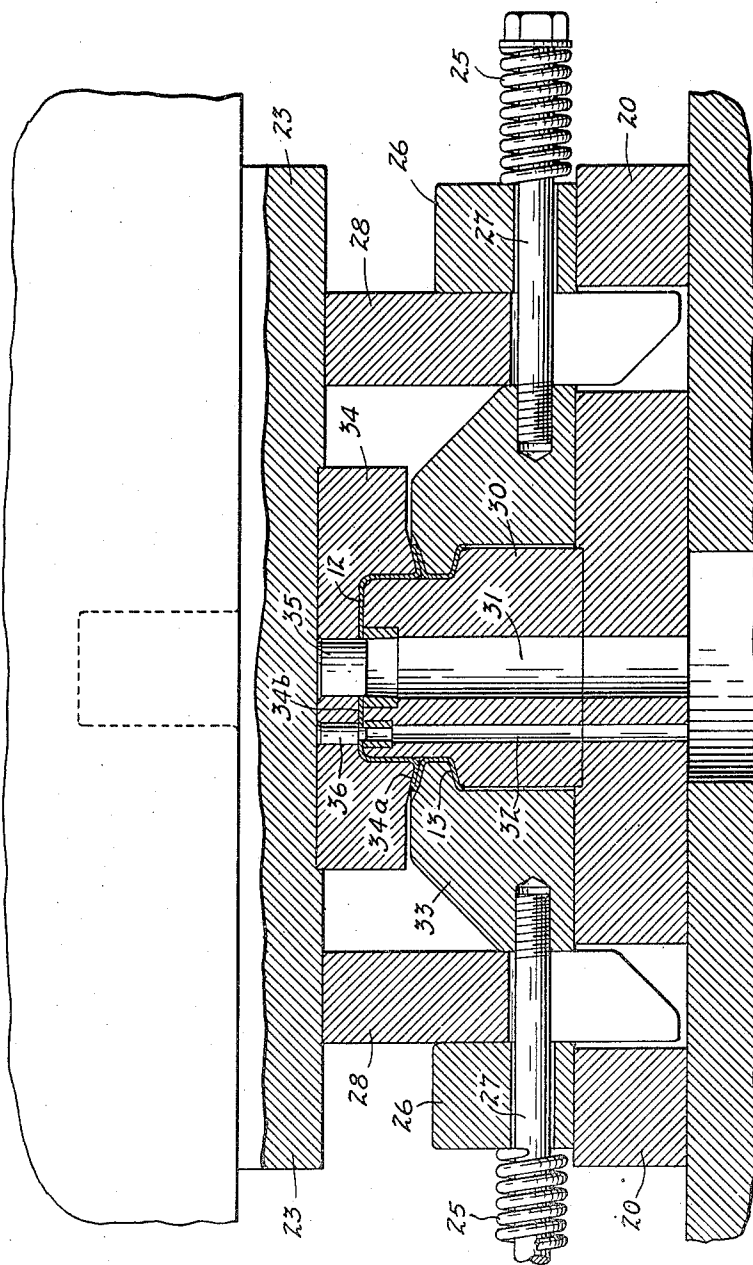


Fig. 9

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METHOD OF MAKING PULLEYS

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3 Claims. (Cl. 113-51)

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The present invention relates to a method for making pulleys and more particularly to a method for making pulleys from sheet metal by stamping operations alone.

In the past, pulleys constructed from sheet metal were either spun on a lathe to form the flanges or were stamped in two separate parts, each having a flange around its periphery, the two parts then being secured together by spot welding, riveting or the like to form the finished pulley.

The method of spinning sheet metal on a lathe to form a pulley is tedious and time consuming and therefore costly, and the method of stamping two separate parts followed by welding or riveting them together is not only time consuming and expensive but the finished pulley does not have the strength which can be attained when the pulley is made in a single piece.

According to the present invention the pulley is made in a single piece from sheet metal by stamping operations alone, thereby avoiding the disadvantages mentioned above.

It is, therefore, an object of this invention to provide a method for making pulleys from sheet metal by stamping alone.

A further object is to provide a novel method for making pulleys in a single piece from sheet metal without spinning and without the need for welding or riveting a plurality of parts together.

Other objects and advantages will be apparent from the following detailed description of the method in which particular reference will be made to the accompanying drawings and in which

Figures 1 to 6 inclusive show the successive stages in this process of stamping a pulley from a sheet metal blank, each view being partially in elevation and partially in vertical cross-section.

Figure 7 is a vertical cross-section of the stamping dies just before the stamping operation for forming the inner pulley flange as shown in Figure 5,

Figure 8 is a vertical cross-sectional view of the dies similar to Figure 7 but showing the dies immediately after the stamping operation has been carried out, and

Figure 9 is a vertical cross-section of the dies immediately after carrying out the final stamping operation.

With reference to Figures 1 to 6 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 blank 11 is then stamped and drawn to form the outwardly

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flared flange 13 as shown in Figure 2. This operation also reduces the diameter of the blank and increases its length or depth. The depth of the blank at this stage, i. e. the distance from the web 12 to the flange 13 determines to a large extent, though not exclusively, the final location of the web with respect to the groove of the finished pulley. The next operation, as shown in Figure 3 consists in spreading the flange 13 to correspond with the outer flange of the finished pulley. The blank 11 is then stamped as shown in Figure 4 to trim the edge of the flange 13 and to provide a rounded edge. This completes the stamping operation for forming the outer flange of the pulley and the blank 11, at this stage will be termed a preformed cylindrical cup-shaped blank.

Figure 5 shows an annular bulge 14 which is formed around the cylindrical wall of the blank 11 and which is ultimately formed into the inner flange 15 of the pulley, as shown in Figure 6.

The operation for forming the bulge 14 is carried out by applying pressure to the base 12 of the blank 11, and at the same time by applying outward radial pressure against the cylindrical wall of the blank 11 at the point where the bulge 14 is to be formed. The manner of carrying out this operation will be more fully described hereinafter.

Figure 6 shows the finished pulley in which the bulge 14 has been crimped together to form the flange 15; the flanges 13 and 15 forming the pulley groove 16. To accomplish this, pressure is applied on opposite sides of the crown of the bulge 14 to fold the metal flat upon itself in the manner shown.

As shown in Figure 6 the base or web 12 of the finished pulley is spaced from the plane of the peripheral groove 16. If desired the web 12 of the pulley may lie in the same plane as the groove 16 or within the general plane of the inner flange 15 or in any other desired plane depending upon the use for which the pulley is designed. The pulley shown in Figure 6 is especially designed for use as a fan-belt pulley in automobiles.

With reference to Figure 7 a stamping press is shown which includes a die holder 20 and a form punch 21 removably secured thereto in any conventional manner. The form punch 21 is shaped to receive the flange 13 of the blank 11 after it has been preformed as seen in Figure 4. A pair of semi-circular slide form blocks 22, which constitute a split ring assembly, are slidably mounted on the holder 20. A portion of the blocks are

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shaped to complement the form punch 21 so that the blank 11 will be gripped around the flange 13 during the stamping operation. A vertically movable punch holder 23 is located above the die holder 20 and its associated parts. A form ring 24 is removably secured to the punch holder 23 in any conventional manner. Blocks 22 normally take their open or retracted position, as shown in Figure 7, by the action of springs 25. The springs 25 cooperate with cam heel blocks 26 and the heads of bolts 27 which are secured to the slide form blocks 22 in the manner shown. When the punch holder 23 is lowered, the form blocks 22 are drawn together by cams 28 to the position shown in Figure 8. During this operation the cams 28 strike the tapered or conical surface 22a of the slide form blocks 22 and force them into the closed position, thus gripping blank 11 about the flange 13. The cam heel blocks 26 act as bearing surfaces for the cams 28 when they are lowered. The form ring 24 is recessed at 24a to receive the top of blank 11.

The slide form blocks 22 are each provided with annular recesses 22b for shaping the lower half of the bulge 14 while the form ring 24 is provided with a similar annular recess 24b which serves as a mold for the upper half of the bulge 14.

The form punch 21 which engages the lower portion of blank 11 is provided with a block of rubber 29 as shown in Figure 7 which acts as an expander as hereinafter described. This rubber block 29 is made of 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. The diameter of the rubber block 29 is substantially the same as the internal diameter of the blank 11 so that the blank can be easily placed thereon. However, the height of the rubber block 29 is such that when the blank 11 is in place as shown in Figure 7, the flange 13 thereof will be spaced slightly from the corresponding surface of the form punch 21 for purposes described hereinafter.

Figure 8 shows the position of the elements at the conclusion of the operation for forming the bulge 14, as shown in Figure 5.

In starting this operation the stamping device appears as shown in Figure 7. When the punch holder 23 is lowered the cams 26 draw the slide form blocks 22 together. Thus the inner edge of the blocks 22 will strike the upper surface of the flange 13 and by a camming action, will draw the blank 11 downward till it is seated on the form punch 21 thus compressing the rubber block so it will be engaged snugly at all points against the inner surface of blank 11. At the same time the form ring 24 descends and fits over the blank 11 and exerts pressure upon the base 12 of the blank tending to crush the cylindrical walls. However, the rubber block 29 prevents the walls from bending inwardly due to the initial compression of the block as well as the further compression by the form ring 24. The rubber block 29 will bulge and thus force the walls of the blank outwardly and into the mold provided by recesses 22b and 24b. When the form ring 24 and slide form blocks 22 have been brought completely together as shown in Figure 8, the recesses 22b and 24b define the outer limits of the bulge 14. The rubber block 29 pushes the walls of blank 11 outwardly as it is being crushed, thus shaping the blank as shown in Figure 5. It is to be particularly noted that the bulge 14 is not formed only by the radial pressure exerted on the cylindrical walls by the rubber

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block 29 but also by the pressure exerted by the form ring 24 on the base 12 as it descends and tends to crush the blank 11. The principal function of the rubber block 29 is to "trigger" the walls of the blank 11 as they are crushed by the form ring 24 and thus start their outward bending. However, the rubber block 29 continues to exert some pressure on the walls all through this operation so that the metal is pressed firmly into the recesses 22b and 24b thus forming a smooth uniform bulge in the walls.

After the bulge 14 has been formed, the next step is to crimp the bulge so as to form the inner flange 15 as shown in Figure 6. This is accomplished by stamping the bulged blank 11 in the manner shown in Figure 9. In this view many of the elements are the same as those shown in Figures 7 and 8 and serve the same purpose. However, those elements which stamp or press the blank 11 are different. A form punch 30 is mounted on the die holder 20 and is shaped to support the blank 11 around the outer flange 13. The form punch 30 is provided with an axial hole 31 which is adapted to receive a punch as described further hereinafter. Another hole 32 is provided in the form punch 30 spaced from the axial hole 31, for purposes described below. The slide form blocks 33, which are operated and controlled in the same manner as in Figures 7 and 8, are shaped to cooperate with the form punch 30 so as to grip the flange 13 of the blank when the press is actuated. However, the blocks 33 are provided with an inwardly sloping conical surface 33a around the center to receive and crimp the lower half of bulge 14.

A form ring 34 is secured to the punch holder 23 and is provided with an outwardly extending conical surface 34a adapted to cooperate with the surface 33a to receive and crimp the upper half of the bulge 14 to form the inner flange 15. The form ring 34 is also provided with a centrally located depression 34b to receive the base 12 or web of the blank 11. Two punches 35 and 36 are provided in the depression 34b to cooperate with holes 31 and 32 respectively for punching holes in the base 12 of the blank. The central hole which is cut out by the punch 35 enables the finished pulley to be mounted on a shaft or other rotatable element and the smaller hole cut out by the punch 36 is for receiving a locking bolt or the like.

In operation, the blank 11 which has been stamped to provide the bulge 14 as shown in Figure 5 is placed upon the form punch 30 and the punch holder is lowered. The slide form blocks 33 are contracted by means of the cams 28 so as to grip the flange 13 of the blank 11. At the same time the form ring 34 engages the base of the base 12 of the blank in the depression 34b as well as the bulge 14 on the conical surface 34a and crushes the bulge against the conical surface 33a of the blocks 33. By this operation, the bulge 14 is transformed into the inner flange 15 as shown in Figure 6. Near the end of the downward travel of the punch holder 23 the punches 35 and 36 will punch the holes as referred to above thus completing the pulley.

If desired a single stamping press may be used for all the various operations in forming the pulley, but this necessitates changing the form punch, slide form blocks and form ring to perform any one particular operation. Therefore, it is preferable to have a series of stamping presses, each one adapted to perform a single operation on the blanks. In this instance the

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blanks proceed from one press to the next as the various operations are completed.

Various gauges of sheet steel may be shaped according to the present invention. For example 20 gauge up to 12 gauge steel may be shaped without difficulty. Gauges lighter than 20 gauge will sometimes tear or split during the stamping operations due to lower tensile strength and gauges heavier than 12 gauge will not respond at all times to the radial pressure exerted by the rubber block 29.

While the invention has been described with regard to a particular operation, it will be understood that various modifications will be obvious to one skilled in the art. The invention therefore, is not limited by the description thereof but is defined by the appended claims.

What is claimed is:

1. The method of forming a V-belt pulley from sheet metal comprising the steps of forming from a blank of said metal a seamless flanged cup having a wall of substantially uniform thickness, the flange on said cup constituting a first flange of a V-belt groove and being formed at an obtuse angle to the wall of said cup; simultaneously transmitting an axial compressive force along said cup wall and applying an outward transaxial force to an annular portion of said cup wall to form an annular bulge in the wall of said cup above said flange, said axial and transaxial forces being simultaneously exerted while confining said first flange, the edge thereof, and an annular portion of said cup wall intermediate said flange and said bulge, said bulge taking up an axial length of the wall of said cup substantially equal to twice the length of said first flange; and, while confining said first flange, the edge thereof, and said intermediate annular wall portion, subjecting the annular portion of the bulge which is remote from said first flange to a force pressing said remote portion toward said flange and simultaneously subjecting the annular portion of said bulge adjacent said first flange to a force opposing that applied to said remote portion in order to fold said bulge along a median annular fold line and to form a second flange at an acute angle to said cup wall, said acute angle to said second flange being complementary to the obtuse angle of said first flange to form a V-belt groove, said groove being accurately sized by the confining of said first flange, its edge and the intermediate wall portion during the said bulging and folding operations.

2. The method of forming a V-belt pulley from sheet metal comprising the steps of drawing a seamless flanged cup having a wall of substantially uniform thickness and a bead on the edge of said flange, the flange constituting a first flange of a V-belt groove and being formed at an obtuse angle to the wall of said cup; simultaneously transmitting an axial compressive force along said cup wall and applying an outward transaxial force to an annular portion of said cup wall to form an annular bulge in the wall of said cup above said flange, said axial and transaxial forces being simultaneously exerted while

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confining said first flange, said bead and an annular portion of said cup wall intermediate said flange and said bulge, and, while confining said first flange, said bead, and said intermediate annular wall portion, applying compressive forces to the sides of said bulge and folding said bulge on a circular fold line concentric with and spaced from said bead to form a second flange having a wall adjacent said first flange and at an angle complementary thereto.

3. The method of forming a V-belt pulley from sheet metal comprising the steps of forming from a blank of said metal a seamless cup having a bottom, a wall of substantially uniform thickness, and a flange integral with said wall, the flange on said cup constituting a first flange of a V-belt groove and being formed at an obtuse angle to the wall of said cup; simultaneously transmitting an axial compressive force along said cup wall and applying an outward transaxial force to an annular portion of said cup wall to form an annular bulge in the wall of said cup above said flange, said axial and transaxial forces being simultaneously exerted while confining said first flange, the edge thereof, and an annular portion of said cup wall intermediate said flange and said bulge, said bulge taking up an axial length of the wall of said cup substantially equal to twice the length of said first flange; while confining said first flange, the edge thereof, and said intermediate annular wall portion, subjecting the annular portion of the bulge which is remote from said first flange to a force pressing said remote portion toward said flange and simultaneously subjecting the annular portion of said bulge adjacent said first flange to a force opposing that applied to said remote portion in order to fold said bulge along a median annular fold line to form a second flange at an acute angle to said cup wall, said acute angle of said second flange being complementary to the obtuse angle of said first flange to form a V-belt groove; and fabricating said cup bottom to provide a web for said pulley and means for locating said web on a hub concentric with said V-belt groove.

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