The invention relates to new and useful improvements in a die press, and more particularly a die press for forming and shaping metal parts such as can ends.

It has been a common practice in die presses to use a draw ring in connection with circular blanks which yieldingly clamps the blank adjacent the outer edge thereof. In the deep drawing of the metal for the shaping of the same, considerable difficulty has been experienced due to the fact that the metal flows differently along the grain of the stock than it does across the grain. The draw rings while yieldingly supported as a whole, are of the rigid type, and the result is that the metal, as it is drawn, is drawn out-of-round at the edge portion and a trimming operation is necessary in the finishing of the article.

An object of the present invention is to provide an improved draw ring which is so constructed and supported that in the deep drawing of a blank of circular contour, the flow of the metal will be uniform and the blank retained in a substantially circular shape at its outer edge so that the trimming operation is unnecessary.

In the drawings which show by way of illustration one embodiment of the invention—

Figure 1 is a vertical sectional view through drawing dies with the improved draw ring and supporting means therefor.

Fig. 2 is a view partly in plan and partly in section of the drawing die, the section being taken on the line 3—3 of Fig. 1;

Fig. 3 is a view similar to Fig. 1, on an enlarged scale and showing the blank as having been drawn and the first operation thereon completed;

Fig. 4 is a sectional view through the blank at the completion of the first operation and showing also in broken lines the blank from which the part is drawn, and

Fig. 5 is a sectional view showing the completed can as end produced by the second drawing operation.

The invention has to do with drawing dies for deep drawing metal parts. As illustrated, the invention is applied to the forming of can ends. The can end is made from a circular blank and by the drawing and shaping of the metal. A plurality of drawing operations are applied to the blank. The invention has particularly to do with the dies for the first drawing operation, and the construction and supporting means for the draw ring associated with said drawing dies. The drawing dies are of the usual construction, and the draw ring so disposed as to engage the blank and grip the same all the way around at the peripheral edge thereof. This draw ring is preferably given a very slight bevel, being higher at the smaller diameter than at the larger diameter to allow for the increasing stock thickness as it flows radially inward. The draw ring is dimensioned so that it will yield under pressure. It is supported on a plurality of pins which make free connection with the draw ring and in turn make free connection with a yieldable block, preferably of rubber. Between the pins and the block is a very thin piece of metal so that certain of the pins may yield independently of the others.

Referring more in detail to the drawings, the invention is shown as applied to the forming of a can end. The can end is made from a blank indicated at 1 in the drawings. The dies illustrated are utilized for performing the first drawing operation on the blank. There is a lower drawing die 2 which includes a supporting table 3 and an outer annular shearing member 4 within which is the improved draw ring 5. Cooperating with this lower die member is an upper punch or die member 6 which is provided with a central shaping die 7 and a combined clamping and punching annular member 8. This member is of substantially the same width as the draw ring 5. The members of the die punch are operated in the usual manner and further description of the details of these members is not thought necessary. They will, of course, be shaped to provide the desired forming of the metal part which is being produced. The draw ring 5 as shown in Figures 1 and 3 is preferably given a very slight downward bevel, being higher at the smaller diameter than at the larger diameter. The draw ring as to depth is also so dimensioned that it can yield. The draw ring is supported on pins 9. Each pin extends through the table 3 and is hardened at its ends and serves as the sole support for the draw ring. There are a number of these supporting pins. As shown in the drawings, there are sixteen supporting pins, so that they are approximately twenty degrees apart. The draw ring rests on these pins freely, and is unattached to the pins, so that a section of the draw ring may yield and move a pin downward. The pins, at their lower ends, all rest freely on a thin sheet of metal 10 which in turn is mounted on a rubber pad 11 of the usual character. This pad in turn is carried by a support 14. As noted, the pins 9 are not connected to the supporting means therefor, but freely rest thereon. The metal part 10 is a wear plate, and is sufficiently thin as to readily yield in different sections thereof without yielding as a whole.
The sheet of metal is placed between the blanking dies, and the blank 1 is cut therefrom, and the edge portion of the blank is gripped between the punch 8 and the draw ring 5. In blanking dies as herebefore constructed, a draw ring has been used which can yield as a whole, as it is more or less rigid and is supported at spaced points by rods attached to a supporting part. It is well known that metal flows differently in a drawing operation along the grain of the stock than it does across the grain, as has already been noted. In the drawing of a can end from a circular blank, there is necessarily a radial flow of the metal. With a rigid draw ring and a deep drawing operation, there will be a different diameter of the resultant blank for the first operation along the grain from that across the grain. This results in a drawn blank which is out-of-round, and it is necessary to trim the blank in the completing of the article.

In the draw ring as shown and described, there is a flexibility in the ring and the support therefor that produces a yielding pressure on the stock more nearly in proportion to the thickness of the stock, and this uniform pressure around its circumference results in a blank which is substantially round, so that no trimming of the blank is necessary in the completing of the article. The out-of-round condition resulting from deep drawing of a blank may be due to non-uniformity in the thickness of the stock, or non-uniformity in the ductility of the stock as well as grain. Again, it may be due to variation in the spring of the parts in the punch press. The flexible draw ring described will take care of these variations, and produce a deep drawn shaped part from a circular blank, which drawn part is retained at its outer edge portion in substantially the same contour as the blank so that a trimming operation is unnecessary.

The invention has been described in connection with a punch die for producing a can end. The blank 1, as noted, is first drawn into the shape shown in Fig. 4. The central portion 1a is shaped as it is to be in the finished can end. A deep vertical wall 1b has been drawn from the blank and the edge of the blank 1c is still circular and no trimming of this shaped part is necessary in the completing of the can end. The can end blank as shown in Fig. 4, is then subjected to the next drawing operation, wherein the vertical wall 1b is reversed so as to provide a vertical wall 1d and the annular flange 1e is curled at 1f, thus completing the can end. While the specific application of the invention has been described, it will be understood that the flexible draw ring may be used in the shaping of other articles where a deep drawing of a circular blank is necessary. By the use of this flexible draw ring, the trimming operation herebefore necessary in connection with deep drawing is eliminated. This in turn will cut down the number of operations, lessen die repairs, and result in a saving of the plate by eliminating the stock trimmed off.

From the above it will be apparent that a die press for shaping and drawing circular metal parts from a circular metal blank has been produced wherein the draw ring is so dimensioned as to be vertically flexible and is supported so that it will yield to provide a uniform pressure on the edge portion of the blank at all the way around and thereby maintain the circular contour of the part being drawn. In the subsequent operations to complete the article, no trimming is necessary. The blank is preferably cut from a sheet preparatory to the first shaping and drawing action, but this may be done in a separate machine. The edge of the can end is preferably curled in the next forming operation, but this also may be done in a later operation. The essential features of the present invention regardless of the particular shaping of the article is the flexible draw ring so mounted as to maintain the circular contour of the blank during the deep drawing of the same in the forming of the article.

While the invention has been described as useful in connection with the drawing of an article having a circular blank, it will be understood that the article may be otherwise shaped, as for example, rectangular in shape with rounded ends, in the forming of what is termed a square can end. The essential feature resides in the maintaining of the contour of the blank in the finished article so that the trimming operation is not necessary. The contour is determined when the blank is formed and is maintained in substantially the same shape at the outer edge portion of the article during the drawing thereof.

Having thus described the invention, what I claim as new and desire to secure by Letters-Patent, is—

1. A die press for shaping and drawing a metal part from a metal blank comprising cooperating die shaping members, a drawing member and a cooperating annular draw ring, said draw ring being dimensioned so as to be independently vertically yieldable at different sections thereof, and means for supporting said draw ring including a flexible supporting pad and a relatively thin yielding wear plate resting on said flexible pad and a series of pins connected to the draw ring and contacting with said wear plate whereby said ring will yield independently at different sections to provide a uniform pressure on the edge portion of the blank being drawn and thereby produce a drawn article, the outer edge portion of which is of substantially the same contour as the metal blank.

2. A die press for shaping and drawing a circular metal part from a circular metal blank comprising cooperating die shaping members, a drawing member, a cooperating annular draw ring, said draw ring being dimensioned so as to be independently vertically yieldable at different sections thereof, closely spaced pins on which said draw ring freely rests, a flexible supporting pad for said pins, and a thin metal wear plate between the pins and the pad on which said pins freely rest whereby said ring will yield independently at different sections thereof to provide a uniform pressure on the edge portion of the blank and thereby maintain the circular contour of the part being drawn.

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