Dec. 13, 1949 R. E. SLATER 2,490,926

BLANKING AND CUPPING DIE UNIT

Filed June 1, 1945

Fig. 1.

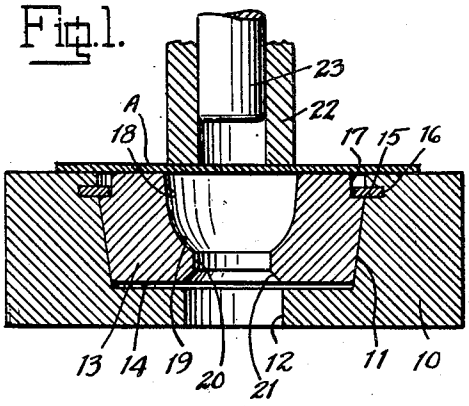


Fig. 4.

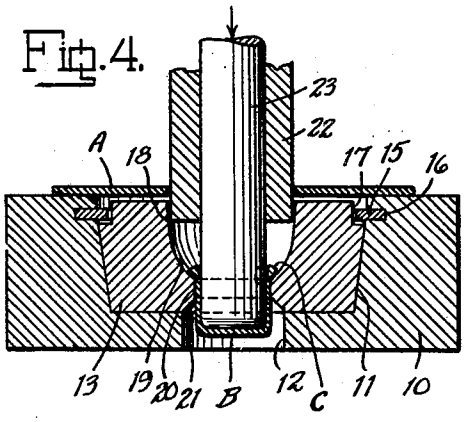


Fig. 2.

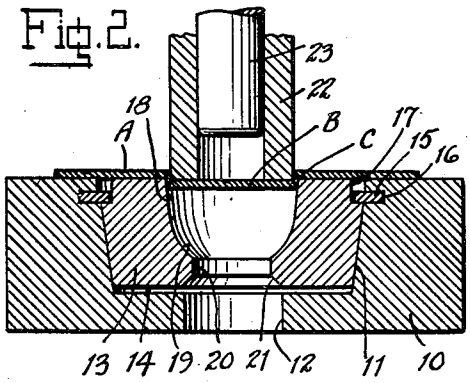


Fig. 5.

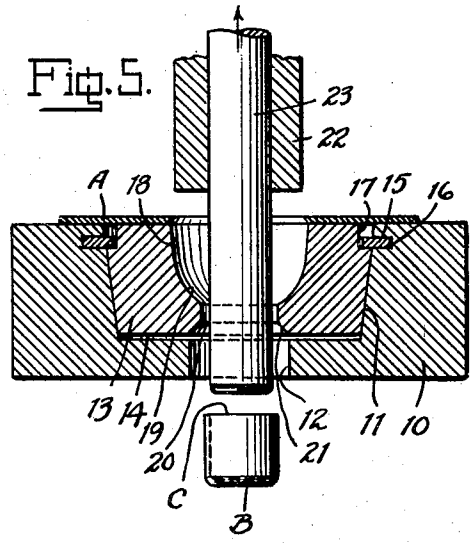
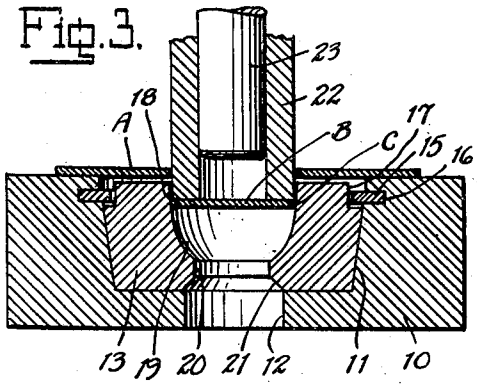


Fig. 3.



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BLANKING AND CUPPING DIE UNIT

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2 Claims. (Cl. 113—42)

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The present invention relates to a die, particularly a blanking and forming die for producing tubular metal cups, such for instance as are used in the formation of cartridge cases, battery cups, or other ammunition components. An object of the invention is to provide a die wherein steel or other suitable sheet metal, having its grains or fibers directionally oriented, as distinguished from a random orientation, may be employed, and wherein the resultant drawn cup will have a substantially smooth or non-scalloped mouth edge, which has heretofore only been possible with the use of metal having a random orientation of the grains or fibers.

The orientation of the grains or fibers of the metal results from cold rolling, which has the tendency to orient the grains or fibers in the direction of rolling, and when this type of metal is drawn in a die the drawn cup has a characteristic scalloped edge consisting of four ears or scallops located at substantially 90° to each other. Further drawing of the cup will cause the scalloping to move down the lines of weakness, which have occurred because of the cupping operation, so that these lines of weakness, retained in the cup throughout further drawing thereof, may extend down into the body portion of the cup even after the scalloped edge has been removed by the cutting off of a relatively wide band. In the case of ammunition components, such as cartridge cases, firing may cause the case to split along these lines of weakness. In the case of flanged battery cups the lines of inherent weakness may cause splitting as the edge flange is turned over.

It is proposed in the present invention to provide a die wherein the edge of the blanked disc is subjected in the die to an ironing or swaging action which has the effect of changing the directional properties of the metal at the edge of the blank, creating therein a compacted peripheral area in which the grains or fibers have a random orientation. The edge of the blank which becomes the mouth portion of the drawn cup is thus prevented from developing the characteristic scalloping, and has the effect of sealing off the usual lines of weakness and the potential fracture starting points.

With the above and other objects in view, an embodiment of the invention is shown in the accompanying drawings, and this embodiment will be hereinafter more fully described with reference thereto, and the invention will be finally pointed out in the claims.

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In the drawings—

Fig. 1 is a vertical sectional view of the die and its cooperating punch, according to the illustrated exemplary embodiment of the invention, a piece of sheet metal, from which the disc is to be blanked and cupped, being shown in relation to the die.

Fig. 2 is a similar view, showing the disc blanked from the metal sheet.

Fig. 3 is a similar view showing the disc pressed into the die to the point where the ironing or swaging operation upon its edge is performed.

Fig. 4 is a similar view, showing the drawing of the cup from the disc.

Fig. 5 is a similar view showing the completed cup carried through the die and the drawing punch disengaged therefrom through its upstroke.

Similar reference characters indicate corresponding parts throughout the several figures of the drawings.

Referring to the drawings, the die, according to the illustrated exemplary embodiment of the invention, comprises a die holder 10 provided with a downwardly converging tapered pocket 11 having a central opening 12 in its flat bottom. Within the die holder there is engaged a die block 13 having a tapered periphery fitting the tapered wall of the pocket 11 and normally having its base spaced above the base of the pocket 11, as at 14. The die block is retained in the die holder by means of a locking ring 15, engaged in an annular groove 16 in the die holder and projecting into a shouldered peripheral recess 17 at the upper end of the die block, the ring normally engaging the base of the shouldered recess, to prevent upward disengagement of the die block, and the recess being open above the ring to permit downward movement of the die block in the holder, as will presently more fully appear. The work receiving opening through the die consists of a slightly tapered downwardly converging upper portion 18, an arcuate inwardly and downwardly curved guide portion 19, and a cylindrical die land 20 having a beveled clearance recess 21 at its under side, the arcuate guide portion 19 blending with the tapered upper portion 18 and extending to the die land 20.

The die holder 10 is rigid and non-elastic, being suitably hardened and of sufficiently massive structure as to withstand any dimensional change in its pocket 11 when downward pressure is applied to the die block through the downward impact occurring upon cooperation of the punch therewith during the blanking and forming of the cup. The die block is formed of a suitably hard-

ened elastic metal, as for example tungsten carbide steel, which has the property of being compressed under a downward load thereon, so that it may move downwardly within the tapered pocket of the rigid die holder to the point where further downward movement is prevented by engagement of the bottom of the die block with the bottom of the die holder. This downward movement and compression of the die block causes a reduction in the diameter of the opening therethrough, and it is pointed out that this opening is suitably dimensioned, so that the reduced diameter of the die land 20, determined by the point of engagement of the die block with the base of the holder, corresponds to the desired outside diameter of the drawn cup. The angle of the cooperating tapered surfaces of the die block and the die holder is such that the die block will return to its normal unstressed position when the load thereon is released. Attention is directed to applicant's co-pending application Serial No. 535,011, filed May 11, 1944, now Patent No. 2,433,929, January 6, 1948, for Conical die for metal drawing, wherein the die holder has a tapered aperture which engages the tapered exterior surface of the die, and wherein the die is rigid while the die holder is relatively elastic. In the present invention the relative rigidity and elasticity of the cooperating parts is reversed, the die holder being rigid, and the die block being elastic, so that, whereas in the co-pending application a constant diameter of the die land is maintained, irrespective of the impact of the punch and the downward load thereon, in the present invention the impact and downward load results in a compression of the die block and a reduction in the land diameter.

The combination punch for cooperation with the die comprises a tubular blanking punch 22 and a drawing punch 23 relatively movable within it, the diameter of the blanking punch being slightly less than the diameter of the upper edge of the tapered portion 18 of the die block, which constitutes the cooperating blanking edge of the die, the diameter of the drawing punch corresponding to the desired internal diameter of the drawn cup.

In operation, the sheet metal A is placed over the die beneath the punch, as shown in Fig. 1, whereupon the blanking punch 22 moves downwardly to blank the disc B from the metal sheet. The blanking edge of the die which forms a blanking anvil at the under surface of the metal sheet is of slightly larger diameter than the peripheral blanking edge of the punch engaging the upper surface, so that the resultant blanked disc is of frusto-conical form, its edge C being beveled and converging upwardly. Consequently, the lower surface of the disc which forms the outer surface of the drawn cup has a larger area than the upper surface which forms the interior surface of the drawn cup.

As the blanked disc is carried into the die its lower edge engages the tapered surface 18 of the die opening resulting in a downward impact upon the die block forcing it downwardly within the die holder to the position shown in Fig. 3. Simultaneously with this downward movement, which compresses the die block and reduces the diameter of the die opening, the disc is forced downwardly along the tapered surface 18 to the point where the downward movement of the blanking punch is stopped. It is pointed out that the smaller diameter of the blanking punch with respect to the diameter of the upper end of the tapered portion 18 permits the blanking punch to

enter the die opening to a suitable depth to force the disc downwardly along the tapered surface 18 simultaneously with the compression of the die block and the reduction of the diameter of the tapered surface. The depth to which the punch moves may be limited by contact of the edge of the blanking punch with the tapered surface 18, but preferably the punch operating mechanism of the press is of the conventional double acting type such as illustrated in the Yost Patent No. 2,387,698, October 23, 1945, and is designed to stop the downward movement of the blanking punch before its peripheral edge actually engages the tapered surface 18.

The peripheral edge C of the disc is both ironed by the downward movement within the tapered surface 18 and swaged by the sudden inward compression of the die and reduction in its hole diameter, causing the inclined edge to be worked into a substantially cylindrical form, as shown in Fig. 3, with a consequent reduction in the diameter of the disc. This decrease in diameter, taking place simultaneously with the downward movement of the disc, abruptly produces a heavy compression in the periphery of the disc, which has been found to be more effective than a pressure which depends solely on the downward movement of a work piece in a die, which, instead of being compressed, tends to be extended by the application of internal pressure. The result of this action is that a random orientation is given to the grains or fibers in the peripheral area of the disc, and this action is intensified at the under side of the disc, which in the drawn cup forms the outer surface and is subjected to a relatively greater de-formation and stress than the inner surface. The reduction in the directional properties of the metal in the peripheral area of the disc, which becomes the mouth area of the drawn cup, has the effect of sealing off to a great extent potential fracture starting points.

Following the blanking and edge ironing and swaging operation, the drawing punch moves downwardly carrying the disc into the land opening 20 and causing it to be drawn into cup form. As a result of the random orientation of the grains or fibers in the edge of the disc, the drawn cup does not have the characteristic scalloped edge which results from the use of directional metal but has a relatively flat and even edge, as shown in Fig. 5. The drawn cup is removed from the punch by suitable stripping means, not shown, and as the punch moves upwardly and the load is removed the die block resumes its unstressed raised position limited by the locking ring 15, as shown in Fig. 5. The cup may be subjected to further drawing operations without developing scallops and lines of weakness, and may also be flanged at its mouth edge without developing splits in the flange.

The form of the invention illustrated in the drawing and described herein is typical and illustrative only, and it is evident that the invention is capable of embodiments in other forms, all falling within the scope of the appended claims, which are to be broadly construed.

What is claimed is:

1. Apparatus for the production of substantially smooth edged cups from metal sheet having directional properties comprising a substantially rigid die holder, a tapered recess in said die holder, a die of elastic metal freely supported in said recess, the exterior of said die being tapered to conform to the taper of said recess and of such height and diameter as to be spaced

from the bottom of said recess when unstressed, said die having a downwardly converging work blank receiving aperture, a blanking punch of less diameter than the maximum diameter of said converging aperture, and means to move said punch into said die aperture to blank a disk from a sheet and advance said disk into the work receiving aperture of said die and thereby simultaneously moving said die downwardly in said recess to compress said die radially and reduce the diameter of said die aperture so as to change the directional properties of the metal in the periphery of said disk which is in engagement with the walls of the die aperture.

2. Apparatus for the production of smooth edge cups from sheet metal having directional properties comprising a blanking punch; a blanking die comprising a die block having therein an aperture in axial alignment with said punch, the intersection of the wall of said aperture with a planar face of said die block forming a shearing edge cooperating with said punch, the diameter of said shearing edge being greater than the diameter of said punch and the wall of said aperture sloping inwardly from said shearing edge to form said aperture to progressively reduced diameter, the inclination of said aperture wall being such as to enable said punch to enter said decreasing diameter aperture a distance exceeding the thickness of said sheet metal; and punch actuating means to advance the punch toward said shearing edge to shear a disk from a sheet interposed between said punch and said die and to further advance said punch into said die aperture to thrust said disk while transversely substantially undeformed into the reduced diameter portion of said aperture, thereby compressively straining and altering the directional properties of the edge portion of said disk.

RAYMOND E. SLATER.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
37,189	Westlake	Dec. 16, 1862
94,857	Allonas	Sept. 14, 1869
181,356	Milbank	Aug. 22, 1876
1,043,520	Higgins	Nov. 5, 1912
1,692,902	Moltrup	Nov. 27, 1928
2,150,708	Andrews	Mar. 14, 1939
2,415,940	Eckstein	Feb. 18, 1947

FOREIGN PATENTS

Number	Country	Date
5,112	Great Britain	Apr. 6, 1887