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METHOD AND APPARATUS FOR SHAPING METALLIC ARTICLES

Filed June 29, 1922

Fig. 1

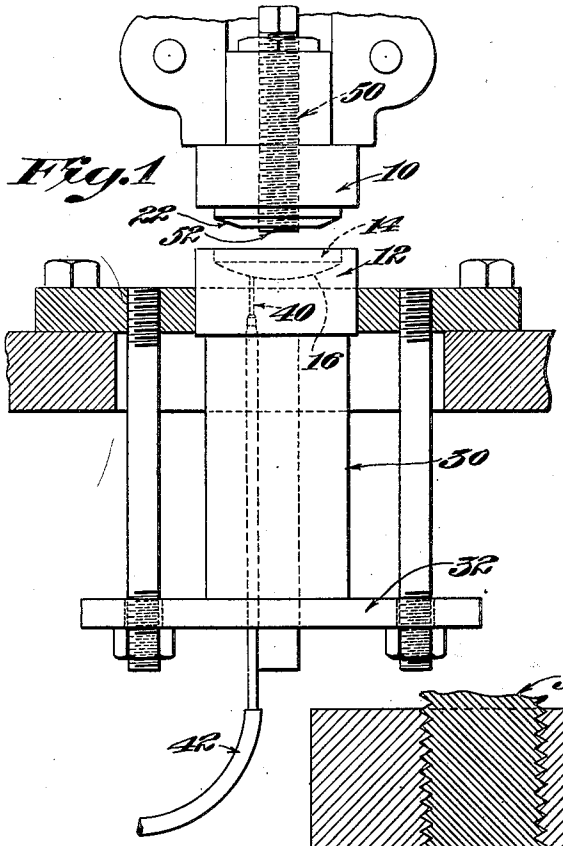


Fig. 3

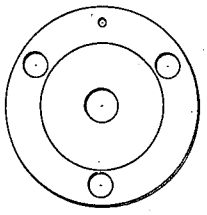
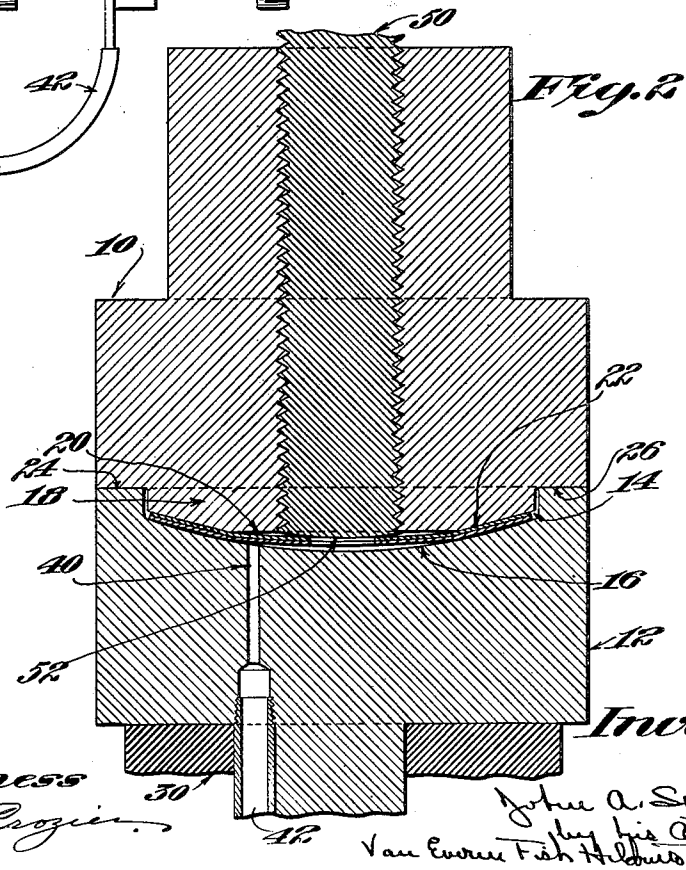


Fig. 2



Witness

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UNITED STATES PATENT OFFICE.

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METHOD AND APPARATUS FOR SHAPING METALLIC ARTICLES.

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The present invention relates to a method and apparatus for shaping metallic articles and more particularly for shaping relatively thin flat blanks.

The object of the present invention is to shape previously blanked metallic sheets into a predetermined form without fracturing or otherwise injuring the sheets during the forming operation.

With this object in view a feature of the invention contemplates the provision of cooperating dies of dissimilar shape which are designed to initially engage the blank throughout a restricted portion of its area to impart approximately the desired shape and which are adapted to positively engage with one another, leaving a cavity of sufficient depth to receive the blank without exerting too great a pressure thereon. This feature of construction is of particular importance when operating upon metallic blanks of relatively soft material which which may vary in thickness, as otherwise a setting of the dies for a relatively thin blank might well cause too great a pressure to be exerted upon a blank of greater thickness. The invention has particular utility in connection with the shaping of blanks consisting of two metals having dissimilar thermal coefficients of expansion and united to form a composite sheet, such blanks varying in thickness owing to irregularities in the thickness of the sheet from which they are stamped.

A further feature of the present invention consists in the combination with cooperating dies for the production of an arched or cup shaped blank of means for varying the arch or curvature of the blank throughout the central portion, as desired. The provision of such an adjustment permits the temperature at which the arched blank suddenly flexes to be varied within desired limits. In this connection, it may be stated that blanks of this type are designed to suddenly change shape at predetermined temperature limits and a relatively slight change in arch or curvature of the central portions of the blank permits the temperature point at which change of shape occurs to be varied accordingly.

Still further features of the invention consist in certain novel features of construction, combinations and arrangements of parts hereinafter described and claimed, the advantages of which will be obvious to those skilled in the art from the following description.

In the accompanying drawings illustrating the preferred form of the invention Fig. 1 represents an elevation partly in section of the mechanism for shaping previously blanked out sheets according to the improved method; Fig. 2 is a detail showing a section in elevation of the cooperating dies with the blank engaged therebetween, together with means for varying the curvature of the blank; and Fig. 3 is a detail illustrating one of the blanks formed according to the improved method.

The illustrated embodiment of the invention is shown more particularly in connection with the formation of a thermostatic disk such as disclosed in the copending application of Spencer, Serial No. 565,255, filed June 1, 1922. This disk is blanked out of a sheet of thermostatic material consisting of two metals having dissimilar thermal coefficients of expansion intimately united to form a composite sheet. By shaping such a sheet into a non-developable surface, which may be an aproximately spherical surface or a cup shaped surface having a relatively flat central portion and an annular rim portion inclined thereto, it has been found that upon raising the temperature of the blank or thermostatic member to a predetermined point a sudden reversal of curvature takes place. Thereafter, upon reducing the temperature of the blank to a certain lower predetermined point, the blank reverses to the initial shape. As these thermostatic members are formed from flat blanks of sheet material which may be made of relatively soft metals, the shaping of the blank without obtaining a high percentage of discards or rejects presents a considerable problem.

According to the present invention, the flat blank is shaped between cooperating male and female dies, indicated generally at 10 and 12. The female dies is provided with a cavity indicated at 14, which has a smooth unbroken curved surface 16, which may be developed on the surface of a sphere.

The cooperating die 10 is provided with a shaping projection 18 having a pressing surface, which consists of a relatively flat central portion 20 bounded by an annular conical surface 22, as indicated clearly in Fig. 2. The inclination of the conical surface 22 is such with respect to the curvature of the surface 16 that as the two dies move together to shape the blank between them the latter is engaged by the die 10 at the junction of the surfaces 20 and 22 and thereby pressed into substantial conformity with the surface 16. By engaging the blank in this manner, the outer peripheral portion of the blank is free to move inwardly within the die cavity 14 without drawing the blank or changing the thickness. In order to prevent the exertion of too great a pressure upon the blank, the cooperating dies 10 and 12 are provided with shouldered portions 24 and 26, which positively engage with one another when the two dies are moved into substantially the position shown in Fig. 2 and thereafter prevent the exertion of further pressure upon the blank, these shouldered portions being so designed, however, that a sufficient relative movement of the dies to properly shape the blank is permitted. In order to prevent too great an impact when the dies come together, the upper die 10 is preferably reciprocated in the usual manner by any suitable form of mechanism and the lower die 12, which is normally stationary, is supported upon a yielding buffer 30, which, as indicated, may be formed of rubber or similar material, this yielding buffer being interposed between the lower portion of the die 12 and a fixed portion 32 of the machine frame. It should be understood in this connection that the buffer or other means for supporting the die 12 should have sufficient strength to resist any downward movement of the die 12 until the shouldered portions 24 and 26 positively engage but to thereafter permit movement of the two dies in unison until the stroke of the upper die is completed. The removal of the blank from the cavity 14 may be conveniently effected by a jet of air, which is projected beneath the blank through an air passage 40, extending through the die 12 into one side of the mold cavity and connected through a pipe 42 with any suitable source of air under pressure (not shown). In this connection it should be understood that the removal of the blank from the die cavity 14 is a relatively simple matter, as the shaping of the blank reduces the diameter and draws the peripheral edges of the blank away from the corresponding edges of the mold cavity.

It is desirable in the formation of articles of this character that the curvature shall be varied in order to vary the temperature point at which the thermostatic member shall change shape and to this end the male die 10 is provided with an adjustable plug member 50 extending down through the male die and having a lower curved end 52, which engages with the central portion of the blank and shapes it accordingly. By varying the projection of this lower end 52, the curvature of the central portion of the blank may be accordingly varied; in other words, the central portion may be brought more or less into conformity with the shape of the surface 16 and thus the temperature at which the control changes shape may be likewise varied.

I claim—

1. An apparatus for shaping metal blanks comprising cooperating dies having pressing surfaces of dissimilar shape, and cooperating abutments which do not engage the blank, for limiting the movement of the dies toward one another, leaving a space between the pressing surfaces of the dies when the abutments are in engagement sufficient to receive the blank.

2. An apparatus for shaping metal blanks comprising cooperating male and female dies, one of the dies having a concave pressing surface developed upon a smooth unbroken curve and a cooperating die having a substantially flat central portion and an outer conical portion so designed that the pressing surface engages with the blank throughout a restricted portion of its area inside the peripheral edge, and cooperating shoulders formed upon the dies and adapted to limit the movement of the dies toward one another.

3. An apparatus for shaping metal blanks comprising cooperating male and female dies, one of the dies having a concave pressing surface developed upon a smooth unbroken curve and a cooperating die having a substantially flat central portion and an outer conical portion so designed that the pressing surface engages with the blank throughout a restricted portion of its area inside the peripheral edge.

4. An apparatus for shaping metal articles comprising male and female dies shaped to clamp the stock therebetween along a conical annulus radially displaced from the center thereof, one die having less convexity throughout its central portion than the concavity of the other die throughout its corresponding portion, whereby the stock is not clamped throughout a region inside said annulus.

5. An apparatus for shaping metal articles comprising a die provided with a curved concave pressing surface, a cooperating die provided with a convex pressing surface having a substantially flat central portion bounded by an annular conical portion and adapted to grip the metal blank approximately at the junction of the flat

central portion and conical portion, and abutments for limiting the relative movement of the two dies toward one another.

6. An apparatus for shaping metal articles comprising cooperating dies adapted to form a flat blank into substantially concavo convex shape, and unitary means rigidly but adjustably associated with one of the dies for varying the curvature of a portion of the blank.

7. An apparatus for shaping sheet metal blanks comprising cooperating dies adapted to form the blank into a substantially concavo convex shape, and an adjustable member movable to different fixed positions relatively to one of the dies and adapted to vary the curvature imparted to the blank.

8. An apparatus for shaping metal articles comprising a female die having a substantially concave pressing surface, a cooperating male die having a substantially convex pressing surface of dissimilar shape, and an adjustable plug projecting from the central portion of the convex pressing surface and movable to different positions to vary the curvature imparted to this portion of the blank.

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