

Oct. 30, 1962

H. P. HOPP ETAL

3,060,992

MEANS AND METHOD FOR FORMING NON-PLANAR ARTICLES

Filed Jan. 11, 1960

2 Sheets-Sheet 1

Fig. 1

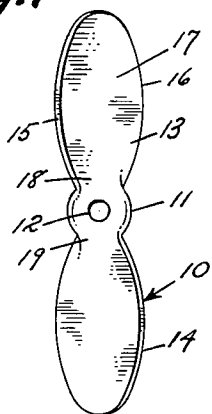


Fig. 2

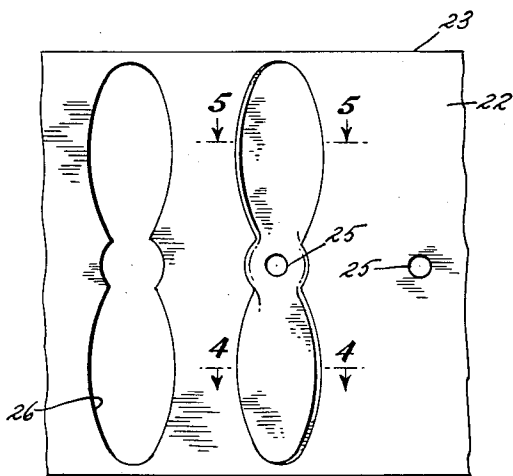
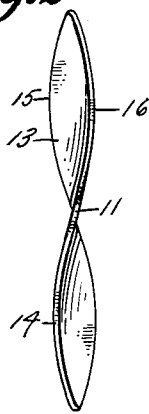


Fig. 3

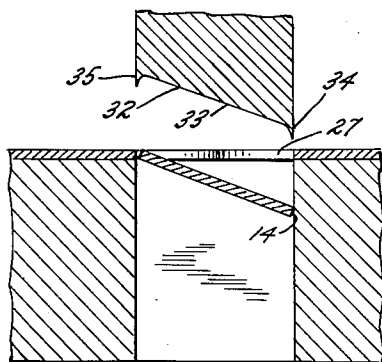


Fig. 4

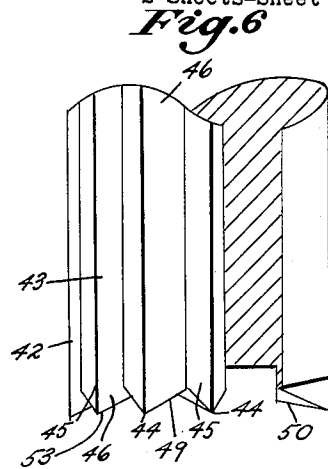


Fig. 6

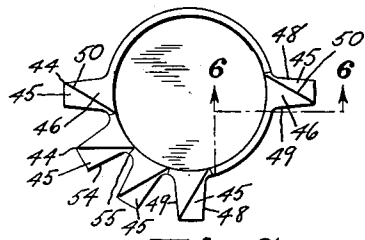


Fig. 7

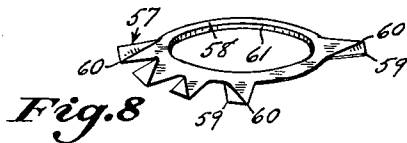


Fig. 8

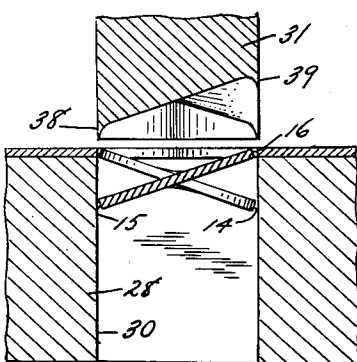


Fig. 5

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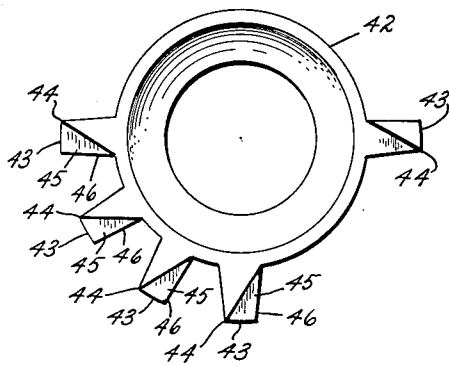


Fig. 9

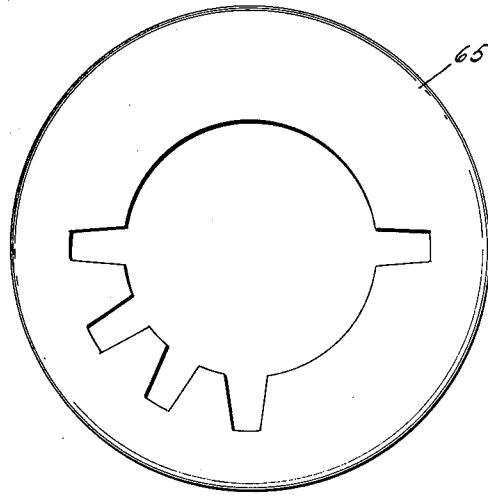


Fig. 10

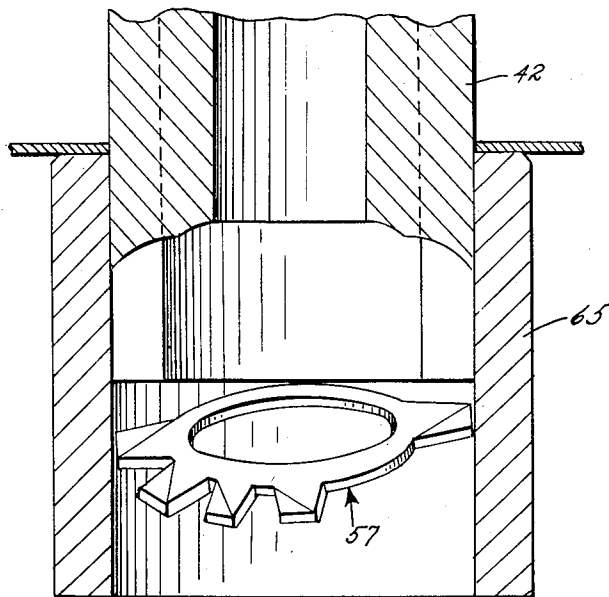


Fig. 11

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MEANS AND METHOD FOR FORMING NON-PLANAR ARTICLES

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7 Claims. (Cl. 153-2)

This invention relates generally to the field of stamping and forming of sheet metal, and more particularly to an improved means and method for forming articles of nonplanar configuration.

It is known in the prior art to form metallic stampings, using a punch shaped to the configuration of the desired article, the punch operating upon sheet metal stock supported upon or in a correspondingly shaped die. This procedure includes several stamping operations, a first operation serving to blank the desired form out of the plane of the sheet metal and slightly depress the blank below the level of the web of the sheet material. A subsequent stage will form or shape the article further out of the plane of the web of material, and subsequent pressing operations detach the formed part from the blank. This procedure requires several generally similarly shaped dies, and several stamping or punching stations.

It is among the principal objects of the present invention to provide an improved punch and die cooperating therewith in which the necessity of several stations is eliminated, and in which forming and severing operations are combined at the single station, with consequent elimination of the necessity of forming several sets of punches and dies, or the doubling or trebling of possible capacity using the same number of punches and dies.

Another object of the invention lies in the provision of an improved punch having a non-planar face contoured to that of the desired finished article, and which may progressively shear and form the desired article to identical configuration with each successive stamping movement.

Still another object of the invention lies in the provision of means whereby the cost of forming non-planar stampings is materially reduced by elimination of the heretofore necessary subsequent bending or shaping steps as distinguished from cutting steps.

A feature of the invention lies in the fact that the invention may be practiced in conjunction with existing stamping presses and other equipment in general use in the prior art.

These objects and features, as well as other incidental ends and advantages, will more fully appear in the progress of the following disclosure, and be pointed out in the appended claims.

FIGURE 1 is a view in perspective of a non-planar stamped article formed in accordance with the present invention.

FIGURE 2 is a side elevational view thereof.

FIGURE 3 is a fragmentary view in elevation showing a partially formed article at a stage in which it is still partially connected to a web of material.

FIGURE 4 is a fragmentary sectional view seen from the plane 4-4 in FIGURE 3.

FIGURE 5 is a fragmentary sectional view as seen from the plane 5-5 in FIGURE 3.

FIGURE 6 is a fragmentary elevational view, partly in section of a punch element employed in the formation of a second non-planar article.

FIGURE 7 is a bottom plan view as seen from the plane 7-7 in FIGURE 8.

FIGURE 8 is a view in perspective showing a completed non-planar article, formed by using the punch element shown in FIGURES 6 and 7.

FIGURE 9 is a bottom plan view of the punch element seen in FIGURE 6.

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FIGURE 10 is a plan view of a corresponding die element mating with the punch element of FIGURE 6.

FIGURE 11 is a vertical central sectional view showing the coaction of the punch and die disclosed in FIGURES 9 and 10.

In accordance with the invention, there is illustrated in FIGURES 1 and 2, a completed non-planar article, generally indicated by reference character 10, in the instant case, the article being a toy airplane propeller. The article 10 includes a base portion 11 having a centrally disposed opening 12 therein as well as first and second blades 13 and 14, respectively. Each of the blades includes a leading edge 15 and a trailing edge 16, as well as a median portion 17. Connecting portions 18 and 19 interconnect the blades 13 and 14 with the base portion 11. It is known in the art to stamp the article 10 in planar condition from sheet metallic stock, and subsequently manually bend the blades 13 and 14 to the desired contours after the blank has been severed from the web of material from which it is stamped. The present invention contemplates the stamping of the article 10 to its finished contours in a single stamping operation.

Referring to FIGURE 3 in the drawing, there is illustrated a continuous web of sheet material, generally indicated by reference character 22 bounded by two longer side edges 23 and 24. A plurality of openings 25 are pre-cut into the web 22, and will ultimately form the centrally disposed opening 12 in the finished article 10. A large opening 26 indicates the removal of material forming an article 10, while reference character 27 indicates a partially formed opening occurring during the stamping of the article from the web.

Referring to FIGURES 4 and 5, a die element 28 includes an opening 30 corresponding to the outer configuration of the article 10, while a correspondingly shaped punch element 31 includes a face portion 32 having cutting edges 33 in mutual non-planar relation. The edges 33 include a leading portion 34 as well as a trailing portion 35.

Referring to FIGURE 5, the die element 28 is shaped to shear in an opposite direction as compared with that portion of the die seen in FIGURE 4, and includes a correspondingly oppositely disposed leading portion 38, and a corresponding trailing portion 39.

From a consideration of FIGURES 4 and 5, it will be apparent that by virtue of provision of leading and trailing shearing edges on the punch element, the shearing action exerted by the punch takes place progressively, and the bulk of the shearing action is performed while at least a portion of the finished article is still connected to the web 22. As the punch element 31 comes progressively into contact with the material comprising the planar web, it is simultaneously shaped by bending to lie flat against the face 32 of the punch element, so that when final severing occurs, the article is completely shaped and finished, and requires no further bending operation. It is possible to perform the simultaneous shearing and shaping at a single station, owing to the progressive nature of the shearing, which differs from conventional punching in that only a portion of the finished edge is sheared at any given time.

Referring to FIGURES 6 and 7, there is shown a second punch element 42 employed in the manufacture of a second non-planar stamped article 57. The punch element 42 includes a plurality of tooth-cutting members 43, each member including a centrally disposed pointed portion 44, an angularly disposed face 45, and a planar face 46 lying in a plane parallel to the line of travel of the punch element during a cutting cycle. The angularly disposed face 45 is bounded by converging cutting edges 48 and 49 as well as a fold line forming edge 50. The face 46

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includes a cutting edge 53 having a rectilinear portion 54 and a base portion 55.

Referring to FIGURE 8, the formed article 57 includes a planar annular portion 58 and a plurality of radially extending portions 59, each having angularly disposed tip portion 60. The centrally disposed opening 61 may be prepunched comparable with the opening 12 in the first embodiment. The punch element 42 coacts with a die 65, having an opening corresponding to the planar projection of the lower face of the punch element 42 (see FIGURES 9 and 10). The coaction of these elements is illustrated in FIGURE 11, wherein a completed article is shown in formed condition immediately after detachment from planar stock.

We wish it to be understood that we do not consider the invention limited to the precise details of structure shown and set forth in this specification, for obvious modifications will occur to those skilled in the art to which the invention pertains.

We claim:

1. Means for simultaneously punching and shaping a non-planar object from planar sheet stock comprising: a die having an opening corresponding to the planar projection of said non-planar object, and a punch, the outer configuration of which corresponds to the opening in said die, said die having a cutting edge of non-planar configuration.

2. Means for simultaneously punching and shaping a non-planar object from planar sheet stock comprising: a die having an opening corresponding to the planar projection of said non-planar object, and a punch, the outer configuration of which corresponds to the opening in said die, said punch having a cutting edge and a shaping face of non-planar configuration.

3. Means for simultaneously punching and shaping a non-planar object from planar sheet stock comprising: a die having an opening corresponding to the planar projection of said non-planar object, and a punch, the outer configuration of which corresponds to said opening in said die, said die having cutting edges bordering a shaping surface of non-planar configuration.

4. Means for simultaneously punching and shaping a non-planar object from planar sheet stock comprising: a die having an opening corresponding to the planar

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projection of said non-planar object, and a punch, having curved non-planar cutting edges thereon which are disposed as an acute angle with respect to the edges of said opening in said die.

5. Means for simultaneously punching and shaping a non-planar object from planar sheet stock comprising: a die having a planar surface for supporting said sheet stock and an opening extending into the plane of said surface, said opening being configured to the planar projection of said non-planar object, a punch having a curved-planar cutting surface disposed at an angle with respect to the plane of the upper surface of said die and configured to correspond to said opening in said die, whereby said punch in executing relative movement toward said die may perform a progressive shearing action upon said stock to simultaneously deform and sever said article from the plane of said stock.

6. The method of forming a non-planar object from sheet planar stock comprising the steps of: (1) providing a die having an opening therein corresponding to the planar projection of said object; (2) providing a punch having an outer configuration corresponding to the opening in said die, and a curved non-planar cutting edge disposed at an angle with respect to the plane of said opening in said die; (3) positioning said sheet planar stock upon said die and moving said punch into said opening in said die to simultaneously progressively sever and form said object.

7. Means for simultaneously punching and shaping an at least partially non-planar object from planar sheet stock comprising: a pair of mating male and female cutting and forming members, at least one of which is provided with a mating peripheral portion which is non-planar in configuration.

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