March 8, 1932. B. HEYMANN 1,848,173

ARTICLE OF MANUFACTURE

Filed April 23, 1928

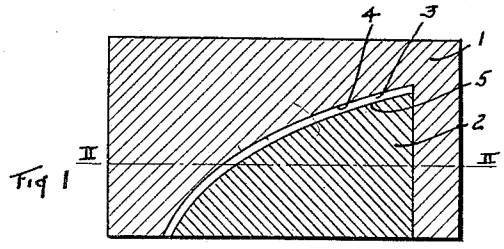


Fig 1

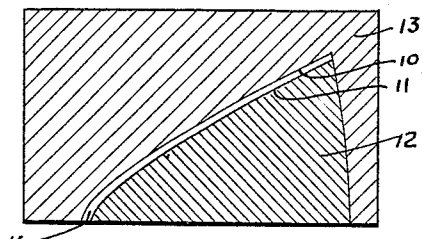


Fig 7

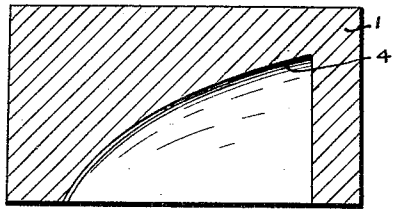


Fig 3

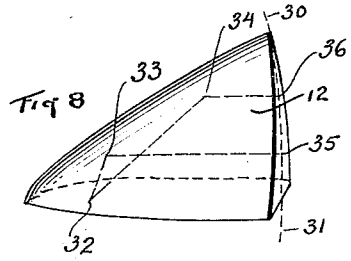


Fig 8

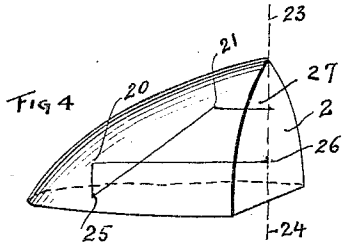


Fig 4

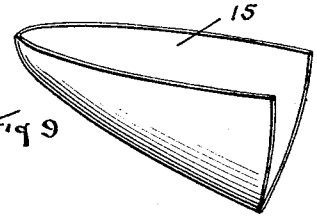


Fig 9

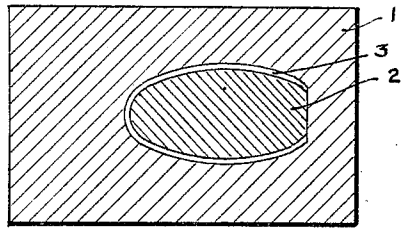
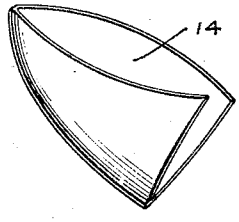


Fig 2

Fig 5



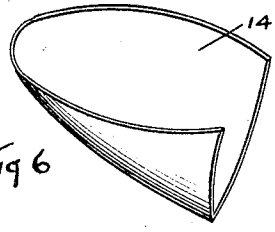


Fig 6

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1,848,173

UNITED STATES PATENT OFFICE

BRUNO HEYMANN, OF SAN FRANCISCO, CALIFORNIA.

ARTICLE OF MANUFACTURE

Application filed April 23, 1928. Serial No. 272,040.

In my co-pending application Ser. No. 732,475, filed August 14, 1924, now Patent #1,667,153, Apr. 24, 1928, I have set forth a machine for producing irregular surfaces such as employed in dies, punches and the like and by which thin metal surfaces such as reflectors may be readily formed, and wherein the surface produced varies in accordance with a formula involving variables of the second degree without being a surface of revolution on any single axis.

The invention herein disclosed is directed to dies, punches and the like as articles of manufacture and which may be employed for the production of such surfaces and particularly such thin surfaces of metal or other rigid material as a foundation for the formation of reflectors as employed in headlights, beam projection apparatus and the like.

In the formation of such a reflector surface it is customary to employ a convex punch or die and a concave die between which the thin metallic surface is formed as by pressing or casting.

The convex side of the said metallic surface takes on the form of the concave die and the concave side of the surface takes on the form of the convex die or punch. The latter is the more important as on it is preferably formed the reflecting surface for the projector.

The thin metal may also be formed by forcing against one of my dies by fluid pressure from the opposite side.

The accurate form of the convex and concave surfaces is therefore a matter of vital importance in the production of such a reflector and tools as dies and punches for these surfaces may be produced by the machine of my invention set forth above.

In such dies heretofore, there is an axis of symmetry whereas in the dies of my present invention while there may be a plane of symmetry, there is no axis of symmetry.

The dies of my invention may be employed in any conventional press or other machine to form the desired surface between them.

In my present invention the forming surfaces of the said dies are in each case the envelope of consecutive intersections of a family of conicoids of revolution and may be produced by the machine fully described in the above entitled application to which reference is herein made.

Referring to the drawings wherein is set forth certain specific forms of my invention particularly suited to produce reflection: Fig. 1 is a vertical central longitudinal section through a pair of dies wherein the convex and concave surfaces are formed by an infinite number of points whose locus is the envelope of consecutive intersections of a family of conicoids of revolution having variable parameters with a pencil of planes.

Fig. 2 is a horizontal section of Fig. 1 on the line II—II thereof.

Fig. 3 is a section similar to Fig. 1 of the concave die and Fig. 4 is a side view of the convex die or punch of Fig. 1.

Figs. 5 and 6 are perspective views of thin metallic surfaces that have been formed in the dies of Figs. 1 to 4.

Figure 7 is an alternate form of my invention wherein the forming surfaces of the dies are envelopes of a family of ellipsoids of revolution of varying parameters.

Fig. 8 is a perspective view of the convex die of Fig. 7 and Fig. 9 is a thin metal reflecting surface formed between the dies of Fig. 7.

In the production of reflectors from my dies, the light source with which they are to be employed is to be located at the said common focus resulting in a reflection of the said light source from every point on the reflector surface in a predetermined beam array and therefore the illumination of a predetermined area by the said beam array.

Throughout the figures similar numerals refer to identical parts.

Referring to Fig. 1 the numeral 1 indicates the concave die and the numeral 2 the convex die in assembled position with the space 3 therebetween and in which the reflector or other surface is to be formed.

The space 3 indicating the said thickness in the figures is exaggerated to better illustrate the clearance between the two dies. The inner or concave die surface at 4 in the die 1 is formed substantially symmetrical

with and as substantially parallel with the convex surface 5 of the convex die 2. This die surface 5 is the counterpart of the desired finished reflector surface.

When a piece of thin metal has been formed in the space 3 between the surfaces 4, 5, the form shown in Figs. 5 and 6 is the result and the inner surface of this formed reflector then has the characteristics of the combination of the varying conicoids wherein the said conicoids all have one focus in common.

In Fig. 7 the concave die 13 has a surface at 10 to form the back of a thin metallic reflector in the space 16 and the surface 11 of the convex die 12 forms the reflector surface the thin metal being formed in the space 16 as before. The thin metal after being formed between the dies of Fig. 7 has the appearance shown at 15 in Fig. 9.

Its reflecting surface 12 which has been formed against the concave surface 11 embodies the characteristics of an envelope of variable conicoids above specified, and wherein there is a common focal point for all of said conicoids.

Referring to Fig. 4, 20 is one point on my surface and 21 is a second. The vertical line 23, 24 is forward of the focal point 25. The distance 20, 25, plus 20, 26 is, in my surface, equal to the distance 21, 25 plus 21, 27. In Fig. 8, the curved line 30, 31 is forward of the focal point 32. The points 33 and 34 lie upon the surface. The distance 32, 33 plus 33, 35 is equal to the distance 32, 34, plus 34, 36.

In the reflecting surfaces formed from tools here illustrated every point on such surface is positioned such that the sum of its distances from the common focal point and from a central line forward thereof is constant; and in Figs. 1 to 6 the said line will be a straight line while in Figs. 7, 8, 9 the said front line will be a curved line. Such straight and curved lines are known as regular lines.

It will now be obvious that other forms of die forming surfaces such as hemi-ellipsoids, elliptical paraboloids, elliptical hyperboloids and parabolical hyperboloids all being quadrics or conicoid envelopes of intersections of conics of revolution may be produced without departing from my invention and I desire to be understood as claiming all such.

I claim:

1. As an article of manufacture, a tool for forming thin surfaces comprising a forming face every point on which is positioned such that the sum of its distances from a fixed line and from a focal point is a constant.

2. A pair of forming dies having substantially parallel forming faces spaced apart, one of said faces being a surface every point on which is positioned such that the sum of its distances from a fixed line and from a focal point is a constant.

3. As an article of manufacture a tool having a forming face and constructed and adapted to form thin surfaces against said face and wherein said face is constructed with every point thereon positioned such that the sum of its distances from a line and from a focal point is a constant.

BRUNO HEYMANN.