W. E. SHERBONDY.

DIES.

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1,147,273.

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Fig. 1

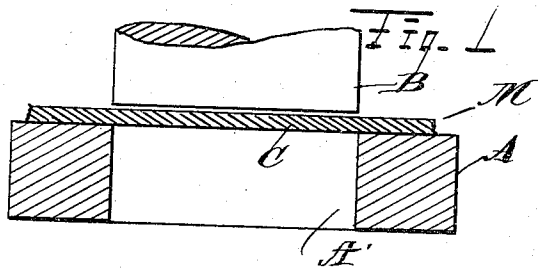


Fig. 2

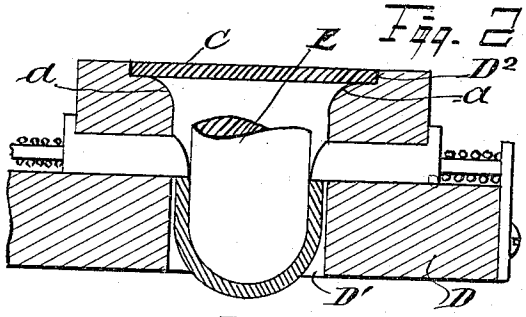


Fig. 4

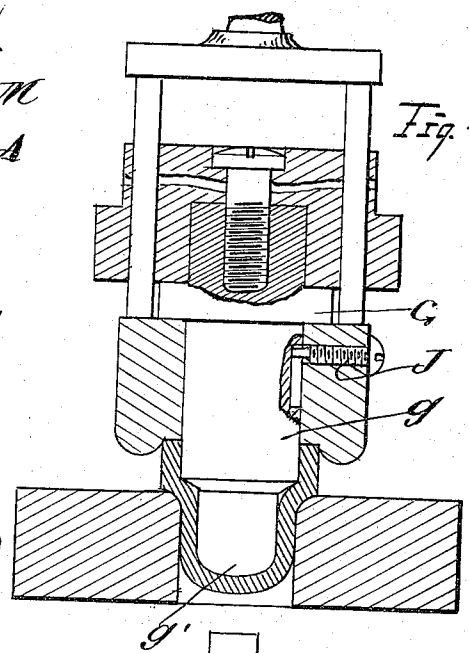


Fig. 3

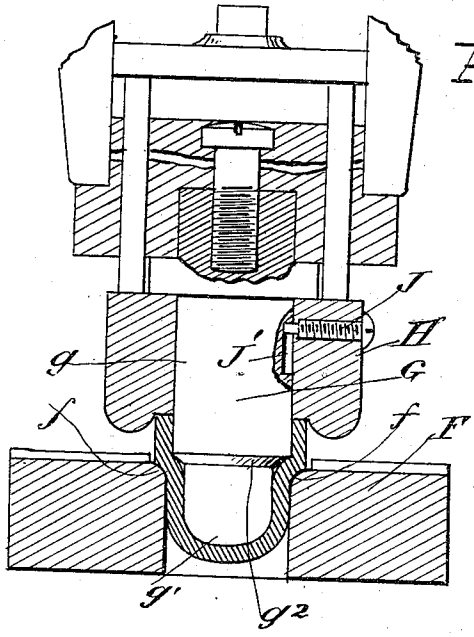
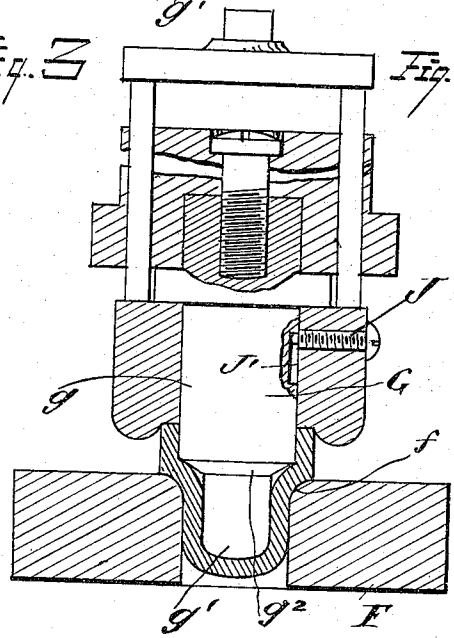


Fig. 5



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DIES.

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To all whom it may concern:

Be it known that I, WILLIAM E. SHERBONDY, a citizen of the United States, and resident of Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Dies, of which I hereby declare the following to be a full, clear, and exact description, such as will enable others skilled in the art to which it appertains to make and use the same.

The objects of the invention are to provide a tool or tools such as a die and punch for carrying out the several steps of a method for constructing the shell of a spark plug from a sheet metal blank.

To produce such an article from sheet metal having the thickness of wall and small diameter of a shell for a spark plug requires dies of a peculiar shape and construction, and thinner metal cannot be employed since there must be sufficient thickness left in the wall to provide for the internal screw thread and also for the projecting angles of the hexagonal portion, to leave the corners sharp and clean as they would be if formed in the usual manner from bar stock.

The nature of the operation which must be taken in a succession of stages to gradually draw the metal into the desired forms requires, that the metal should first be drawn into a cup shaped form of larger diameter than the finished shell, and that the lower portion of this cup should be drawn out to reduce it in diameter while the diameter of the upper portion remains substantially the same, and upon the upper portion the hexagon is formed by drawing it through dies which gradually reduce it in diameter and simultaneously cause the angles to project and assume the hexagonal shape.

This invention has to do with the dies which prepare the cup for the final process of shaping the hexagon thereon.

The invention is further illustrated in the accompanying drawings and specifically pointed out in the claims.

In the accompanying drawings Figure 1 is a transverse section showing the preliminary dies which strike out a disk shaped blank from sheet metal; Fig. 2 is a similar section showing the dies which form the blank into a cup of larger diameter than the finished shell, and Figs. 3, 4, and 5 are similar sections that show the dies which form the cup into the shape from which the hexagonal shell can be produced.

This application is confined to the specific form of dies which elongate and reduce the lower portion of the cup in diameter, while retaining the upper portion substantially unchanged in diameter.

It has been found by careful experiment that the hexagonal shape of the upper portion of the spark plug cannot be impressed upon a hollow cylindrical blank or cup by drawing a blank having the finished outer diameters, and that the cup shaped blank must first be made of a larger diameter and afterward be reduced by drawing the same through peculiarly formed dies.

The dies for making the preliminary form are clearly shown in Figs. 3, 4, and 5, and may be described as follows, together with the dies used in leading up to this step.

In Fig. 1 A is a die block having a cylindrical opening A′ over which the flat piece of sheet metal M is placed, and B is a punch which cuts a disk C of metal from the sheet M.

In Fig. 2 D is a die block having a cylindrical opening D′ of less diameter than the disk and also provided with an annular shoulder D^2 against which the disk rests, and which centers it accurately in relation to the central opening since if the slightest eccentricity should exist in the disk the edges of the cup would be uneven and an unsightly product would result.

E is the punch of less diameter than the die opening; *a*, *a*, are the rounded upper corners of the die opening which are made with an arc sufficiently large to give a free flowing movement to the metal as the punch draws it through the die. Otherwise the metal would crack and become useless, hence no distinct shoulder is formed at this point.

After the cup has been formed, dies of the character shown in Figs. 3, 4, and 5 are employed. In these figures F is a die block having a cylindrical opening, smaller than the diameter of the cup and having rounded corners at *f*, *f*, upon which the shoulder of the shell is formed. These corners must not be too abrupt or the metal will become torn before the lower end can be sufficiently elongated.

G is a punch having two diameters, *g* and *g′*. The diameter *g* is the same as the original inside diameter of the cup and the di-

ameter g' is the same as the inside diameter of the portion of the cup to be reduced. The shoulder g^2 separates these portions of the punch.

The length of the reduced portion of the punch should correspond with the desired length of the reduced portion of the cup and the punch and die should be accurately concentric with each other, otherwise one side of the shell will be thicker than the other and one side will be drawn altogether out of proportion to the other, and a perfect hexagon cannot be formed thereon.

Upon the upper portion of the punch is mounted a sleeve die H which encircles the same.

This sleeve die rests upon the upper part of the cup and is provided with an annular projecting edge h which retains the exposed portion of the edge of the cup in place while the punch is operating.

The sleeve die is employed to assist the punch in pushing the metal through the small opening in the die block and tends to prevent the cracking of the metal as the reduction is made over the corners f, f. The punch must not advance too far or the metal will be weakened between the shoulder g^2 and the corners f, f, and a uniform thickness of the lower part is preserved. The upper portion of the punch moves freely in the sleeve die but the sleeve die and punch move together during the latter portion of the stroke so that shortly after the smaller portion of the punch enters the die the sleeve die will begin to push against the edge of the cup and thus assist the punch in drawing out the metal. Ordinarily the sleeve die will have the effect of somewhat thickening or upsetting the upper portion of the cup, thus preparing it to receive the internal screw thread and the projecting angles; as shown in the figures the punch and sleeve die are operatively connected by the screw J which has a limited movement in the slot J'.

In Fig. 4 the punch is shown having a still further reduced lower end, thus further elongating and reducing the lower end of the cup while retaining the diameter of the upper portion, substantially unchanged. The opening in the die is also correspondingly smaller.

In Fig. 5 the die and punch are still further reduced and the radius of the curve of the corner f, f, constantly increases in length, since the diameter of the upper portion of the cup remains unchanged while the lower portion constantly grows smaller.

After passing through these dies the metal cup is ordinarily so hard as to require annealing before further steps are taken. As many dies of this character can be used as may be necessary to gradually draw the cup into the required portions of different diameter from which a shell for a spark plug can be made.

Having described the invention what I claim as new and desire to secure by Letters Patent is:

1. In dies for forming a cup of two diameters from a sheet metal cup, and for the purpose described, a die block having an opening of less diameter than the cup, a punch having a shoulder, and a portion of reduced diameter, and a die sleeved over said punch, having a limited movement thereon, substantially as described.

2. The combination with a die block having an opening provided with rounded upper edges, of a punch therefor having a reduced lower end of less diameter than said opening, a shoulder separating the two portions of said punch, and a sleeve encircling the larger portion of said punch and having a predetermined amount of movement thereon.

3. In dies for forming a cup shaped blank from sheet metal, said blank having an upper cylindrical portion and a lower integral portion of reduced diameter, a die block having an opening, the upper corners of which are rounded, a punch having a portion of less diameter than said opening, and a portion of substantially the same diameter as said opening, a shoulder at the juncture of said portions of said punch, and a sleeve operatively attached to the larger portion of said punch and having a limited loose motion thereon, said sleeve engaging the enlarged extremity of said blank.

4. In dies for forming a cup shaped article having a cylindrical upper end and a lower end of reduced diameter, from a cup shaped sheet metal blank, a die block having an opening, a punch therefor of less diameter than said opening, said punch having a portion of larger diameter, a shoulder connecting said portions, a sleeve upon the larger portion of said punch, and operated thereby to engage and compress the upper portion of said blank, and to assist in pushing the forward end of the blank through said die block, and permitting a limited amount of free movement of the sleeve upon said punch.

5. In a tool for forming a cup shaped blank of two diameters from a sheet metal cup shaped blank, a die block having an opening with rounded upper corners, a punch having a portion of less diameter than said opening, and a portion of larger diameter, and a device having a limited movement upon said punch for exerting pressure upon the upper edge of said blank to assist in forcing said blank into said die.

6. In a tool for reducing the extremity of a cup shaped blank, and for slightly thickening the upper end thereof, a die having an opening provided with rounded corners,

a punch having a portion of less diameter than said opening and a larger portion, a shoulder intermediate of said portions, a sleeve upon said enlarged portion of said punch having a limited movement thereon, a shoulder on said punch engaging said sleeve to drive the same, said sleeve having an annular extremity for engaging the edge of said blank and an annular rib encircling the same.

In testimony whereof, I hereunto set my hand this 12 day of August 1914.

WILLIAM E. SHERBONDY.

In presence of—

WM. M. MONROE,

RALPH W. JEREMIAH.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."