Sept. 28, 1943. G. A. LYON 2,330,228

DIE FOR DRAWING SHEET METAL ARTICLES

Original Filed March 26, 1940 2 Sheets-Sheet 1

Fig. 1.

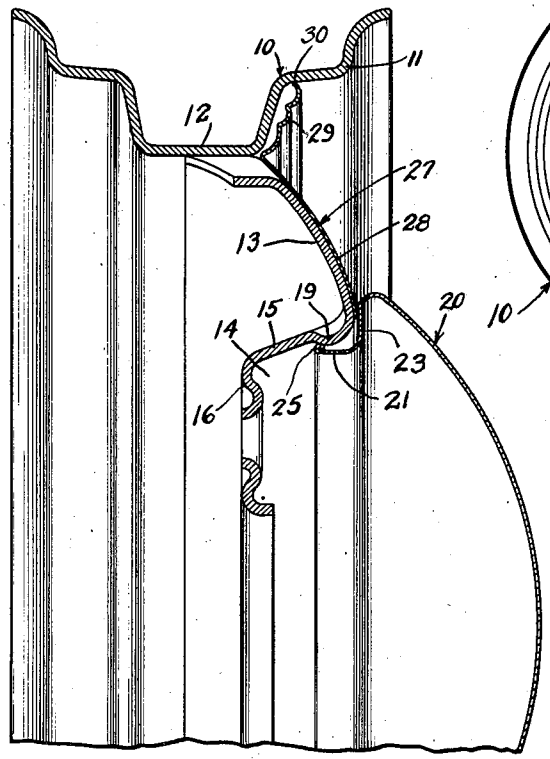


Fig. 2.

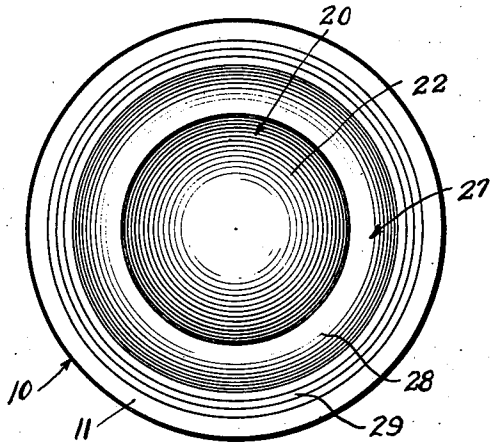


Fig. 3

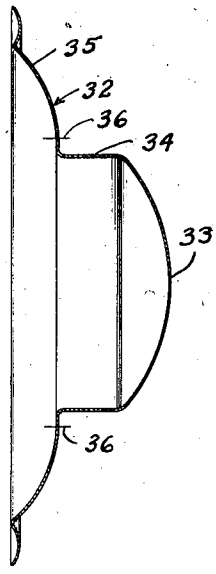


Fig. 4.

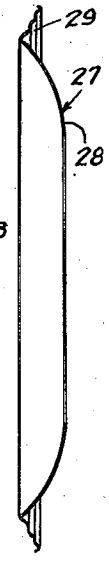
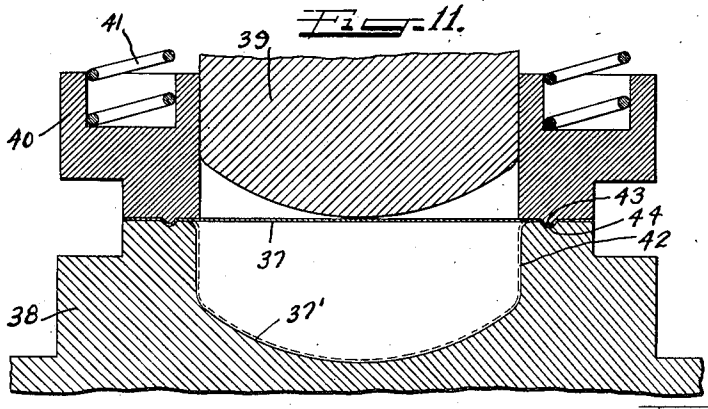


Fig. 11.



Inventor
GEORGE ALBERT LYON.

By Charles Fellows Atty.

Sept. 28, 1943. G. A. LYON 2,330,228

DIE FOR DRAWING SHEET METAL ARTICLES

Original Filed March 26, 1940 2 Sheets-Sheet 2

Fig. 10.

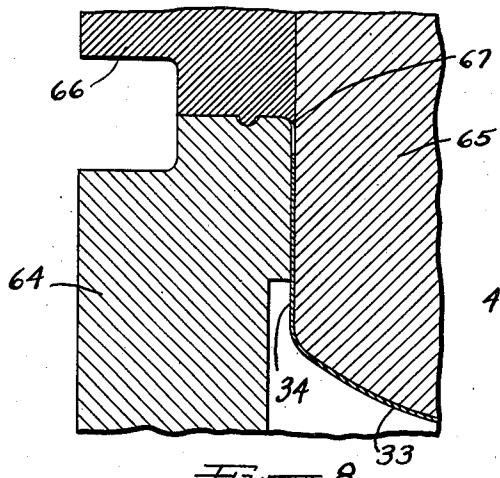


Fig. 5.

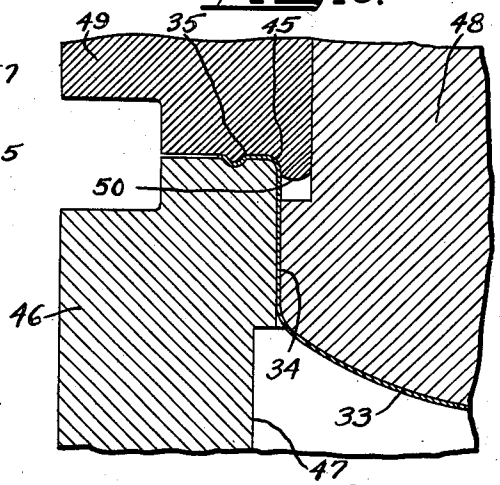


Fig. 8.

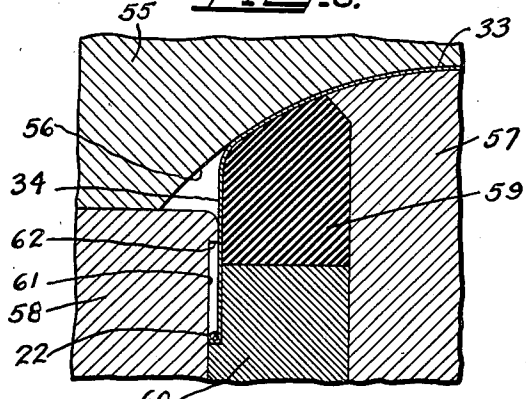


Fig. 6.

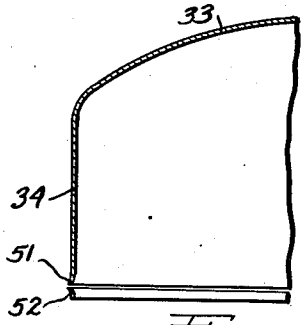


Fig. 9.

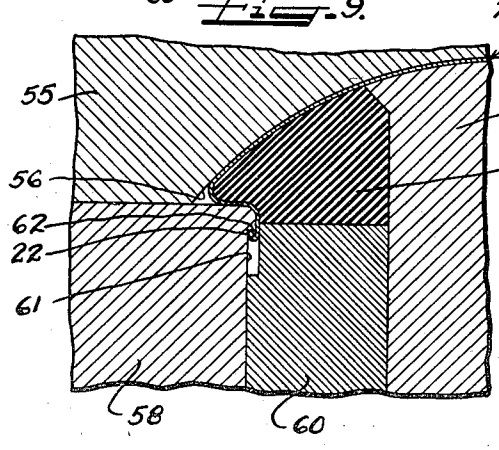
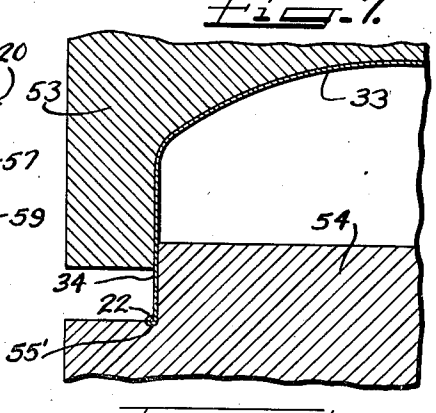


Fig. 7.



INVENTOR

GEORGE ALBERT LYON.

BY Charles Allen ATTY.

Patented Sept. 28, 1943 2,330,228

UNITED STATES PATENT OFFICE

2,330,228

DIE FOR DRAWING SHEET METAL ARTICLES

George Albert Lyon, Allenhurst, N. J.

Application September 16, 1940, Serial No. 356,960, which is a division of application Serial No. 326,037, March 26, 1940. Divided and this application June 16, 1941, Serial No. 398,255

2 Claims. (Cl. 113—44)

This invention relates to an automobile wheel construction and, more particularly, to a die for drawing a wheel cover or hub cap.

The subject matter of this application constitutes a division of my copending application Serial No. 356,960, filed September 16, 1940 (now Patent No. 2,304,582, December 8, 1942), which is, in turn, a division of my copending application Serial No. 326,037, filed March 26, 1940.

An object of this invention is to provide an improved and simplified die for drawing a cover member or hub cap for an automobile wheel.

Another object of this invention is to provide improved die construction for making an automobile wheel hub cap in such a way that there will be less waste of metal than heretofore.

Another object of this invention is to provide an improved die for making an automobile wheel hub cap or cover in such a manner that fewer operations are required in the fabrication of the article.

In accordance with the general features of this invention, there is provided a drawing die for forming a hub cap, and whereby the hub cap is first drawn to an intermediate form having a crown portion surrounded by a cylindrical wall; the free edge of the cylindrical wall being then trimmed to eliminate any irregularities produced by the drawing operation and then curled to form a beaded edge. The die also includes mechanism for bulging out the portion of the cylindrical wall next to the crown portion to give the hub cap its final shape and in which final operation the beaded edge is positively prevented by means in the die from being drawn into an irregular shape so that no additional straightening or trimming operations are necessary.

In previous drawing apparatus for making hub caps of the type to which this invention relates, it has been the practice to perform the bulging out operation before curling the edge of the metal and without preventing the formation of irregularities in the edge of the metal. As a consequence, it has heretofore been necessary to perform a second trimming operation after the bulging operation and before the curling of the edge of the metal into a bead. The present die construction eliminates any such second trimming operation.

Other objects and features of this invention will more fully appear from the following detailed description taken in connection with the accompanying drawings which illustrate several embodiments thereof, and in which:

Figure 1 is a fragmentary vertical cross sectional view taken through a wheel construction showing my novel wheel hub cap applied thereto;

Figure 2 is a front view, on a reduced scale, of the construction shown in Figure 1;

Figure 3 is a cross sectional view taken through a metal blank after it has been subjected to the first operation performed by my novel drawing die;

Figure 4 is a cross sectional view illustrating a further operation that is performed on the wheel cover shown in Figure 3 by my novel die construction;

Figures 5, 6, 7, 8, and 9 are fragmentary cross sectional views illustrating progressive or successive steps performed by my novel die in the formation of the hub cap shown in Figures 1 and 2, certain of these views also illustrating the apparatus employed in performing the steps or operations;

Figure 10 is a fragmentary cross sectional view similar to Figure 5 showing a modified form of apparatus for performing the operation illustrated in Figure 5; and

Figure 11 is a cross sectional view through a die set and blank of my present invention for carrying out the initial step in the formation of the hub cap when it is desired to make a hub cap without simultaneously making a wheel cover disk.

As shown on the drawings:

It is believed that a description of my die may best be understood by first describing the article which the die is adapted to make and the manner in which it is used. The necessity of the form of die set will become apparent from a description of the article and its use.

The reference character 10 designates generally a conventional drop center tire rim, including the usual side flanges 11 and a base flange 12, to which is riveted, welded, or otherwise secured, a spider or body member 13 which has a central depression or bolt access opening 14, defined by a lateral wall 15 terminating in a bolt flange 16. This bolt flange 16 is adapted to be secured in the usual way, such as by cap screws or bolts, to a suitable circular support or hub of the automobile.

As is well known to those skilled in the automobile wheel art, it is common practice to provide a detachable closure member for concealing these bolts. A closure or cap member constructed in accordance with the features of this invention is shown in Figures 1 and 2 and is designated generally by the reference character 20. The closure member, as I shall describe more in detail hereinafter, is adapted to have a snap-on

coaction with a plurality of lateral projections or bumps 19 on the wall 15 of the wheel body part 13. These projections may, if it is so desired, be attached to this body part although the preferable way of providing them is to depress spaced portions of the body part at the time that the body or spider part is being fabricated.

Each of these projections 19 is of relatively narrow width and of a predetermined height for coaction with a flexible skirt 21 on the hub cap or cover member 20. While any suitable number of projections may be used, I have found that satisfactory results may be obtained by using four equidistantly spaced projections.

The hub cap 20 is made from a single sheet or piece of metal and, in addition to the skirt 21, includes a dome or crown portion 22 connected to the skirt 21 by a turned under margin 23, which defines a shoulder adapted to seat on the outer face of the wheel body member 13, as shown in Figure 1. Also, the innermost extremity or edge of the flexible skirt 23 is curled into a small wire-like bead 25 for enhancing the tension of the rear edge of the cap, particularly when this edge is sprung into hub cap retaining cooperation with the spaced projections 19.

The dome portion 22 of the hub cap is resilient to the extent that it is like a spring in that it is capable of resisting impact blows and, moreover, will enable slight indentations therein to be snapped or pressed outwardly by manual pressure on the inner side of the indentation.

The skirt 21, by reason of its extending in a generally axial direction, has its greatest flexibility at its inner edge 25. Moreover, when this skirt is in a sprung condition on the wheel, it does not materially affect the remaining portions of the hub cap by reason of the fact that it emanates from a shoulder 23 on the cap which is held and seated tightly against an outer face of the wall of the body part 13.

The shoulder 23 is between the flexible dome and flexible skirt and by reason of its being located at the turned and channeled section of the margin of the cap is relatively rigid so that it can withstand without distortion or buckling the pressure of a pry-off tool inserted between the edge of the shoulder and the adjoining wheel body. In the application of the hub cap to the wheel, it is first brought to a position in which the bead 25 rests against the protuberances 19 at points spaced axially outwardly of the final point of contact between the bead 25 and the protuberances 19. The hub cap is then forced bodily axially inwardly and snapped into place, the portions of the bead 25 in contact with the protuberances 19 and the adjacent portions of the skirt 21 of the hub cap are deflected radially inwardly during this operation, while the intermediate portions of the bead 25 and skirt 21 spring radially outwardly. In its final position, shown in Figure 1, the bead 25 and the skirt 21 of the hub cap are in the above described flexed position, thereby tightly and flexibly binding the edge under tension to the body part of the wheel so as to detachably retain the hub cap on the wheel. This coaction is of such a magnitude that it requires the use of a pry-off tool, such as a screw driver, as well as considerable pressure, to remove the cap from the wheel; this removal being effected by inserting the edge of the screw driver between the relatively rigid lateral shoulder 23 of the cap and the wheel body member 13, and prying the cap outwardly.

The wheel construction, as illustrated in Figure 1, is also provided with a wheel cover disk 27 having an inner part 28 overlying the wheel body 13 and an outer part 29 overlying a portion of the rim 10. The wheel cover disk 27 is retained in place on the wheel by its axially inner edge which fits in under and is secured by the turned-under margin 23 of the hub cap 20. If desired, the wheel cover disk 27 may also be held in place by a frictional engagement of its outer marginal edge 30 with the axially inner surface of the side flange 11 of the rim 10.

In Figures 3 to 8 of the drawings, I have illustrated the novel operation in the making of the hub cap 20 and the wheel cover disk 27 illustrated in Figures 1 and 2. More particularly, both the hub cap 20 and the wheel cover disk 27 are blanked from a single piece of metal stock 32. The first operation in the forming of the hub cap 20 and the wheel disk 27 comprises taking a circular blank of suitable size and drawing it by one or more operations into the shape shown in cross section in Figure 3. It will be noted that this shape comprises a central rounded crown portion 33 joined by a cylindrical wall portion 34 to a wide rim or disk portion 35. The wall portion 34 has the same diameter as the skirt portion 21 of the finished hub cap, and the outer rim or disk portion 35 has approximately the same outside diameter and the same general configuration as the finished wheel cover disk 27.

After the blank 32 has been formed to the shape shown in Figure 3, it is divided into two parts by being cut along a circle whose position is indicated in Figure 3 by the lines 36. The diameter of this circle is the same as the inside diameter of the finished wheel cover disk 27, and the wheel cover disk 27 is completely formed by shaping the severed disk portion to the final form shown in Figure 4.

The central portion of the partially formed blank shown in Figure 3, this central portion comprising the crown 33, the cylindrical wall 34, and the radially inner part of the disk 35 lying between the lines 36, is subjected to further operations and finally forms the finished hub cap 20. If it is desired to produce a hub cap 20 without producing a wheel cover disk 27, a circular sheet metal blank 37, considerably smaller than the blank 32, may be employed in making a partially formed hub cap similar to the central portion of the partially formed hub cap and wheel cover disk shown in Figure 3. In carrying out this alternative procedure, the blank 37, as shown in Figure 11, is placed in a suitable die set comprising a die 38, a punch 39, and a blank holder 40 connected to the punch by suitable springs 41. The die 38 is formed with a central recess 42 into which the punch 39 is adapted to draw the blank 37, and the die 38 and the blank holder 40 are provided with a circular tongue 43 and groove 44 concentric with the recess 42 of the die. The tongue 43 and groove 44 provide a tortuous passage through which the edge of the blank 37 is drawn. This serves to more effectually hold the edge of the blank 37 and also to cold work, to an additional extent, that portion of the blank being drawn through the tortuous passage and to thereby enhance its physical properties. When the stroke of the punch 39 is completed, the blank 37 has been drawn to the shape indicated by the dotted line 37' and has substantially the same shape as the portion of the member shown in Figure 3 and lying between the lines 36.

The partially formed hub cap, made by either of the operations described above, is then subjected to a further drawing operation, as illustrated in Figure 5. Figure 5 shows a portion of a die set generally similar to the die set shown in Figure 11 in that it comprises a die **46** having a central circular opening **47**, a punch **48**, and an annular blank holder **49** fitting around the punch **48** above the die **46**. Since both sides of the die set are alike, one side only is illustrated in Figure 5. The principal differences between the die set illustrated in Figure 5 and the die set illustrated in Figure 11 are that, in the former die set, the aperture **47** in the die **46** extends clear through the die so that the piece being worked upon can be discharged through the opening, and in that the blank holder **49** is provided with a lip **50** which is adapted to extend down into the die **46** inside of the cylindrical wall **34** of the blank being worked upon. It will be noted that the blank is formed with a fillet portion **45** between the cylindrical wall portion **34** and the relatively flat rim portion **35** and that the fillet **45** is securely held, both on the outside and the inside, by the die **46** and the lip **50** of the blank holder **49**.

The operation which is performed in the die set illustrated in Figure 5 consists of drawing all of the metal in the fillet **45** and in the flange **35** into an extension of the cylindrical wall **34**, the metal being guided throughout its entire movement into the cylindrical wall formed by means of the die **46** and the blank holder **49**. The movement of the metal is, of course, caused by the downward movement of the punch **48** in the conventional manner.

After the operation performed in the die set shown in Figure 5 has been completed, the blank has the shape shown in cross section in Figure 6 and consists entirely of a crown portion **33** and a cylindrical wall portion **34**. The next operation is to trim the edge of the wall portion **34** to exactly the proper length by making a cut **51** at the proper place. The cut **51** removes a small strip of waste **52** from the rim of the cylindrical portion **34** and eliminates any variation in length or irregularities in the edge of the work piece **33—34**.

The next operation in the formation of the hub cap is the curling of the edge of the cylindrical wall portion **34** to form a bead **22**. This operation is carried out with a curling punch **53** and die **54** having the configuration shown in Figure 7. The edge of the cylindrical wall portion **34** is forced by the die **53** into an annular round bottomed groove or trough **55'** in the die **54** and is thereby forced to curl around and form itself into the bead **22**.

The next operation in the forming of the hub cap consists of bulging out the portion of the cylindrical wall **34** adjacent the crown portion **33** in order to form the edge portion of the dome **22** and the turned-under margin **23** of the finished hub cap shown in Figure 1. This operation is performed by the die set illustrated in Figures 8 and 9. This die set comprises an upper die member **55** whose under surface is formed with a round hollow **56** having the shape of the dome portion **22** of the finished hub cap, a central lower die member **57** having its upper end shaped and positioned to hold the center of the crown portion **33** of the partially completed hub cap against the center of the hollow **56** in the upper die member, a plurality of outer lower die members **58** which together form a ring adapted to fit around the cylindrical wall portion **34** of the partially formed hub cap, a rubber expander **59** in the form of a ring fitting around the upper part of the central lower die member **57** and shaped to fit against the outer part of the crown portion **33** and the upper part of the wall portion **34** of the partially completed hub cap, and an annular compressor **60** fitting between the central and outer lower die members **57** and **58** immediately below the rubber expander **59**. It will be noted that the outer lower die members **58** are formed with an undercut **61** on their inner surfaces, this undercut accommodating the bead **22** and terminating in a shoulder **62** near the top. When the partially formed hub cap **33—34—22** is placed in the dies, the bead **22** on its lower edge lies some distance below the shoulder **62** on the outer lower die members, as shown in Figure 8.

The die set shown in Figures 8 and 9 is operated by forcing the upper die member **55**, the central lower die member **57** and the outer lower die members **58** downwardly with respect to the compressor **60**. This forces the rubber expander **59** down onto the compressor **60** and, since rubber is practically incompressible volumetrically, causes the expander **59** to bulge out laterally as shown in Figure 9. This bulging forces the upper portion of the cylindrical wall **34** out into the peripheral portion of the hollow **56** in the upper die member **55** and draws the bead **22** up against the shoulder **62** on the outer lower die members **58**. The pressure applied is sufficient to pull the bead **22** up tightly against the shoulder **62** around its entire circumference. If any portion of the bead **22** should pull up against the shoulder **62** before any other portion, that first portion is stopped and prevented from pulling up further by the shoulder **62** until the other portions are pulled up into line. Thus, the bead **22** is formed into a perfect circle irrespective of any small irregularities that may occur during the drawing operation. This completes the formation of the hub cap **20**, with the exception, of course, of such operations as polishing and embossing or painting ornamental or identifying features.

An alternative set of dies **64—65—66**, shown in Figure 10, may be employed for carrying out the operations performed by the dies shown in Figure 5. This alternative set of dies comprises an annular lower die member **64**, a punch **65**, and an annular blank holder **66** adapted to fit around the punch **65** and on top of the die **64**. The die set **64—65—66** is generally similar to the die set shown in Figure 5, but the lip **67** on the lower inner corner of the blank holder **66** is considerably thinner than the corresponding lip **50** on the other die set. This allows the side of the punch **65** to be made straight and of a constant diameter instead of having the upper portion of reduced diameter, as is the case with the punch **48** in the die set shown in Figure 5.

From the foregoing, it will be seen that I have provided a die for producing hub caps and wheel cover disks or for producing hub caps alone which performs with less waste of material and fewer operations than previously known dies for producing these articles. It will therefore be apparent that my invention brings about a substantial reduction in the manufacturing cost of these articles. While I have disclosed only one principal way of carrying out the invention and two modifications thereof, it will, of course, be understood that I do not wish to be limited thereto,

since many modifications may be made, and I, therefore, contemplate by the appended claims to cover all such modifications as fall within the true spirit and scope of my invention.

I claim as my invention:

1. A die set for bulging out a portion of a cylindrical wall of a sheet metal article having a round beaded rim forming one end of said wall and a crown portion merging into the other end, said die set comprising an internal die member constructed and arranged for applying internal pressure to said portion of said cylindrical wall, an external die member having a wall spaced from the wall of said internal die member to define a passage for said beaded rim to hold said rim against deformation while permitting movement thereof towards said crown portion, and an overhanging portion on said external die member for engaging said bead and for limiting said movement.

2. A die set for bulging out a predetermined portion of a cylindrical wall of a sheet metal article having a round beaded rim forming one end of said wall and a crown portion merging into the other end, said die set comprising an internal die member constructed and arranged for applying internal pressure to the portion of said cylindrical wall next to said crown portion, an external die member having a wall spaced from the wall of said internal die member to define a passage for said beaded rim to hold the remaining portion of said cylindrical wall and said beaded rim against deformation while permitting movement thereof towards said crown portion, and an overhanging portion on said external die member for engaging said bead and for limiting the movement of said rim towards said crown portion.

GEORGE ALBERT LYON.