Feb. 21, 1961 R. O. GREENSHIELDS ET AL 2,972,183

METHOD OF FORMING FLANGED HUBS BY FORGING AND COINING

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FIG. 1

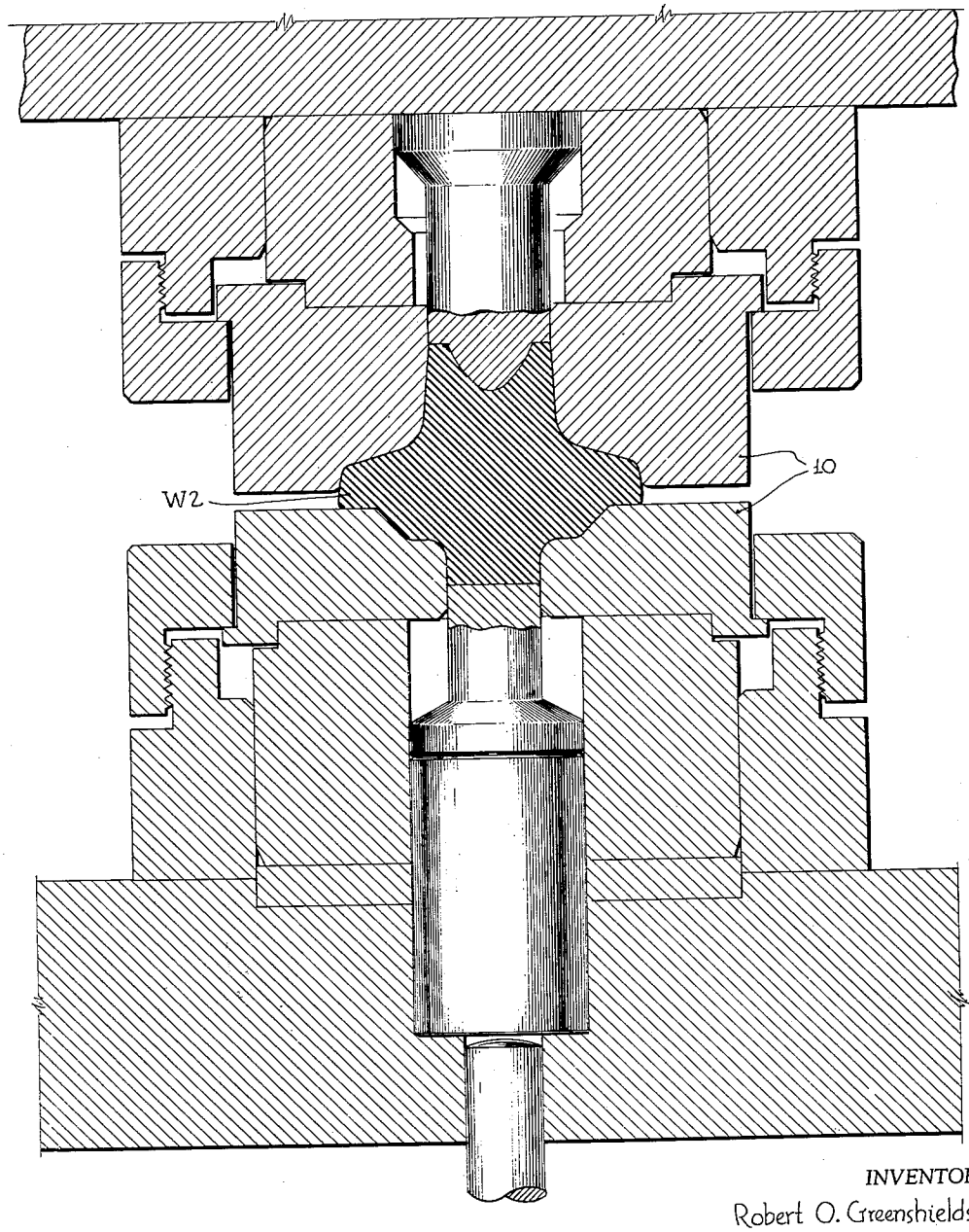

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FIG. 2

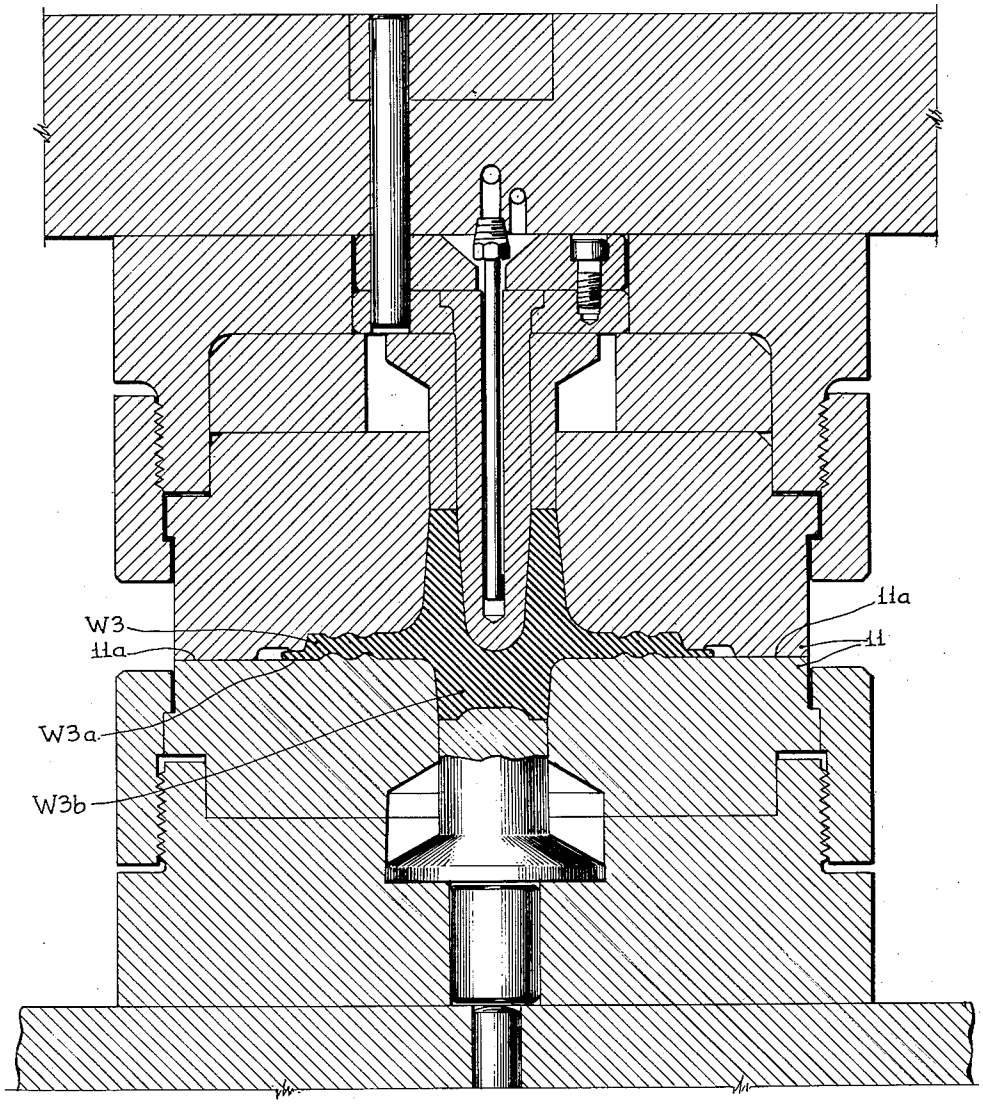

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FIG.3

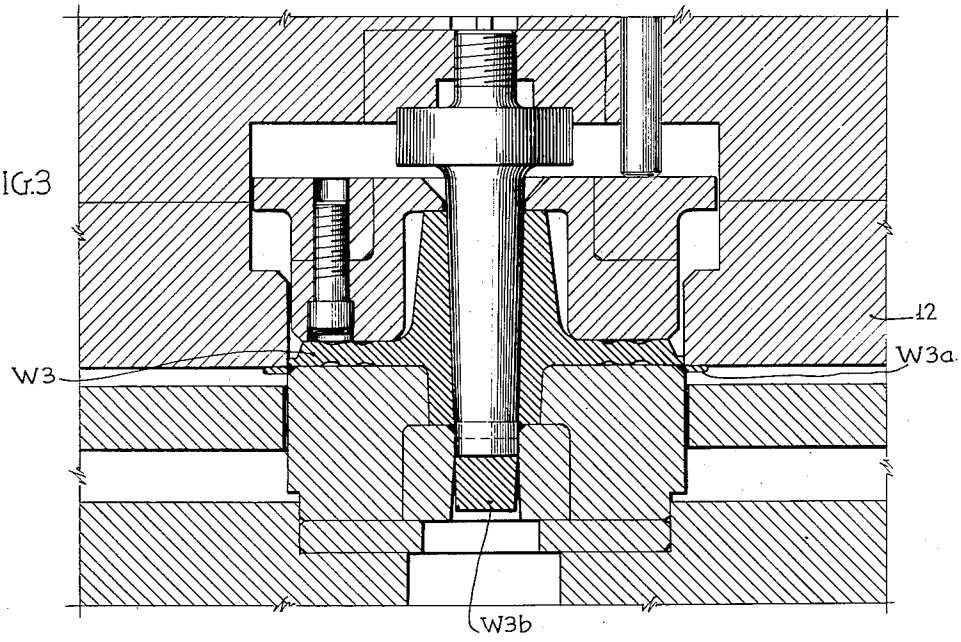
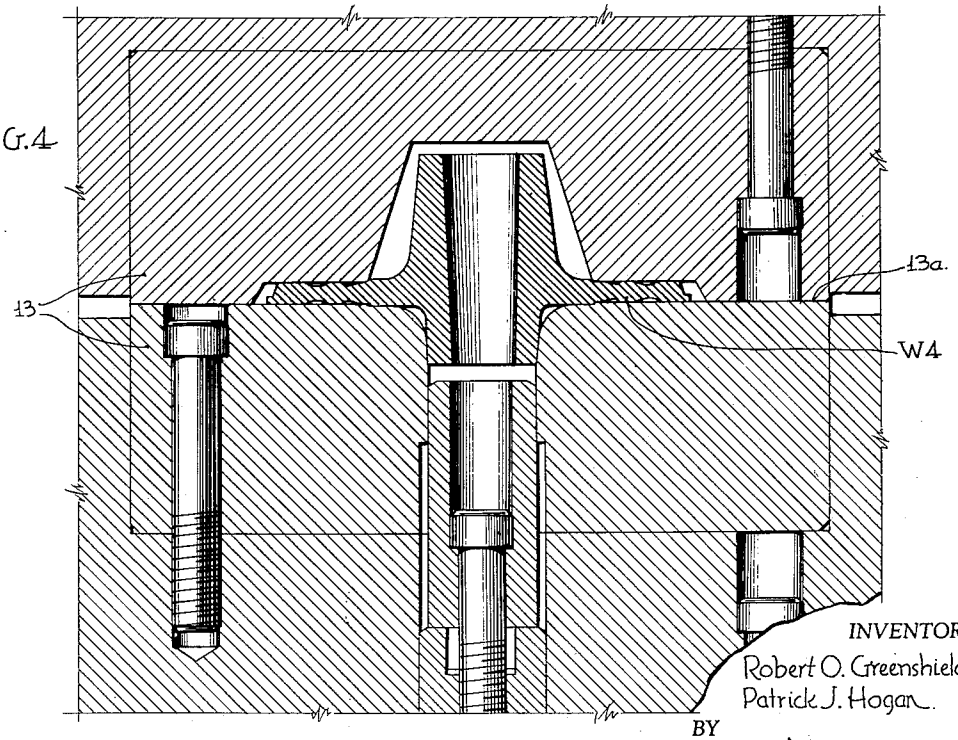


FIG.4



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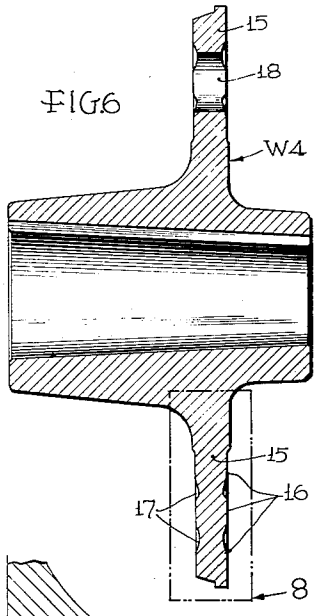

FIG.6

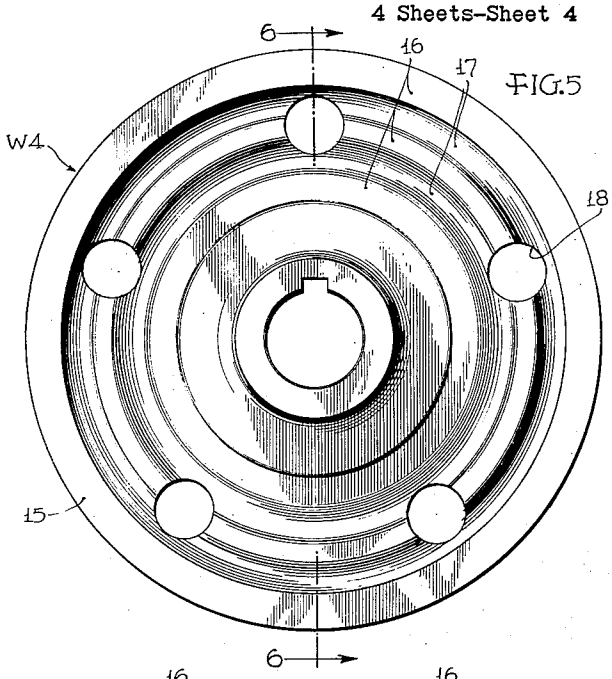

FIG.5

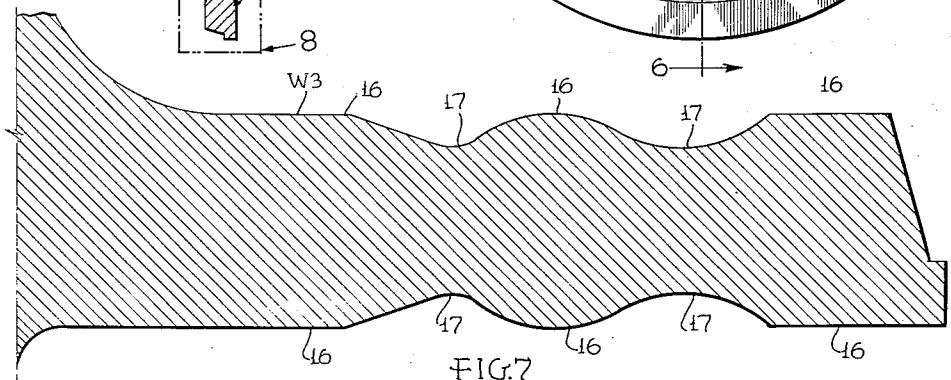

FIG.7

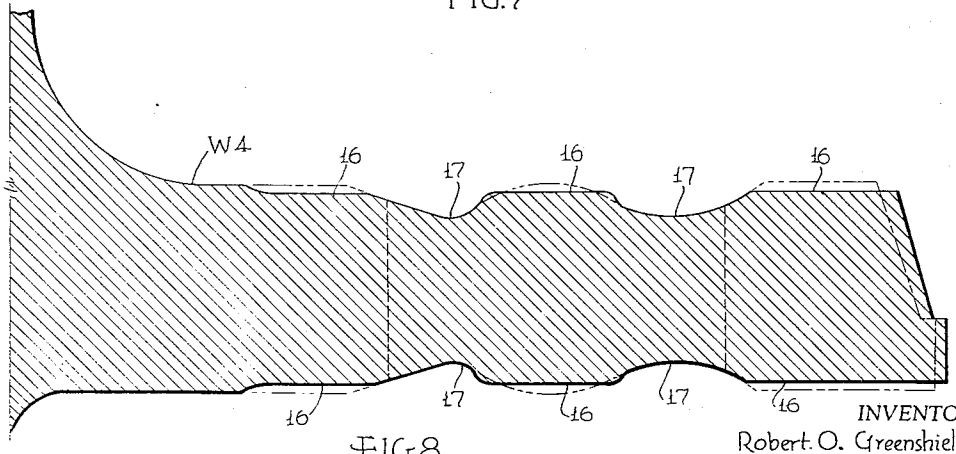

FIG.8

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2,972,183

METHOD OF FORMING FLANGED HUBS BY FORGING AND COINING

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1 Claim. (Cl. 29—159.3)

This invention relates to a method of forming flanged hubs by forging and coining.

Heretofore it has been usual to cast or forge flanged hubs to approximate shape and to machine turn all critical fitting surfaces to finished size. This is an expensive procedure and wastes much metal as scrap. The turning procedure for a large diameter like the flange is very slow; and the need to drill out and finish the entire center hole or bore wastes much material.

According to the present invention a hub is formed by a forging operation to leave a tubular blank having a flange, and the flange is then brought to final shape by a coining operation, so that it is only necessary to machine finish the inside bore of the hub; and since the diameters of the bore are quite small, the turning or drilling operations required can be very rapid. In the final forging operation the hub flange is brought accurately to the size and shape required for the subsequent cold finishing operation by coining dies. In the coining operation the dies stop or "kiss" against mutually cooperating surfaces after working on the flange to bring it into final accurate shape.

It is one of the particular objects of the invention to provide a rapid, economical, and accurate method of forming flanged hubs and to provide an improved and less expensive flanged hub.

The objects and advantages of the invention will be apparent from the following description of an exemplary embodiment, reference being made to the accompanying drawings, wherein:

Fig. 1 is a vertical section through a first set of forging dies showing the hub blank or workpiece after this forging action has been completed;

Fig. 2 is a vertical section through a second set of forging dies, the blank being shown after the forging action has been completed;

Fig. 3 is a vertical section through a set of blank trimming dies showing the outer flash and the core slug being removed from the blank and the bore of the blank being re-shaped;

Fig. 4 is a vertical section through a set of flange coining dies at the end of the action of the dies on a blank;

Fig. 5 is an enlarged end elevation of the finished blank;

Fig. 6 is an axial section taken on the line 6—6 of Fig. 5;

Fig. 7 is an enlarged partial section of the blank as shown in Fig. 3 after the completion of the forging and trimming operations; and

Fig. 8 is an enlarged partial section, taken in the zone 8 of Fig. 6, showing the flange after the final coining operation, the view also showing in broken lines the shape after final forging, as in Fig. 7, for purposes of comparison.

The original blank or slug from which the flanged hub is formed may be a predetermined length of cylindrical steel bar stock. It is heated, preferably in an electric induction furnace, to keep it clean and free from scale.

This blank or slug is squeezed while hot (Fig. 1) at very high pressure and at a single stroke between the dies 10 of a press, such as a "maxipress," to form the first forged hub blank shape W2. Here the bore and flange have been started.

The blank W2 is transferred to a second set of forging dies 11 (Fig. 2) and while still hot is squeezed under high pressure at a single stroke, as by a "maxipress," to form the final forged blank W3. These dies stop or "kiss" at a broad annular outer surface 11*a* to form the blank very accurately to a predetermined shape. Some flash W3*a* is formed at the outer edge of the flange and the bore is almost pierced through, the greater penetration being from the upper end.

The blank W3 is transferred to a set of trimming dies 12 (Fig. 3) and while still hot has the flange flash W3*a* trimmed off, the bore slug W3*b* pushed out, and the interior of the bore reshaped.

Before the next operation the blank W3 is thoroughly cleaned, as for example, by shot blasting.

After the forging and trimming operations have been completed and with the blank W3 in cold condition, it is placed in a set of flat-faced flange coining dies 13 (Fig. 4) and the flange is coined to final finished form. These dies have abutting or "kissing" surfaces 13*a* to limit their closing movement so that the flange will have a very precise predetermined thickness. They may be referred to as limit stop or bottoming dies, as may also the dies 11 in Fig. 2. The finished blank after the flange coining operation is referred to as W4. It is only necessary to machine the inner bore of this blank and this can be done very rapidly since the small diameter being machined permits very rapid rotation. The final machined form is illustrated in Figs. 5 and 6.

The blank W3 in final forged form is shown in Figs. 5, 6 and 8. It has a flange 15 which is formed with a plurality of narrow oppositely disposed annular ribs 16 and adjacent oppositely disposed depressions 17. The ribs before coining (Fig. 7) are somewhat rounded at the top with sides sloping toward the depressions and are coined by dies which have substantially flat faces. This results in the ribs being flattened at the top, as shown in Fig. 8. The ribs are sufficiently narrow to permit the metal to flow outward into the depressions during the coining operation without requiring undue force and without injury to the metal by undue distortion. By having the ribs disposed opposite each other the force of the opposed coining dies is solidly resisted through the metal of the flange and there is no spring-back or distortion of the flange. By stopping the coining action before the ribs and grooves have been eliminated, a flange of very precise thickness and without waviness is produced; whereas if the ribs were fully forced down into the body of material to form a smooth or plane surface this would not be possible. It is also to be noted that by providing projections uniformly around the flange from the outer edge inward for an annular zone, specifically annular ribs and grooves, the metal can flow principally in a radial direction outward to avoid unbalanced distortion or waviness in the flange.

As shown, three annular ribs separated by two annular grooves are provided on the flange. This is advantageous in the smooth seating of the flange with other wheel parts and also gives a good area for drilling the bolt holes 18 needed for securing the flange to adjacent wheel parts.

The described method of forming hubs is very fast and economical and makes superior hubs of very accurate shape and having a densified flange which is very strong. A minimum of machining operations is required,

only the inner surfaces of small diameter needing to be turned and this can be done at very high speed.

While one embodiment of the invention has been described and illustrated by way of example, it is to be understood that there may be other embodiments within the scope of the invention.

What is claimed is:

The method of forming a flanged hub to accurate flange thickness without waviness and with hard cold-worked face surfaces, which comprises, forging a blank to form a hub body having a flange with a plurality of radially spaced annular convex-topped raised portions and a plurality of intervening concave-bottomed shallow annular depressed portions extending in an annular zone from the outer edge inward completely around the flange on both of its sides or faces, the raised portions and depressed portions being disposed in opposition respectively on opposite sides of the flange, the flange being of uniform predetermined thicknes measured at the tops of the raised portions, and cold-striking the flange in the annular zone of said raised and depressed portions with limit-stop flat-faced dies to flatten the tops of said raised portions while leaving their lower or base portions and the depressed portions therebetween, to form a flange of predetermined thickness without waviness in said annular zone.

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