No. 866,026. PATENTED SEPT. 17, 1907.

J. M. HANSEN.

APPARATUS FOR FORGING CAR WHEELS.

APPLICATION FILED MAY 19, 1906.

2 SHEETS—SHEET 1.

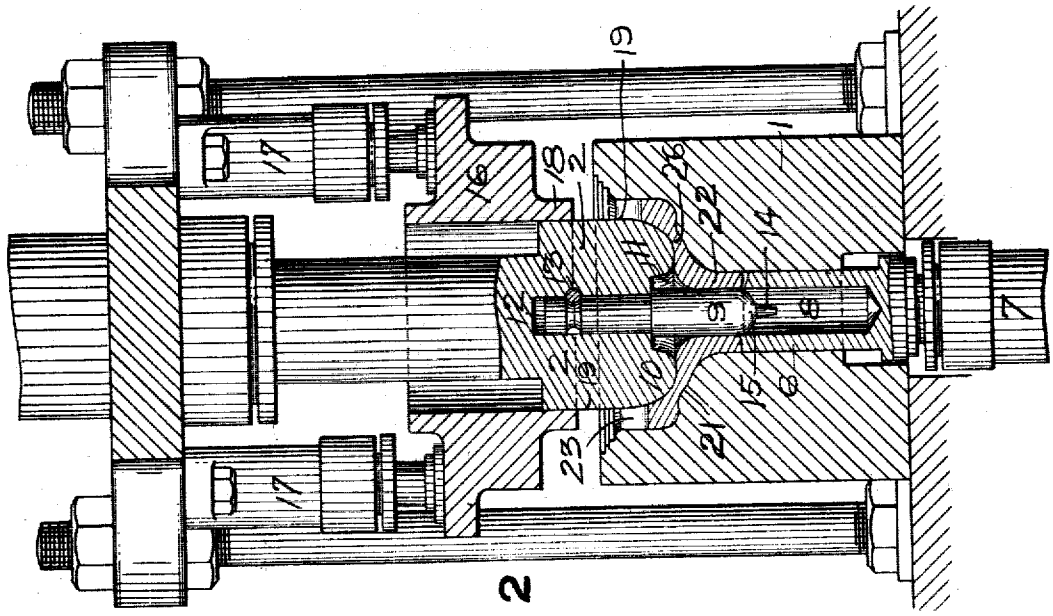


FIG. 2

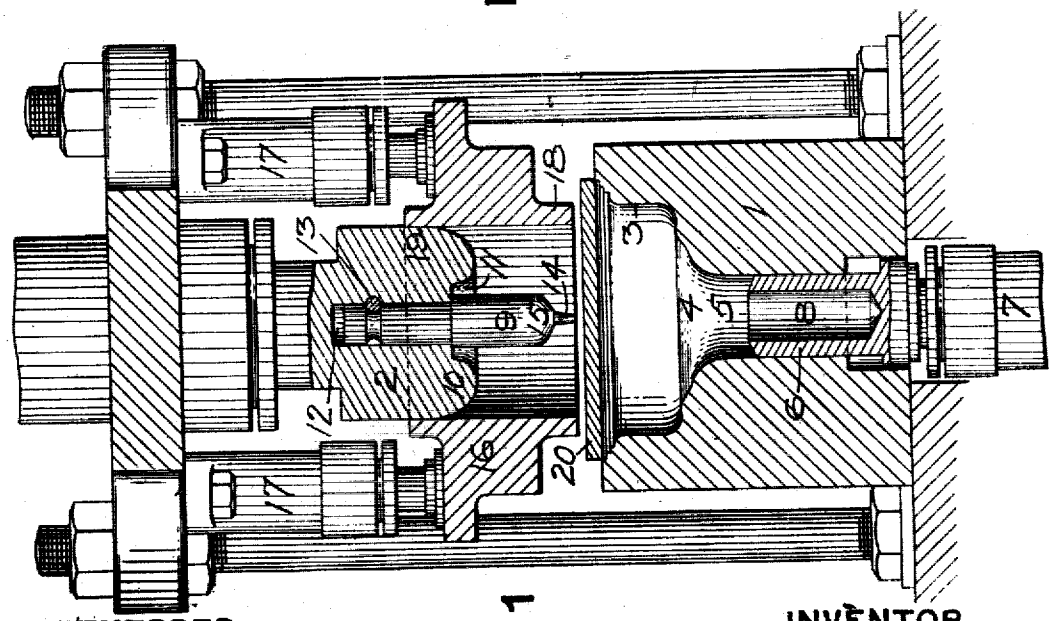


FIG. 1

WITNESSES.

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2 SHEETS—SHEET 2.

FIG. 5

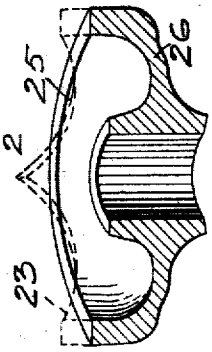
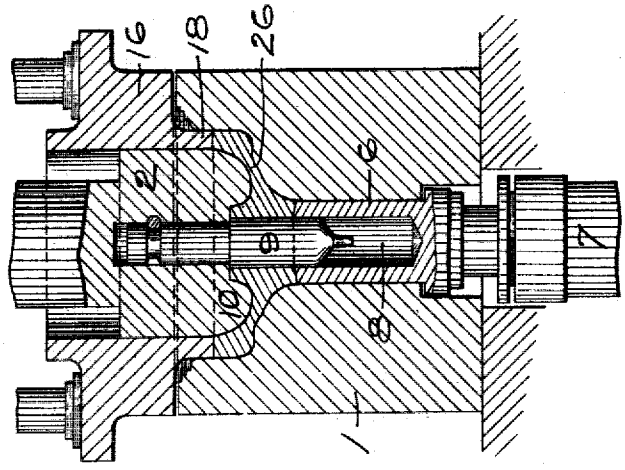



FIG. 4



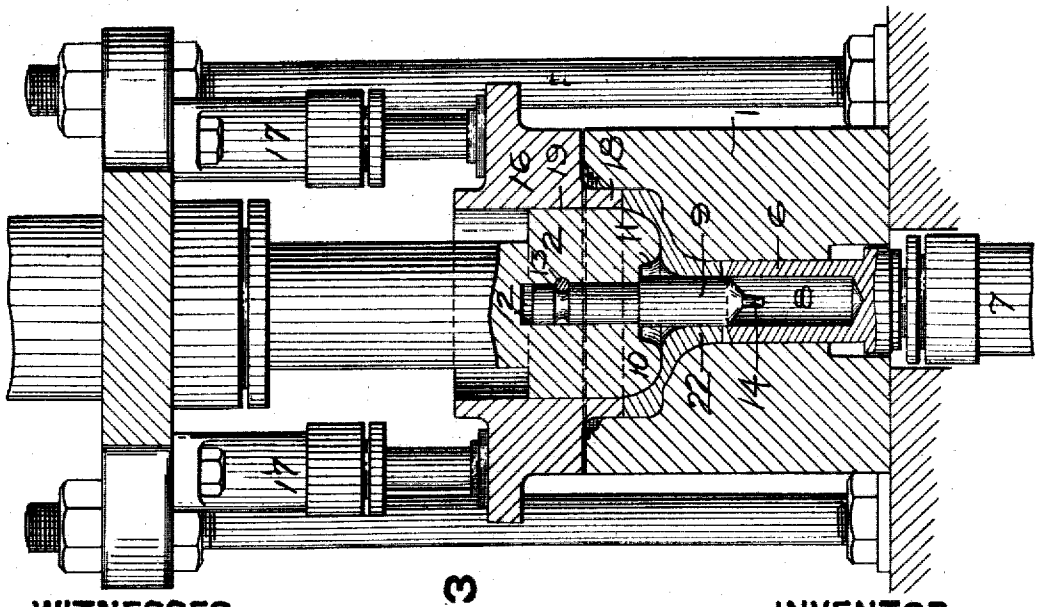




FIG. 3

WITNESSES.

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# UNITED STATES PATENT OFFICE.

JOHN M. HANSEN, OF PITTSBURG, PENNSYLVANIA, ASSIGNOR TO FORGED STEEL WHEEL COMPANY, OF PITTSBURG, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

## APPARATUS FOR FORGING CAR-WHEELS.

No. 866,026. Specification of Letters Patent. Patented Sept. 17, 1907.

Application filed May 19, 1906. Serial No. 317,739.

*To all whom it may concern:*

Be it known that I, JOHN M. HANSEN, a resident of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Apparatus for Forging Car-Wheels; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to apparatus for the manufacture of forged steel car and similar wheels. Its object is to provide apparatus for the thinning of the web portion, the development of the hub portion and the formation of the tread or rim portion by which wheels can be formed either from a circular blank or from a square or other polygonal blank without loss of metal and at minimum cost.

The apparatus is especially adapted for the practice of the method covered in an application filed by me of even date herewith, Serial No. 317,738 such being one of the specific methods set forth in another application filed by me of even date herewith, Serial No. 317,733.

The apparatus includes the employment of a bowl-shaped or female die having a central opening and an annular follower die arranged within said central opening, a convex or male die adapted to press the blank into the bowl-shaped die, and a piercing mandrel central of said male die adapted to pierce the blank and force it downwardly into the central opening of the female die, so that when the blank is so confined through the annular follower die the rudimentary hub formed by the piercing of the blank may be upset to form the hub of the wheel. Where the apparatus operates on a square or other polygonal blank I form the upper walls of the two main dies substantially vertical and provide an annular rim upsetting die around the upper male die so that after the blank has been carried down into the lower die and its outer edges turned upwardly this annular rim forming die will pass between the two main dies and compress the irregular edge portion of the blank, causing the metal of the angular or projecting portions thereof to flow laterally and fill up the depressed portions and thereby bring the blank to true circular form with an even top edge.

In the accompanying drawing Figure 1 is a vertical sectional view partly in full lines showing the dies; Fig. 2 is a similar view to Fig. 1 showing the upper or male die and piercing punch forced forward so as to forge the blank, turn it into bowl-shape and pierce it; Fig. 3 shows the rim forming die depressed and operating upon the upper angular edge portion of the bowl-shaped blank; Fig. 4 shows the lower annular die raised to upset the hub portion; Fig. 5 is a perspective view illustrated in full lines of completed blank, and in dotted lines the condition of the upper edge prior to the action of the annular tread forming die.

The apparatus comprises the lower main or female die 1 and the upper main or male die 2. The lower die is preferably bowl-shaped as shown, the upper wall thereof being vertical as at 3, below which is the curved portion 4 leading down to a central opening 5. In the drawing as shown the die 1 is stationary and passing upwardly through the same is the annular follower die 6 operated in any suitable way, such as by the hydraulic ram 7, this die 6 serving to upset the hub portion of the blank after it is pierced and having a central opening 8 for the reception of the piercing die 9.

The upper die 2 is provided with the annular projection 10 corresponding to the interior of the bowl-shaped blank as forged and having within the same the hub recess 11 which, as illustrated, operates in connection with the curved hub forming recess or base 4 of the bowl-shaped die 1. The piercing die 9 is adapted to operate centrally of the upper male die and can be mounted in any suitable way so as to engage with the central portion of the blank, pierce the same and in so doing force the metal of the central or hub forming portion of the blank entirely to one side thereof. I have illustrated this die as secured to the upper or male die 2 fitting within the recess 12 thereof and held by a suitable key 13. This mandrel 9 is provided with a piercing punch 14 at its lower end back of which the mandrel is curved or cone-shaped as at 15 to spread the metal after the piercing operation. It will be noticed that after the piercing of the blank this mandrel 9 enters within the central recess 8 of the follower die 6.

When operating upon a square or other polygonal blank in order to provide for the pressing of the upper edge thereof, to form an even top edge, as above described, I provide the annular rim forming die 16 which is shown as operated by suitable rams 17 and which fits closely around the male die 2, and the ring 18 of which, when forced down as shown in Figs. 3 and 4, enters within the space between the dies 1 and 2 fitting closely to the vertical wall 3 of the bowl-shaped die 1 and traveling along the vertical outer face 19 of the male die 2 and acting in its compressing stroke upon the upper edge of the blank when confined between said vertical faces 3 and 19. The ring 18 of the annular die 16 has a flat lower face as shown. Such annular rim forming die may of course be employed with any form of dies to operate upon any up-turned irregular edge portion in order to cause the lateral or peripheral flow of the metal and even up the top edge thereof.

The operation of forging the blank with the above-

described set of dies is as follows: The heated blank 20 is either a circular blank or an ordinary square slab such as would be cut from a rolled slab of steel, is brought to a forging heat and placed upon the lower die 1, as illustrated in Fig. 1. The upper die 2 then descends, forcing the blank downwardly into the bowl-shaped cavity of the die 1 and forging it into substantially bowl-shape, as shown at 21. The punch 9 in the construction illustrated descends with this upper die 2 and engages centrally with the blank, piercing the same by means of the piercing point 14 and then through its tapering lower end 15 forces the central or hub-forming portion of the blank downwardly and spreads it within the central opening 5 of the lower die, as shown at 22 Fig. 2. The steps to complete the blank with the apparatus above described are to upset the rudimentary hub 22 and to compress the irregular edge portion 23 and these steps can take place simultaneously or successively in any order desired. To form the hub the annular follower die 6 is forced upwardly as shown in Fig. 4, upsetting the rudimentary hub 22 and forcing it upwardly into the hub forming space 11 of the upper die 2, the hub thus being formed within said hub forming space 11 and the curved neck portion 4 at the base of the bowl-shaped die 1. If a circular blank has been employed this completes the operation of the apparatus. If, however, a square or other polygonal blank is employed it is necessary to even up the top edge of the blank and for that purpose the annular rim forming die 16 is forced downwardly so that its ring 18 enters between the vertical upper portion 3 of the lower die 1 and the vertical wall 19 of the upper die 2, and compresses or upsets the upper edge of the blank, as shown in Figs. 3 and 4. As shown in Figs. 2 and 5 the corner portions 24 of the polygonal blank have by the previous die forging operation been turned upwardly, leaving the depressions 25, said projections and depressions being shown in dotted lines in said figures, and in full lines in Fig. 3. Under the compression of this tread or rim forming die the metal of the projections 24 is caused to flow laterally or peripherally and filling the depressions 25 and so complete the blank. This operation of course can be applied to any polygonal bowl-shaped or concavo-convex blank. In this way the blank is brought within the dies to proper shape for completing the forging of the wheel, as fully described in said applications Serial Nos. 317,733 and 317,738. I am enabled by means of these dies to forge the blank to shape without loss of metal, utilizing the central portion of the blank for forming the hub, while thinning the web portion 26 thereof and forcing the metal thereof into the hub portion of the blank and, where a polygonal blank is employed, utilizing the metal of the corner portions thereof to fill out the depressions of the blank and thus enabling me to form a bowl-shaped blank from a square or like polygonal blank, and from a square blank of smaller width than is necessary in using a circular blank. I am also enabled by so compressing the edge portion of the polygonal blank to work the same and increase its density and toughness throughout the entire tread forming portion, improving such portion for the subsequent formation of a dense, tough, tread portion of the finished wheel.

What I claim is:

1. In apparatus for forging wheel blanks, the combination of a pair of dies each having a central hub forming cavity, a piercing mandrel adapted to pierce the blank and force it into one of said cavities, and a reciprocating annular follower die central of the main die and adapted to engage with the rudimentary hub formed by the piercing mandrel and upset the metal within the hub forming cavities of the dies and around the piercing mandrel.

2. In apparatus for forging wheel blanks, the combination of a female die and a male die having an annular projection and adapted to compress the blank within the female die and bring it to concavo-convex form, said dies each having a hub forming cavity, a piercing mandrel central of said dies and adapted to pierce the blank and spread it within one of said cavities, and an annular follower die adapted to engage with the rudimentary hub so formed and upset it within the die cavities of said bowl-shaped and male dies.

3. In apparatus for forming wheel blanks, the combination of an integral female die having a cavity provided with a substantially concavo-convex bottom and substantially vertical walls beyond the same, a male die adapted to enter the same and compress the blank, and an annular rim forming die fitting around the male die and adapted to enter between it and the outer wall of the female die and compress the upturned edge of the blank.

4. In apparatus for forming wheel blanks, the combination of an integral female die having a cavity with substantially vertical wall portions, a male die having a substantially vertical outer face of smaller diameter than the female die and arranged to enter the cavity thereof, and an annular rim forming die surrounding the male die and independently movable thereof and arranged to enter the annular space between the male and female dies.

5. In apparatus for forming wheel blanks, the combination of a female die having a cavity with substantially vertical wall portions and a central opening at the base thereof, a male die having a substantially vertical outer face of smaller diameter than the female die and arranged to enter the cavity thereof, a central piercing mandrel arranged to pierce the blank and spread it within the lower cavity of the female die, and an annular rim forming die surrounding the male die and independently movable thereof and arranged to enter the annular space between the male and female dies.

6. In apparatus for forming wheel blanks, the combination of a female die having a cavity with substantially vertical wall portions and a central opening at the base thereof, a male die having a substantially vertical outer face of smaller diameter than the female die and arranged to enter the cavity thereof, a central piercing mandrel arranged to pierce the blank and spread it within the lower cavity of the female die, an annular rim forming die surrounding the male die and independently movable thereof and arranged to enter the annular space between the male and female dies, and an annular follower die operating centrally of said dies and arranged to upset the metal around the piercing mandrel.

In testimony whereof, I the said JOHN M. HANSEN have hereunto set my hand.

JOHN M. HANSEN.

Witnesses:
F. W. WINTER,
ROBERT C. TOTTEN.