Feb. 14, 1933. C. S. SWANSON 1,897,646

PROCESS OF MAKING FORGED STEEL WHEELS

Original Filed May 11, 1931 2 Sheets-Sheet 1

Fig. 1.

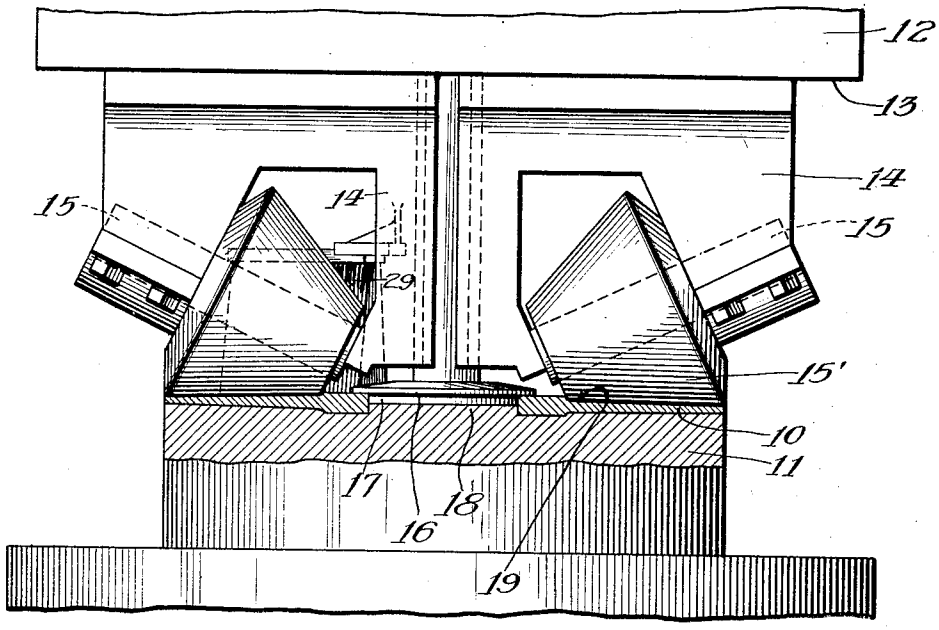

Fig. 2.

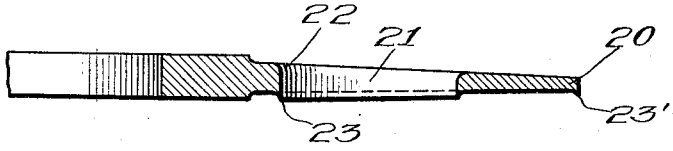

Fig. 3.

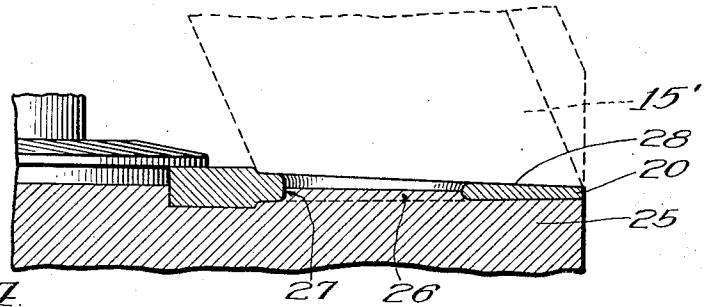

Fig. 4.

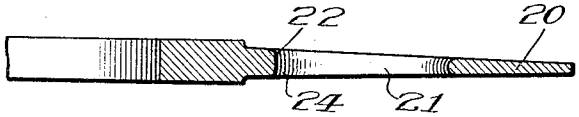

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Fig. 5.

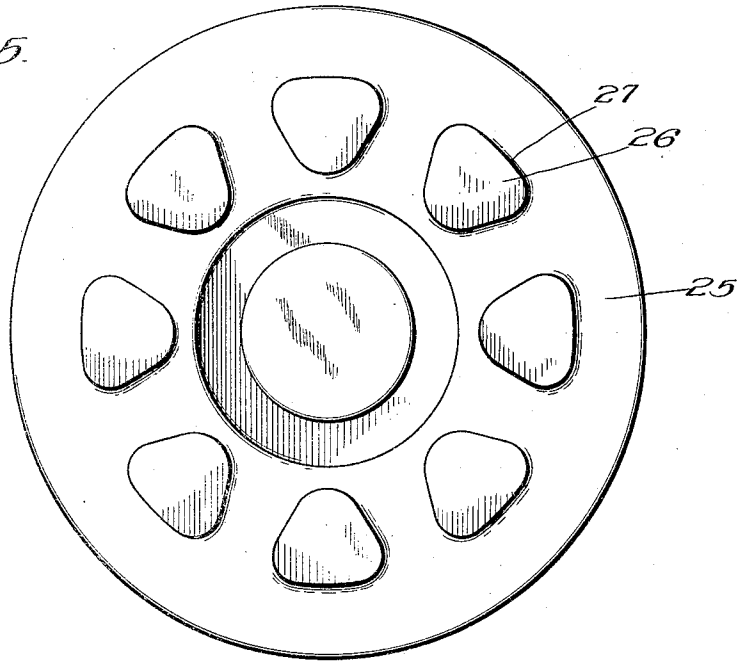
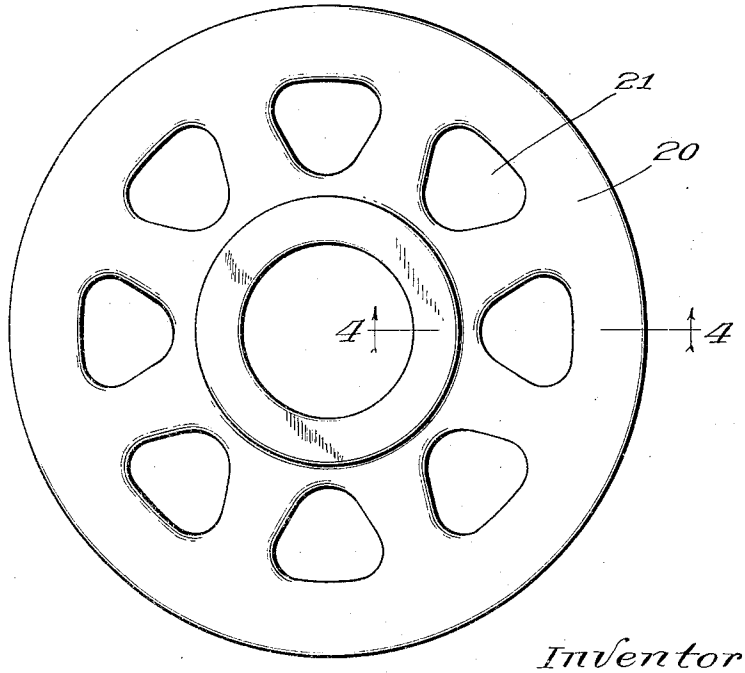


Fig. 6.



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Patented Feb. 14, 1933

1,897,646

UNITED STATES PATENT OFFICE

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PROCESS OF MAKING FORGED STEEL WHEELS

Original application filed May 11, 1931, Serial No. 536,324. Divided and this application filed January 25, 1932. Serial No. 588,623.

This invention relates to a process of making forged steel wheels. In practicing the process I preferably use apparatus such as shown and described in my co-pending application Serial No. 536,324 filed May 11, 1931, of which this application is a division.

My improved method, as well as the apparatus referred to in said co-pending application, may be used for producing solid discs, by which I mean discs which are non-apertured between their punched out hub centers and perimeters, or may be used for producing discs which are apertured inwardly of the perimeter to form spokes, the spokes being connected at their outer ends by a peripheral part of the metal which may be bent to form a rim flange.

Preferably the discs produced according to the present invention consist of a hub center having parallel sides and a web portion tapering from the hub center to the perimeter of the disc.

The main object of the invention is to economically produce forged steel discs for vehicle wheels, with smooth, well finished surfaces, free from scale and irregularities.

Another object is to provide means for accurately producing any desired predetermined contour of disc or web plate, free from distortions in contour which are commonly caused by the punching and trimming of the disc following the forging step.

My method of making forged steel discs of the character described comprises forging a metal billet into its intended disc contour between a pair of forging dies; then trimming and punching the forged disc in a press; and then ironing and sizing the disc, first on one side and then on the other, and simultaneously with the ironing step, removing the scale.

In the accompanying drawings an apparatus for carrying out the ironing and sizing step of the process has been shown, but the forging dies and the punching and cutting press have not been illustrated for the reason that these parts of the apparatus are well known in the art.

In the drawings:

Fig. 1 is a side elevation of an apparatus used in the ironing step of my process, the forged disc, in this view, being a solid disc, shown in section.

Fig. 2 is an enlarged section of part of an apertured disc, showing in slightly exaggerated form the contour of the metal, adjacent the aperture, following the trimming and punching step.

Fig. 3 shows the disc of Fig. 2 in place between the die and ironing rolls, the die differing from the die of Fig. 1 in order to properly shape the metal adjacent the aperture in the disc, as will be explained.

Fig. 4 is a sectional view of the disc of Fig. 2, after the ironing step has been completed, taken on the line 4—4 of Fig. 6.

Fig. 5 is a plan view of the die used in the apparatus for ironing apertured discs.

Fig. 6 is a plan view of an apertured disc.

In carrying out my improved method of producing forged discs for vehicle wheels, a heated metal billet which may be of any desired shape, but preferably is smaller in cross section and considerably thicker than the disc to be formed, is placed on top of a lower die which is rotatable in a horizontal plane. This part of the apparatus is well known. The face of the lower die is complemental to one side of the disc to be forged; in this instance it is provided with a central depression, circular in shape, which is complemental to the hub center of the disc before the hub center is centrally punched. Outwardly of this center, the die surface is radially inclined upwardly to conform to the taper of the disc between the hub center and perimeter. Cooperating with the lower rotatable die is a reciprocating upper die, the lower face of which may also be complemental to the contour of the side of the disc, or it may be provided with spaced, taper-forming vanes such as shown in Figs. 2 and 3 of the Jernberg Patent No. 1,710,058 of April 23, 1929. In fact, any desired forging apparatus by which the billet is shaped into a disc or web plate may be used for carrying out the forging step of the method.

The second step, namely, the trimming and punching step of the process, may be performed by any one of a number of well known

types of machines for this purpose. If a solid disc is desired, only the hub center of the forged disc is punched out and the perimeter is trimmed to form a true circle, but frequently portions of the disc between the hub center and perimeter are cut out to form spokes connected together at their outer ends.

Referring to Fig. 1, after the forging and the trimming and center punching steps have been accomplished, the disc 10 is placed upon a lower die 11 which is arranged to rotate in a horizontal plane. Any conventional driving gear for rotating the die 11 may be used. The die 11 is complemental to the hub center and tapered web portion of the disc 10. Above the die 11, in a frame (not shown) is mounted a slidable member 12 which has mounted in its face 13 a plurality of roll carriers 14 which carry shafts 15 on which are loosely mounted rotatable cone-shaped rolls 15′. In the present embodiment, two rolls 15′ are used. The slidable member 12 is connected with a pressure operated cylinder (not shown), by which the rolls are raised and lowered into juxtaposition to the disc 10. A hold-down disc 16 is also mounted in the member 12 and projects below the roll carrier 14. When the member 12 has been lowered by the pressure cylinder to its operative position, the hold-down disc 16 presses on the hub center of the forging 10 and its depending portion 17 fits into the center opening of the disc 10 and meets the centering projection 18 of the die 11. The rolls 15′ bear on the tapered surface 19 of the forging 10 in radially extending line contact therewith. The die 11, being rotatable, moves the forging 10 relatively to the rolls 15′ which are rotatable on the shafts 15, with the result that the surface 19 is ironed and rendered smooth, and irregularities in the surface and contour of the disc are corrected. After one side has been ironed and sized, the roll carrying mechanism is raised, the disc 10 is turned on its other side, the rolls lowered and the ironing operation is repeated.

When it is desired to produce an apertured disc 20, such as shown in Figs. 4 and 6, the trimming and punching step of the process is preferably performed by a machine in which the aperture cutters are so shaped that in passing downwardly through the metal to cut the apertures 21, a curved surface 22 will be formed adjacent each aperture 21 by means of the shape of the knife above its cutting edge. While it is possible to curve the metal surrounding the aperture margin at the upper side of the disc 20, that is, on the side into which the cutters first enter, the cutters necessarily leave a sharp edge at the opposite side adjacent the aperture. In fact, there usually is formed a small fin or downwardly projection 23 adjacent the lower side of the aperture 21 and a fin 23′ at the periphery, as a result of the punching and trimming operation, as will be seen by reference to Fig. 2.

In order to make the contour of the metal surrounding the apertures 21 uniform at both sides of the disc 20, and curved symmetrically, as indicated at 22 and 24 in Fig. 4, I provide means in the ironing apparatus for correcting the imperfections caused by the aperture cutting step. In Figs. 3 and 5 the die 25 used in the ironing step for treating apertured discs is provided with fixed pads 26 corresponding with the number and size of the apertures 21 in the disc 20. The pads 26 project upwardly from the face of the die 20 a distance substantially equal to one-half of the thickness of the tapered disc. The upwardly directed walls 27 of the pads 26 are curved and complemental to the curved surfaces 22 and 24 which it is desired to produce in the disc 20.

When the forged, apertured and trimmed disc 20 comes from the press, in the form shown in Fig. 2, it is placed on the die 25 with the pads 26 registering with the apertures 21. When the rolls 15′ have been lowered into position adjacent the inclined surface 28 of the disc 20, the fin 23 produced by the cutting operation is pressed between the die 25 and the rolls 15′ so that it assumes the desired curved form of the walls 27 of the pads 26 and thus the curved surface 24 is formed on the disc 20. The pressure on the rolls 15′ is such that the disc, as a whole, is straightened and its surface 28 is ironed, whereby a smooth, polished surface, free from irregularities and imperfections of contour, is produced. However, the disc having been initially forged to desired contour and thickness, this rolling operation is not carried out under pressure sufficient to distort the body of the metal, but only such pressure as will iron and smooth the surface of the disc. As heretofore stated, the ironing operation is practiced first on one side and then on the other side of the disc, and if the curved walls 22 as initially formed by the aperture cutters, are not perfect, they are made to match the walls 24 when the disc 20 is turned over for ironing on that side.

During the ironing step, water is sprayed on the rolls 15′ to keep the bearings cool. The water reaches the surface of the forging which is being ironed and the scale on the forging is cracked and removed simultaneously with the ironing of the disc surfaces. A steel wire brush 29 adapted to contact with the upper surface of the forging while it rests on the die 11 or 25 is mounted on an arm which is part of the member 14. As the forging is being rotated, the brush loosens the scale and an air current directed to the forging, carries the loosened scale off the forging and prevents it from being rolled into the surface of the disc.

Cooperating conical rolls have been used at

opposite sides of a parallel sided metal disc for the purpose of rolling it into radially tapered form, the metal body being distorted and the contour of the disc substantially altered during the rolling operation. In carrying out my invention, however, a billet is initially forged into tapered form, between a horizontally rotatable die and a vertically reciprocating die, to substantially the size and contour required, and the action of the rolls 15′ is an ironing or surface finishing action, as distinguished from a metal distorting rolling action. The ironing apparatus comprises a rotatable die and conical rolls such as herein described, in which rotation of the conical rolls about the shafts 15 is produced by the frictional engagement of the rolls 15′ with the upper surface of the forging which is carried by the rotatable lower die. By this construction, slipping of the rolls over the forging surface is avoided and wearing and pulling of the roll out of alignment are eliminated. The contact between the conical roll and the forging is a radially extending line contact. The roll is so designed that its speed of rotation is governed by the movement of the forging, and the speed is uniform, relatively to the forging, at any point along said line of contact, whether the point is nearer the hub or the periphery of the disc.

I claim:—

The method of finishing a rough forged wheel blank which has its web portion pierced from one side to the other at spaced points surrounding the wheel hub to form spoke-simulating portions, said piercing forming a projection or burr on said other side of the blank around the pierced portions, the method comprising ironing or burnishing said one side of the web and utilizing the pressure derived therefrom for simultaneously forging the projections or burrs into the material of the blank to shape and finish the edges of the spoke-simulating portions.

In testimony, that I, claim the foregoing as my invention, I affix my signature, this 20th day of January, 1932.

CLARENCE S. SWANSON.