March 11, 1930. J. W. HUGHES 1,750,176

METHOD AND APPARATUS FOR ROLLING TAPERED WHEEL DISKS

Filed Nov. 3, 1926 2 Sheets-Sheet 1

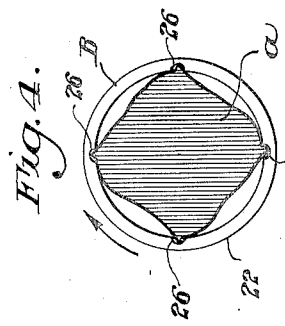



Fig. 4.

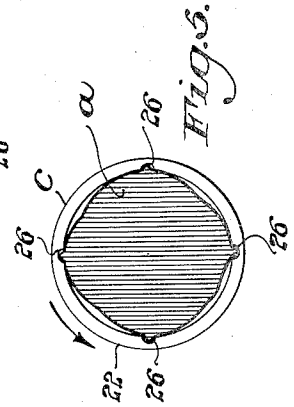



Fig. 5.

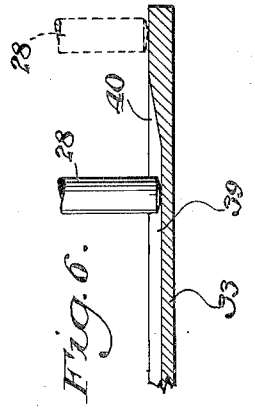



Fig. 6.

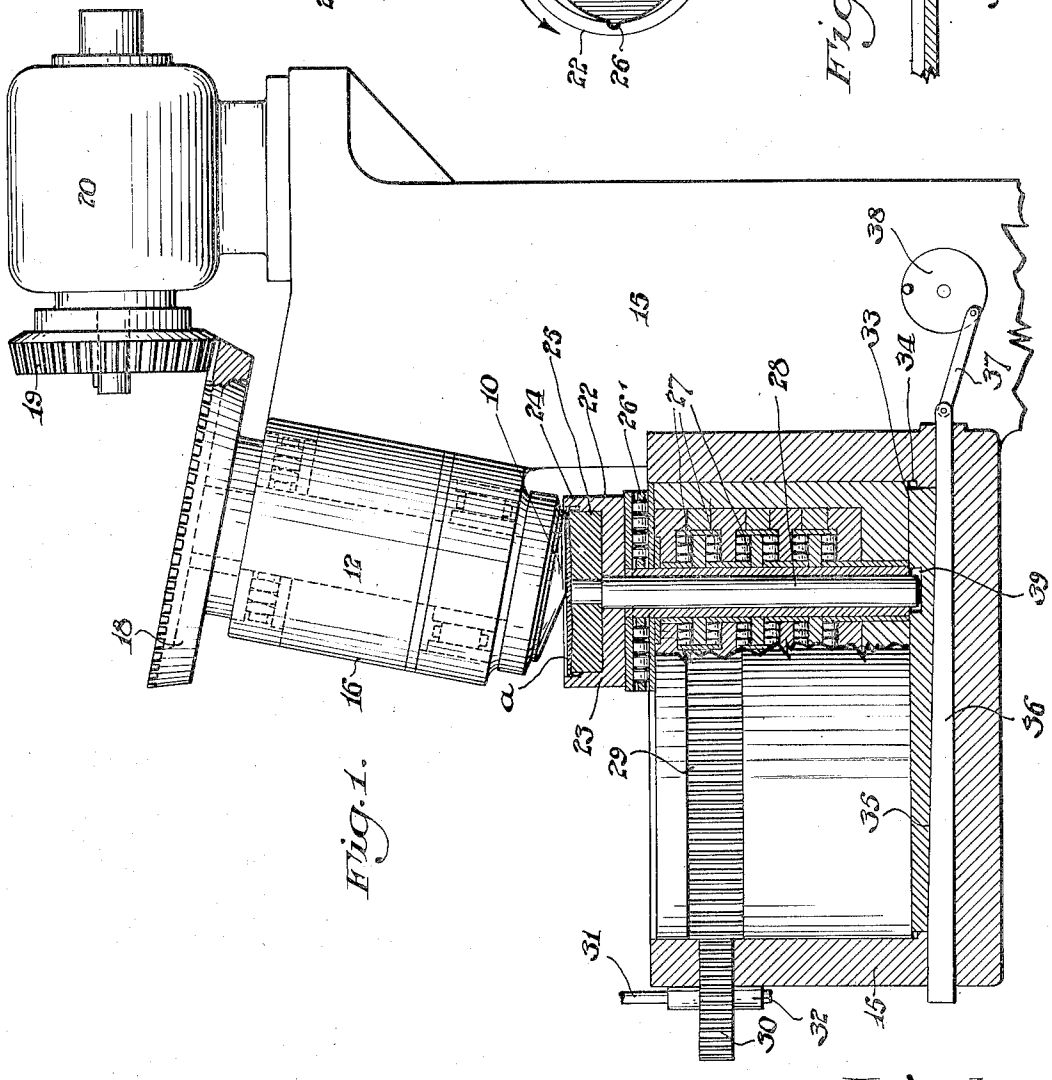



Fig. 1.

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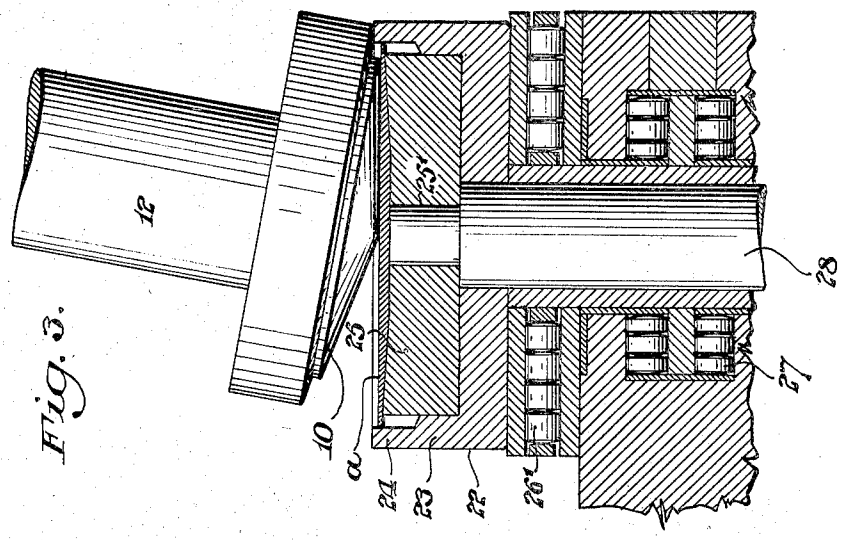



Fig. 3.

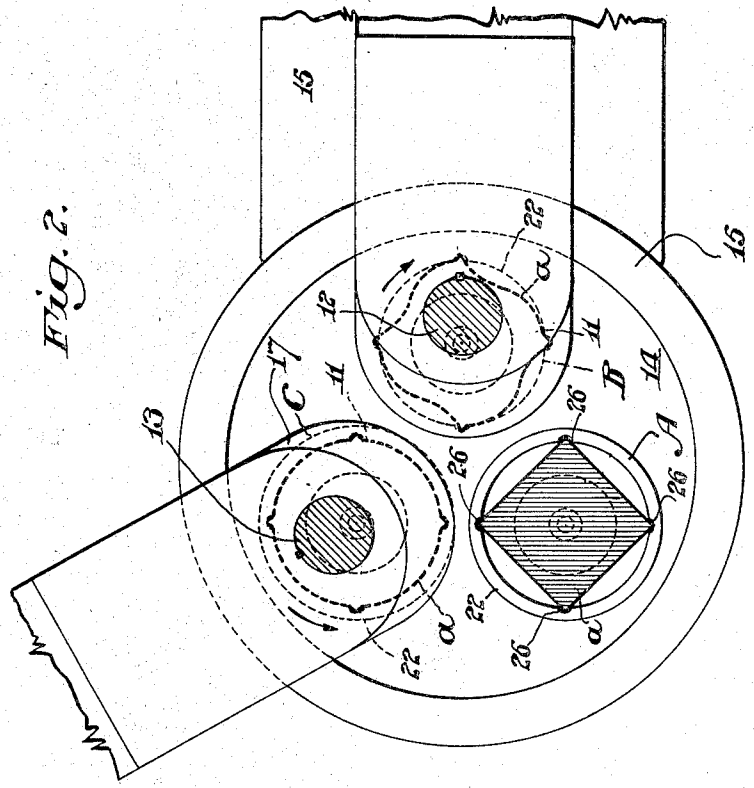



Fig. 2.

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# UNITED STATES PATENT OFFICE

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## METHOD AND APPARATUS FOR ROLLING TAPERED WHEEL DISKS

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The invention relates to a method of and an apparatus for rolling tapered metallic disks such as are used in the manufacture of motor vehicle wheels, and more particularly to a method of and apparatus for rolling such disks from square blanks.

It is an object of the invention to provide a method of and apparatus for rolling such disks, either singly or in packs, and to do this expeditiously so that only one heating of the blanks is necessary.

Other objects of the invention are the production of such disks with a minimum of handling, and an almost negligible waste of metal, and at a very rapid rate, thereby greatly lowering the cost of production.

Other and further objects and advantages will become apparent from the following description read in connection with the drawings illustrating one form of apparatus adapted to the carrying out of the method.

In the drawings which are of a diagrammatic nature, omitting well-known details of commercial machines:

Fig. 1 shows partly in side elevation and partly in vertical section a portion of a machine embodying one form of the invention. Fig. 2 represents a portion of such machine when viewed in plan.

Fig. 3 is a view similar to Fig. 1 showing parts thereof only, but on an enlarged scale.

Figs. 4 and 5 show the blank and the platen upon which it is supported at two different stages of the rolling operation.

Fig. 6 is a sectional detail of the means for raising the rolled disk or disks above the flanged edge of the platen.

The improved method consists in rolling a heated square blank or a pack of heated square blanks by subjecting the opposite sides of the blank or of the pack of blanks to a rolling pressure acting at one instant of time along a radial line and causing a rotation of the blank or blanks in one direction to effect the rolling of the entire surface of the blank, and, thereafter subjecting the blank or pack of blanks to a similar rolling action but with the blank and rolling elements rotating in the reverse direction. By suitably choosing the rolling pressures and the duration of the rotation of the blank or pack of blanks in either direction, the blank or the pack of blanks may be very quickly expanded into substantially circular disks having a contour dependent upon the contour of the surfaces of the rolls between which the rolling is effected.

In the form of apparatus disclosed in the drawings for carrying out the improved method, I have shown a plurality of conical faced rolls 10 and 11 secured to spindles 12 and 13 inclined to the vertical and arranged 120° apart above a turntable 14 rotatably supported in a bearing seat provided therefor in the massive frame 15 of the machine.

The spindles 12 and 13 of the rolls are supported in the portions 16 and 17 of the frame 15 overhanging the turntable 14. At their upper ends, these spindles are provided with large gears, as 18, which are adapted to mesh with smaller gears, as 19 driven by motors, as 20, see Fig. 1. The gearing and motors are not shown in Fig. 2, and Fig. 1 shows but one of the sets of gears and the motor cooperating therewith, it being understood that the construction of the driving mechanism for the two rolls is identical.

As indicated by the arrows in Fig. 2 it will be noted, however, that the spindles of the two rolls are driven in opposite directions.

The turntable 14 is shown provided with three rotatable platens 22 spaced 120° apart whereby two of these platens may be brought opposite the two rolls, respectively, while the third is in an intermediate loading and unloading position as indicated in Fig. 2.

As shown in Figs. 1 and 3, each platen comprises an outer portion 23 having a circumferential flange 24, and forms a cylindrical seat for a vertically slidable bed plate 25 the upper face of which has a slightly dished contour to conform to the taper which it is desired to give the disks being rolled. This construction permits the ready substitution of plates 25 having different contours if desired.

It will be noted by reference to the drawing that the inner periphery of the circum-

ferential flange 24 of each of the platens 22 is provided with four equally spaced niches or recesses 26 which are adapted to receive the four corners of the square blank or blanks being rolled, and thus provide a positive lock to prevent relative rotation of the blanks on the platen.

Each of the platens 22 has a downwardly extending sleeve connected thereto this sleeve and the main body of the platen being rotatably supported in the turntable by suitable antifriction bearings, as 26′ and 27. Within this sleeve is slidably mounted a shaft 28, the reduced upper end of which projects into a hole 25′ in the bed plate 25. From this construction, it will be obvious that the raising of the shaft 28 from the position shown in Fig. 1 also raises the bed plate 25 for a purpose to be described presently.

The turntable may be rotated by any suitable means, to bring the platens 22 successively opposite the respective rolls 10 and 11.

In the drawings, I have shown a conventional means consisting of a toothed zone 29 at the periphery of the turntable, meshing with a gear 30 secured to a shaft 31 journalled in bearings 32 secured to the shell surrounding the turntable. The shaft may be rotated by any suitable means to permit the rapid turning of the turntable to advance it a step of 120°.

When the turntable is being turned it is in a lowered position within its bearing seat in the frame from the position shown in Figs. 1 and 3, where the roll 10 and platen 22 are shown in operative rolling engagement with the opposite sides of a blank *a*. A suitable means may be employed to effect the approach and separation movements of the rolls and turntable and I have indicated a conventional means for this purpose in Fig. 1. Below the turntable is shown a plate 33 which is non-rotatably secured in the lower portion of the bearing seat of the turntable by a suitable means such as the spline 34. This plate 33 has formed in its under side one or more grooves, as 35, having an inclined upper surface, and this groove or grooves are adapted to receive the wedge or wedges, as 36. The reciprocation of these wedges 36, effects the raising and lowering of the turntable and thereby causes the approach and separation movements of the platens 22 and rolls 10 and 11. I have indicated the pitman 37 and the crank disk 38 as conventional means for reciprocating the wedge or wedges 36. It will be evident that, as the wedge is moved to the left from the position shown in Fig. 1 the turntable will be allowed to descend by gravity and the flanges 24 on the platens 22 beneath the rolls 10 and 11 will be lowered so as to clear the rolls. The turntable can then be rotated.

To lift the finished disk or disks above the flange 24 of the platen and thus permit its easy removal, the plate 33 is provided on its upper face with a cam groove 39 within which the lower ends of the shafts 28 project. At one point, between the position of the finishing roll 11 and the loading position between the two rolls 10 and 11, the cam groove 39 has a raised portion, as indicated at 40, in Fig. 6. As the turntable is rotated the lower end of the shaft 28 adjacent said raised portion 40 rides up the inclined side thereof to the position indicated by the dotted lines Fig. 6. In this dotted line position, the shaft has raised the bed plate 25 so as to bring its upper surface flush with or above the circumferential flange 24 of the turntable, when the disk or disks seated thereon may be readily removed.

The operation of the improved apparatus is as follows:

Assuming the rolls 10 and 11 to be continuously driven in opposite directions as shown by the arrows, Fig. 2 and the turntable to be located in the position shown in said figure, and in its lowered position, a heated blank or a stack of heated blanks is placed upon the platen 22 at the loading position at station A, so that the four corners of the square blanks fit into the recesses 26 and thus lock the blanks against rotation relative to the platen. The turntable is then quickly rotated through 120° to bring this loaded platen under the roll 10 at station B. The turntable is then raised to subject the opposite sides of the blank or the stack of blanks to the rolling action of the rotating roll 10. If sufficient pressure is brought to bear upon the blank, after one complete revolution of the platen, the blank will have been rolled to a shape somewhat as indicated in Fig. 4 and in dotted lines in Fig. 2. It is obvious that several revolutions of the platen may be made if necessary, before the desired rolling action is had, but this is a matter which can be varied to suit conditions. While the blank is being rolled at station B, the platen at station A is being loaded, and when the rolling operation at station B is completed, the turntable is lowered, and quickly rotated through another step of 120° to bring the partly rolled blanks, as shown in Fig. 4, under the roll 11 at station C and the unworked blanks under the roll 10 at station B. When the turntable is now raised, rolling will take place at both stations B and C, and the blank or blanks at station C will, after one or more revolutions, depending on conditions of pressure and plasticity of the metal, be formed to the substantially circular shape shown in Fig. 5 and in dotted lines in Fig. 2 and to the taper of the bed plate 25. While rolling was taking place at stations B and C, the third platen 22 was being loaded at station A, and when the turntable is now lowered and again rotated through 120° the finished disks *a* leaving station C are lifted by

raised portion 40 in cam groove 39 above the flange 24 on the platen, where they can be readily removed and replaced by an unworked blank or blanks at station A. The operation may now be continuous as long as blanks are supplied to each successive platen when it reaches station A.

While I have herein described a method of rolling metal disks from square heated blanks, it will be understood that the method may also be practiced with cold blanks if the plasticity of the metal is such as to secure adequate flow under the rolling pressures, and while I have described a specific form of apparatus for carrying out this method, it will be understood that changes and modifications may be made, which will fall within the spirit of my invention, and I aim to cover such changes and modifications in the the claims appended hereto.

What I claim is:—

1. The method of rolling metal disks from substantially square blanks which consists in subjecting a blank to the action of a pair of oppositely rotating rolling elements acting, at a given instant, upon the opposite sides of the blank along a line extending from approximately the center to the periphery of the blank, and rotating the blank in one direction until the entire peripheral portion of the blank has been subjected at least once to the action of such rolling elements, and thereafter subjecting the blank similarly to the action of rolling elements rotating in reverse directions.

2. The method of rolling metal disks from substantially square blanks which consists in subjecting a blank to the action of opposed rolling elements rotating in opposite directions and acting, at a given instant, upon the blank along a substantially radial line extending from the periphery of the blank toward the center, said rolling action continuing until the entire peripheral portion of the blank has been subjected at least once to the action of such rolling elements, and thereafter subject said blank similarly to the action of rolling elements rotating in reverse directions.

3. The method of rolling metal disks from substantially square blanks, which consists in projecting a rolling element against one side of a blank, suitably supported on its other side, to subject the blank to rolling pressure acting on the blank, at a given instant, along a line extending from the periphery to a point adjacent the centre of the blank, rotating said blank and roll in one direction while maintaining the rolling pressure until the entire peripheral portion of the blank has been subjected at least once to the rolling action of the rolling element, and thereafter subjecting the blank similarly to the action of a rolling element while said blank and element are relatively rotating in reverse directions.

4. The method of rolling tapered disks from substantially square blanks which consists in non-rotatably seating said blank on a support, then by relative approaching movement of said support and a rolling element subjecting the blank to a rolling pressure along a line of substantial length extending from a point near the center to the periphery of the blank, and while maintaining said pressure, rotating said support and roll in one direction, then subjecting the blank to a similar rolling action while relatively rotating the support and the roll then coacting with the support in reverse directions.

5. The method of rolling tapered metal disks from substantially square blanks which consists in securing a blank against rotation on a plane having a surface conforming to the contour to be given the blank, then bringing a conical faced roll into position to act upon the blank with a rolling pressure along a line extending from a point adjacent the center of the blank to its periphery, relatively rotating said platen and roll, while the rolling pressure is maintained, to a predetermined extent in one direction and then subjecting the blank to a similar rolling action, but with the platen and the roll then acting thereon rotating in reverse directions.

6. The method of rolling tapered metal disks from substantially square blanks, which consists in subjecting the blank while held against rotation relative to a rotating support, to the action of a roll rotating in one direction and acting, at a given instant, upon the blank along a line extending from the periphery toward the center of the same, and thereafter subjecting the blank to the similar action of a roll rotating in the opposite direction.

7. The method of forming tapered disks which consists in successive rolling of a blank, first in one direction, then in the reverse direction, between opposed rotatable dies, which contact with said blank along substantially radial lines.

8. In a machine for rolling thin metal disks, the combination of a rotary support for a blank, a pair of rolls, means for successively bringing said blank into operative engagement with the the rolls to force the metal of the blank outwardly, and means for rotating said rolls in different directions with regard to said blank.

9. In a machine of the class described the combination of a rotary support for a blank, a pair of oppositely rotating rolls with regard to said blank, each adapted to be successively projected against the blank to roll the same, and means for so projecting the rolls successively against the blank, each for a predetermined time sufficient to permit sub-

stantially the entire surface of the blank to be rolled.

10. In a machine of the class described, the combination of a rotary support for a blank, a pair of oppositely rotating rolls adapted to coact successively with said support to subject the blank, at a given instant, to a rolling pressure along a substantially radial line extending from the periphery of the blank inwardly toward the center, and means for successively bringing said rolls into operative relation to said blank and support.

11. In a machine of the class described, the combination of a rotary support for a blank and means for securing the blank against rotation relative to the support, a pair of oppositely rotating rolls adapted to coact successively with said support to subject the blank, at a given instant, to a rolling pressure along a line extending from a point near the center to the periphery, and means for successively bringing said rolls into operative relation to said blank and support, said last named means including a turntable carrying said support.

12. In a machine of the class described, the combination of a plurality of rotary supports for blanks, a plurality of oppositely rotating rolls adapted to coact successively with said supports, a turntable carrying said supports and adapted to bring the same in operative relation to the rolls, and means for causing relative approach and separation movements between said rolls and the turntable whereby when the supports have been brought, one into cooperative relation with each roll, they may coact therewith to effect the rolling of the blanks.

13. In a machine of the class described, the combination of a rotary support for a blank and means for securing the blank against rotation relative to the support, a pair of oppositely rotating rolls adapted to successively rotate the work in opposite directions, and means for successively projecting said rolls into working relation with the blank and support.

14. In a machine of the class described, the combination of a turntable, rotary work supports carried at equally-spaced intervals by said turntable, a pair of oppositely rotating rolls spaced the same interval as said work supports, means for bringing the rolls into cooperative relation with two work supports by a relative approach of the work supports and roll, and means for advancing the turntable a step to bring two successive supports into cooperative relation to the said rolls.

15. A machine for rolling metal disks from substantially square blanks comprising a pair of oppositely rotating rolls, a rotary blank support, and means for successively bringing said rolls into cooperative relation to said support whereby to successively roll the blank in opposite directions.

16. A die for holding a polygonal blank to be acted upon by a companion die by a rolling process, comprising a depressed portion of the configuration of the finished piece, a peripheral wall and notches in said peripheral wall adapted to receive the corners of said polygonal blank, and prevent rotation thereof relative to the said die.

17. In apparatus of the character described, a turntable having a plurality of spaced rotatable work supports, a plurality of similarly spaced rotatable die carrier means for rotating said die carriers and work supports, means for causing successive registration of said die carriers and work supports, and means operated by such registering movement for removing work from said work supports.

In testimony whereof he hereunto affixes his signature.

JAMES W. HUGHES.