May 14, 1940. O. M. WHITTEN 2,200,569

METHOD OF FORMING ANNULAR BLANKS TO A PREDETERMINED CROSS SECTIONAL CONTOUR

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Fig. 5.

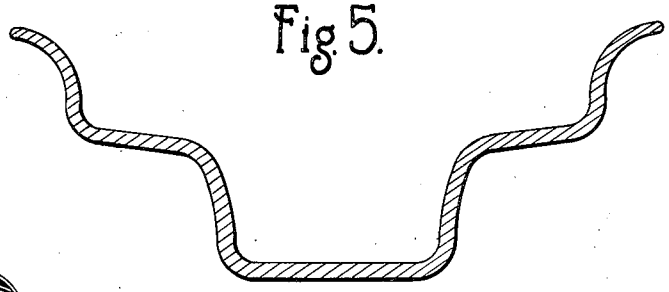


Fig. 1.

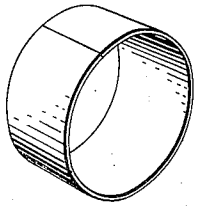
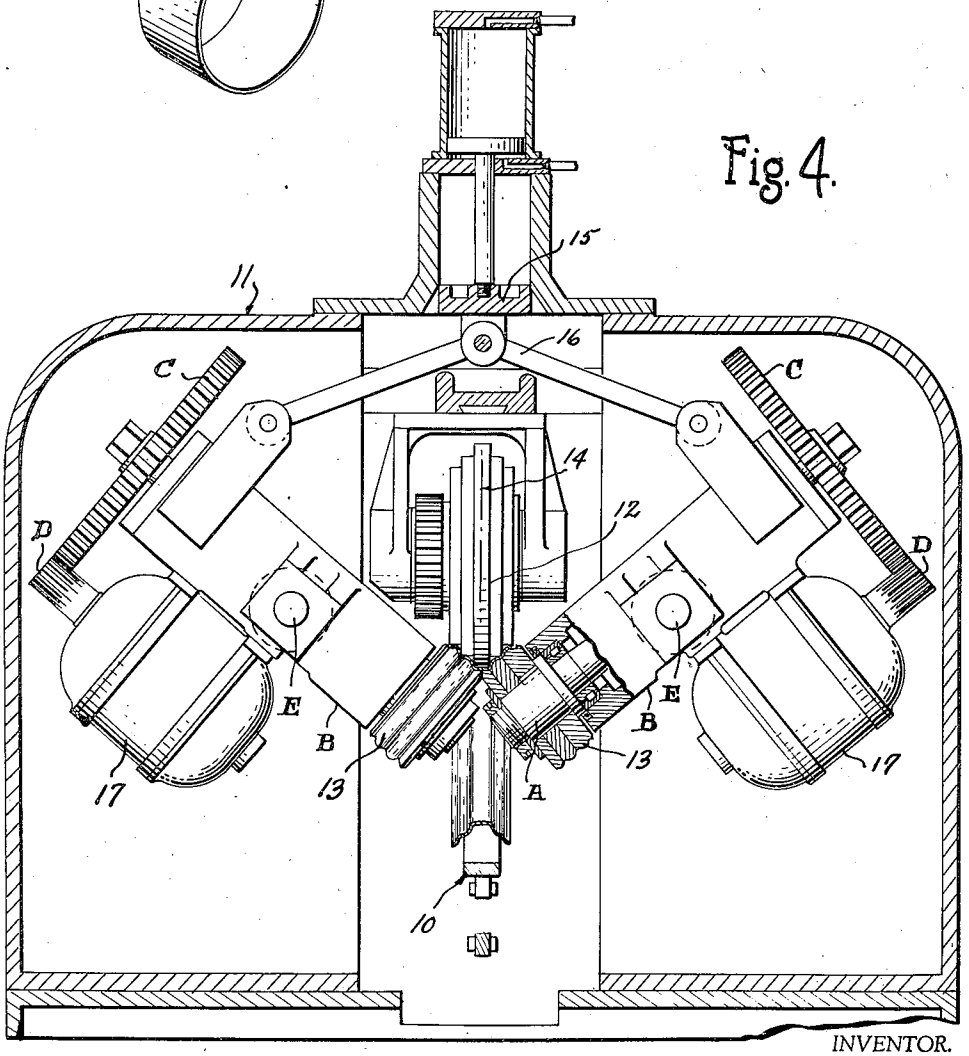


Fig. 4.



INVENTOR.
Owen M. Whitten
BY Whittemore Hulbert & Belknap,
ATTORNEYS.

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Fig 2.

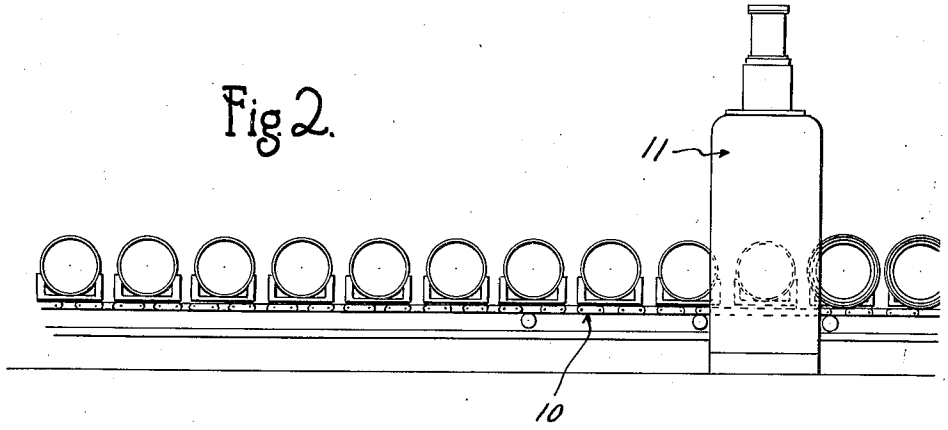
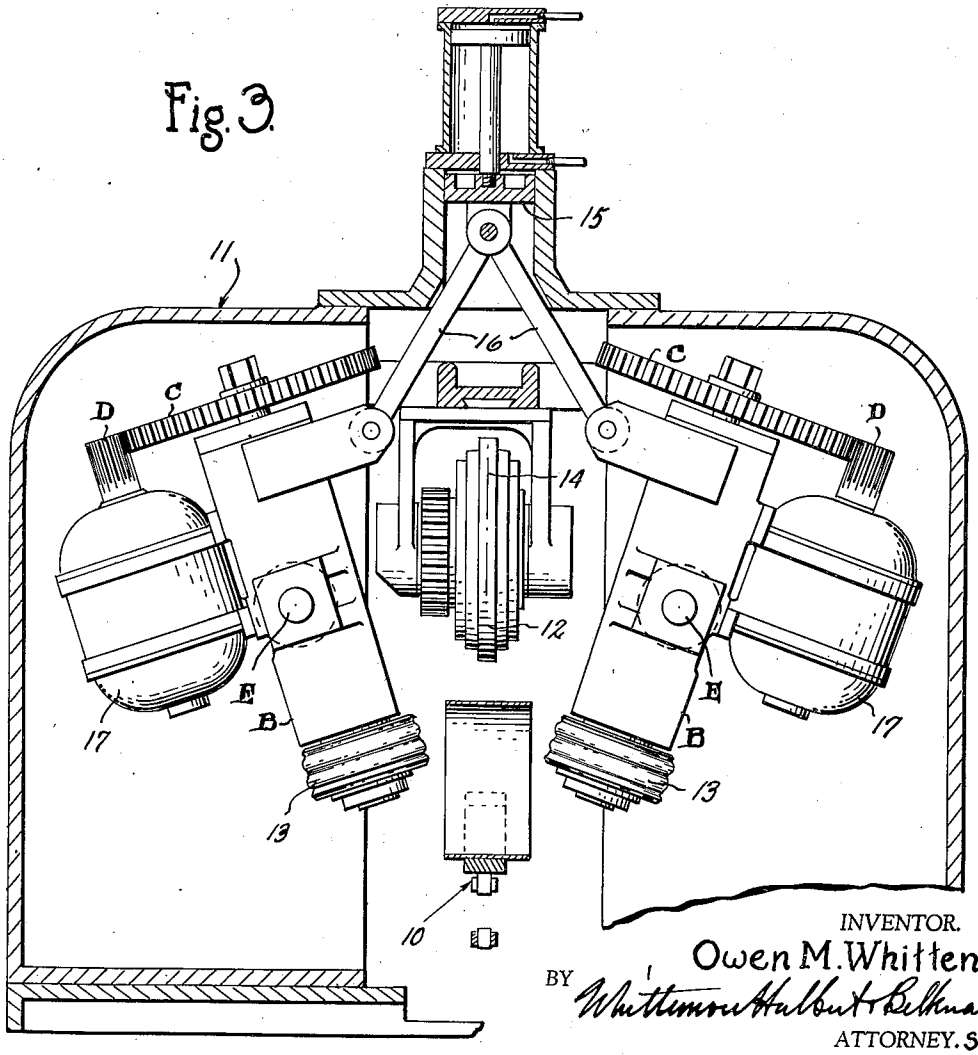


Fig 3.



INVENTOR.
Owen M. Whitten
BY Whittemore Hulbert & Belknap
ATTORNEYS

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METHOD OF FORMING ANNULAR BLANKS TO A PREDETERMINED CROSS SECTIONAL CONTOUR

Owen M. Whitten, Detroit, Mich., assignor to Kelsey-Hayes Wheel Company, Detroit, Mich., a corporation of Delaware

Application June 21, 1937, Serial No. 149,508

8 Claims. (Cl. 153—28)

This invention relates generally to the manufacture of annular members of predetermined cross sectional contour and refers more particularly to an improved method of forming vehicle wheel rims of the drop center type.

It is one of the principal objects of this invention to materially simplify the manufacture of annular members of predetermined cross sectional contour, such as drop center wheel rims, by reducing the number of operations to a minimum and thereby correspondingly reducing the equipment required. In accordance with this invention, an annular blank of selected dimensions is rolled to the desired cross sectional contour in one operation without overworking, or otherwise detrimentally affecting the metal. This is accomplished in the present instance by engaging the annular blank intermediate the ends and at one side thereof with a master and by fashioning the portions of the annular blank at opposite ends of the first mentioned portion by means adapted to cooperate with the master and adapted to move at an angle thereto.

Another advantageous feature of the present invention which contributes materially to simplifying the method of manufacture and reducing the required equipment consists in successively advancing a plurality of blanks to a position for engagement with the cooperating means when in inoperative position, thereafter lifting the blanks from the advancing means into engagement with the master by the cooperating means, and then fashioning the blanks.

Another object of the invention resides in the provision of a method of manufacture wherein the metal of the blank forming the fashioned portions is expanded and gradually tapered toward the ends of the blank during the fashioning operation. This feature is of importance since it offers the possibility of securing a rim possessing the maximum strength and the minimum weight.

A further object of the invention resides in effecting the fashioning of the blank by a rolling operation to thereby enhance the appearance.

The foregoing, as well as other objects will be made more apparent as this description proceeds, especially when considered in connection with the accompanying drawings, wherein:

Figure 1 is a perspective view of a sheet metal blank from which a drop center rim is formed in accordance with this invention.

Figure 2 is a diagrammatic side elevational view illustrating the conveyor for successively advancing the blanks to the rolling machine;

Figure 3 is a semi-diagrammatic cross sectional view of the cooperating forming rolls for fashioning the blank to the desired cross sectional contour;

Figure 4 is a view similar to Figure 3 illustrating the manner in which the blank is rolled in one operation to the desired cross sectional contour; and

Figure 5 is a cross sectional view through a drop center rim formed by the present method.

Although it will be apparent as this description proceeds that my improved method is not limited to forming an annular blank to the cross sectional contour of a drop center vehicle wheel rim, nevertheless, I have selected this particular embodiment of the invention for the purpose of illustration because drop center vehicle wheel rims require considerable working of the metal and offer complicated problems to forming the same in one operation from an annular blank.

In accordance with this invention, a strip of sheet metal of the desired length and width is hooped to form an annulus, and the free ends are welded together to provide an annular and more particularly a cylindrical blank of the type shown in Figure 1. After the flash resulting from the welding operation is removed, the blanks are advanced by a suitable conveyor 10 to successively position the same in operative relation to a machine 11 for fashioning the blanks. As the blanks are successively advanced into operative relation with respect to the machine, they are successively lifted from the conveyor and are formed or fashioned to the predetermined cross sectional contour shown in Figure 5 by one continuous operation.

The manner in which the foregoing is accomplished will perhaps be more fully understood upon considering the operation of the machine selected herein for carrying out my improved method. The machine is a rolling machine, which as diagrammatically shown in Figures 3 and 4, comprises a master roll 12 supported directly above the path of travel of the blanks for rotation about a fixed axis. It will be noted from Figure 3 that the periphery of the master roll 12 corresponds to the cross sectional contour of the fashioned rim shown in Figure 5 and is spaced above the conveyor a distance greater than the diameter of the annular blanks in order to provide sufficient clearance for movement of the blanks therebeneath, both before and after the blanks are fashioned.

In addition, it will be noted that the rolling machine is also provided with a pair of contin-

uously rotated rolls 13 which are adapted to cooperate with the master roll 12 and are mounted upon opposite sides of the median plane of rotation 14 of the master roll for angular movement or movement at an angle to the median plane between the inoperative and operative positions shown in Figures 3 and 4, respectively. As will be observed from these figures, the peripheral surface of each of the cooperating rolls corresponds substantially to one-half of the peripheral cross sectional contour of the master roll. Upon reference to Figure 3, it will be noted that the cooperating rolls are mounted in such a manner that when they are in their inoperative positions, sufficient space is provided between the rolls to permit the passage of the blanks therebetween.

The conveyor 10 may be operated to advance the blanks by a step-by-step or by a uniform movement into operative relation to the cooperating rolls 13 when the latter are in their inoperative positions shown in Figure 3. When a blank is in operative relation, the cooperating rolls, which are being continuously rotated, are swung about their respective pivots in directions toward the master roll 12 and during initial movement of the cooperating rolls toward the master roll, the former extend partially into opposite ends of the blank and engage its inner surface at the top to lift the blank into contact with the periphery of the master roll. The blank is accurately positioned by the cooperating rolls so that its median plane of rotation coincides with the median plane of rotation of the master roll. If desired, the machine may also be provided with suitable guides for engaging the ends of the blank to properly position the same. This insures proper engagement of the blank with the master roll which first engages the intermediate portion of the blank so that as the cooperating rolls continue their angular movement toward the median plane of the master roll, the metal of the blank at the opposite ends of the intermediate portion is worked by the cooperating rolls. The cooperating rolls are continuously moved toward the master roll until the rolls assume the relative positions shown in Figure 4, wherein the blank assumes the desired cross sectional contour. The cooperating rolls are then swung about their respective pivots in a direction away from the median plane of rotation of the master roll to their inoperative positions shown in Figure 3, and the fashioned rim is returned to the conveyor, after which the next blank is brought into operative relation to the machine.

It follows from the foregoing that the cooperating rolls 13 lift the blank into cooperative relation to the master roll 12 and roll the blank to the desired cross sectional contour in a single operation. It will also be noted from the foregoing description that the cooperating rolls move at an angle to the median plane of rotation of the master roll into engagement with the blank to effect the rolling operation and this feature is largely responsible in permitting the blank to be rolled in a single operation without overstressing or otherwise harming the metal. It will further be noted that the cooperating rolls expand the fashioned portions of the blank and stretch the metal to such an extent as to effect a gradual taper of the metal from the intermediate portion toward the opposite ends of the blank.

Although it is to be understood that the method of manufacture forming the subject matter of this invention is by no means limited to the apparatus briefly defined above, nevertheless, for the purpose of illustration, the cooperating rolls 13 are shown as movable throughout their respective angular paths by means of a fluid pressure actuated cross head 15 and toggle linkage 16 connecting the cross head to the roll carrying spindles. The cooperating rolls are adapted to be continuously rotated by the electric motors 17. Briefly described, each roll 13 is provided with a section keyed to one end of a spindle A which, in turn, is rotatably supported in a casing B and has a gear C secured to the opposite end for meshing engagement with a pinion D secured to the shaft of the motor 17. The casings B are pivotally supported on the machine frame, as at E, on opposite sides of the forming roll 14 to provide for the angular movement aforesaid of the cooperating forming rolls 13, and a motor 17 is suitably mounted on each casing for movement as a unit with the rolls 13. While plain rolls may be used, it will be noted from the drawings that each of the rolls are formed of a plurality of sections adapted to rotate relative to each other and also that the sections of the cooperating rolls cooperate with corresponding sections of the master roll to impart the desired contour to the blank. By reason of this construction, the different peripheral speeds of the rolls is compensated for and rubbing of the metal by the rolls is minimized.

While in describing this invention, particular stress has been placed upon forming the complete rim in one operation, nevertheless, it is to be understood that in forming certain types of rims it may be advisable to employ a second operation to secure the desired contour. In cases where it is desired to employ a second operation, this operation may be similar to the one previously described and form a continuation thereof. Accordingly, reservation is made to make such changes in the method as may come within the purview of the accompanying claims.

What I claim as my invention is:

1. Those steps in the method of forming an annular blank to a predetermined cross sectional contour, which consist in successive advancing a plurality of blanks to a forming station, and successively fashioning the blanks by engaging rolls with the inner surface of the wall of a blank adjacent opposite ends of the latter and moving said rolls in a direction to lift the blank from said advancing means, and opposing the force exerted on the blank by the rolls with an oppositely acting force as movement of the rolls is continued.

2. Those steps in the method of forming an annular blank to a predetermined cross sectional contour, which consist in successively advancing a plurality of blanks to a forming station, and successively fashioning the blanks by engaging rolls with the inner surface of the wall of a blank adjacent opposite ends of the latter and moving said rolls in a direction to lift the blank from said advancing means, opposing the force exerted on the blank by the rolls with an oppositely acting force as movement of the rolls is continued, and subsequently allowing the blank to return to the advancing means by withdrawing the rolls.

3. Those steps in the method of forming an annular blank to a predetermined cross sectional contour, which consist in successively advancing a plurality of blanks to a forming station, successively lifting the blanks from the advancing means at the forming station by moving rolls at an angle to the median plane of the blank into engagement with the inner surface of the wall of

the blank adjacent opposite ends of the latter, continuing the movement of said rolls in a direction to lift the blank from the advancing means, and opposing the force exerted on opposite end portions of the blank by said rolls with a force applied to the outer surface of the wall of the blank intermediate the rolls.

4. Those steps in the method of forming a cylindrical blank to a predetermined cross sectional contour, which consist in successively advancing a plurality of blanks to a forming station, successively lifting the blanks from the advancing means at the forming station by moving rolls at an angle to the median plane of the blank into engagement with the inner surface of the wall of the blank adjacent opposite ends of the latter, continuing the movement of said rolls in a direction to lift the blank from the advancing means, opposing the force exerted on opposite end portions of the blank by said rolls with a force applied to the outer surface of the wall of the blank intermediate the rolls, and subsequently withdrawing the rolls to permit the formed blank to lower onto the advancing means.

5. Those steps in the method of forming an annular blank to a predetermined cross sectional contour, which consist in successively advancing a plurality of blanks to a forming station, successively lifting the blanks from the advancing means as the blanks assume positions at the forming stations by moving cooperating forming rolls in converging paths into opposite ends of the blank and into engagement with the inner surface of the opposite end portions of the blank, and opposing the lifting movement of the blank by the cooperating forming rolls to fashion the blank to a predetermined contour.

6. Those steps in the method of forming an annular blank to a predetermined cross sectional contour, which consist in successively advancing a plurality of blanks to a forming station, successively lifting the blanks from the advancing means as the blanks assume positions at the forming station by moving cooperating forming rolls in converging paths into opposite ends of the blank and into engagement with the inner surface of the opposite end portions of the blank, and fashioning the blank to a predetermined contour during the lifting movement by applying a rolling pressure to the outer surface of the blank in opposition to the lifting force exerted by the cooperating rolls.

7. Those steps in the method of forming an annular blank to a predetermined cross sectional contour, which consist in successively advancing a plurality of blanks to a forming station, successively lifting the blanks from the advancing means as the blanks assume positions at the forming stations by moving cooperating forming rolls in converging paths into opposite ends of the blank and into engagement with the inner surface of the opposite end portions of the blank, opposing the continued lifting movement of the blank by the cooperating forming rolls in a manner to expand the opposite end portions of the blank, and returning the blank to the advancing means by withdrawing the rolls from engagement with the blank.

8. Those steps in the method of forming an annular blank to a predetermined cross sectional contour, which consist in successively advancing a plurality of blanks to a forming station, successively lifting the blanks from the advancing means as the blanks assume positions at the forming stations by moving cooperating forming rolls in converging paths into opposite ends of the blank and into engagement with the inner surface of the opposite end portions of the blank, and expanding the opposite end portions of the blank by opposing continued lifting movement of the blank with a rolling pressure initially applied to the outer side of the blank intermediate the end portions aforesaid of the blank and cooperating with the forming rolls upon continued movement of the latter along the diverging paths aforesaid to form the blank to a predetermined contour.

OWEN M. WHITTEN.